Former Signore, Inc.

CATTARAUGUS COUNTY

ELLICOTTVILLE, NEW YORK

SITE MANAGEMENT PLAN

NYSDEC Site Number: C905034

Prepared for:

Iskalo Ellicottville Holdings LLC

Harbinger Square

5166 Main Street

Williamsville, New York 14221

Prepared by:

GZA GeoEnvironmental of New York

535 Washington Street

Buffalo, New York 14203

716-685-2300

Revisions to Final Approved Site Management Plan:

Revision No.	Date Submitted	Summary of Revision	NYSDEC Approval Date

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SEPTEMBER 2015

CERTIFICATION STATEMENT

I BART A. KLETTKE, P.E., certify that I am currently a NYS registered professional engineer as 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).

______________________ BART A. KLETTKE, P.E.,

9-30-15 DATE

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SITE MANAGEMENT PLAN

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List of Acronyms

AS	Air Sparging
ASP	Analytical Services Protocol
BCA	Brownfield Cleanup Agreement
BCP	Brownfield Cleanup Program
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CAMP	Community Air Monitoring Plan
C/D	Construction and Demolition
CFR	Code of Federal Regulation
CLP	Contract Laboratory Program
COC	Certificate of Completion
CO2	Carbon Dioxide
CP	Commissioner Policy
DER	Division of Environmental Remediation
EC	Engineering Control
ECL	Environmental Conservation Law
ELAP	Environmental Laboratory Approval Program
ERP	Environmental Restoration Program
GHG	Green House Gas
GWE&T	Groundwater Extraction and Treatment
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
OM&M	Operation, Maintenance and Monitoring
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PID	Photoionization Detector
PRP	Potentially Responsible Party
PRR	Periodic Review Report
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RP	Remedial Party
RSO	Remedial System Optimization
SAC	State Assistance Contract
SCG	Standards, Criteria and Guidelines
SCO	Soil Cleanup Objective

SMP	Soil Management Plan
SOP	Standard Operating Procedures
SOW	Statement of Work
SPDES	State Pollutant Discharge Elimination System
SSD	Sub-slab Depressurization
SVE	Soil Vapor Extraction
SVI	Soil Vapor Intrusion
SVMS	Soil Vapor Mitigation System
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leachate Procedure
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VCA	Voluntary Cleanup Agreement
VCP	Voluntary Cleanup Program

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 C905034 Former Signore, 55-57 Jefferson Street, Ellicottville, NY

Institutional Controls:	1. The property may be used for restricted residential, commercial, and industrial use.
	2. All Engineering Controls must be operated and maintained as specified in the 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 property is prohibited without necessary water quality treatment as determined by the NYSDOH of the Cattaraugus County DOH 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 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 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.

Site Identification:	BCP Site C905034 Former Signore, 55-57 Jefferson Street, Ellicottville, NY

Engineering Controls:	1. Assessment and/or control of Soil Vapor Intrusion for all on Site occupied structures.

Inspections:	Frequency
1. Site use inspection	Annually
Monitoring:	
1. Groundwater Monitoring	Semi-annually
Reporting:	
1. Groundwater Monitoring Data	Semi-Annually
2. 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 Former Signore, 55-57 Jefferson Street located in Ellicottville, 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. C905034 which is administered by New York State Department of Environmental Conservation (NYSDEC).

Iskalo Ellicottville Holdings LLC entered into a Brownfield Cleanup Agreement (BCA) in January 2011 with the NYSDEC to remediate the site. A figure showing the site location and boundaries of this site is provided in Figures 1 and 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 A.

After completion of the remedial work, some contamination was left at this site, See Table 2, which is hereafter referred to as "remaining contamination". Institutional Controls 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 Cattaraugus 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 grounds 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 #C905034) 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 B of this SMP.

This SMP was prepared by GZA GeoEnvironmental of New York, on behalf of Iskalo Ellicottville Holdings LLC, 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 on the following page 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 B.

Table 1: Notifications*

Name	Contact Information
NYSDEC Project Manager	phone: 716-851-7200
NYSDEC Regional HW Engineer	phone: 716-851-7220
NYSDEC Site Control	phone: 518-402-9553

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

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

2.1 Site Location and Description

The site is located in Ellicottville, Cattaraugus County, New York and is identified as Section 55.043 Block 1 and Lot 3.1 on the Cattaraugus Tax Map (see Figure 2). The BCP Site (Site number C905034) is an approximate 8.43-acre area that is part of the larger approximate 55-acre former Signore property, the Signore Superfund Site (Site number C905023) . The BCP Site is bounded by residences and the rest of the Signore property to the north, residences, the rest of the Signore property, and wooded vacant land to the south, Jefferson Street, residences, and a cemetery to the east, and the rest of the Signore property to the west (see Figure 2 – Site Layout Map). The boundaries of the site are more fully described in Appendix A –Environmental Easement. The owner(s) of the site parcel(s) at the time of issuance of this SMP is Iskalo Ellicottville Holdings LLC.

2.2 Physical Setting

2.2.1 Land Use

The Site consists of an approximate 168,000 square foot concrete foundation (former main site building demolished in July and August 2012) and three remaining smaller ancillary buildings and parking areas. The Site is zoned industrial and is currently vacant. Plum Creek, a tributary to Great Valley Creek, flows into the larger Signore property from the north and flows through the central portion of the larger Signore property. It forms the western and southern boundary of the Signore BCP Site and flows off the property on the east towards Great Valley Creek.

The properties adjoining the Site and in the neighborhood surrounding the Site primarily include recreational, commercial and residential properties. The properties immediately south of the Site include vacant land and residential; beyond which are recreational properties; the properties immediately north of the Site include commercial and residential properties; the properties immediately east of the Site include community (cemetery), commercial, and residential properties; and the properties to the west of the Site include vacant land and residential properties.

2.2.2 Geology

The topography and geology in the area were drastically altered by glaciation. Rivers in the area, prior to the Pleistocene aged glacial period, flowed north towards Lake Erie and the St. Lawrence River. Southern glacial advancement were halted near Salamanca, located approximately nine miles south of Ellicottville, by the north flowing Allegheny River. The glacial advancement and eventual glacial melt waters altered the river flow patterns to the south as they exist today. This area of the Site consists of glacial outwash from the melting glaciers that were deposited in the surrounding valleys. On top of the glacial outwash are river derived alluvial deposits, from rivers and streams flowing along or into the valleys. Below the glacial outwash deposits is Devonian aged bedrock (350 million years old) at approximately 90 feet below ground surface.

Approximately one to two feet of fill is present at the Site which generally consists of subbase stone and sand/gravel mixtures. The native overburden consists of three stratigraphic units; an upper alluvial deposit (10 to 30 feet thick and consists of sandy silt with some clay and gravel), middle outwash deposits (20 to 50 feet thick and consists of fine to coarse sand and gravel with a little silt) and a lower variable unit consisting of outwash, glacial till and lake deposits.

Site specific boring logs are provided in Appendix C.

2.2.3 Hydrogeology

Groundwater measurements were taken throughout Site investigation and remedial activities. Groundwater flow directions measured during the semi-annual groundwater monitoring events conducted from 2009 through 2015 show a southeasterly flow direction similar to the flow direction of Great Valley Creek. Groundwater was measured during the Site Remedial Investigation from the 14 microwells installed at the BCP Site. Groundwater levels in these 14 wells range from 9.6 feet bgs to 15.8 feet bgs. Groundwater flow direction has repeatedly been determined to be in a southeasterly direction, similar to the regional flow direction. Properties in the vicinity of the Site are provided water from the municipality. The Ellicottville Town Well is sampled semi-annually and is located approximately 3,400 feet southeast of the BCP Site. Representative groundwater contour maps are shown in Figures 3A and 3B. Representative groundwater elevation data is provided in Table 3. Groundwater monitoring well construction logs are provided in Appendix C.

2.3 Investigation and Remedial 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. Full titles for each of the reports referenced below are provided in Section 7.0 - References.

Prior to closing in 2007, the Signore BCP Site had been used for manufacturing purposes for over 50 years. It is reported that a tool and die operation occupied a garage associated with the residential dwelling that was formerly present on the property. The Signore BCP Site was primarily used for the manufacturing of metal products (i.e., file cabinets, lockers, desks and computer furniture). The Signore building, once present on the Site, had undergone various expansions since 1952. The actual development date for the property is unknown, but occurred sometime between the 1940s and 1952 as the property was identified as vacant woodland between 1922 and 1939.

The property was occupied by Signore until May 2007, when operations ceased. Iskalo took ownership of the property on February 11, 2008. The entire property is approximately 55 acres, the majority of which is hillside and undeveloped. The 8.43 acre Signore BCP Site was occupied by the former building (168,000 square feet), other smaller ancillary buildings and parking areas. The main building was demolished by Iskalo in July and August 2012. The small ancillary buildings and the main building concrete-slab remain.

REMEDIAL INVESTIGATIONS ASSOCIATED WITH SITE LISTING AS CLASS 4 SITE #905023 – APRIL 1991-2006

The 55 acres Signore Property is currently listed as Site #905023, a Class 4 Site on the NYSDEC's Registry of Inactive Hazardous Waste Site (IHWS). The following historic documents are available for the Site and have been previously submitted to NYSDEC.

1. "Remedial Investigation Report for Signore, Inc. Facility, Ellicottville, NY Volume 1 of 2," 4/91, by Groundwater Associates, Inc.
2. "Remedial Investigation Report for Signore, Inc. Facility, Ellicottville, NY Volume 2 of 2," 4/91, by Groundwater Associates, Inc.
3. "Feasibility Study Report for Signore, Inc. Facility, Ellicottville, NY," 12/91

4. Order On Consent, Index # B9-0258-89-03
5. “Comprehensive Monitoring Report, Remediation System Monitoring, Signore, Inc., Ellicottville, NY,” 1/96 by Groundwater Associates, Inc.
6. Various historic reports completed prior to Remedial Investigation in 1991.
7. “Phase I Environmental Site Assessment, Signore, Inc. Facility,” dated 12/95, by Niagara Frontier Consulting Services, Inc.
8. Sampling data/results from 1993 to 2006

The Remedial Investigation (RI) consisted of sampling a variety of media at the Signore Property. A summary of the work contained in the RI report follows.

- Thirteen monitoring wells were installed to define the site geology, evaluate the aquifer characteristics and collect groundwater samples to evaluate the horizontal and vertical extent of contamination on and downgradient from the Signore Property and Signore BCP Site.
- Groundwater samples were collected from the monitoring wells to characterize the groundwater quality at and downgradient of the Signore Property.
- Two soil gas surveys were conducted to evaluate the presence of VOCs in the interstitial soil gas and as a screening tool to determine potential areas of subsurface contamination.
- Fourteen soil borings were completed to characterize the subsurface stratigraphy and collect soil samples to evaluate the vertical and horizontal extent of potential soil contamination. The soil boring locations were based on the soil gas survey results. A total of 31 soil samples were submitted for laboratory analysis. Fourteen soil samples were submitted for TCL VOC analysis and 17 were submitted for the complete target analyte list (TAL).
- The RI concluded that soil results do not indicate any new sources of contamination. Only minimal concentrations of VOCs were detected in the soil samples and no significant impact of SVOC or metals was identified.
- Six upgradient and downgradient surface water and sediment samples were collected from Plum Creek and three downgradient surface water and sediment samples were collected from Great Valley Creek to evaluate surface water quality impacts. Surface water and sediment samples were analyzed for TCL VOCs, SVOCs, pesticides/PCBs and TAL metals and cyanide.

Additional subsurface investigation work, other than the Record of Decision (ROD) requiring semi-annual sampling, was not completed after the RI work in the early 1990s until the Phase II Environmental Site Assessment (ESA) performed in 2007, as discussed later in this section.

PHASE I ENVIRONMENTAL SITE ASSESSMENT – NOVEMBER 2007

A Phase I ESA was completed in November 2007 by Lender Consulting Services (LCS). The Phase I ESA reportedly was done in general accordance with the American Society for Testing and Materials (ASTM) E1527-05. The following Recognized Environmental Conditions (RECs) were identified:

- Signore was identified as a NYSDEC listed IHWS.
- Several monitoring wells were located on the Site.
- The Site had previously sustained environmental contamination events that were subject to intervention by the NYSDEC. Due to this contamination, monitoring wells, both on- and off-Site are in place to monitor groundwater conditions.
- The Site had been utilized as a metal manufacturing facility since 1960 or earlier.

The following de minimus conditions were also noted.

- The Site was identified as a RCRA small quantity generator of hazardous waste with violations. Compliance has been achieved for the violations. The Site was also listed for registrations on other state and federal databases.
- Staining was noted on the floor in the paint room and paint mixing rooms within the main manufacturing building.
- Staining was noted on the soil beneath a degreaser unit in a former wall cavity outside the main manufacturing area.
- Radon concentrations in the area had been reported to be slightly greater than the United States Environmental Protection Agency (USEPA) recommendations.
- A portion of the undeveloped property along and west of Plum Creek lies within the 100-year flood zone with most of this within the flood plain “fringe”.
- Mapped soil units, Chanakoin Channery, Holderton silt and Ischua Channery reportedly present on the Signore Property, are classified as hydric soils, suggesting the potential for presence of on-site wetlands. The majority of the flat land area of the Signore Property was improved and/or disturbed. Hence, prior to any future development of the Site, a wetland delineation survey was recommended

in the undeveloped portions of the subject property (referenced above to be mostly west of Plum Creek) to assess whether regulatory wetlands exist.

- Approximately two-hundred 55-gallon drums of paint sludge and approximately ten drums of waste and new oil were located on the property. Evidence of releases was noted in the area of these materials. At the time of the Phase I ESA report, the purchaser of the property reported that the previous property owner was in the process of removing the drums and containers. An inspection of the property was to be conducted prior to the closing on the purchase to verify this.

PHASE II ENVIRONMENTAL SITE ASSESSMENT – DECEMBER 2007

GZA completed a Phase II ESA at the Site for due diligence purposes on behalf of Iskalo. A description of the field explorations conducted is presented in the following subsections.

GZA was retained to evaluate the potential presence of an on-Site cVOC contaminant source. GZA's work included observing soil probes at 29 locations and test pit excavations at eight locations. Soil samples collected during soil probes and test pit activities were screened for total volatile organics with an organic vapor meter (OVM) equipped with 10.6eV photoionization detector (PID). Thirty subsurface soil samples and 16 groundwater samples were submitted for chemical analysis.

During the Phase II activities, significant VOC contamination and separate phase petroleum (SPP) product impacting soil and groundwater at the Site was identified. Three areas of concern (AOC) were identified where the soil contaminant concentrations were greater than the NYSDEC Part 375 criteria.

1. AOC-1 – Petroleum underground storage tank (UST) Area – Three 1,000-gallon USTs, located on the eastern portion of the Site, were closed in-place in December 1986. SPP product and petroleum impacted soil was identified during test pit completion. GZA contacted NYSDEC and Spill #707350 was assigned to the Site.

2. AOC-2 – One 1,000-gallon UST Area – The historic contents of an UST identified on the southwest side of the main building are unknown. The UST was reportedly closed in the late 1980s. Separate phase petroleum product (SPPP) was identified during the test pit completed in this area.

3. AOC-3 – Paint Kitchen Area – VOC impacted soil was identified in the area within the main building identified as the paint kitchen and spray booth area. Additionally, a former septic system was also present in the area. “Product” was identified during the soil probe investigation.

In addition to the three identified AOCs, impacted subsurface soil and groundwater was detected at a location south of a floor drain that contained sludge. Groundwater impacts from the identified VOCs in AOC-1, -2 and -3 appeared to be present at the Site at approximately 10 to 12 feet below ground surface (bgs). The detected compounds in AOC-2 and AOC-3 included toluene, ethylbenzene, TMBs, and xylenes.

Semi-Annual Groundwater Monitoring Well Sampling (April 2009 through June 2015)

The Signore Property is listed as Site #905023, a Class 4 Site on the NYSDEC’s IHWS listing. As part of the Record of Decision (ROD) issued, numerous monitoring wells were to be sampled on a semi-annual basis. Currently, twelve monitoring wells, Main School well and one town well are required to be sampled.

The monitoring wells were last sampled by Signore, the former property owner and operator, in October 2006. Iskalo has been completing the semi-annual sampling in accordance with the ROD and has completed eleven semi-annual sampling events since April 2009, the most recent being June 2015.

PREVIOUS INTERIM REMEDIAL MEASURES

In August 1989, Signore entered into an Administrative Order of Consent (#89-258-89-03) to perform a Remedial Investigation/Feasibility Study at the Site and three Interim Remedial Measures (IRMs). The three IRMs included the following:

- Installation of an interceptor well upgradient of the Town drinking water well;
- Connection of 34 residential properties to the municipal water supply source; and
- Installation of an interceptor well on the downgradient portion of the Signore Property.

The above referenced IRM activities were completed by others and put into operation by January 1992. We note that, based on the Phase II ESA completed in December 2007 and the presence of USTs at the Site, additional IRM activities were completed under the BCP.

BCP INTERIM REMEDIAL MEASURES

This section describes the two IRMs completed at the Signore BCP Site (BCP Site # C905034) during two separate events in 2011 and 2013 under the BCP.

IRM activities in 2011 included the removal of six USTs and related petroleum impacted soil. TREC Environmental Inc. (TREC) was the earthwork contractor hired by Iskalo to perform these remedial activities and GZA provided the environmental oversight for the project.

IRM activities in 2013 included the removal of two closed-in place septic tanks and impacted soils located in the vicinity of AOC-2 and AOC-3; and the completion of a pilot test to assess the viability of chlorinated volatile organic compound (cVOC) groundwater contamination treatment. Matrix Environmental Technologies, Inc. (Matrix) was the earthwork contractor hired by Iskalo to perform these remedial activities and GZA provided the environmental oversight for the project.

2011 IRM Activities

The first IRM work was completed in general accordance with the NYSDEC-approved IRM Work Plan, dated July 2011. The objective of the IRM was to remove underground storage tanks (USTs) and accessible petroleum impacted soils at the two (2) accessible exterior areas of AOC-1 and AOC-2). Three (3) USTs were present within AOC-1 and one (1) UST within AOC-2.

In addition to the four (4) USTs identified above within AOC-1 and AOC-2, two additional USTs were also present and removed during the IRM activities as follows;

> A 6,000-gallon steel UST was identified on the north side of the Paint Storage building. This UST was an emergency dump tank used to temporarily store flammable liquids underground if a fire occurred at the facility. It is reported that this UST was closed-in-place in December 1987 by removing the contents and sludge, cleaning the inside of the tank and filling it with concrete

A 1,520-gallon concrete UST was located along the western side of the building and used as an emergency dump tank to temporarily store flammable liquids underground if a fire occurred at the facility.

In addition to the two USTs discussed above that were located outside of an AOC, two additional USTs were reportedly[5] present and investigated as part of the Phase II ESA, as follows.

A 500-gallon UST was reportedly located on the western side of the Maintenance building and used to temporarily store liquids spilled in the maintenance building. Three test pits completed in the vicinity of this UST, did not identify the presence of a tank. Analytical results of a soil sample collected from 6 to 7 feet bgs identified four (4) VOCs below their respective Unrestricted SCOs. Therefore, no additional work was completed in this vicinity as part of the IRM.

A 1,000-gallon UST was reportedly located between the Paint Storage and Maintenance Buildings and used as an emergency dump tank to temporarily store flammable liquids underground if a fire occurred at the facility. A test pit completed to approximately 6 feet bgs in the vicinity of this UST did not identify the presence of a tank. Field observations and field screening with an organic vapor meter (OVM) did not identify impacted soil at this location. Therefore, no additional work was completed in this vicinity as part of the IRM.

As stated earlier, the first IRM activities were completed at exterior accessible locations. The Site building was still present; therefore, a portion of AOC-2 and all of AOC-3 was present beneath the building. After the building was demolished, the second IRM activities were completed, as discussed below.

<u>2013 IRM Work</u>

The 2013 IRM work was completed in general accordance with the NYSDEC-approved IRM Work Plan, dated July 2013. The objective of this IRM work included:

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5 "Remedial Investigation Report, Signore Facility, Ellicottville, New York, Volume 1 of 2" dated April 1991. Prepared by Lozier/Groundwater Associates for Signore, Inc.

- removal of remaining soil contamination associated with AOC-2 and AOC-3;
- removal of two closed-in-place concrete septic tanks.
- Implementation of a pilot test for treatment of cVOC contaminated groundwater in the vicinity of the former septic tanks in the central portion of the Site. This area of the site was found to contain groundwater with total cVOC concentrations in excess of 200 ppb. The pilot test technology involved the injection of an electron donor compound (EDC) into the groundwater.

We note that a third septic tank was encountered during the AOC-3 soil removal activities, which was not closed-in-place. This tank and its contents were removed as part of the AOC-3 activities.

IRM FIELD ACTIVITIES

AIR MONITORING

Air surveillance monitoring for total organic vapors and particulates was performed during excavation activities. The monitoring was conducted in accordance with Section 5.0 (Air Monitoring) of the Health and Safety Plan[1].

EXCAVATION ACTIVITIES

2011 IRM Excavation Activities

Excavated soils were field screened by GZA for total organic vapors with an OVM equipped with an 11.7 eV bulb. These field screening results, along with visual observations and olfactory senses were used to assess soil removed from the excavation. A track excavator (Deere 200-C LC) was used to excavate and place soil into the bucket of a front loader (Deere 644H). The front loader would transport the soil to the soil stockpile staging area located on the northwestern side of the former building. The soils were staged on an existing concrete slab covered with polyethylene sheeting. At the end of each day, the soil pile was covered with polyethylene sheeting.

1 "Health and Safety Plan, Former Signore Facility, Ellicottville, New York, Brownfield Cleanup Program, Site Number C905034" dated July 2011, prepared by GZA GeoEnvironmental of New York.

AOC-1 Excavation

AOC-1 excavation work was conducted from October 31 through November 4th and November 8th through November 11, 2011. Backfilling occurred throughout excavation activities in order to access impacted materials to be removed, due to the size of the excavation and presence of the former building. Backfilling was completed on November 14, 2011.

Three steel USTs filled with concrete and approximately 858 tons of petroleum impacted soil was removed from AOC-1 for disposal. The steel walls were peeled away from the concrete fill. No product was observed. One UST measured 12 feet long by 5 feet in diameter and the other two USTs both measured 12 feet long by 4 feet in diameter. Some areas of rusted holes were observed in the side walls of the USTs.

The steel USTs were crushed using the excavator bucket and taken via trailer to Archie Nichols Inc. (Archie Nichols) located in Frewsburg, New York as scrap metal to be recycled. The concrete from within the USTs was broken into manageable pieces, stockpiled and taken to Swift River Associates, Inc. (Swift River) located in Tonawanda, New York to be recycled. The impacted soil was taken to Hyland Facility Associates Landfill located in Angelica, New York.

The AOC-1 excavation was approximately 70 feet long (north/south) by 30 feet wide (east/west) with depths ranging from 11 feet (eastern portion of AOC-1) to 15 feet (western portion of AOC-1), as shown on Figure 4. Petroleum impacted soil was encountered from ground surface to approximately 9.5 feet bgs (eastern portion of AOC-1) and from 9 to 14 feet bgs (western portion of AOC-1). Approximately 858 tons of petroleum impacted soils were removed from the AOC-1 excavation and stockpiled for off-site landfill disposal.

Based on field screening and observations, the top 9 feet of soil in the western portion of the AOC-1 excavation area was not impacted with petroleum contamination. Therefore, soil from ground surface to 9 feet bgs in this area was staged on polyethylene sheeting and used to backfill the excavation.

AOC-2 Excavation

AOC-2 excavation activities started on October 24 and were completed by October 25, 2011. The excavation remained open until confirmatory sample results were received. Backfilling occurred on November 7, 2011.

The concrete tank present and approximately 350 tons of petroleum impacted soil was removed from AOC-2. The UST had been previously closed in place by filling with sand and gravel. No product was observed within the tank. The tank measured approximately 12 feet in length by 5 feet in diameter and was orientated vertically. The concrete UST was broken into manageable pieces and stockpiled for disposal with the impacted soil.

Based on field screening and observations, the top 4 feet of soil present in the excavation was not impacted with petroleum contamination. Therefore, soil from ground surface to 4 feet bgs in this area was separated from soils located below 4 feet bgs, staged on polyethylene sheeting in the vicinity of the excavation and later used for backfill within the excavation.

We note that the AOC-2 excavation activities occurred on the exterior of the former building. Additional AOC-2 activities were conducted after the building was demolished as part of the 2013 IRM activities, as discussed later in the 2013 IRM Activities.

6,000 Gallon Steel UST Excavation

6,000-Gallon UST excavation work started on October 25 and was completed by October 28, 2011. The excavation remained open until confirmatory sample results were received. Backfilling occurred on November 7, 2011.

One , 6,000-gallon steel UST filled with concrete and approximately 25 tons of petroleum-impacted soil was removed from the excavation. The steel walls were peeled away from the concrete fill. No product was observed. TREC was unable to remove the concrete in one piece from the excavation, therefore a backhoe (TX760 Terex) equipped with a jackhammer was used to break up the concrete into manageable pieces for removal from the excavation. The steel tank measured approximately 14 feet in length by 8 feet in diameter. The UST appeared to be in good condition with no areas of rust or holes observed.

The steel USTs were crushed using the excavator bucket and taken via trailer to Valley Recycling, LLC (Valley Recycling) located in Allegany, New York as scrap metal to be recycled. The concrete from within the USTs was broken into manageable pieces, stockpiled and taken to Swift River to be recycled. The impacted soil was taken to Hyland Facility Associates Landfill located in Angelica, New York.

Based on field observations the top approximately 5 feet of soil present in the excavation was not impacted with petroleum contamination. Therefore soil from 0 to 5 feet bgs in this area was separated from the limited amount of impacted soils located on the north side of the UST. It was staged on-Site atop polyethylene sheeting to be later used for backfill within the excavation.

1,520 Gallon Concrete UST Excavation

The 1,520-Gallon Concrete UST excavation work was started and completed on November 1, 2011. The excavation remained open until stone for backfilling activities was delivered to the Site on November 7, 2011 when it was backfilled.

The excavation was then backfilled on November 7, 2011 using the clean soil removed from the 1,520-Gallon Concrete UST excavation and #2 crusher run stone from the Mapes-Machias Mine. The bucket of the excavator was used to compact the backfill materials placed into the excavation.

2013 Excavation Activities

Excavated soils were field screened by GZA for total organic vapors with an OVM equipped with an 11.7 eV bulb. These field screening results, along with visual and olfactory observations were used to assess excavated soil. A track excavator (Kobelco SK 210LC) was used to excavate the soil associated with AOC-2 and AOC-3. Apparent non-impacted soils were screened with the OVM and placed on polyethylene sheeting in the proximity of the excavations for subsequent use as backfill.

Impacted and non-saturated soils were directly loaded into trucks for off-site disposal. Impacted and saturated soils encountered were placed on soil benches/areas within the excavation and were allowed to decant within the excavation limits. The benches/areas contained impacted soil that would be removed at a later time. Decanting did not occur over non-impacted soil. The decanted impacted soils were then moved from within the excavation limits onto polyethylene sheeting for staging and further drying. When the impacted material was sufficiently dry for transport, it was loaded onto dump trucks via a front loader, for off-Site disposal. The soil pile was covered with polyethylene sheeting when rain was forecasted. The soil pile and open excavations were secured with snow fencing along their perimeters when GZA/Matrix were off-Site.

Additional AOC-2 Excavation

A concrete UST and associated impacted soil were removed as part of the IRM activities in 2011. However, due to the presence of the former building at the time of the work in 2012, some impacted material was left along the building foundation and presumably under the concrete floor slab. The building was demolished in the summer of 2013 and removed. With the building now gone, AOC-2 excavation activities were completed on August 12, 2013.

An area north of the foundation wall (approximate 20 feet long (north/south) by 12 feet wide (east/west)) was excavated to about 14 feet bgs. These soils were observed to be apparently non-impacted as the OVM readings from the soil on the north side of the building foundation wall were less than 1 ppm. No visual or olfactory evidence of impacts were noted.

Therefore, the excavation to remove the remaining impacted soil associated with AOC-2 was south and adjacent to the building foundation wall to a depth of 15 feet bgs.

AOC-3 Excavation

AOC-3 consisted of petroleum-based VOC impacted soil which was identified during the previous Phase II ESA. It was identified in an area under the former main building identified as the paint kitchen and spray booth area. We note that a concrete septic tank was identified during the AOC-3 excavation activities, which was removed along with its contents.

AOC-3 excavation activities occurred between August 13 and August 23, 2013. The excavation remained open until confirmatory sample results were received. Backfilling occurred between August 27 and August 30, 2013.

Septic Tank Removals

Two (2) closed-in place septic tanks were located in the central portion of the Signore BCP Site under the concrete slab. These tanks were reportedly cleaned and filled with concrete. The septic tank removals were completed on August 12 and the excavations backfilled on August 13 and August 30, 2013. The soils in the septic tank excavations were apparently non-impacted, with no visual or olfactory evidence of contamination observed. Soils excavated during the septic tank removals were non-detect on the OVM equipped with a 11.7 eV bulb. NYSDEC indicated via e-mail that confirmatory analytical samples of the septic tank excavations were not required due to the non-detect OVM soil screening. The apparent non-impacted soil was staged on polyethylene sheeting south of the excavations and was used as backfill.

West Septic Tank Removal

The approximate 550-gallon hexagonal concrete septic tank was removed and broken into manageable fragments for disposal at the Swift River Associates Landfill. The septic tank was observed to be filled with concrete. The excavation was approximately 11 feet long (north/south) by 8 feet wide (east/west) with a depth of 7 feet bgs. The excavation was partially backfilled with the non-impacted material from the excavation on August 13, 2013. Backfilling was completed on August 30, 2013 with bank run gravel also utilized in AOC-3 (top approximate 1 to 2 feet). The bucket of the excavator was used to compact the backfill materials placed into the excavation.

East Septic Tank Removal

The approximate 550-gallon hexagonal concrete septic tank was removed and broken into manageable fragments for disposal at the Swift River Associates Landfill. The septic tank was observed to be filled with concrete. The excavation was approximately 9 feet long (north/south) by 8 feet wide (east/west) with a depth of 7 feet bgs. The excavation was partially backfilled with the non-impacted material from the excavation on August 13, 2013. Backfilling was completed on August 30, 2013 with bank run gravel also utilized in AOC-3 (top approximate 1 to 2 feet). The bucket of the excavator was used to compact the backfill materials placed into the excavation.

ELECTRON DONOR COMPOUND INJECTION PILOT TEST

The groundwater data from the SRI, as discussed in Section 5.5, indicates that the cVOC plume (cVOC concentrations greater than 200 ppb) may be originating in the vicinity of the former septic tanks in the central portion of the Signore BCP Site. Prior to implementing a full-scale in-situ groundwater treatment program, a pilot test was initiated in September 2013, as discussed below, to assess the effectiveness of the remedial alternative and collect pre-design data.

The pilot test consisted of the injection of approximately 1,775 pounds of EDC material in the vicinity of SP-3 and the 200 ppb contour, 500 pounds of EDC in the vicinity of 100 ppb contour near SP-32, and monitoring the groundwater conditions in the areas of the injections. The EDC material was composed of food-grade vegetable oils and surfactants.

The EDC material was mixed into slurry and injected into the subsurface groundwater. The following injection methodology was implemented for the two pilot test areas, identified by nearby soil probe locations.

SP-3 Area

EDC injections were conducted in this area on September 6, 9, and 10, 2013. A direct push soil probe unit was used to advance the probe of the injection equipment. Injection points were completed in an approximate 15-foot horizontal spacing, over a 40 foot by 30 foot area, for a total of nine (9) injection points.

A total of 1,775 pounds of material was used in this injection area. The 1,775 pounds of material was mixed with about 1,800 gallons of water to create an injectable slurry. The EDC material and water was mixed on-site in tanks until the EDC material dissolved into solution. The EDC material was observed to dissolve into solution easily. Once dissolved, the slurry was injected into the subsurface under pressure using a grout pump. The injection rate was limited to the rate at which the formation accepted the slurry material. The injection pressure was regulated and monitored to avoid "blow-back" up the sides of the injection rods or up previously completed injection points.

The injection quantities were approximately 195 pounds of EDC material per injection location (97.5 pounds per injection interval) using approximately 200 gallons of water per injection location (100 gallons per injection interval).

SP-32 Area

EDC injections were conducted in this area on September 5, 2013. A direct push soil probe unit was used to advance the probe of the injection equipment. Injection points were completed in an approximate 10-foot horizontal spacing, over a 20 foot by 20 foot area, for a total of five (5) injection points.

Injections occurred in two intervals below the groundwater table at each injection location. The shallow injection intervals were conducted approximately five feet below the groundwater table at 14 feet bgs. The deeper injection intervals were conducted approximately ten feet below the groundwater table at 19 feet bgs. Injections were completed by advancing the probe to the first depth injection interval, injecting the required quantity of EDC material, and then advancing the probe deeper to the next injection interval and injecting the required quantity of EDC material using a top-down approach.

A total of 500 pounds of material were used in this injection area. The 500 pounds of material was mixed with about 550 gallons of water to create an injectable slurry. The EDC material and water was mixed on-site in tanks until the EDC material dissolved into solution. The EDC material was observed to dissolve into solution easily. Once dissolved, the slurry was injected into the subsurface under pressure. The injection rate was limited to the rate at which the formation accepted the slurry material. The injection pressure was regulated and monitored to avoid "blow-back" up the sides of the injection rods or up previously completed injection points.

The injection quantities were approximately 100 pounds of EDC material per injection location (50 pounds per injection interval) using approximately 110 gallons of water per injection location (55 gallons per injection interval).

The pilot test groundwater sampling results appear favorable, as there is a decrease in parent compound concentrations at four of the six sampling locations within nine months of the injections. At the 6 week post-injection sampling event, we noted that at two locations, SP-32 and SP-43, acetone and 2-butanone were detected for the first time. Acetone and 2-butanone (2-butanone is also known as methyl ethyl ketone, or MEK) are short-lived chemical intermediates typically generated during the initial stages of cVOC bioremediation. These intermediate compounds are likely due to degradation pathways of the EDC organic carbon amendment. In agreement with our experience at other sites, acetone and MEK intermediates were quickly attenuated and are now non-detect at all six pilot test sampling locations.

IRM CONCLUSIONS & RECOMMENDATIONS

AOC-1

Of the 11 confirmatory soil samples collected from the sidewalls and bottom of the excavation, one location (AOC-1-Bottom-Center), contained VOCs above their respective PGWSCOs but below the RRSCOs. Additional soil was not removed from within the vicinity of this sample location as the groundwater table had been encountered and due to the size of the excavation, the excavator could not effectively reach the location. The remaining confirmatory results were below the PGWSCOs and RRSCOs.

The results of the groundwater sample collected from AOC-1 indicated that 14 VOCs were detected above method detection limits; of which nine were detected above their respective NYSDEC Class GA groundwater criteria, with a total VOC concentration of 271 ppb.

The analytical results of both the soil and groundwater indicate that residual contamination was present in the vicinity of AOC-1 at the time that the IRM work was completed, but the majority of the contamination was removed. A remedial injection system was installed within the limits of the excavation, prior to backfill, if eventually determined necessary.

The SRI involved the collection of a groundwater sample from a microwell installed at TP-10, approximately 80 feet downgradient (south) of AOC-1 to assess the presence of VOCs in the groundwater related to AOC-1. The results of the SRI groundwater sampling are provided in Table 11. No petroleum related VOC were detected above method detection limits. Therefore, no additional remedial actions are required at AOC-1.

AOC-2

Based on the nine 2011 IRM confirmatory soil samples collected from the sidewalls and bottom of the excavation, two locations, EXC-2-NW-Wall (8 to 10 feet bgs) and EXC-2-Bottom-N (14 to 15 feet bgs), contained VOCs above their respective PGWSCOs and RRSCOs. The additional remedial activities completed as part of the 2013 IRM removed the additional soil contamination associated with AOC-2. Therefore, no additional remedial work will be required in the vicinity of the northwestern corner of AOC-2.

The results of the groundwater sample collected from AOC-2, indicated nine VOCs were detected above method detection limits, of which six were detected above their respective NYSDEC Class GA groundwater criteria, with a total VOC concentration of 2,060 ppb. However, monitoring well MW-5S (sampled semi-annually as part of on-going groundwater monitoring, is located about 25 feet south and hydraulically downgradient of AOC-2. The monitoring well screen zone of MW-5S is from approximately 7.5 to 17.5 feet bgs, which screens across the bottom of AOC-2 excavation depth. The groundwater analytical results from the eight semi-annual sampling events conducted from April 2009 through June 2015 did not indicate the presence of similar VOCs detected in the groundwater sample collected from AOC-2. Therefore, it does not appear that the VOCs associated with AOC-2 are migrating from this area.

6,000-gallon UST Excavation

Analytical results of the five confirmatory soil samples collected from the side walls and bottom of the excavation indicate no contamination is present above the PGWSCOs or RRSCOs. No additional remedial action is needed related to this UST.

1,520-gallon UST Excavation

Based on the field screening results and olfactory observations of the sidewalls and bottom soils of this excavation, no impacted soil was identified during the UST removal or during the previous Phase II ESA activities. No additional remedial action is needed related to this UST.

AOC-3

Analytical results of the 16 confirmatory soil samples collected from the side walls and bottom of the excavation were below the PGWSCOs and RRSCOs.

The analytical results of groundwater sample AOC-3-GW included 15 VOCs detected above method detection limits of which nine were detected above their respective NYSDEC Class GA groundwater criteria with a total VOC concentration of 507 ppb. The analytical results of groundwater sample AOC-3-GW-2 included 13 VOCs at concentrations above method detection limits of which 10 were detected above their respective NYSDEC Class GA groundwater criteria with a total VOC concentration of 6,251 ppb.

Monitoring well MW-5S (sampled semi-annually as part of on-going groundwater monitoring) is located about 100 feet south and hydraulically downgradient of AOC-3. The monitoring well screen zone of MW-5S is from approximately 7.5 to 17.5 feet bgs, which screens across the bottom of AOC-3 excavation depth. The groundwater analytical results from the nine semi-annual sampling events conducted from April 2009 through October 2013 did not indicate the presence of similar VOCs detected in the groundwater sample collected from AOC-3. It does not appear that the VOCs associated with AOC-3 are migrating from this area. Therefore, no additional remedial actions are required at AOC-3.

The analytical results of both the soil and groundwater indicate that residual contamination was present in the vicinity of AOC-3 at the time the IRM work. However, the majority of the contamination was removed. Two remedial injection systems were installed within the limits of the excavation, prior to backfill, if deemed necessary.

Septic Tank Removals

Based on the field screening results and olfactory observations made of the material removed from the two septic tank excavations, no impacted soil was identified. No additional remedial action is needed related to the soil associated with these two former septic tank locations.

Based on the results of the AOC-4 pilot study, GZA recommended implementing a full scale injection program to enhance and accelerate natural attenuation of cVOCs at the BCP site. The full scale in-situ groundwater treatment involves injecting an organic carbon (OC) electron donor material into the cVOC-impacted groundwater via direct-push technology. Natural attenuation could then further reduce the concentrations at downgradient locations. As degradation of the remaining source of cVOCs would be enhanced by the in-situ treatment, this should help achieve the groundwater SCOs more quickly. The full scale in-situ groundwater treatment was conducted in July 2015.

SITE INVESTIGATION

The Supplemental Remedial Investigation (SRI) field explorations were performed in general accordance with the NYSDEC-approved Work Plans to obtain and evaluate site-specific data, nature and extent of contamination and the degree to which releases and contamination pose a threat to human health and the environment.

The following tasks, as described in this report, were completed.

- Test pit excavations;
- Soil probes & microwell installation; and
- Soil, groundwater and off-site vapor intrusion sampling.

A description of the field explorations conducted during this SRI is presented in the below. The scope of work of the SRI was intended to supplement the investigation activities previously completed by GZA and others.

TEST PIT EXPLORATION

GZA subcontracted with TREC to complete ten (10) test pit explorations at the Signore BCP Site to evaluate the subsurface conditions and potential contamination outside of the remaining concrete slab-on-grade floor. The building was demolished in Fall 2012 prior to the start of the on-site SRI activities, but the concrete slab-on-grade floor and building footers remained in-place. The test pits were completed on September 25 and 26, 2012.

SOIL PROBE EXPLORATION

GZA's subcontractor, TREC, completed twenty-one (21) soil probes at the Signore BCP Site to evaluate the subsurface conditions, potential contamination within former building footprint and to install microwells. The soil probes were completed between September 26 and October 1, 2012.

Seventeen soil samples were collected for analysis, at least one sample from each soil probe, SP-30 through SP-45, and two samples were collected from SP-37. Soil samples were analyzed for VOCs.

SURFACE SOIL SAMPLING

Surface soil samples were collected on September 27, 2012 from four on-Site locations. These samples were collected and analyzed to assess if contamination is present in surface soils. Surface soil samples were collected using a stainless steel spoon from the 2-inches of soil below the vegetative cover present at the sampling locations.

SOIL VAPOR INTRUSION SAMPLING

Soil vapor intrusion (SVI) sampling was completed at nine off-site locations during the heating season from January 2012 through April 2012. One location, House 3 was also tested in January 2013. Five of the locations were upgradient (north of the Signore BCP Site) and four locations were downgradient (south of the Signore BCP Site).

The purpose of this vapor intrusion air sampling was to assess off-site residential dwellings along Jefferson Street for potential soil vapor intrusion, due to the detections of chlorinated solvents in groundwater at the Site.

GROUNDWATER SAMPLING

Groundwater sampling consisted of existing monitoring wells and newly installed microwells. The well sampling was conducted utilizing low-flow sampling techniques using a water quality meter, disposable polyethylene tubing and a variable speed pump.

Surface Soil Samples

Four surface soil samples (excluding QC duplicate and a matrix spike/matrix spike duplicate (MS/MSD) samples) were collected from four surface soil locations as part of the SRI. A duplicate soil sample was collected from SS-3 and a MS/MSD soil sample was collected from SS-1.

Subsurface Soil Samples

Twenty-one subsurface soil samples (excluding QC duplicate and a matrix spike/matrix spike duplicate (MS/MSD) samples) were collected from the 10 test pits and 21 soil probes completed as part of the SRI. A duplicate soil sample was collected from SP-33, 2 to 4 feet below ground surface (bgs) and a MS/MSD soil sample was collected from SP-45, 4 to 6 feet.

Groundwater Samples

Nineteen groundwater samples (excluding duplicate and MS/MSD samples) were collected from the 14 microwells installed as part of the SRI and five existing wells at the Signore BCP Site. A duplicate groundwater sample was collected from SP-38 and a MS/MSD was collected from SP-42.

Refer to Tables 4 through 15 for analytical data tables pertaining to the above referenced historical investigations and remedial activities.

IN-SITU GROUNDWATER TREATMENT AND MONITORING

As outlined in the Remedial Work Plan, impacted on-site groundwater was treated in-situ to enhance the reductive dechlorination process by replacement of chlorine with elemental hydrogen, in the presence of an electron donor. The electron donor enhances the anaerobic breakdown of parent cVOCs present at the Site to daughter breakdown products which continue to degrade anaerobically or aerobically. In July 2015, GZA implemented the in-situ groundwater remedial program by injecting an organic carbon additive mixure of lactose, brewer's yeast, sodium bicarbonate and trace nutrients. Approximately 7000 pounds of the mixture was mixed with 5000 gallons of water to produce an injectable slurry. This slurry was injected into the subsurface using direct-push soil probes as specified in the RWP. Pre- and post-injection groundwater sampling was performed per the RWP. Further details of the remedial injection program were reported in the Final Engineering Report (FER) prepared by GZA, September, 2015.

2.4 Remedial Action Objectives

The Remedial Action Objectives (RAOs) for the Site as listed in the RWP and Decision Document dated July 24th, 2015 are as follows:

Groundwater

RAOs for Public Health Protection

  - Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.
- Prevent contact with, or inhalation of, volatiles from contaminated groundwater. RAOs pertaining to vapor mitigation are discussed later in this section.

RAOs for Environmental Protection

- Restore ground water aquifer to pre-disposal/pre-release conditions, to the extent practicable.
- Prevent the discharge of contaminants to surface water.
- Remove the source of ground or surface water contamination. Soils exceeding PGWSCOs were remediated during the IRM activities conducted in 2011 and 2013.

Soil

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil; and
- Prevent inhalation of or exposure from contaminants volatilizing from contaminants in soil. RAOs pertaining to soil vapor mitigation are discussed later in this section.

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater or surface water contamination; and
- Prevent impacts to biota from ingestion/direct contact with soil causing toxicity or impacts from bioaccumulation through the terrestrial food chain.

The remedial objective for the Site soil is a Track 2 cleanup under the BCP. Soils exceeding RRSCOs were remediated during IRM activities conducted in 2011 and 2013; therefore, additional remedial actions pertaining to subsurface soils are not required and Site RAOs for soil have been achieved. However, activities that disturb subsurface soils should follow applicable screening and health and safety procedures.

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 Remaining Contamination

2.5.1 Soil

Table 2 and Figure 4 summarize the results of the few soil samples collected that exceed the Unrestricted Use SCOs and the restricted residential and commercial use SCOs at the site after completion of remedial action. As discussed previously in this SMP, impacted soil of concern was removed from the Site. The only known remaining soil with a contaminant present above commercial and/or restricted residential SCOs is arsenic at just three locations. The arsenic concentrations are only slightly above the commercial SCO at two of these locations (reported concentrations of 16.9 and 20 mg/kg, Table 2) and slightly above the restricted residential SCO at the third location (reported concentration of 14.6 mg/kg,

Table 2). Arsenic is a naturally occurring element and often naturally present in soil and rock at such concentrations.

2.5.2 Groundwater

Tables 8, 9, and 14 and Figure 6 summarize the results of samples of groundwater that exceed the SCGs after completion of the IRM remedial action. The remedial groundwater injections were completed in July of 2015 and post remedial groundwater monitoring data is presented in the semi-annual groundwater monitoring reports subsequent to the July 2015 ground water remediation.

2.5.3 Soil Vapor

Sources of VOCs of concern have be removed from the Site and no occupied structures are present on Site at the time of the writing of this SMP. An SVI investigation was completed at five hydraulically upgradient and four hydraulically downgradient locations from the Signore BCP Site. According the NYSDOH Guidance, results of the sampling indicate that No Further Action is required at these locations.

Any new buildings constructed on-site and any existing buildings which become occupied will be evaluated for the potential for soil vapor intrusion by a qualified environmental professional in accordance with the NYSDOH's "Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York," dated October 2006. This evaluation will occur prior to the building becoming occupied. A copy of this reference document is included as Appendix I. If the results of a soil vapor intrusion assessment indicates that further action is warranted in accordance with the NYSDOH guidance, actions will be taken to address exposures related to soil vapor intrusion. Alternatively, the Site owner may elect to install an active vapor mitigation system on any new construction or existing building which becomes occupied.

New buildings constructed on-site will include vapor barriers and subsurface piping for passive SSD systems. The effectiveness of any passive or active vapor mitigation system or vapor barrier installed will need to be evaluated. SSDs, where installed, will be operated and monitored until such time the NYSDOH approves a request to diminish or eliminate the requirement to do so.

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 Decision Document 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 restricted residential, 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 the survey map (Figure D14-692) attached with the EE. These ICs are:

- The property may be used for : Restricted residential, Commercial, and Industrial use;
- All ECs must be operated and maintained as specified in this SMP;
- All ECs must be inspected at a frequency and in a manner defined in the SMP.
- The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the Cattaraugus 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.
- Groundwater and other environmental or public health monitoring must be performed as defined in this SMP;
- Data and information pertinent to site management must be reported at the frequency and in a manner as 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 on the Signore Site, and any potential impacts that are identified must be monitored or mitigated.

3.3 Engineering Controls

3.3.1 Sub-Slab Depressurization (SSD) System

Sources of VOCs of concern have be removed from the Site and no occupied structures are present on Site at the time of the writing of this SMP. An SVI investigation was completed at five hydraulically upgradient and four hydraulically downgradient locations from the Signore BCP Site. According the NYSDOH Guidance, results of the sampling indicate that No Further Action is required at these locations.

However, vapor intrusion will be evaluated on new buildings and mitigation systems if installed (i.e. subslab depressurization systems (SSDSs) will be operated and monitored until such time the NYSDOH approves a request to diminish or eliminate the requirement to do so. An 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.

3.3.2 Monitoring Wells associated with Monitored Natural Attenuation

Groundwater monitoring activities to assess natural attenuation will continue, as determined by the NYSDEC with consultation with NYSDOH, until residual groundwater concentrations are found to be consistently below ambient water quality standards, the site SCGs, or have become asymptotic at an acceptable level over an extended period. In the event that monitoring data indicates that monitoring for natural attenuation may no longer be required, a proposal to discontinue the system will be submitted by the remedial party. Monitoring will continue until permission to discontinue is granted in writing by the NYSDEC. If groundwater contaminant levels become asymptotic at a level that is not acceptable to the NYSDEC, additional treatment and/or control measures will be evaluated.

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 Quality Assurance Project Plan provided in Appendix G.

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);
- 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 monitoring wells;
- 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, an inspection form will be completed as provided in Appendix I – Site Management Forms. The form will compile sufficient information to assess the following:

- 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 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 requirements of this SMP and the Environmental Easement;
- Achievement of remedial performance criteria; and
- If site records are complete and up to date; and

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 Post-Remediation Media Monitoring and Sampling

Groundwater samples shall be collected from the wells as specified in the RWP on a routine basis (Figure 4). Sampling locations, required analytical parameters and schedule are provided in Table 16 below– Remedial System Sampling Requirements and Schedule below. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

Table 16 – Post Remediation Sampling Requirements and Schedule

Sampling Locations	**Analytical Parameters**				**Schedule**
	VOCs (EPA Method 8260C)	TOC Chloride Nitrate Sulfate	Methane Ethane Ethene	Dissolved Iron Dissolved Manganese	
EW-1.25	X	X	X	X	one month after remedial injections and then semi-annually (spring and fall) concurrent with the Site-wide GW monitoring.
EW-1.5	X	X	X	X	
EW-2.5	X	X	X	X	
MW-1I	X	X	X	X	
MW-5S	X	X	X	X	
SP-32	X	X	X	X	
SP-37	X	X	X	X	
SP-38	X	X	X	X	
SP-43	X	X	X	X	
SP-45	X	X	X	X	
TP-11	X	X	X	X	

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

4.3.1 Soil Sampling

Soil sampling will be performed prior to transport of on-site soils to off-site locations to assess the quality of the soil following completion of the remedial actions. Modification to the sampling requirements will require approval from 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 soil sampling program are specified in Section 7.0 – Reporting Requirements.

4.3.2 Groundwater Sampling

Groundwater monitoring will be performed approximately one month after completion of the in-situ groundwater remedial injection program which was completed in July 2015 and then semi-annually thereafter at the same time as the site-wide monitoring to assess the performance of the remedy. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

The network of monitoring wells has been installed to monitor upgradient, on-site and downgradient groundwater conditions at the site. The network of on-site wells has been designed based on the following criteria:

Monitoring well construction logs are included in Appendix C of this document.

If biofouling or silt accumulation occurs in the on-site and/or off-site monitoring wells, 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.

4.3.3 Monitoring and Sampling Protocol

All sampling activities will be recorded in a field book and associated sampling log as provided in Appendix I - Site Management Forms. Other observations (e.g., groundwater monitoring well integrity, etc.) will be noted on the sampling log. The sampling log will serve as the inspection form for the monitoring network. Additional detail regarding monitoring and sampling protocols are provided in the site-specific Field Activities Plan provided as Appendix F of this document.

5.0 OPERATION AND MAINTENANCE PLAN

5.1 General

The site remedy does not rely on any mechanical systems, such as groundwater treatment systems, sub-slab depressurization systems or air sparge/soil vapor extraction systems to protect public health and the environment. Therefore, the operation and maintenance of such components is not included in this SMP. If in the future SSD systems are installed in on-site occupied structures then an O&M Plan will be included in this SMP for the SSDs.

6.0. REPORTING REQUIREMENTS

6.1 Site Management Reports

All site management inspection, maintenance and monitoring events will be recorded on the appropriate site management forms provided in Appendix I. These forms are subject to NYSDEC revision.

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 Table 6-1 below and summarized in the Periodic Review Report.

Table 6-1: Schedule of Interim Monitoring/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 interim monitoring/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.

6.2 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 A -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 ECs/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™ 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 RAWP and Decision Document;
  - The operation and the effectiveness of all SSD units, if present, 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 remedy and/or Monitoring and Sampling Plan; and
  - 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.
  - The overall performance and effectiveness of the remedy.

6.2.1 Certification of Institutional and Engineering Controls

Following the last inspection of the reporting period, a 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*
- *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 _________________________, of __________________, am certifying as [Owner/Remedial Party or Owner's/Remedial Party's Designated Site Representative] for the site."

For BCP projects which the Department has determined do not represent a significant threat to public health or the environment, but where contaminants in groundwater exceed drinking water standards, the following should also be included for both IC/EC and IC scenarios listed above:

- *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*

For BCP projects, every five years the following certification will be added:

- *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.

6.3 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.

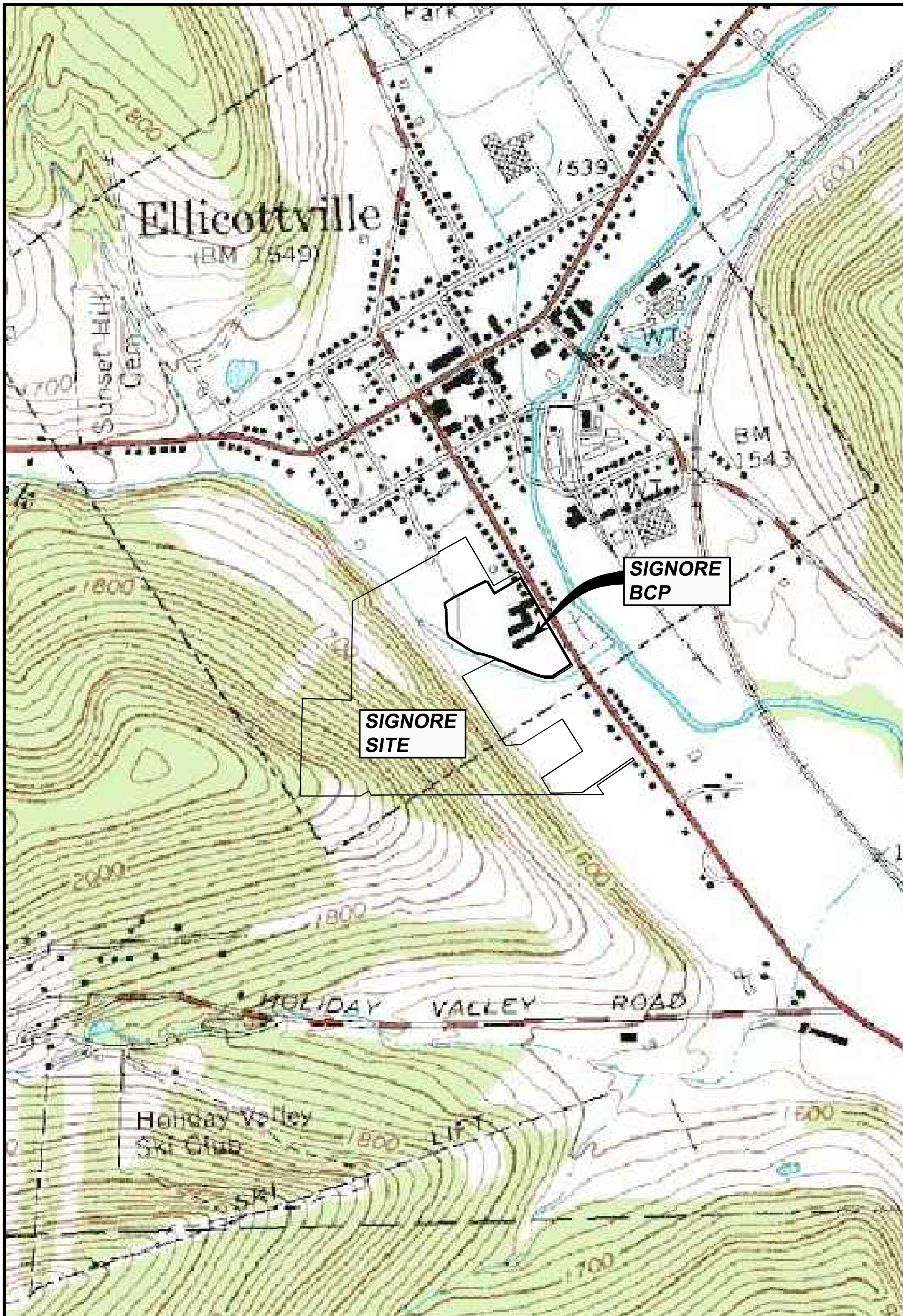
7.0 REFERENCES

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

NYSDEC DER-10 – “Technical Guidance for Site Investigation and Remediation”.

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).

Supplemental Remedial Investigation/Interim Remedial Measure/Alternative Analysis Report and Remedial Work Plan, Former Signore BCP Site, April 2015, GZA GeoEnvironmental of New York.



NOTE:
BASE MAP ADAPTED FROM U.S.G.S. TOPOGRAPHIC MAPS DOWNLOADED FROM TERRASERVER.MICROSOFT.COM

DRAWN BY: DEW
DATE: JULY 2015

GZA GeoEnvironmental of New York

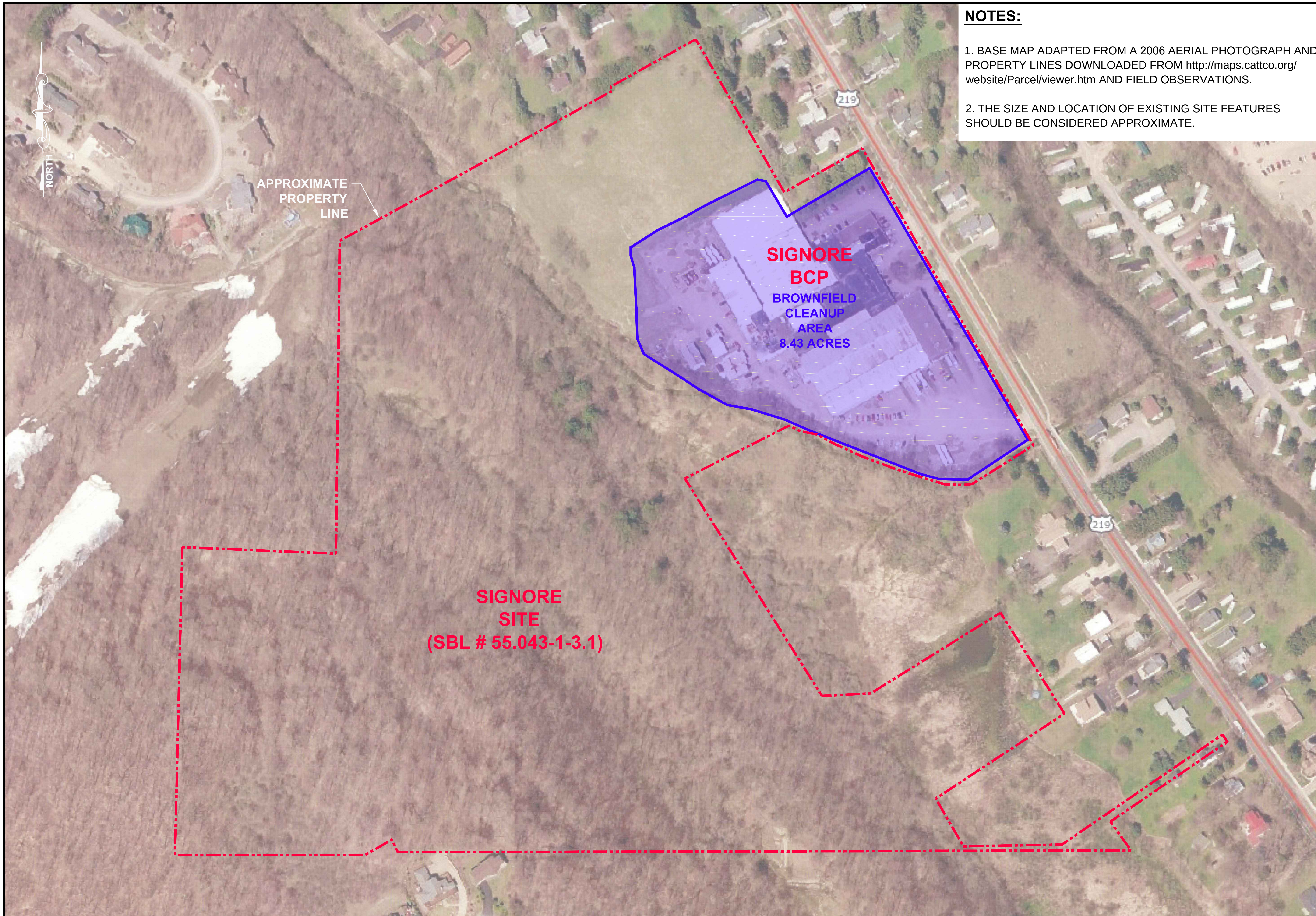
SCALE IN FEET
0 500 1000 2000

SITE MANAGEMENT PLAN
FORMER SIGNORE FACILITY
ELLICOTTVILLE, NEW YORK
BROWNFIELD CLEANUP PROGRAM
SITE NO. C905034
LOCUS PLAN

PROJECT No.
21.0056367.50

FIGURE No.
1

GZA-J:\21.0056367.50\Figures\CAD\Figure 1 Locus Plan.dwg [Figure 1] July 23, 2015 - 4:41pm miguel.torres



NOTES:

1. BASE MAP ADAPTED FROM A 2006 AERIAL PHOTOGRAPH AND PROPERTY LINES DOWNLOADED FROM http://maps.cattco.org/website/Parcel/viewer.htm AND FIELD OBSERVATIONS.

2. THE SIZE AND LOCATION OF EXISTING SITE FEATURES SHOULD BE CONSIDERED APPROXIMATE.

DRAWN BY: DEW

DATE: JULY 2015

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APPROXIMATE SCALE IN FEET

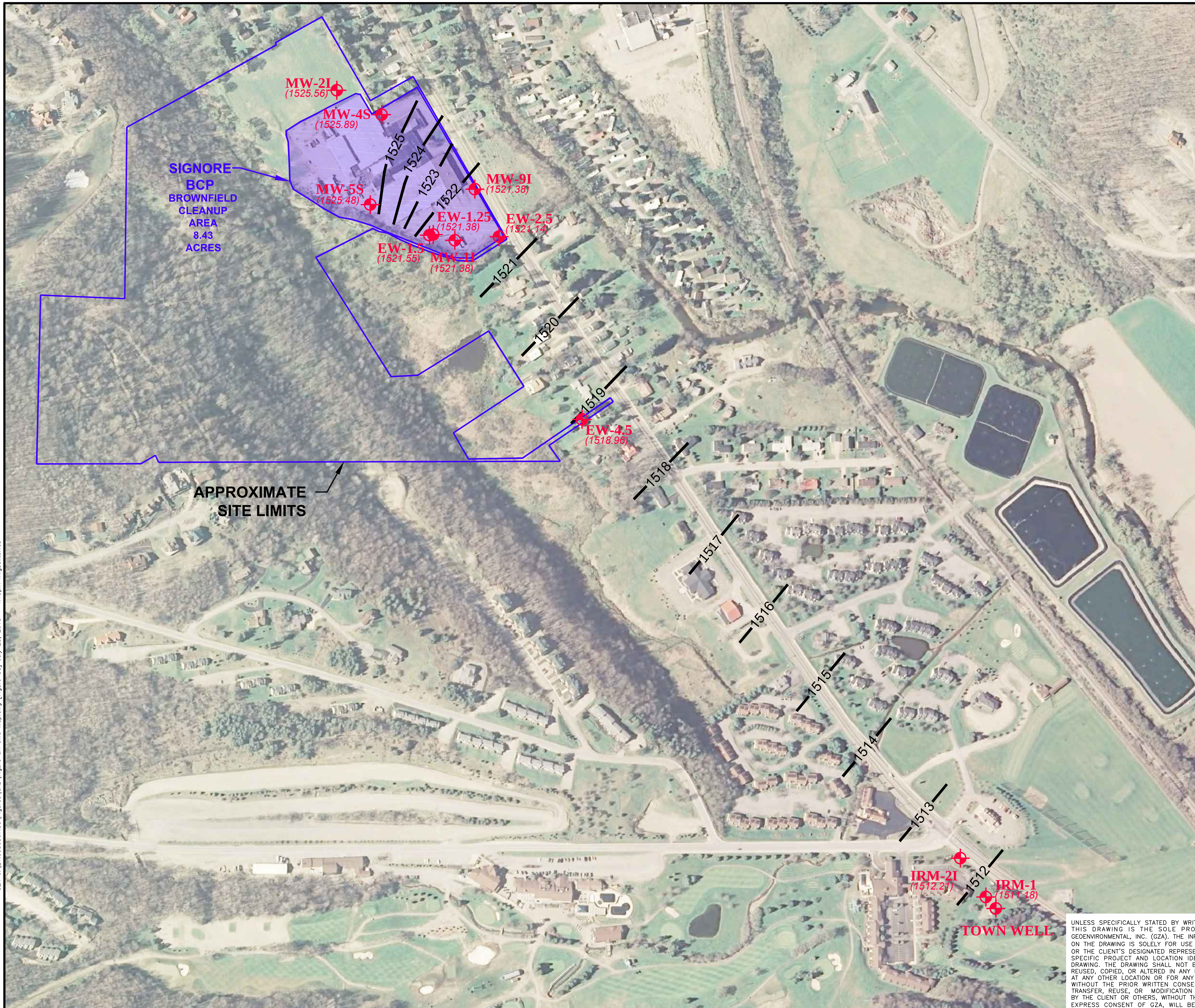
0 100 200 400

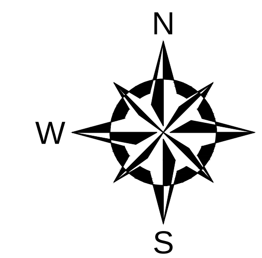
SITE MANAGEMENT PLAN
FORMER SIGNORE FACILITY
ELLICOTTVILLE, NEW YORK
BROWNFIELD CLEANUP PROGRAM
SITE NO. C905034
SITE LAYOUT MAP

PROJECT No.
21.0056367.50

FIGURE No.
2

GZA-J:\21.0056367.50\Figures\CAD\Figure 2 Site Layout Map.dwg [Figure 2] July 23, 2015 - 4:32pm miguel.torres





LEGEND:

MW-9I (1521.38) — APPROXIMATE LOCATION AND DESIGNATION OF GROUNDWATER MONITORING WELL INSTALLED BY OTHERS, SHOWN WITH GROUNDWATER ELEVATION MEASURED ON JUNE 2-4, 2015.

1520 — APPROXIMATE LOCATION AND GROUNDWATER ELEVATION CONTOUR AS MEASURED ON JUNE 2-4, 2015 (SEE NOTE 3).

NOTES:

1. BASE MAP ADAPTED FROM A 2006 AERIAL PHOTO DOWNLOADED FROM http://www.nysgis.state.ny.us/gateway/mg/index.html AND FIELD OBSERVATIONS.

2. THE SIZE AND LOCATION OF EXISTING SITE FEATURES SHOULD BE CONSIDERED APPROXIMATE.

3. THE GROUNDWATER CONTOURS SHOWN WERE DEVELOPED BY INTERPOLATING BETWEEN WIDELY SPACED MONITORING WELLS AND ARE SHOWN ON THIS DRAWING FOR DISCUSSION PURPOSES ONLY. ACTUAL GROUNDWATER ELEVATIONS WILL VARY DUE TO PRECIPITATION, BAROMETRIC PRESSURE AND OTHER FACTORS.

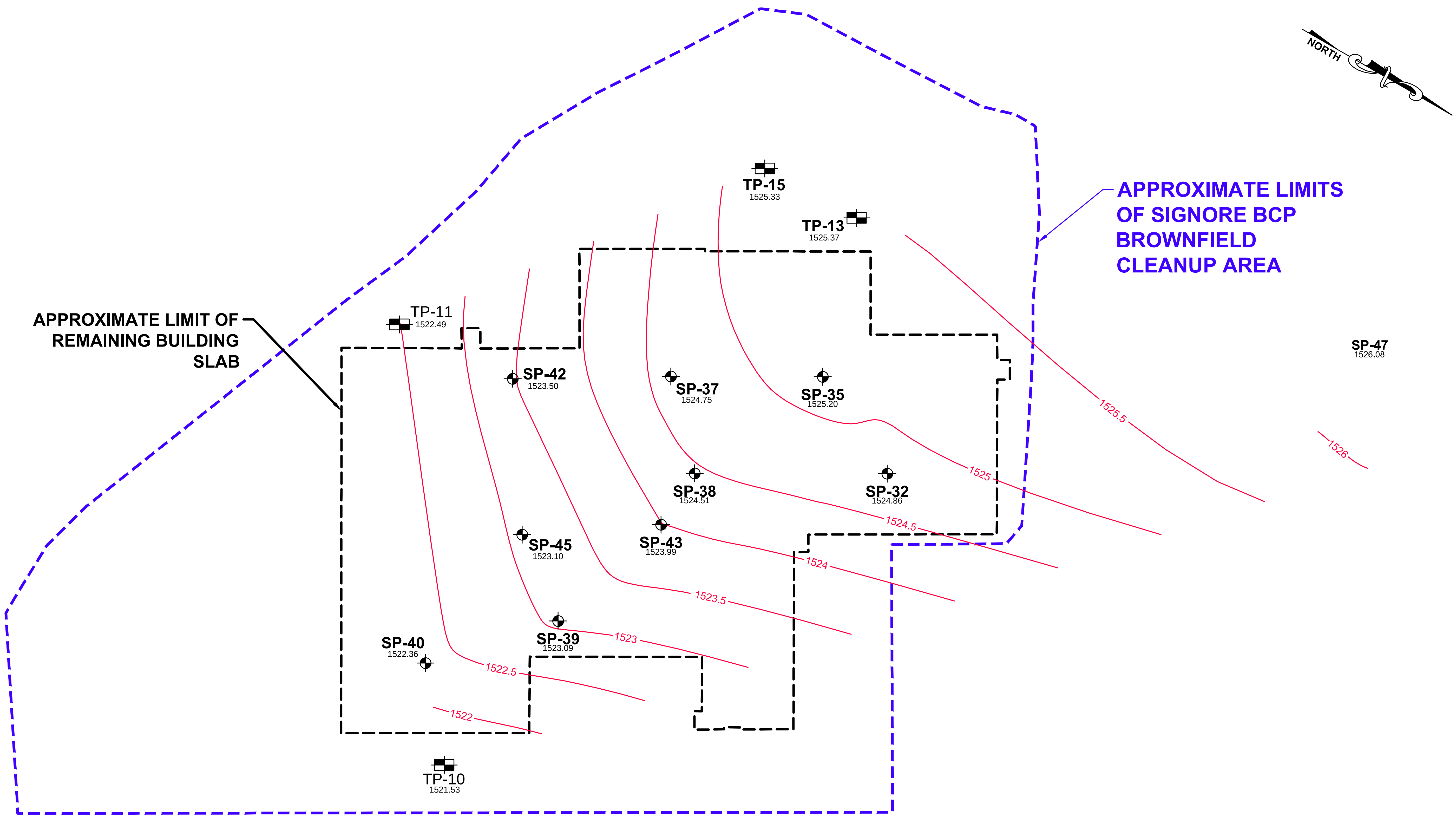
0 200 400 800
SCALE IN FEET

NO.	ISSUE/DESCRIPTION	BY	DATE

FORMER SIGNORE FACILITY
55 JEFFERSON STREET
ELLICOTTVILLE, NEW YORK

JUNE 2015
GROUNDWATER CONTOUR MAP

PREPARED BY:		PREPARED FOR:	
GZA GeoEnvironmental of N.Y. Engineers and Scientists 535 WASHINGTON STREET 11th FLOOR BUFFALO, NEW YORK 14203 (716) 685-2300		ISKALO ELLICOTTVILLE HOLDINGS, LLC	
PROJ MGR: JR	REVIEWED BY:	CHECKED BY:	FIGURE 3A
DESIGNED BY:	DRAWN BY: DEW	SCALE: AS SHOWN	
DATE JULY 2015	PROJECT NO. 21.0056367.50	REVISION NO.	



NOTES:

1. THE SIZE AND LOCATION OF EXISTING SITE FEATURES SHOULD BE CONSIDERED APPROXIMATE.

LEGEND:

SP-47 1526.08 — APPROXIMATE LOCATION AND DESIGNATION OF 1" MICROWELL INSTALLED, AND GROUNDWATER ELEVATION MEASURED ON NOVEMBER 16, 2012.

1522 — APPROXIMATE LOCATION AND ELEVATION OF GROUNDWATER CONTOUR LINE BASED ON MEASUREMENTS TAKEN ON NOVEMBER 16, 2012..

DRAWN BY: DEW

DATE: JULY 2015

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APPROXIMATE SCALE IN FEET

0 40 80 160

SITE MANAGEMENT PLAN

FORMER SIGNORE FACILITY

ELLICOTTVILLE, NEW YORK

BROWNFIELD CLEANUP PROGRAM

SITE NO. C905034

MICROWELL GROUNDWATER ELEVATION CONTOUR PLAN

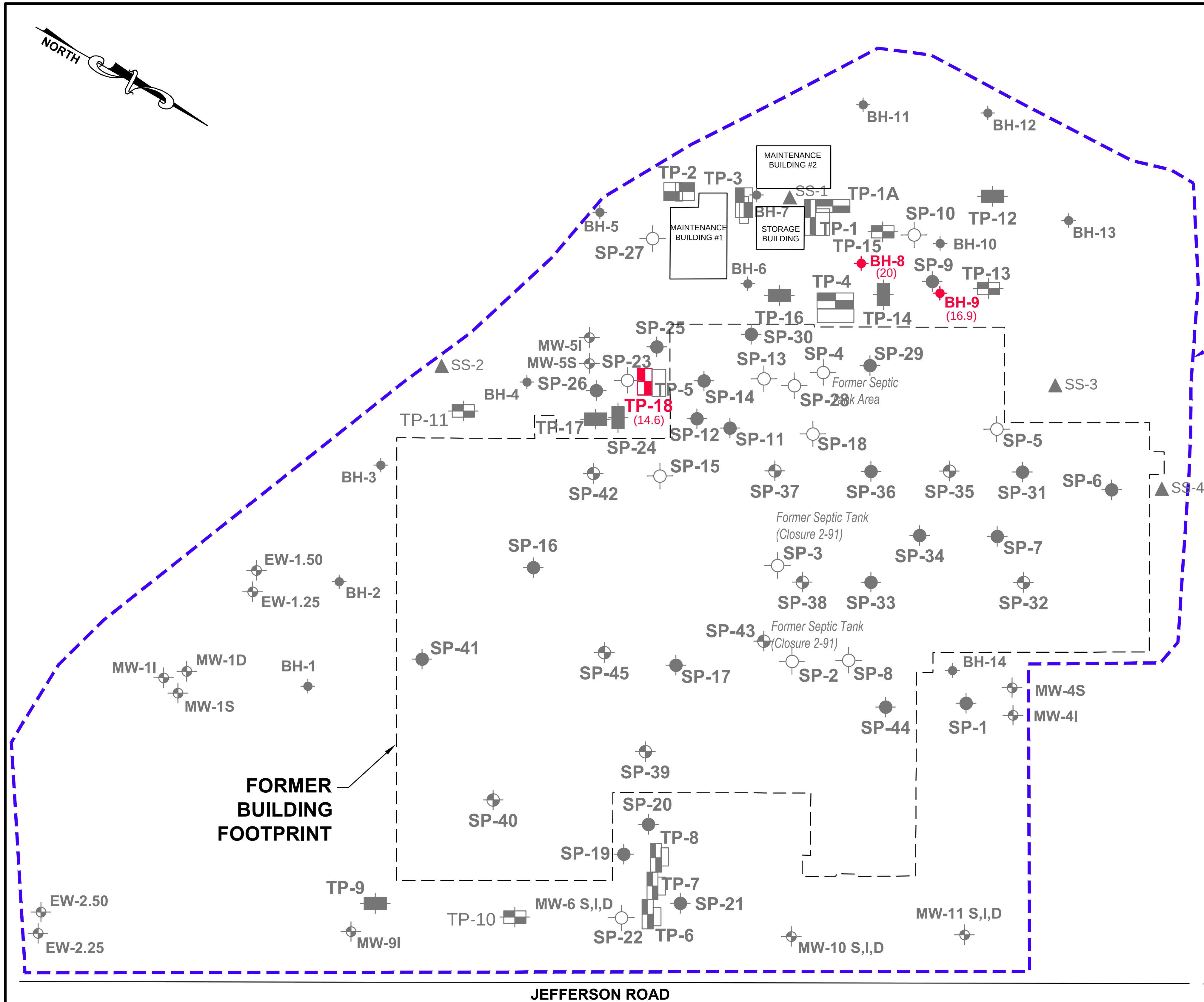
PROJECT No.

21.0056367.50

FIGURE No.

3B

GZA-J:\21.0056367.50\Figures\CAD\Figure 3B Groundwater Contour Plan.dwg [Figure 3B] July 23, 2015 - 11:09am miguel.torres



LEGEND:

SP-33	APPROXIMATE LOCATION AND DESIGNATION OF SOIL PROBE
SP-32	APPROXIMATE LOCATION AND DESIGNATION OF SOIL PROBE WITH 1" MICROWELL INSTALLED
TP-18	APPROXIMATE LOCATION AND DESIGNATION OF TEST PIT
TP-10	APPROXIMATE LOCATION AND DESIGNATION OF TEST PIT WITH 1" MICRO-WELL INSTALLED
SS-3	APPROXIMATE LOCATION AND DESIGNATION OF SURFACE SOIL SAMPLE
BH-1	APPROXIMATE LOCATION AND DESIGNATION OF BORE HOLES DONE PREVIOUSLY
SP-20	APPROXIMATE LOCATION AND DESIGNATION OF SOIL PROBE DONE BY MATRIX ENVIRONMENTAL TECHNOLOGIES, INC. IN OCTOBER 2007
SP-27	APPROXIMATE LOCATION AND DESIGNATION OF SOIL PROBES WITH TEMPORARY MICROWELL DONE BY MATRIX ENVIRONMENTAL TECHNOLOGIES, INC. IN OCTOBER 2007
TP-8	APPROXIMATE LOCATION AND DESIGNATION OF TEST PIT DONE BY MATRIX ENVIRONMENTAL TECHNOLOGIES, INC. IN OCTOBER 2007
EW-1.25	APPROXIMATE LOCATION AND DESIGNATION OF EXISTING MONITORING WELL SAMPLED
/	APPROXIMATE LOCATION OF TEST PIT/BOREHOLE WITH ARESENIC (mg/kg) RESTRICTED RESIDENTIAL EXCEEDANCE

NOTES:

1. BASE MAP ADAPTED FROM A 2006 AERIAL PHOTOGRAPH DOWNLOADED FROM www.cattco.org/real_property/parcel_news.asp AND FIELD OBSERVATIONS.

2. THE SIZE AND LOCATION OF EXISTING SITE FEATURES SHOULD BE CONSIDERED APPROXIMATE.

DRAWN BY: DEW

DATE: JULY 2015

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APPROXIMATE SCALE IN FEET

0 40 80 160

SITE MANAGEMENT PLAN

FORMER SIGNORE FACILITY

ELLICOTTVILLE, NEW YORK

BROWNFIELD CLEANUP PROGRAM

SITE NO. C905034

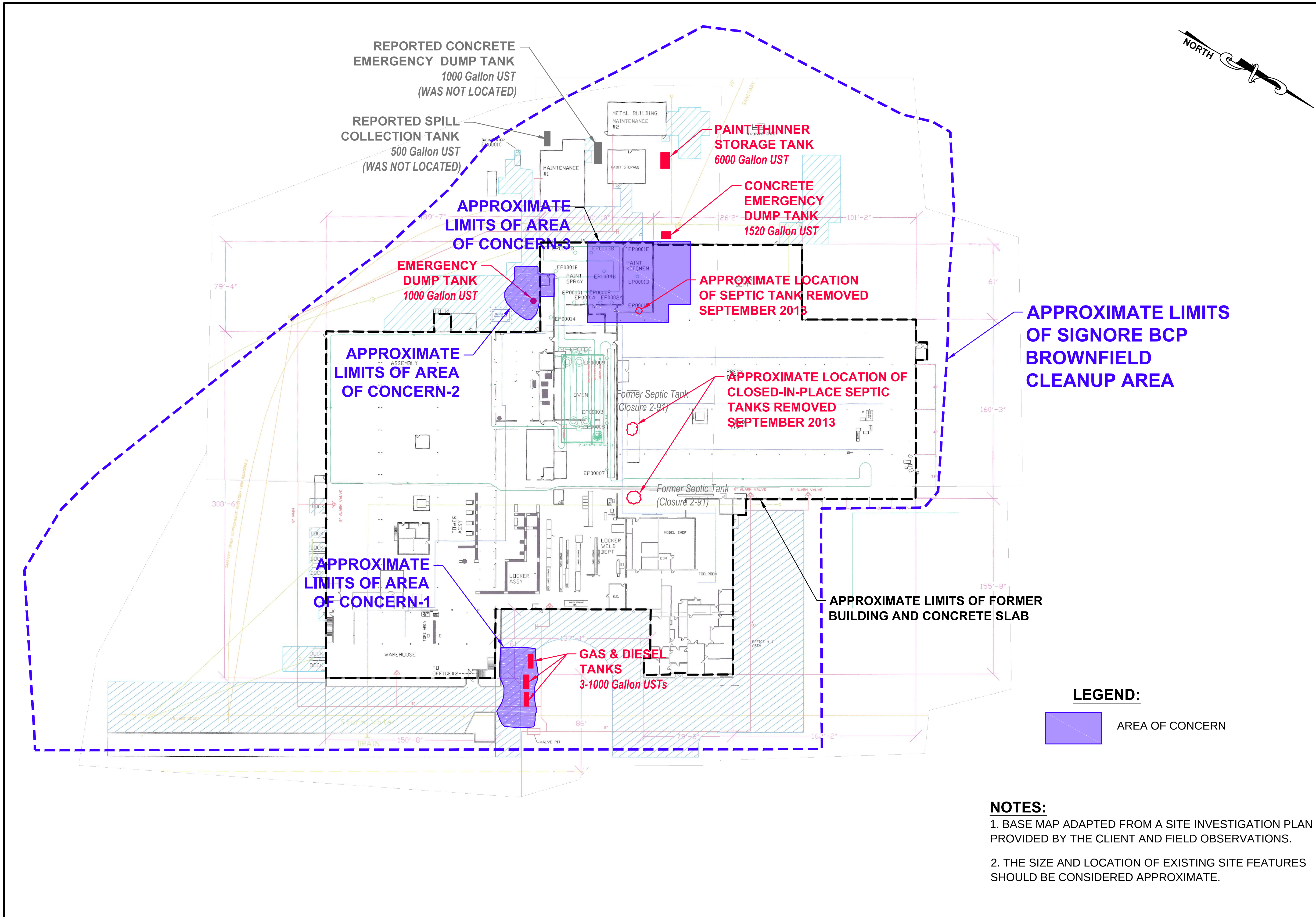
REMAINING SOIL SAMPLE EXCEEDANCES

PROJECT No.

21.0056367.50

FIGURE No.

4



DRAWN BY: DEW
DATE: JULY 2015

GZA GeoEnvironmental of New York

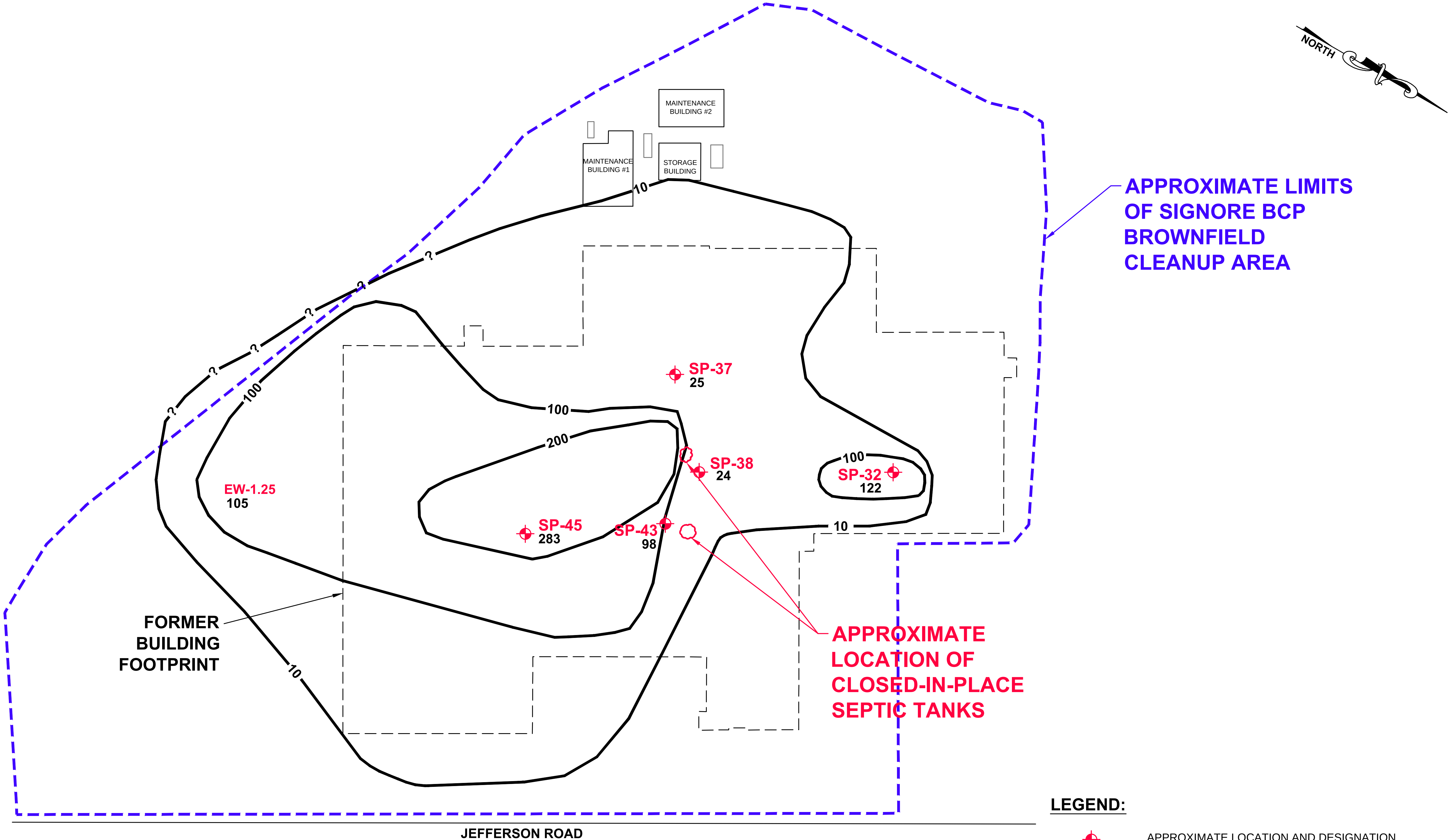
APPROXIMATE SCALE IN FEET
0 40 80 160

SITE MANAGEMENT PLAN
FORMER SIGNORE FACILITY
ELLICOTTVILLE, NEW YORK
BROWNFIELD CLEANUP PROGRAM
SITE NO. C905034
HISTORICAL SITE AREAS OF CONCERN

PROJECT No.
21.0056367.50

FIGURE No.
5

GZA-J:\56000's\21.0056367.50\Figures\CAD\SMP-2015\Figure 5 Historical Site AOCs.dwg [Figure 3] September 14, 2015 - 12:57pm edward.morris



LEGEND:

SP-45 — APPROXIMATE LOCATION AND DESIGNATION OF WELLS MONITORED AS PART OF PILOT TESTING (6 LOCATIONS)

122 — MEASURED CONCENTRATION (AT SAMPLING POINT) OF TOTAL CHLORINATED VOCs IN GROUNDWATER (PARTS PER BILLION, PPB)

100 — CONTOUR OF CONCENTRATION OF TOTAL CHLORINATED VOCs IN GROUNDWATER (PARTS PER BILLION, PPB)

NOTES:

1. BASE MAP ADAPTED FROM A 2006 AERIAL PHOTOGRAPH DOWNLOADED FROM www.cattco.org/real_property/parcel_news.asp AND FIELD OBSERVATIONS.

2. THE SIZE AND LOCATION OF EXISTING SITE FEATURES SHOULD BE CONSIDERED APPROXIMATE.

DRAWN BY: DEW

DATE: JULY 2015

GZA GeoEnvironmental of New York

APPROXIMATE SCALE IN FEET: 0 40 80 160

SITE MANAGEMENT PLAN
FORMER SIGNORE FACILITY
ELLICOTTVILLE, NEW YORK
BROWNFIELD CLEANUP PROGRAM
SITE NO. C905034

PRE-REMEDIAL INJECTION TOTAL CHLORINATED VOC GROUNDWATER CONCENTRATIONS

PROJECT No. 21.0056367.50

FIGURE No. 6

Table 2
Remaining Soil Sample Exceedances
Site Management Plan
Former Signore Facility
Ellicottville, New York
BCP Site No. C905034

Sample Location Sample Depth (ft bgs) Sample Date	Part 375 Unrestricted SCOs	Part 375 Restricted Residential SCOs	Part 375 Commercial SCOs	BH-8 4-6 7/30/90 - 8/3/90	Q	BH-9 10-11.5 7/30/90 - 8/3/90	Q	TP-18 2.3 9/26/2012	Q
Metals - EPA Method 6010/7471 (mg/kg)									
Arsenic	**13**	16	16	**20**	J	**16.9**	J	**14.6**	

NOTES:

Notes:

1. Only soil samples with exceedances are presented in this table.
2. Q = laboratory qualifier. J = estimated concentration.
3. mg/kg = parts per million.
4. Part 375 Residential Soil Cleanup Objectives (SCOs) are from NYCRR Subpart 375-6, Remedial Program Soil Cleanup Objectives, dated December 14, 2006.
5. BH-8 and BH-9 conducted during Remedial Investigation by others in July and August 1990.
6. **BOLD** Concentrations exceed its Part 375 Unrestricted SCOs.
7. Shaded Concentrations exceed its Part 375 Restricted Residential and Commercial SCO (same value).

Table 3
Representative Groundwater Elevation Measurements
Former Signore Facility
Ellicottville, New York
BCP Site No. C905034

	June 2015 Semi-Annual Groundwater Elevation Measurements			
	Monitoring Well Location	**Top of Riser Elevation (ft.)**	**Groundwater Depth (ft.)**	**Groundwater Elevation (ft.)**
On-Site BCP Wells	EW-1.25	1531.96	10.58	1521.38
	EW-1.5	1532.05	10.50	1521.55
	EW-2.5	1533.92	12.78	1521.14
	MW-1I	1531.79	10.41	1521.38
	MW-4S	1535.32	9.43	1525.89
	MW-5S	1534.16	8.68	1525.48
	MW-9I	1532.30	10.92	1521.38
Off-Site Wells	MW-2I	1540.87	15.31	1525.56
	EW-4.5	1535.65	16.69	1518.96
	IRM-1	1534.75	23.57	1511.18
	IRM-2I	1535.99	23.78	1512.21
	November 2012 Supplemental Remedial Investigation Groundwater Elevation Measurements			
	Monitoring Well Location	**Top of Riser Elevation (ft.)**	**Groundwater Depth (ft.)**	**Groundwater Elevation (ft.)**
On-Site BCP Wells	SP-32	1514.32	10.54	1524.86
	SP-35	1514.81	10.39	1525.20
	SP-37	1514.19	10.56	1524.75
	SP-38	1513.71	10.80	1524.51
	SP-39	1511.54	11.55	1523.09
	SP-40	1509.83	12.53	1522.36
	SP-42	1512.81	10.69	1523.50
	SP-43	1512.79	11.20	1523.99
	SP-45	1511.30	11.80	1523.10
	SP-47	1510.29	15.79	1526.08
	TP-10	1510.16	11.37	1521.53
	TP-11	1510.39	12.10	1522.49
	TP-13	1515.65	9.72	1525.37
	TP-15	1515.78	9.55	1525.33

Table 4
Analytical Sample Summary
IRM Analytical Testing Program Summary
Revised SRI/IRM/AA Report
Former Signore Facility
Ellicottville, New York
BCP Site No. C905034

Location	Date Collected	Depth/ Interval (ft bgs)	VOCs EPA Method 8260-TCL	SVOCs EPA Method 8270-STARS	RCRA 8 Metals EPA Method 6010/7471	SVOCs EPA Method 8270-BN	PCBs EPA Method 8082	TCLP VOCs EPA Method 8260C	TCLP LEAD EPA Method 6010C	FLASHPOINT EPA Method 1010	VOCs EPA Method SW-846, 8260B	SVOCs EPA Method 8270-BN Acid Extractables	Methane, Ethane, Ethene RSK 175	T.O.C. EPA Method 9060	Chloride, Sulfate EPA Method 300	Nitrate EPA Method 335.2	Dissolved Iron, Manganese SW-846, 6010B
SOIL SAMPLES AOC-1 EXCAVATION																	
AOC-1-E-WALL	11/3/2011	5 to 7	X	X													
AOC-1-NE-WALL	11/3/2011	5 to 7	X	X													
AOC-1-BOTTOM-E	11/3/2011	10.5 to 11	X	X													
AOC-1-NW-WALL	11/4/2011	6 to 10	X	X													
AOC-1-BOTTOM-W	11/4/2011	7 to 8	X	X													
AOC-1-SE-WALL	11/4/2011	6 to 8	X	X													
AOC-1-SW-WALL	11/7/2011	7 to 10	X	X													
AOC-1-BOTTOM-CENTER	11/9/2011	15	X	X													
AOC-1-BOTTOM-SW	11/9/2011	15	X	X													
AOC-1-BOTTOM-W	11/11/2011	15	X	X													
AOC-1-W-WALL	11/11/2011	9 to 11	X	X													
SOIL SAMPLES AOC-2 EXCAVATION																	
EXC-2-NE-WALL	10/24/2011	8 to 10	X	X													
EXC-2-NW-WALL	10/24/2011	8 to 10	X	X													
EXC-2-BOTTOM-N	10/25/2011	14 to 15	X	X													
EXC-2-BOTTOM-S	10/25/2011	14 to 15	X	X													
EXC-2-SW-WALL	10/25/2011	8 to 10	X	X													
EXC-2-S-WALL	10/25/2011	8 to 10	X	X													
EXC-2-E-WALL	10/25/2011	8 to 10	X	X													
EXC-2-SE-WALL	10/25/2011	8 to 10	X	X													
EXC-2-BOTT-NWALL	8/12/2013	14	X														
EXC-2-BOTT-SWWALL	8/12/2013	15	X														
EXC-2-NWWALL-5	8/12/2013	5	X														
EXC-2-BOTT-SEWALL	8/12/2013	15	X														
SOIL SAMPLES AOC-3 EXCAVATION																	
AOC-3-BOTT-SW	8/13/2013	15	X														
AOC-3-BOTT-NW	8/13/2013	15	X														
AOC-3-STOCK-S	8/14/2013	NA	X														
AOC-3-STOCK-N	8/14/2013	NA	X														
AOC-3-BOTT-3	8/15/2013	15	X														
AOC-3-WWALL-1	8/15/2013	12	X														
AOC-3-WWALL-2	8/15/2013	12	X														
AOC-3-WWALL-3	8/15/2013	10	X														
AOC-3-NWALL-1	8/19/2013	12	X														
AOC-3-BOTT-4	8/19/2013	15	X														
AOC-3-SWALL-1	8/19/2013	12	X														
AOC-3-EWALL-1	8/22/2013	12	X														
AOC-3-BOTT-5	8/22/2013	15	X														
AOC-3-EWALL-2	8/22/2013	12	X														
AOC-3-SWALL-2	8/22/2013	12	X														
AOC-3-NWALL-2	8/22/2013	14	X														
AOC-3-EWALL-3	8/22/2013	12	X														
AOC-3-BOTT-6	8/22/2013	15	X														
SOIL SAMPLES 6,000-GALLON STEEL UST EXCAVATION																	
UST-EXC-N-WALL	10/28/2011	5 to 7	X	X													
UST-EXC-S-WALL	10/28/2011	5 to 7	X	X													
UST-EXC-E-WALL	10/28/2011	5 to 7	X	X													
UST-EXC-W-WALL	10/28/2011	5 to 7	X	X													
UST-EXC-BOTTOM	10/28/2011	9 to 9.5	X	X													
GROUNDWATER SAMPLE AOC-1 EXCAVATION																	
AOC-1-GW	11/9/2011	NA	X														
GROUNDWATER SAMPLE AOC-2 EXCAVATION																	
EXC-2-GW	10/25/2011	NA	X	X													
GROUNDWATER SAMPLES AOC-3 EXCAVATION																	
AOC-3-GW	8/14/2013	NA	X														
AOC-3-GW-2	8/22/2013	NA	X														
GROUNDWATER SAMPLES FALL 2013 ELECTRON DONOR COMPOUND INJECTION PILOT STUDY																	
EW-1.25	10/17/2013	NA	X										X	X	X	X	X
SP-32	10/17/2013	NA									X		X	X	X	X	X
SP-37	10/17/2013	NA									X		X	X	X	X	X
SP-38	10/17/2013	NA									X		X	X	X	X	X
SP-43	10/17/2013	NA									X		X	X	X	X	X
SP-45	10/17/2013	NA									X		X	X	X	X	X

Notes:
1. ft bgs = feet below ground surface.
2. VOCs = Volatile Organic Compounds.
3. SVOCs = Semi-Volatile Organic Compounds.
4. RCRA Metals = Resource Conservation and Recovery Act.
5. PCBs = Polychlorinated biphenyls.
6. TCL = Target Compound List.
7. BN = Base Neutrals.
8. TCLP = Toxicity Characteristic Leaching Procedure.
9. T.O.C. = Total Organic Carbon

Table 5
IRM AOC-1 Confirmatory Soil Sample Results Summary
Revised SRI/IRM/AA Report
Former Signore Facility
Ellicottville, New York
BCP Site No. C905034

Parameter	Protection of Groundwater Restricted Use Soil Cleanup Objectives	**Restricted Residential Use Soil Cleanup Objectives**	Restricted Commercial Soil Cleanup Objectives	AOC-1-E-Wall 5 to 7 feet bgs Results	AOC-1-NE-Wall 5 to 7 feet bgs Results	AOC-1-Bottom-E 10.5 to 11 feet bgs Results	AOC-1-NW-Wall 6 to 10 feet bgs Results	AOC-1-Bottom-W 7 to 8 feet bgs Results	AOC-1-SE-Wall 6 to 8 feet bgs Results	AOC-1-SW-Wall 7 to 10 feet bgs Results	AOC-1-Bottom-Center 15 feet bgs. Results	AOC-1-Bottom-SW 15 feet bgs Results	AOC-1-Bottom-W 15 feet bgs Results	AOC-1-W-Wall 9 to 11 feet bgs Results
Volatile Organic Compounds - EPA Method 8260 TCL (ug/kg)														
Carbon disulfide	NV	**NV**	NV	< 6.1	< 6.3	< 5.6	< 5.5	< 6.2	< 6	< 5.6	0.57J	< 5.6	< 6.5	< 6.1
Acetone	50	**100,000**	500,000	43	< 6.3	< 5.6	< 5.5	< 6.2	< 6	< 5.6	81	12	18	< 6.1
Methylene chloride	50	**100,000**	500,000	2.3J	2.4J	2.3J	2.3J	< 6.2	< 6	< 5.6	< 5.6	< 5.6	< 6.5	< 6.1
2-Butanone	NV	**NV**	NV	3.4J	< 6.3	< 5.6	< 5.5	< 6.2	< 6	< 5.6	< 5.6	< 5.6	< 6.5	< 6.1
Benzene	60	**4,800**	44,000	< 6.1	< 6.3	< 5.6	2.4J	< 6.2	< 6	4.3J	300J	6.3	< 6.5	< 6.1
Toluene	700	**100,000**	500,000	< 6.1	< 6.3	< 5.6	16	1.9J	< 6	84	3,100	88B	2.3J	2.3J
Ethylbenzene	1,000	**41,000**	390,000	< 6.1	< 6.3	< 5.6	5.1J	< 6.2	< 6	32	870	12	< 6.5	< 6.1
m&p-Xylene	1,600	**100,000**	500,000	< 6.1	< 6.3	< 5.6	32	< 6.2	< 6	180	6,800	78	< 6.5	< 6.1
o-Xylene	1,600	**100,000**	500,000	< 6.1	< 6.3	< 5.6	8.3	< 6.2	< 6	61	2,100	25	< 6.5	< 6.1
Isopropylbenzene	NV	**NV**	NV	< 6.1	< 6.3	< 5.6	< 5.5	< 6.2	< 6	< 5.6	28	< 5.6	< 6.5	< 6.1
n-Propylbenzene	3,900	**100,000**	500,000	< 6.1	< 6.3	< 5.6	1.5J	< 6.2	< 6	14	170	< 5.6	< 6.5	< 6.1
1,3,5-Trimethylbenzene	8,400	**52,000**	190,000	< 6.1	< 6.3	< 5.6	5.1J	< 6.2	< 6	45	1,100	4.1J	< 6.5	< 6.1
1,2,4-Trimethylbenzene	3,600	**52,000**	190,000	< 6.1	< 6.3	< 5.6	18	< 6.2	< 6	110	3,800	10	< 6.5	< 6.1
Naphthalene	12,000	**100,000**	500,000	< 6.1	< 6.3	< 5.6	2.4J	< 6.2	< 6	6.9	90	< 5.6	< 6.5	< 6.1
Total VOCs				48.7	2.4	2.3	93.1	1.9	<	537.2	18,439.6	235.4	20.3	2.3
Semi-Volatile Organic Compounds - EPA Method 8270 TCL (ug/kg)														
Naphthalene	12,000	**100,000**	500,000	< 410	< 430	< 370	< 400	< 410	< 390	< 370	130	< 370	< 430	< 410
Fluoranthene	100,000	**100,000**	500,000	< 410	110J	< 370	< 400	210J	< 390	< 370	< 380	< 370	110J	< 410
Pyrene	100,000	**100,000**	500,000	< 410	< 430	< 370	< 400	130J	< 390	< 370	< 380	< 370	87J	< 410
Benzo [a] anthracene	1,000	**1,000**	5,600	< 410	< 430	< 370	< 400	88J	< 390	< 370	< 380	< 370	< 430	< 410
Chrysene	1,000	**3,900**	56,000	< 410	< 430	< 370	< 400	120J	< 390	< 370	< 380	< 370	< 430	< 410
Benzo [b] fluoranthene	1,700	**1,000**	5,600	< 410	< 430	< 370	< 400	130J	< 390	< 370	< 380	< 370	< 430	< 410
Benzo [a] pyrene	22,000	**1,000**	1,000	< 410	< 430	< 370	< 400	89J	< 390	< 370	< 380	< 370	< 430	< 410
Benzo [g,h,i] perylene	1,000,000	**100,000**	500,000	< 410	< 430	< 370	< 400	91J	< 390	< 370	< 380	< 370	< 430	< 410
Total SVOCs				<	110	<	<	858	<	<	130	<	197	<

Notes:
1. Compounds detected in one or more samples are presented on this table. Refer to Attachment C for list of all compounds included in analysis.
2. Analytical testing completed by Spectrum Analytical., Inc. located in Warwick, RI.
3. ug/kg = part per billion, mg/kg = part per million.
4. NV = no value.
5. "J" qualifier = indicates an estimated value due to either the compound being detected below the report limit, or an estimated concentration for tentatively identified compound.
6. "B" qualifier = compound was also detected in the associated Method Blank.
7. < 6.1 = compound was not detected above its respective reporting limit.
8. Shading indicates value exceeds Restricted Commercial Use Soil Cleanup Objectives.
9. **Bold** indicates value exceeds Restricted Residential Use Soil Cleanup Objectives.
10. Underline indicates value exceeds Protection of Groundwater Restricted Use Soil Cleanup Objectives.
11. Soil cleanup objectives (SCOs) are from NYSDEC Part 375, Subpart 375-6: Unrestricted Use and Restricted Use Soil Cleanup Objectives.

Table 6
IRM AOC-2 and AOC-3 Confirmatory Soil Sample Results Summary
Revised SRI/IRM/AA Report
Former Signore Facility
Ellicottville, New York
BCP Site No. C905034

				AOC-2											
Parameter	Protection of Groundwater Restricted Use Soil Cleanup Objectives	**Part 375 - Restricted Residential Use SCOs**	Restricted Com Soil Cleanup Objectives	EXC-2-NE-WALL 8 to 10 feet bgs Results	EXC-2-NW-Wall 8 to 10 feet bgs Results	EXC-2-Bottom-N 14 to 15 feet bgs Results	EXC-2-Bottom-S 14 to 15 feet bgs Results	EXC-2-SW-Wall 8 to 10 feet bgs Results	EXC-2-S-Wall 8 to 10 feet bgs Results	EXC-2-E-Wall 8 to 10 feet bgs Results	EXC-2-SE-Wall 8 to 10 feet bgs Results	EXC-2-BOTT-NWALL 14 feet bgs Results	EXC-2-BOTT-SWWALL 15 feet bgs Results	EXC-2-BOTT-SEWALL 15 feet bgs Results	EXC-2-NWWALL-5 5 feet bgs Results
Volatile Organic Compounds - EPA Method 8260 TCL (ug/kg)															
Acetone	50	**100,000**	500,000	< 6	< 3,700	7.9	< 5.8	< 5.3	< 6.1	5.2J	< 6.1	< 5.7	< 6.1	< 6.2	< 5.9
1,1,1-Trichloroethane	680	**100,000**	500,000	< 6	< 3,700	2.8J	1.4J	< 5.3	< 6.1	< 5.5	< 6.1	< 5.7	< 6.1	< 6.2	< 5.9
Tetrachloroethene	1300	**19,000**	150,000	< 6	< 3,700	1.6J	2.8J	2J	3J	< 5.5	1.9J	< 5.7	< 6.1	< 6.2	< 5.9
Trichloroethene	470	**21,000**	200,000	< 6	< 3,700	< 5.8	9.6	1.7J	2.7J	< 5.5	1.2J	< 5.7	< 6.1	< 6.2	< 5.9
Methylene chloride	50	**100,000**	500,000	< 6	< 3,700	< 5.8	< 5.8	< 5.3	< 6.1	< 5.5	< 6.1	< 5.7	< 6.1	< 6.2	< 5.9
Toluene	700	**100,000**	500,000	13	**400,000D**	2,500	< 5.8	< 5.3	5.4J	13	4.7J	< 5.7	2.9 J	2.7 J	< 5.9
Ethylbenzene	1,000	**41,000**	390,000	< 6	**81,000D**	750	< 5.8	< 5.3	< 6.1	< 5.5	< 6.1	< 5.7	< 6.1	< 6.2	< 5.9
m&p-Xylene	1,600	**100,000**	500,000	2.9J	**290,000D**	4,900	< 5.8	< 5.3	4.2J	3.4J	2.4J	< 5.7	< 6.1	14	< 5.9
o-Xylene	1,600	**100,000**	500,000	< 6	**110,000D**	2,300	< 5.8	< 5.3	1.5J	1.2J	< 6.1	< 5.7	2.6 J	23	< 5.9
Isopropylbenzene	NV	**NV**	NV	< 6	2,800J	35	< 5.8	< 5.3	< 6.1	< 5.5	< 6.1	< 5.7	< 6.1	< 6.2	< 5.9
n-Propylbenzene	3,900	**100,000**	500,000	< 6	2,000J	19	< 5.8	< 5.3	< 6.1	< 5.5	< 6.1	< 5.7	< 6.1	< 6.2	< 5.9
1,3,5-Trimethylbenzene	8,400	**52,000**	190,000	< 6	< 3,700	19	< 5.8	< 5.3	< 6.1	< 5.5	< 6.1	< 5.7	< 6.1	< 6.2	< 5.9
sec-Butylbenzene	11,000	**100,000**	500,000	< 6	< 3,700	< 5.8	< 5.8	< 5.3	< 6.1	< 5.5	< 6.1	< 5.7	< 6.1	< 6.2	< 5.9
1,2,4-Trimethylbenzene	3,600	**52,000**	190,000	< 6	1,500J	35	< 5.8	< 5.3	2.7J	< 5.5	2.1J	< 5.7	< 6.1	< 6.2	< 5.9
p-Isopropyltoluene	10,000 Note 11	**NV**	NV	< 6	< 3,700	< 5.8	< 5.8	< 5.3	< 6.1	< 5.5	< 6.1	< 5.7	< 6.1	< 6.2	< 5.9
n-Butylbenzene	12,000	**100,000**	NV	< 6	< 3,700	< 5.8	< 5.8	< 5.3	< 6.1	< 5.5	< 6.1	< 5.7	< 6.1	< 6.2	< 5.9
Naphthalene	12,000	**100,000**	500,000	< 6	< 3,700	< 5.8	< 5.8	< 5.3	< 6.1	< 5.5	< 6.1	< 5.7	< 6.1	< 6.2	< 5.9
Total VOCs				15.9	887,300	10570.3	13.8	3.7	19.5	22.8	12.3	0	5.5	39.7	0
Semi-Volatile Organic Compounds - EPA Method 8270 TCL (ug/kg)															
Total SVOCs				<	<	<	<	<	<	<	<	NT	NT	NT	NT

Notes:
1. Compounds detected in one or more samples are presented on this table. Refer to Attachment C for list of all compounds included in analysis.
2. Analytical testing completed by Spectrum Analytical., Inc. located in Warwick, RI.
3. ug/kg = part per billion, mg/kg = part per million.
4. NV = no value.
5. "J" qualifier = indicates an estimated value due to either the compound being detected below the report limit, or an estimated concentration for tentatively identified compound.
6. "B" qualifier = compound was also detected in the associated Method Blank.
7. "D" qualifier = compound concentration was obtained from a secondary dilution analysis.
8. < 6 = compound was not detected above its respective reporting limit.
9. Shading indicates value exceeds Restricted Commercial Use Soil Cleanup Objectives.
10. **Bold** indicates value exceeds Restricted Residential Use Soil Cleanup Objectives.
11. NT = Not tested.
12. Underline indicates value exceeds Protection of Groundwater Restricted Use Soil Cleanup Objectives.
13. Soil cleanup objectives (SCOs) are from NYSDEC Part 375, Subpart 375-6: Unrestricted Use and Restricted Use Soil Cleanup Objectives.
14. Results shown for AOC-3-SWALL-1 are the higher of this sample or its respective duplicate.

Table 6
IRM AOC-2 and AOC-3 Confirmatory Soil Sample Results Summary
Revised SRI/IRM/AA Report
Former Signore Facility
Ellicottville, New York
BCP Site No. C905034

				AOC-3																	
Parameter	Protection of Groundwater Restricted Use Soil Cleanup Objectives	**Part 375 - Restricted Residential Use SCOs**	Restricted Com Soil Cleanup Objectives	AOC-3-WWALL-1 12 feet bgs Results	AOC-3-WWALL-2 14 feet bgs Results	AOC-3-WWALL-3 10 feet bgs Results	AOC-3-NWALL-1 12 feet bgs Results	AOC-3-NWALL-2 14 feet bgs Results	AOC-3-SWALL-1 12 feet bgs Results	AOC-3-SWALL-2 12 feet bgs Results	AOC-3-EWALL-1 12 feet bgs Results	AOC-3-EWALL-2 12 feet bgs Results	AOC-3-BOTT-SW 15 feet bgs Results	AOC-3-BOTT-NW 15 feet bgs Results	AOC-3-BOTT-3 15 feet bgs Results	AOC-3-BOTT-4 15 feet bgs Results	AOC-3-BOTT-5 15 feet bgs Results	AOC-3-BOTT-6 15 feet bgs Results	AOC-3-EWALL-3 12 feet bgs Results	AOC-3-STOCK-S Results	AOC-3-STOCK-N Results
Volatile Organic Compounds - EPA Method 8260 TCL (ug/kg)																					
Acetone	50	**100,000**	500,000	< 5.6	< 420	< 5.7	< 15	< 5.4	< 5.9	< 6	< 6.2	< 6.2	< 6.3	< 6.8	< 340	< 60	< 350	< 5.6	< 5.8	< 5.8	< 5.7
1,1,1-Trichloroethane	680	**100,000**	500,000	< 5.6	< 420	< 5.7	< 15	< 5.4	< 5.9	< 6	< 6.2	< 6.2	< 6.3	< 6.8	< 340	< 60	< 350	< 5.6	< 5.8	< 5.8	< 5.7
Tetrachloroethene	1300	**19,000**	150,000	< 5.6	< 420	< 5.7	< 15	< 5.4	< 5.9	< 6	< 6.2	< 6.2	< 6.3	< 6.8	< 340	< 60	< 350	< 5.6	< 5.8	< 5.8	< 5.7
Trichloroethene	470	**21,000**	200,000	< 5.6	< 420	< 5.7	11 J	< 5.4	3.1 J	< 6	3 J	< 6.2	< 6.3	< 6.8	< 340	< 60	< 350	< 5.6	8.4	< 5.8	< 5.7
Methylene chloride	50	**100,000**	500,000	< 5.6	< 420	< 5.7	< 15	5.4 B	< 5.9	5.6 BJ	< 6.2	5.7 BJ	< 6.3	< 6.8	< 340	< 60	< 350	< 5.6	< 5.8	< 5.8	< 5.7
Toluene	700	**100,000**	500,000	< 5.6	< 420	< 5.7	< 15	< 5.4	< 5.9	< 6	< 6.2	< 6.2	< 6.3	< 6.8	< 340	< 60	< 350	< 5.6	< 5.8	< 5.8	< 5.7
Ethylbenzene	1,000	**41,000**	390,000	< 5.6	< 420	< 5.7	< 15	< 5.4	< 5.9	< 6	< 6.2	< 6.2	< 6.3	< 6.8	87 J	< 60	56 J	< 5.6	< 5.8	< 5.8	< 5.7
m&p-Xylene	1,600	**100,000**	500,000	< 5.6	< 420	< 5.7	< 15	< 5.4	< 5.9	< 6	< 6.2	< 6.2	< 6.3	< 6.8	640	< 60	380	< 5.6	< 5.8	< 5.8	< 5.7
o-Xylene	1,600	**100,000**	500,000	< 5.6	170 J	< 5.7	86	< 5.4	15	< 6	< 6.2	< 6.2	< 6.3	< 6.8	340	290	140 J	7	< 5.8	< 5.8	< 5.7
Isopropylbenzene	NV	**NV**	NV	< 5.6	< 420	< 5.7	< 15	< 5.4	< 5.9	< 6	< 6.2	< 6.2	< 6.3	< 6.8	< 340	< 60	49 J	< 5.6	< 5.8	< 5.8	< 5.7
n-Propylbenzene	3,900	**100,000**	500,000	< 5.6	90 J	< 5.7	< 15	< 5.4	< 5.9	< 6	< 6.2	< 6.2	< 6.3	< 6.8	310 J	< 60	350	< 5.6	< 5.8	< 5.8	< 5.7
1,3,5-Trimethylbenzene	8,400	**52,000**	190,000	< 5.6	650	< 5.7	270	8.4	8.4	< 6	< 6.2	< 6.2	2.6 J	7.3	1400	980	1400	62	< 5.8	< 5.8	< 5.7
sec-Butylbenzene	11,000	**100,000**	500,000	< 5.6	< 420	< 5.7	< 15	< 5.4	< 5.9	< 6	< 6.2	< 6.2	< 6.3	< 6.8	< 340	< 60	71 J	< 5.6	< 5.8	< 5.8	< 5.7
1,2,4-Trimethylbenzene	3,600	**52,000**	190,000	< 5.6	400 J	< 5.7	< 15	< 5.4	< 5.9	< 6	< 6.2	< 6.2	< 6.3	< 6.8	3300	< 60	3500	11	< 5.8	< 5.8	< 5.7
p-Isopropyltoluene	10,000 Note 11	**NV**	NV	< 5.6	< 420	< 5.7	18	< 5.4	< 5.9	< 6	< 6.2	< 6.2	< 6.3	< 6.8	< 340	37 J	< 350	< 5.6	< 5.8	< 5.8	< 5.7
n-Butylbenzene	12,000	**100,000**	NV	< 5.6	93 J	< 5.7	20	< 5.4	< 5.9	< 6	< 6.2	< 6.2	< 6.3	< 6.8	170 J	44 J	230 J	5.7	< 5.8	< 5.8	< 5.7
Naphthalene	12,000	**100,000**	500,000	< 5.6	230 J	< 5.7	< 15	< 5.4	< 5.9	< 6	< 6.2	< 6.2	3.1 BJ	< 6.8	220 J	< 60	< 350	< 5.6	< 5.8	< 5.8	< 5.7
Total VOCs				0	1633	0	405	13.8	26.5	5.6	3	5.7	5.7	7.3	6467	1351	6176	85.7	8.4	0	0
Semi-Volatile Organic Compounds - EPA Method 8270 TCL (ug/kg)																					
Total SVOCs				NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT

Notes:
1. Compounds detected in one or more samples are presented on this table. Refer to Attachment C for list of all compo
2. Analytical testing completed by Spectrum Analytical., Inc. located in Warwick, RI.
3. ug/kg = part per billion, mg/kg = part per million.
4. NV = no value.
5. "J" qualifier = indicates an estimated value due to either the compound being detected below the report limit, or an es
6. "B" qualifier = compound was also detected in the associated Method Blank.
7. "D" qualifier = compound concentration was obtained from a secondary dilution analysis.
8. < 6 = compound was not detected above its respective reporting limit.
9. Shading indicates value exceeds Restricted Commercial Use Soil Cleanup Objectives.
10. **Bold** indicates value exceeds Restricted Residential Use Soil Cleanup Objectives.
11. NT = Not tested.
12. Underline indicates value exceeds Protection of Groundwater Restricted Use Soil Cleanup Objectives.
13. Soil cleanup objectives (SCOs) are from NYSDEC Part 375, Subpart 375-6: Unrestricted Use and Restricted Use S
14. Results shown for AOC-3-SWALL-1 are the higher of this sample or its respective duplicate.

Table 7
IRM 6,000 Gallon UST Confirmatory Soil Sample Results Summary
Revised SRI/IRM/AA Report
Former Signore Facility
Ellicottville, New York
BCP Site No. C905034

Parameter	Protection of Groundwater Restricted Use Soil Cleanup Objectives	**Restricted Residential Use Soil Cleanup Objectives**	Restricted Commercial Soil Cleanup Objectives	UST-EXC-N-Wall 5 to 7 feet bgs Results	UST-EXC-S-Wall 5 to 7 feet bgs Results	UST-EXC-E-Wall 5 to 7 feet bgs Results	UST-EXC-W-Wall 5 to 7 feet bgs Results	UST-EXC-Bottom 9 to 9.5 feet bgs Results
Volatile Organic Compounds - EPA Method 8260 TCL (ug/kg)								
Acetone	50	**100,000**	500,000	<	<	25	<	7.8
Toluene	700	**100,000**	500,000	<	<	1.6J	<	1.4J
1,3,5-Trimethylbenzene	8,400	**52,000**	190,000	<	<	<	<	6.8
1,2,4-Trimethylbenzene	3,600	**52,000**	190,000	<	<	<	<	15
Naphthalene	12,000	**100,000**	500,000	<	<	<	<	2.2J
Total VOCs				<	<	26.6	<	33.2
Semi-Volatile Organic Compounds - EPA Method 8270 TCL (ug/kg)								
Total SVOCs				<	<	<	<	<

Notes:
1. Compounds detected in one or more samples are presented on this table. Refer to Attachment C for list of all compounds included in analysis.
2. Analytical testing completed by Spectrum Analytical., Inc. located in Warwick, RI.
3. ug/kg = part per billion, mg/kg = part per million.
4. NV = no value.
5. Shading indicates value exceeds Restricted Commercial Use Soil Cleanup Objectives.
6. **Bold** indicates value exceeds Restricted Residential Use Soil Cleanup Objectives.
7. Underline indicates value exceeds Protection of Groundwater Restricted Use Soil Cleanup Objectives.
8. Soil cleanup objectives (SCOs) are from NYSDEC Part 375, Subpart 375-6: Unrestricted Use and Restricted Use Soil Cleanup Objectives.

Table 8
IRM Excavation Groundwater Sample Results Summary
Revised SRI/IRM/AA Report
Former Signore Facility
Ellicottville, New York
BCP Site No. C905034

Parameter	Class GA Criteria	AOC-1-GW 11/09/2011 Result	EXC-2-GW 10/25/2011 Result	AOC-3-GW 08/14/2013 Result	AOC-3-GW-2 08/22/2013 Result	GW-AOC-3-NORTH 06/10/2014 Result
Volatile Organic Compounds - EPA Method 8260 TCL (ug/L)						
1,1-Dichloroethane	0.6	< 1	< 5	0.65 J	< 1	< 1
Acetone	50	< 1	< 25	< 5	5.2	5.9
1,1,1-Trichloroethane	5	4.9	2.6 J	2.7	0.66 J	< 1
Trichloroethene	5	18	3.5 J	6.9	9.9	2.7
Benzene	1	6.5	< 5	< 1	< 1	< 1
Toluene	5	51	950	2.2	15	3.3
Tetrachloroethene	5	2.3	<	0.79 J	0.78 J	< 1
Ethylbenzene	5	14	100	31	89	2.2
m,p-xylene	5	74	680	100	370	4.4
o-Xylene	5	41	300	29	110	2.5
Isopropylbenzene	5	1.1	6.4	6.2	30	0.82 J
n-propylbenzene	5	5	< 5	33	120 D	2.5
1,3,5-Trimethylbenzene	5	20	4 J	62	1,400 D	14
1,2,4-Trimethylbenzene	5	29	7.1	220 D	4,000 D	33
sec-butylbenzene	5	< 1	< 5	2.6	< 1	1.3
n-butylbenzene	5	2.5	< 5	5	< 1	1.3
4-Isopropyltoluene	5	< 1	< 1	< 1	< 1	2.9
Naphthalene	10	1.9	< 5	5.4	100	< 1
Total VOCs		271.2	2053.6	507.44	6,250.54	76.82
Semi-Volatile Organic Compounds - EPA Method 8270 Base Neutrals (ug/L)						
		NT	<	NT	NT	NT

Notes:
1. Compounds detected in one or more samples are presented on this table. Refer to Appendix C for list of all compounds included in analysis.
2. Analytical testing completed by Spectrum Analytical., Inc. located in Warwick, RI.
3. NYSDEC Class GA criteria obtained from Division of Water Technical and Operational Guidance Series (TOGS 1.1.1), June 1998.
4. ug/L = part per billion (ppb).
5. "J" qualifier = indicates an estimated value due to either the compound being detected below the report limit, or an estimated concentration.
6. "B" qualifier = compound was also detected in the associated Method Blank.
7. "D" qualifier = result shown is the product of a dilution analysis.
8. < 1 indicates compound was not detected above its repective reporting limit.
9. Shading indicates exceedence of Class GA Criteria.
10. NT = Not tested.

Table 9
Electron Donor Compound Injection Pilot Study
Groundwater Analytical Results Summary
Revised SRI/IRM/AA Report
Former Signore Facility
Ellicottville, New York
BCP Site No. C905034

Sample Location / Sample Date	Class GA Criteria	EW-1.25 6/25/2013	EW-1.25 10/16/2013	EW-1.25 6/10/2014	SP-32 10/3/2012	SP-32 10/17/2013	SP-32 6/10/2014	SP-37 10/5/2012	SP-37 10/17/2013	SP-37 6/10/2014
Volatile Organic Compounds - EPA Method SW-846, 8260B (ug/L)										
Acetone	50	<	<	<	<	240 D	<	<	<	<
Methylene Chloride	5	<	<	<	<	<	<	<	<	<
Carbon disulfide	NV	<	<	<	<	<	<	<	<	<
Chloromethane	NV	0.77 J	<	<	<	<	<	<	<	<
1,1-Dichloroethane	5	4.1	4.1	2.9	<	<	<	<	<	<
Vinyl chloride	2	4.6	5	2.4	<	<	<	<	<	<
2-Butanone	50	<	<	<	<	45	<	<	<	<
cis-1,2-Dichloroethene	5	31	32	23	<	26	11	1.8	7.3	0.99 J
1,1,1-Trichloroethane	5	<	<	<	<	<	<	<	<	<
Tetrachloroethene	5	3.3	3.8	3.6	2.1	<	<	9.6	24	13
Trichloroethene	5	51	59	41	120	3.4	6.4	13	20	7.2
Total VOCs	2	94.77	103.9	72.9	122.1	314.4	17.4	24.4	51.3	27.2
Field Parameters										
Temperature (Deg. C)	NV	13	13.5	10.4	13.2	16.5	13.1	13.5	17	11.9
Specific Conductance (mS/cm)	NV	0.7	0.68	0.7	0.418	0.65	0.392	0.452	0.535	0.305
Dissolved Oxygen (mg/L)	NV	0.05	0.18	0.06	4.92	0.18	0.12	0.28	0.2	0.58
Oxygen Reduction Potential (mv)	NV	-88.5	-99.3	-91.2	50.3	-95.3	-21.9	-122.4	74.8	107.7
pH (std. units)	NV	7.35	6.85	6.78	7.23	6.45	6.48	6.6	6.39	6.28
Turbidity (NTUs)	NV	9.12	3.31	11.71	35	6.76	4.95	2.5	9.35	12.5
Inorganics (ug/L)										
Iron	300	NS	1,000	14,000	NS	3,480	16,000	NS	61.7 B	900
Manganese	NV	NS	1,300	1,600	NS	24,600	19,000	NS	336	150
Miscellaneous Water Quality Parameters										
Methane (ug/L)	NV	NS	1,000	170	NS	120	660	NS	26	2.5
Ethane (ug/L)	NV	NS	<	<	NS	<	<	NS	<	<
Ethene (ug/L)	NV	NS	1.7	<	NS	1.7	<	NS	<	<
Total Organic Carbon (mg/L)	NV	NS	<	<	NS	51	<	NS	4 J	2.8 J
Chloride (mg/L)	NV	NS	66 B	69	NS	5 B	3.1	NS	12 B	3.8
Nitrate (mg/L)	NV	NS	<	<	NS	<	<	NS	4.8	5.2
Nitrite (mg/L)	NV	NS	<	<	NS	<	<	NS	<	<
Sulfate (mg/L)	NV	NS	7.6	7.4 B	NS	4.9 J	14 B	NS	36	24 B

Sample Location / Sample Date	Class GA Criteria	SP-38 10/4/2012	SP-38 10/17/2013	SP-38 6/10/2014	SP-43 10/4/2012	SP-43 10/17/2013	SP-43 6/10/2014	SP-45 10/4/2012	SP-45 10/17/2013	SP-45 6/10/2014
Volatile Organic Compounds - EPA Method SW-846, 8260B (ug/L)										
Acetone	50	<	<	<	<	53	<	<	<	<
Methylene Chloride	5	<	<	<	<	<	<	3.2 DJ	<	<
Carbon disulfide	NV	<	<	<	<	1.3	<		<	<
Chloromethane	NV	<	<	<	<	<	<		<	<
1,1-Dichloroethane	5	<	<	<	<	<	<		<	<
Vinyl chloride	2	<	<	<	<	<	<		<	<
2-Butanone	50	<	<	<	<	84	<		<	<
cis-1,2-Dichloroethene	5	<	1.5	1.2	<	5.4	3.9	6.8	1.1	1.9
1,1,1-Trichloroethane	5	2.4	<	<	<	<	<		<	<
Tetrachloroethene	5	5	<	5.2	93	24	14	260 D	69	130
Trichloroethene	5	17	7.8	19	5.2	2.6	<	13	3.6	6.4
Total VOCs	2	24.4	9.3	25.4	98.2	170.3	17.9	283.0	73.7	138.3
Field Parameters										
Temperature (Deg. C)	NV	13.1	15.2	11.6	14.1	18.4	13	14.6	17.8	16.5
Specific Conductance (mS/cm)	NV	0.437	0.412	0.437	0.445	0.513	0.304	0.543	0.363	0.391
Dissolved Oxygen (mg/L)	NV	3.25	2.88	4.65	1.48	0.22	0.23	1.07	5.21	3.02
Oxygen Reduction Potential (mv)	NV	31.7	103.5	136	44.2	-39.3	149	-29.5	88.3	143.1
pH (std. units)	NV	6.81	6.72	6.72	6.55	5.88	6.13	6.48	6.83	6.71
Turbidity (NTUs)	NV	27.4	2.12	19.2	39.8	4.04	18	3.95	2.3	3.17
Inorganics (ug/L)										
Iron	300	<	<	1,500	NS	6,150	7,100	NS	32.1 B	170 J
Manganese	NV	5,100	41.1 B	180	NS	5,510	1,600	NS	<	<
Miscellaneous Water Quality Parameters										
Methane (ug/L)	NV	<	20	1.1	NS	16	12	NS	14	1.1
Ethane (ug/L)	NV	NM	<	<	NS	2.4	<	NS	<	<
Ethene (ug/L)	NV	NM	<	<	NS	3.7	<	NS	<	<
Total Organic Carbon (mg/L)	NV	<	<	<	NS	80	<	NS	<	<
Chloride (mg/L)	NV	31	40 B	34	NS	6.3 B	2.2	NS	5.1 B	4.2
Nitrate (mg/L)	NV	4.7	1.4	3.3	NS	0.36	8.30	NS	6	5.2
Nitrite (mg/L)	NV			<	NS	<	0.042 J	NS	<	<
Sulfate (mg/L)	NV	23	11	13 B	NS	12	25 B	NS	39	33 B

Notes:
1. Only compounds detected in one or more of the groundwater samples are presented in this table.
2. "<" indicates compound was not detected above the method detection limit.
3. Analytical testing completed by TestAmerica.
4. Criteria is a guidance value.
5. Laboratory qualifiers: B = compound was found in the blank and sample; J = result is less than the RL but greater than or equal to the MDL and the concentration is an approximation;
   * - LCS or LCSD exceeds the control limits; D = value shown is result of dilution analysis; E = value above quantitation range.
6. mg/L = parts per million; ug/L = parts per billion
7. NYSDEC Class GA Groundwater Criteria as promulgated in 6 NYCRR 703; Table 1 in Technical and Operational Guidance Series (1.1.1): Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, dated October 1993; revised June 1998; errata dated January 1999; addendum dated April 2000.
8. NV = no value
9. Shaded concentrations exceed Class GA criteria.

Table 10
SRI Analytical Testing Program Summary
Revised SRI/IRM/AA Report
Former Signore Facility
Ellicottville, New York
BCP Site No. C905034

Location	Sample Depth (ft bgs)	VOCs TCL Method 8260B	SVOCs Method 8270C BN	TAL Metals Method 3050/6010/7471	PCBs Method 8082	Pesticides Method 8081B	Natural Attenuation Parameters	VOCs Method TO-15
Surface Soil Samples								
SS-1	0-0.17	X	X	X	X	X		
SS-2	0-0.17	X	X	X	X	X		
SS-3	0-0.17	X	X	X	X	X		
SS-4	0-0.17	X	X	X	X	X		
Subsurface Soil Samples - Test Pits								
TP-11	8-10	X						
TP-16	10-11.5	X						
TP-17	8-10	X						
TP-18	2.3		X	X	X			
Subsurface Soil Samples - Soil Probes								
SP-30	10-12	X						
SP-31	8-10	X						
SP-32	10-12	X						
SP-33	2-4	X						
SP-34	4-6	X						
SP-35	14-16	X						
SP-36	6-8	X						
SP-37	2-4	X						
SP-37	12-14	X						
SP-38	6-8	X						
SP-39	4-6	X						
SP-40	2-4	X						
SP-41	12-14	X						
SP-42	6-8	X						
SP-43	12-14	X						
SP-44	2-4	X						
SP-45	4-6	X						
Groundwater Samples								
TP-10	NA	X						
TP-11	NA	X					X	X
TP-13	NA	X						
TP-15	NA	X					X	X
SP-32	NA	X						
SP-35	NA	X						
SP-37	NA	X						
SP-38	NA	X					X	X
SP-39	NA	X					X	X
SP-40	NA	X					X	X
SP-42	NA	X					X	X
SP-43	NA	X						
SP-45	NA	X						
SP-47	NA	X						
EW-2.5	NA						X	X
MW-1S	NA	X						
MW-1I	NA	X					X	X
MW-1D	NA	X					X	X
MW-4I	NA	X					X	X
MW-5I	NA	X					X	X
Soil Vapor Intrusion Samples								
DG-1IA-02152012	NA							X
DG-1SS-02152012	NA							X
DG-2IA-02152012	NA							X
DG-2SS-02152012	NA							X
DG-3IA-02152012	NA							X
DG-3SS-02152012	NA							X
DG-4IA-02162012	NA							X
DG-4SS02162012	NA							X
UG-1IA-02162012	NA							X
UG-1SS-02162012	NA							X
UG-2IA002232012	NA							X
UG-2SS-02232012	NA							X
UG-3BF-03142012	NA							X
UG-3FF-03142012	NA							X
UG-4IA-03142012	NA							X
UG-4SS-03142012	NA							X
UG-5IA-04022012	NA							X
UG-5SS-04022012	NA							X
BK-1AO-02152012	NA							X
BK-2AO-02162012	NA							X
BK-3AO-03142012	NA							X
BK-4AO-04022012	NA							X

Notes:
1. NA = not applicable.
2. ft bgs = feet below ground surface
3. VOCs = Volatile Organic Compounds
4. SVOCs = Semi-Volatile Organic Compounds
5. TCL = Total Compound List
6. TAL = Total Analyte List
7. PCB's = Polychlorinated Biphynels
8. DG = downgradient sample location
9. UG = upgradient sample location
10. IA = indoor air sample
11. SS = subslab air sample
12. BF = basement air sample
13. FF = first floor air sample
14. BK = background sample location
15. AO = ambient air sample

Table 11
SRI Test Pit Soil Sample Analytical Results Summary
Revised SRI/IRM/AA Report
Former Signore Facility
Ellicottville, New York
BCP Site No. C905034

Sample Location Sample Depth (ft bgs) Sample Date	Part 375 Unrestricted SCOs	Part 375 Residential SCOs	Part 375 Commercial SCOs	TP-11 8-10 9/25/2012	Q	TP-16 10-11.5 9/26/2012	Q	TP-17 8-10 9/26/2012	Q	TP-18 2.3 9/26/2012	Q
Volatile Organic Compounds - Method 8260 TCL (ug/kg)											
Trichloroethene	**470**	10,000	200,000	56				11		NT	
Semi-Volatile Organic Componds - EPA Method 8270 Base Neutrals (ug/kg)											
Bis (2-ethylhexyl) phthalate	**NV**	NV	NV	NT		NT		NT		110	J
Phenanthrene	**100,000**	100,000	500,000	NT		NT		NT		1,000	
PCB - EPA Method 8082 (ug/kg)											
Metals - EPA Method 6010/7471 (mg/kg)											
Aluminum	**NV**	NV	NV	NT		NT		NT		13,000	*
Antimony	**NV**	NV	NV	NT		NT		NT			
Arsenic	**13**	16	13	NT		NT		NT		**14.6**	
Barium	**350**	350	400	NT		NT		NT		153	*
Beryllium	**7.2**	14	590	NT		NT		NT		0.58	
Cadmium	**2.5**	2.5	9.3	NT		NT		NT		0.46	
Calcium	**NV**	NV	NV	NT		NT		NT		21,800	*J
Chromium	**30**	36	1,500	NT		NT		NT		21.3	*J
Cobalt	**NV**	NV	NV	NT		NT		NT		11.7	
Copper	**50**	270	270	NT		NT		NT		30	*J
Iron	**NV**	NV	NV	NT		NT		NT		28,800	
Lead	**63**	400	1,000	NT		NT		NT		23.5	*
Magnesium	**NV**	NV	NV	NT		NT		NT		4,740	*
Manganese	**1,600**	2,000	10,000	NT		NT		NT		1,060	
Mercury	**0.18**	0.81	2.8	NT		NT		NT		0.025	
Nickel	**30**	140	310	NT		NT		NT		24.6	*
Potassium	**NV**	NV	NV	NT		NT		NT		902	*
Selenium	**3.9**	36	1,500	NT		NT		NT		1.7	
Silver	**2**	36	1,500	NT		NT		NT			
Sodium	**NV**	NV	NV	NT		NT		NT			
Thallium	**NV**	NV	NV	NT		NT		NT		1.2	
Vanadium	**NV**	NV	NV	NT		NT		NT		18	*
Zinc	**109**	2,200	10,000	NT		NT		NT		102	*

NOTES: Notes:
1. Only compounds detected in one or more soil samples are presented in this table.
2. Blank indicates compound was not detected.
3. Analytical testing completed by Spectrum Analytical, Inc.
4. Q = laboratory qualifier. See Appendix F for qualifier definitions.
5. ug/kg = parts per billion, mg/kg = parts per million.
6. Part 375 Residential Soil Cleanup Objectives (SCOs) are from NYCRR Subpart 375-6, Remedial Program Soil Cleanup Objectives, dated December 14, 2006.
7. NV = no value; NS = not specified; NT = not tested; ND = non detect.
8. **BOLD** Concentrations exceed their Part 375 Unrestricted SCOs.
9. Shaded concentrations exceed their respective Part 375 Residential SCOs.

Table 12
SRI Soil Probe Soil Sample Analytical Results Summary
Revised SRI/IRM/AA Report
Former Signore Facility
Ellicottville, New York
BCP Site No. C905034

Sample Location				SP-30		SP-31		SP-32		SP-33		SP-34		SP-35		SP-36		SP-37		SP-37		SP-38		SP-39		SP-40		SP-41		SP-42		SP-43		SP-44		SP-45	
Sample Depth (ft bgs)	Part 375	Part 375	Part 375	10-12		8-10		10-12		2-4		4-6		0.5-2		6-8		2-4		12-14		6-8		4-6		2-4		12-14		6-8		12-14		2-4		4-6	
Sample Date	Unrestricted	Residential	Commercial	9/27/2012		9/27/2012		9/27/2012		9/27/2012		9/27/2012		9/27/2012		9/27/2012		9/27/2012		9/27/2012		9/27/2012		9/28/2012		9/28/2012		9/28/2012		9/28/2012		10/1/2012		10/1/2012		10/1/2012	
	SCOs	SCOs	SCOs		Q		Q		Q		Q		Q		Q		Q		Q		Q		Q		Q		Q		Q		Q		Q		Q		Q
Volatile Organic Compounds - EPA Method 8260 TCL (ug/kg)																																					
Acetone	**50**	100,000	500,000											12	J									9	J					7.1	J						
cis-1,2-Dichloroethene	**250**	59,000	500,000																											3.5	J						
Methylene Chloride	**50**	51,000	500,000															2.4	J																		
Tetrachloroethene	**1,300**	5,500	150,000															4.3	J	5.7	J	22										60				19	
1,1,1-Trichloroethane	**680**	100,000	500,000																			1.7	J														
Trichloroethene	**470**	10,000	200,000																	2.4	J	31								120						20	

NOTES: 1. Only compounds detected in on Notes:
2. Blank indicates compound was not detected.
3. Analytical testing completed by Spectrum Analytical, Inc.
4. Results presented for SP-33, 2-4 ft is the higher of this sample and its respective duplicate.
5. Q = laboratory qualifier. See Appendix F for qualifier definitions.
6. ug/kg = parts per billion, mg/kg = parts per million.
7. Part 375 Residential Soil Cleanup Objectives (SCOs) are from NYCRR Subpart 375-6, Remedial Program Soil Cleanup Objectives, dated December 14, 2006.
8. NV = no value; NS = not specified; NT = not tested; ND = non detect.
9. **BOLD** concentrations exceed their Part 375 Unrestricted SCOs.
10. Shaded concentrations exceed their respective Part 375 Residential SCOs.

Table 13
SRI Surface Soil Sample Analytical Results Summary
Revised SRI/IRM/AA Report
Former Signore Facility
Ellicottville, New York
BCP Site No. C905034

Sample Location Sample Depth (ft bgs) Sample Date	Part 375 Unrestricted SCOs	Part 375 Residential SCOs	Part 375 Commercial SCOs	SS-1 0-2" 9/27/2012	Q	SS-2 0-2" 9/27/2012	Q	SS-3 0-2" 9/27/2012	Q	SS-4 0-2" 9/27/2012	Q
Volatile Organic Compounds - EPA Method 8260 TCL (ug/kg)											
Semi-Volatile Organic Compounds - EPA Method 8270 Base Neutrals (ug/kg)											
Benzo (a) anthracene	**1,000**	1,000	5,600			250	J	370			
Benzo (a) pyrene	**1,000**	1,000	1,000			250	J	360			
Benzo (b) fluoranthene	**1,000**	1,000	5,600			400		550		110	J
Benzo (g,h,i) perylene	**100,000**	100,000	500,000			200	J	300	J		
Benzo (k) fluoranthene	**800**	1,000	56,000			150	J	230	J		
Bis (2-ethylhexyl) phthalate	**NV**	NV	NV	82	J	120	J	140	J	170	J
Butylbenzylphthalate	**NV**	NV	NV			530					
Chrysene	**1,000**	1,000	56,000			310	J	490		93	J
Dibenz (a,h) anthracene	**330**	330	560					75	J		
Fluoranthene	**100,000**	100,000	500,000			660		820		150	J
Indeno (1,2,3-cd) pyrene	**500**	500	5,600			200	J	280	J		
Phenanthrene	**100,000**	100,000	500,000			420		330			
Pyrene	**100,000**	100,000	500,000			490		670		120	J
PCBs - EPA Method 8082 (ug/kg)											
Pesticides - EPA Method 8081 (ug/kg)											
Metals - EPA Method 6010/7471 (mg/kg)											
Aluminum	**NV**	NV	NV	6,000		8,360		5,990		14,200	
Arsenic	**13**	16	16	6.3		7.8		5.6		9.5	
Barium	**350**	350	400	52.8	EJ	92.8	EJ	59.7	EJ	165	EJ
Beryllium	**7.2**	14	590	0.25	B	0.29		0.2	B	0.61	
Cadmium	**2.5**	2.5	9.3	0.24	B	0.44		0.44		1.1	
Calcium	**NV**	NV	NV	34,100	*	14,700		19,000		2,970	
Chromium	**30**	36	1,500	14.4	EJ	14.8	J	10.3	J	22.7	J
Cobalt	**NV**	NV	NV	5.1	EJ	6.6	EJ	4.8	EJ	10.3	EJ
Copper	**50**	270	270	26.2		37.9		24.3		29.3	
Iron	**NV**	NV	NV	13,700	EJ	18,400	EJ	15,200	EJ	24,300	EJ
Lead	**63**	400	1,000	48.7	NEJ	26.1	EJ	14.1	EJ	20.8	EJ
Magnesium	**NV**	NV	NV	5,540	EJ	5,510	EJ	5,300	EJ	3,680	EJ
Manganese	**1,600**	2,000	10,000	510	EJ	606	EJ	429	EJ	591	EJ
Mercury	**0.18**	0.81	2.8	0.08		0.13		0.0069	B	0.15	
Nickel	**30**	140	310	12.3	EJ	17.8	EJ	13.3	EJ	24.3	EJ
Potassium	**NV**	NV	NV	465	EJ	816	J	643	J	1,250	J
Selenium	**3.9**	36	1,500	2.1		2.7		2		3.6	
Sodium	**NV**	NV	NV								
Vanadium	**NV**	NV	NV	7.8	EJ	10.9	J	8.2	J	20.6	J
Zinc	**109**	2,200	10,000	80.9	EJ	**156**	EJ	107	EJ	**255**	EJ

NOTES:
1. Only compounds detected in one or more soil sample Notes:
2. Blank indicates compound was not detected.
3. Analytical testing completed by Spectrum Analytical, Inc.
4. Results presented for SS-2 are the higher of this sample and its respective duplicate.
5. Q = laboratory qualifier. See Appendix F for qualifier definitions.
6. ug/kg = parts per billion, mg/kg = parts per million.
7. Part 375 Residential Soil Cleanup Objectives (SCOs) are from NYCRR Subpart 375-6, Remedial Program Soil Cleanup Objectives, dated December 14, 2006.
8. NV = no value; NS = not specified; NT = not tested; ND = non detect.
9. **BOLD** concentrations exceed their Part 375 Unrestricted SCOs.
10. Shaded concentrations exceed their Part 375 Residential SCOs.

Table 14
SRI Groundwater Sample Analytical Results Summary
Revised SRI/IRM/AA Report
Former Signore Facility
Ellicottville, New York
BCP Site No. C905034

Sample Location		TP-10		TP-11		TP-13		TP-15		SP-32		SP-35		SP-37		SP-38		SP-39		SP-40		SP-42		SP-43		SP-45		SP-47		MW-1S		MW-1I		MW-1D		MW-4I		MW-5I	
Sample Depth (ft bgs)	NYSDEC																																						
Sample Date	Class GA Criteria	10/4/2012		10/4/2012		10/4/2012		10/4/2012		10/3/2012		10/4/2012		10/5/2012		10/4/2012		10/4/2012		10/5/2012		10/5/2012		10/4/2012		10/4/2012		10/4/2012		10/31/2012		10/5/2012		10/5/2012		10/31/2012		10/31/2012	
			Q		Q		Q		Q		Q		Q		Q		Q		Q		Q		Q		Q		Q		Q		Q		Q		Q		Q		Q
Volatile Organic Compounds - EPA Method 8260 TCL (ug/L)																																							
1,1-Dichloroethane	**5**																					2.1								0.66	J	2.6							
1,1-Dichloroethene	**5**					0.54	J																																
cis-1,2-Dichloroethene	**5**			**22**										1.8				2.3				1.6				**6.8**	D			1		3.1				0.62	J		
trans-1,2-Dichloroethene	**5**																					1.3																	
Methylene Chloride	**5**																									3.2	DJ												
Tetrachloroethene	**5**	2.3		1.1		2.6				2.1				**9.6**		5		**79**		4.1		0.74	J	**93**		**260**	D							0.65	J				
1,1,1-Trichloroethane	**5**	4.8				**5.4**										2.4		2		3.3																			
Trichloroethene	**5**	**12**		**110**						**120**		4.9		**13**		**17**		**60**		**19**		**8.7**		**5.2**		**13**										1.2		0.75	J
Vinyl chloride	**2**													0.6	J																								

Notes:

1. Compounds detected in one or more sample are presented on this table. Refer to Appendix C for list of all compounds included in analysis.
2. Analytical testing completed by Spectrum Analytical, Inc.
3. NYSDEC Groundwater Class GA criteria obtained from Division of Water Technical and Operational Guidance Series (TOGS 1.1.1), dated October 1993, revised June 1998, errata January 1999 and amended April 2000 (Class GA).
4. ug/L = part per billion (ppb).
5. Blank indicates compound was not detected above method detection limits.
6. "B" qualifier = Analyte detected in the associated Method Blank.
6. J = laboratory qualifier. See Appendix F for qualifier definitions.
7. Results presented for SP-38 is the higher of this sample and its respective duplicate.
8. **Bold** and shaded concentrations exceed their Class GA criteria.

Table 15
SRI Soil Vapor Intrusion Air Analytical Testing Results Summary
Revised SRI/IRM/AA Report
Former Signore Facility
Ellicottville, New York
BCP Site No. C905034

Associated Background	Samples Associated with Background-1							Samples Associated with Background-2					No Background Sample		Samples Associated with Background-3				Samples Associated with Background-4			Samples Associated with Background-4		
Property Address	House 6		House 8		House 7		Background-1	House 9		House 5		Background-2	House 4		House 2		House 3				Background-3	House 1	41 Jefferson	Background-4
Sample ID	DG-1IA-02152012	DG-1SS-02152012	DG-2IA-02152012	DG-2SS-02152012	DG-3IA-02152012	DG-3SS-02152012	BK-1AO-02152012	DG-4IA-02162012	DG-4SS-02162012	UG-1IA-02162012	UG-1SS-02162012	BK-2AO-02162012	UG-2IA-02232012	UG-2SS-02232012	UG-3BF-03142012	UG-3FF-03142012	UG-4IA-03142012	UF-4SS-03142012	UG-4IA-04022012	UF-4SS-04022012	BK-3AO-03142012	UG-5IA-04022012	UG-5SS-04022012	BK-3AO-04022012
Volatile Organic Compounds via USEPA Method TO-15 (ug/m^3)																								
1,1,1-Trichloroethane	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	11	<1.1	<1.1	<1.1	<1.1	<1.1	0.89 J	0.89 J	<1.1	1.1	<1.1	1.2	<1.1	<1.1	<1.1	<1.1
1,1-Dichloroethene	<0.81	<0.81	<0.81	<0.81	<0.81	<0.81	<0.81	<0.81	<0.81	<0.81	<0.81	<0.81	<0.81	<0.81	0.60 J	0.6 NJ	0.81	<0.81	<0.81	<0.81	<0.81	<0.81	<0.81	<0.81
1,1,2-TrifluoroTrichloroethane											1.2J	1.2 J			1.7	1.7	1.6	1.5 J			1.6			
1,2,4-Trimethylbenzene				1.2					1.3		1.3			0.75 J	4.5		0.75 J	0.9 J			0.85 J			
1,2-Dichloro-1,1,2,2-tetrafluoroethane															1.1 J	1.1 J								
1,2-Dichloroethane				1.2 NJ		1.4			1.6		1.6			1.1	0.7 J	0.7 NJ				0.41 J				
1,3,5-Trimethylbenzene		1.5	0.80 J	1.7			0.75 J	3.4	2.1	1.2	1.9	0.95 J	0.55 J	1.7	12	3.7	0.95 J	1.1		4.5	1.2	2.4	1.6	
1,3-butadiene																								
1,3-Dichlorobenzene																								
1,4-Dichlorobenzene											1.6			1.5										
1,4-Dioxane										0.55 J					0.7 J	1.3								
2-Butanone (MEK)	0.87	2.6	4.9	8.4	1.2	11	1.2	3.4	11	1.9	12	1.1	18	18	2.3	2.1	1.6	3.1		5.5	1.7	1.5	8.9	0.75
4-ethyltoluene		1.3		1.6		1.7		3.6	2.1	1.2	1.9	0.90 J	0.55 J	1.6	15	4.4	0.95 J	1.0		2.6 J	1.2			
4-Methyl-2-Pentanone		0.87 J				12 J			15		15		0.92 J			1.0 NJ	0.79 J	0.92		5.7 NJ				
Acetone		95	16	55		58		11	59	23	88		1,000	730	64	29		91	5.0	90			53	19
Allyl chloride																								
Benzene	0.75	0.78	0.97	1.3	0.84	1.3	0.91	3.4	1.9	1.1	2.0	0.94	0.78	2.3	0.88	0.97	1.0	1.2	0.39 J	1.1	1.4	2.4	6.9	0.49 J
Bromomethane															0.71 J	0.7 J	0.59 J							
Carbon disulfide											1.7			0.44 J	0.63	0.63	0.51 NJ			0.44 J			4.8	
Carbon tetrachloride	<0.26	<1.3	<0.26	<1.3	<0.26	<1.3	<0.26	<0.26	1.1 J	0.96	1.1 J	1.1	<0.26	<1.3	1.5	1.4	1.3	1.3	<0.26	<1.3	1.3	<0.26	0.77 NJ	<0.26
Chloroethane									1.0						0.4									
Chloromethane	1.4	0.57	1.8	0.99	1.2	0.97	1.2			2.1	1.3	1.3				1.8	2.1		0.94		1.6			0.97
cis-1,2-Dichloroethene	<0.81	<0.81	<0.81	<0.81	<0.81	<0.81	<0.81	<0.81	<0.81	<0.81	0.60 J	<0.81	<0.81	<0.81	0.60 J	0.69 J	<0.81	<0.81	<0.81	<0.81	0.85	<0.81	<0.81	<0.81
Cyclohexane								1.9			1.8		0.73	2.1										
Ethylbenzene		0.79 J	0.66 NJ	3.5		4.0		2.2	4.9	0.97	4.3		41	47	19	5.8		4.5		17		2 NJ	4 NJ	0.84 NJ
Freon 11	1.4	1.3	1.4	1.3	1.8	1.4	1.4	1.7	1.4	1.7	1.7	1.7	1.3	1.3	2.2 J	2.3 J	2.2 J	2.1	1.5	1.1	2.3	4.1	2.9	1.3
Freon 113											1 J	1 J			1.7	1.7	1.6	1 J			1.6			
Freon 114															1 J	1 J								
Freon 12	2.5	2.3	2.4	2.4	2.5	2.5	2.5	2.6	2.7	3.0	2.9	2.8	2.4	2.5	3.3	3.4	3.3	3.4	2.7	2.9	3.3	2.8	3.1	2.9
Hexachlorobutadiene															2.2 NJ	2.3 NJ	1.7 J	2.3			2 J			
Hexane		2.1						13		2.4			24	19				11					46	
Isopropanol						7.8	10						9.0								11			
m&p-Xylene				10		11		8.8	14		12		87	98	74	22	1.5 J	9.2		36	2.3	7.3	12	1.9
Methylene chloride		2.6		1.4		1.4			1.4		1.5	0.64 J			**320**	**150**								
n-Heptane		2.9	2.5 NJ											4.6	2.1 J	1.5 J		6.4 J		9.6	1.2 J		48	
o-Xylene		1.3	0.75 J	3.2		3.5		3.5	4.3	1.0	3.8	0.71 J	13.0	17	15	4.7	0.79 J	2.3		5.3	1.0	2.2	2.9	
Styrene				3.8		4.5			5.4		4.8			4.9		0.78 NJ				2.1			2.9	
Tetrachloroethene	<1.4	3.4	<1.4	<1.4	<1.4	1.6	<1.4	<1.4	1.9	<1.4	1.9	1.8	1.1 J	2.8	7.7	4.1	1.2 J	**660**	<1.4	7.9	12	0.76 J	0.76 J	<1.4
Tetrahydrofuran				5.4					5.6		5.2													
Toluene	1.0	5.9	18	9.9	1.3	11	1.1	17	14 B	6.2 B	12 B		130	130	9.7	4.8	1.3	9.3	0.92	63	2.0	14	14	2.1
trans-1,2-Dichloroethene															0.64 NJ	0.64 NJ		0.6 NJ						
Vinyl acetate								0.72 J																
Trichloroethene	<0.22	<1.1	<0.22	<1.1	<0.22	<1.1	<0.22	<0.22	1.3	<0.22	<1.1	<0.22	<0.22	<1.1	<0.22	0.82	<0.22	<1.7	<0.22	<1.1	<0.22	<0.22	<1.1	<0.22
Vinyl chloride	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.1	<0.52	<0.10	<0.52	<0.52	0.42 NJ	0.42 NJ	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52	<0.52

Notes
1. Compounds detected in one or more samples or those assigned to the NYSDOH soil vapor intrusion decision matrices are presented on this table.
2. Analytical testing completed by Enalytic, LLC laboratory in Syracuse, New York.
3. Analytical results were compared to the matrices in the NYSDOH Guidance for Evaluating Soil Vapor Intrusion in New York State, dated October 2006.
4. Samples with IA designation are indoor air samples, SS are sub-slab samples, BK are background samples, BF are basement floor samples, and FF are first floor samples.
5. ug/m^3 = microgram per cubic meter.
6. Samples collected were for an approximate 24-hour sample duration.
7. Green shading indicates comounds are assigned to the NYSDOH soil vapor intrusion guidance Matrix 1 and Yellow shading indicates comounds are assigned Matrix 2.
8. J = estimated concentration detected less than the practical qualification limit (PQL).
9. B = compound was detected in the method blank.
10. NJ = The detection is tenative and estimated in value. There is presumptive evidence of the analyte, the result should be used with caution as a potential false positive and/or elevated quantitative value.
11. Bold indicates compound exceeds NYSDOH soil vapor intrusion guidance matrices or indoor air guidance values.

APPENDIX A – ENVIRONMENTAL EASEMENT

James K. Griffith
CATTARAUGUS COUNTY CLERK

Cattaraugus County Center 303 Court Street
Little Valley, NY 14755
(716) 938-9111
Fax: (716) 938-2773

Instrument Number
243125-001

No. of Pages: (including this cover page)	10	Delivered By:	SLATER LAW FIRM
Receipt No.	243125	Return To:	CRAIG SLATER 500 SENECA STE 504 BUFFALO, NY 14203
Date:	09/01/2015		
Time:	11:51 AM		
Document Type:	EASEMENT/RIGHT OF WAY		
Parties To Transaction:	ISKALO TO NYS PEOPLE		
Town/City:	EL - Ellicottville		

Deed Information		**Mortgage Information**	
Taxable Consideration:	$0.00	Taxable Mortgage Amount:	
State Transfer Tax:	$0.00	Basic Mortgage Tax:	
		Special Mortgage Tax:	
RETT No.:	00318	Additional Mortgage Tax:	
State of New York Cattaraugus County Clerk		Mortgage Serial No.:	

This sheet constitutes the Clerk endorsement required by Section 316-A(5) & Section 319 of the Real Property Law of the State of New York.

James K. Griffith

Cattaraugus County Clerk

Please do not remove this page.

* 2 4 3 1 2 5 - 0 0 1 *

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

THIS INDENTURE made this 28th day of July, 2015 between Owner(s) Iskalo Ellicottville Holdings LLC, having an office at 5166 Main Street, Williamsville, NY 14221, County of Erie, 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 55-57 Jefferson Street in the Town of Ellicottville, County of Cattaraugus and State of New York, known and designated on the tax map of the County Clerk of Cattaraugus as tax map parcel numbers: Section 55.043 Block 1 Lot 3.1, being a portion of the property conveyed to Grantor by deeds dated February 11, 2008 and recorded in the Cattaraugus County Clerk's Office in Instrument No. 96174-004 and 96174-005. The property subject to this Environmental Easement (the "Controlled Property") comprises approximately 8.43 +/- acres, and is hereinafter more fully described in the Land Title Survey dated May 7, 2015 prepared by E&M Engineers & Surveyors, P.C., 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: C905034-01-11, 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:

Restricted Residential as described in 6 NYCRR Part 375-1.8(g)(2)(ii), 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 property is prohibited without necessary water quality treatment as determined by the NYSDOH or the Cattaraugus 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 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 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 this Environmental Easement.

B. The Controlled Property shall not be used for Residential purposes as defined in 6NYCRR 375-1.8(g)(2)(i), 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 site 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 such real 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: C905034
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 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.

Iskalo Ellicottville Holdings LLC:
By: Iskalo Development Corp., Its Manager

By: ______________________

Print Name: Paul B. Iskalo

Title: President & CEO Date: 6-26-15

Grantor's Acknowledgment

STATE OF NEW YORK)
) ss:
COUNTY OF)

On the 26th day of June, in the year 20 15, before me, the undersigned, personally appeared Paul Iskalo, 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.

____
Notary Public - State of New York

Charles G. Kramer
Notary Public State of New York
No. 01KR6310371
Qualified in Erie County
Commission Expires 08/25/2018

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 28th day of July, in the year 2015, 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

BROWNFIELD EASEMENT DESCRIPTION

ALL THAT TRACT OR PARCEL OF LAND situate in the Village of Ellicottville and Town of Ellicottville, County of Cattaraugus and State of New York, being part of Lots 37, 42 and 65 of Town 4 and Range 6 of the Holland Land Company's Survey and further bounded and described as follows:

Beginning at a point on the westerly bounds of Jefferson Street (a.k.a. US Route 219), said point being located approximately 1500.6' southeasterly from the centerline of Washington Street;

Thence, along the westerly bounds of Jefferson Street, S 29°42'51" E a distance of 711.21 feet to a point on the northerly boundary line of lands now or formerly owned by J.N. Adams Development Center;

Thence, along the northerly line of J.N. Adams Development Center, the following 9 courses and distances:

1.) S 58°33'56" W a distance of 36.89 feet to a point;

2.) thence, S 59°55'13" W a distance of 50.21 feet to a point;

3.) thence, S 53°28'21" W a distance of 76.68 feet to a point;

4.) thence, S 86°35'58" W a distance of 43.13 feet to a point;

5.) thence, N 74°19'40" W a distance of 115.79 feet to a point;

6.) thence, N 68°44'43" W a distance of 148.90 feet to a point;

7.) thence, N 65°29'29" W a distance of 56.91 feet to a point;

8.) thence, S 62°23'58" W a distance of 18.42 feet to a point;

9.) thence, N 65°29'29" W a distance of 60.00 feet to a point;

Thence, leaving the northerly line of J.N. Adams Development Center, N 63°35'56" W a distance of 327.32 feet to a point;

Thence, N 08°24'03" W a distance of 227.07 feet to a point;

Thence, N 58°13'48" E a distance of 366.16 feet to a point on the westerly line of lands now or formerly owned by Dean William Burrell;

Thence, along the westerly line of Burrell, and extending past, S 29°33'09" E a distance of 86.28 feet to a point;

Thence, N 60°36'46" E a distance of 198.00 feet to the Point of Beginning.

Containing 8.43 acres of land, more or less, and being shown on a Plat prepared by E&M Engineers and Surveyors, PC, dated May 7, 2015.

LEGEND

- = LANDSCAPE AREAS
- = HEDGE ROW
- = TREE STUMP
- = PINE TREE
- = TREE
- = STREET SIGN
- = SIGN
- M.B. = MAIL BOX
- = HANDHOLE
- W.V. = WATER VALVE
- = FIRE HYDRANT
- P.I.V. = POSITION INDICATOR VALVE
- G.M. = GAS MARKER
- G.MTR. = GAS METER
- G.V. = GAS VALVE
- = LIGHT POLE
- = UTILITY POLE – CUT DOWN
- U.P. = UTILITY POLE
- G.P. = GUY POLE
- = GUY WIRE
- = TRAFFIC LIGHT POLE
- E.M. = ELECTRIC METER
- = SANITARY MANHOLE
- = MANHOLE
- C.O. = CLEAN OUT
- = FIBER OPTIC MANHOLE
- = TELEPHONE MANHOLE
- = STORM MANHOLE
- = STORM INLET
- = PARKING METER
- = BOLLARD
- F.P. = FLAG POLE
- M.W. = MONITORING WELL
- = EXISTING GROUND CONTOURS
- C.B. = CATCH BASIN / STORM INLET
- C.M.P. = CORRUGATED METAL PIPE
- V.C.P. = VITRIFIED CLAY PIPE
- R.C.P. = REINFORCED CONCRETE PIPE
- = SANITARY SEWER PIPE
- = EXISTING PIPE FLOW ARROW
- = FOUND IRON
- = SET REBAR WITH CAP
- N/F = NOW OR FORMERLY
- D = DEED DISTANCE
- M = MEASURED DISTANCE
- R.B. = RECORD BOOK
- D.B. = DEED BOOK
- PG. = PAGE

This property is subject to an environmental easement held by the New York 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 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 derweb@dec.ny.gov

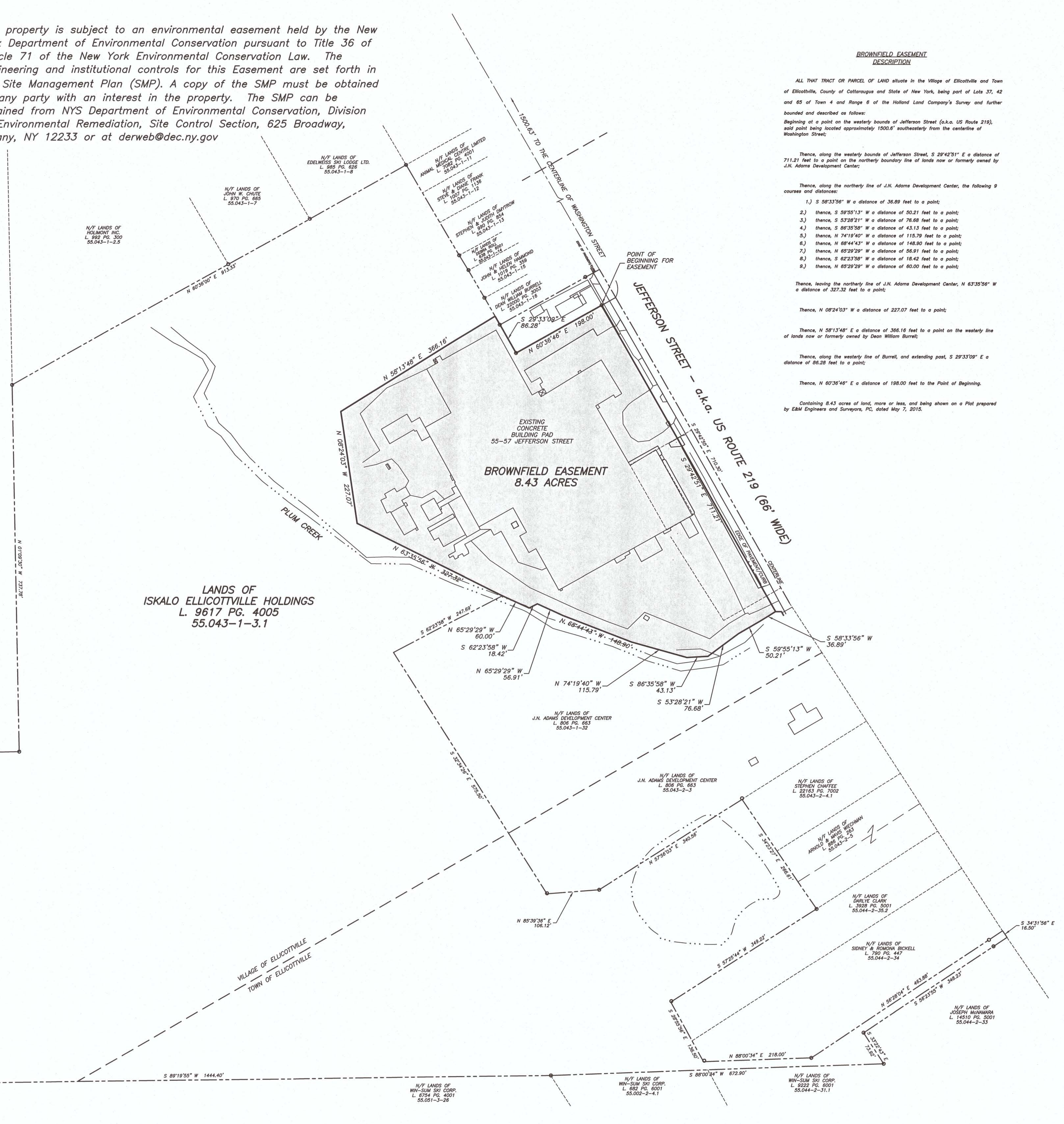


EXHIBIT A LEGAL DESCRIPTION

ALL THAT TRACT OR PARCEL OF LAND situate in the Village of Ellicottville and Town of Ellicottville, County of Cattaraugus and State of New York, being part of Lots 37, 42 and 65 of Town 4 and Range 6 of the Holland Land Company's Survey and further bounded and described as follows:

BEGINNING at a point in the centerline of Jefferson Street (66 foot right of way), also known as U.S. Route 219, said point of beginning located southeasterly as measured along the centerline of Jefferson Street a distance of 973.5 feet from the southerly line of Martha Street, said point of beginning also located southeasterly as measured along the centerline of Jefferson Street a distance of 1,500.63 feet from the centerline of Washington Street; thence S 29° 42' 51" E along the centerline of Jefferson Street, 710.30 feet to a point, said point located northwesterly as measured along the centerline of Jefferson Street a distance of 119.16 feet from the line separating the Village of Ellicottville to the North and the Town of Ellicottville to the South, said point being also the northeasterly corner of lands of the J.N. Adams Development Center as described in a deed recorded in the Cattaraugus County Clerk's Office in Liber 806 of Deeds at Page 663; thence S 58° 33' 56" W along the top of bank of Plum Creek, 69.90 feet to a point; thence S 59° 55' 13" W and still along the top of bank of Plum Creek, 50.21 feet–to a point; thence S 53° 28' 21" W and still along the top of bank of Plum Creek, 76.68 feet to a point; thence S 86° 35' 58" W and still along the top of bank of Plum Creek, 43.13 feet to a point; thence N 74° 19' 40" W and still along the top of bank of Plum Creek, 115.79 feet to a point; thence N 68° 44' 43" W and still along the top of bank of Plum Creek, 148.90 feet to a point; thence N 65° 29' 29" W and still along the top of bank of Plum Creek, 56.91 feet to an iron stake in the southerly line of lands formerly conveyed by Allan E. Roy and wife to Signore, Inc. by deed dated August 21,1968 and recorded in the Cattaraugus County Clerk's Office in Liber 700 of Deeds at Page 943; thence S 62° 23' 58" W and along the southerly line of said lands conveyed by Roy to Signore, Inc., 18.42 feet to a point in the centerline of Plum Creek; thence N 65° 29' 29" W along the centerline of Plum Creek and along the southwesterly line of said lands conveyed by Roy to Signore, Inc., 60.00 feet to a point; thence S 62° 23' 58" W and along the

northwesterly line of aforementioned J.N. Adams Development Center, 247.69 feet to an iron stake; thence S 32° 34' 26" E and along the southwesterly line of J.N. Adams Development Center, 575.50 feet to an iron stake; thence N 85° 39' 36" E and along the southerly line of J.N. Adams Development Center, 106.12 feet to an iron stake; thence N 57° 56' 03" E along the southeasterly line of J.N. Adams Development Center, 340.56 feet to an iron stake at the northwesterly corner of lands of Gerald and Phyllis Woods as described in a deed recorded in the Cattaraugus County Clerk's Office in Liber 886 of Deeds at Page 265; thence S 34° 23' 27" E along the southwesterly line of said Woods and further along the southwesterly line of lands of Arnold and Mavis Wiechman as described in a deed recorded in the Cattaraugus County Clerk's Office in Liber 886 of Deeds at Page 263 a distance of 266.61 feet to an iron stake in the northerly line of lands of Daryle Clark as described in a deed recorded in the Cattaraugus County Clerk's Office in Liber 998 of Deeds at Page 1111; thence S 57° 25' 44" W along the northwesterly line of said Clark, 349.22 feet to an iron stake; thence S 28° 55' 56" E and along the southwesterly line of said Clark and further along the southwesterly line of lands of Sidney and Ramona Bickell as described in a deed recorded in the Cattaraugus County Clerk's Office in Liber 790 of Deeds at Page 447 a distance of 136.50 feet to an iron stake; thence N 88° 00' 34" E along the southerly line of said Bickell, 218.00 feet to an iron stake; thence N 56° 28' 04" E and along the southeasterly line of Bickell, 430.88 feet to an iron stake; thence continuing along the same course, N 56° 28'04" E and still along the southeasterly line of said Bickell, 33.00 feet to a point in the centerline of Jefferson Street; thence S 34° 31' 56" E along the centerline of Jefferson Street, 16.50 feet to a point, being the northeasterly corner of lands of Lillian Rihlens, et al as described in a deed recorded in the Cattaraugus County Clerk's Office in Liber 831 of Deeds at Page 426; thence S 56° 28' 04" W along the northwesterly line of said Rihlens, 33.00 feet to an iron stake; thence continuing along the same course, S 56° 28' 04" W and still along the northwesterly line of said Rihlens, 315.48 feet to an iron stake; thence S 33° 22' 43" E and along the southwesterly line of Rihlens, 73.92 feet to an iron stake in the northerly line of lands of Pengilly Corp.; thence S 88° 00' 34" W along the northerly line of said Pengilly Corp. and further along the northerly line of Alejandro Seidel a distance of 672.90 feet to an iron stake at the northeasterly corner of lands of Fox Ridge Development; thence S 89° 19' 55" W along the southerly line of said Fox Ridge Development, 1,444.10 feet to an iron stake; thence N 00° 49' 50" E and along the easterly line of Fox Ridge Development, 664.50 feet to an iron stake in the

south line of Lot 64 and in the south line of lands of Holimont, Inc.; thence N 89° 15' 00" E along the south line of Lot 64 and along the south line of Holimont, Inc., 360.60 feet to an iron stake at the southeast corner of Lot 64 and the southwest corner of Lot 65 and in the north line of Lot 42; thence N 01° 09' 30" W along the west line of Lot 65 and along the easterly line of Holimont, Inc., 737.78 feet to an iron stake; thence 'N 60° 36' 00" E and along the southeasterly line of Holimont, Inc., 501.50 feet to an iron stake at the southwesterly corner of lands of John W. Chute as described in a deed recorded in the Cattaraugus County Clerk's Office in Liber 970 of Deeds at Page 665; thence continuing along the same course, N 60° 36' 00" E and along the southeasterly line of said Chute, 188.66 feet to an iron stake at the southwesterly corner of Edelweiss Ski Lodge, Ltd. as described in deed recorded in the Cattaraugus County Clerk's Office in Liber 985 of Deeds at Page 626; thence continuing along the same course, N 60° 36' 00" E and along the southeasterly line of said Edelweiss Ski Lodge, Ltd., 223.17 feet to an iron stake; thence S 30° IT 32" E along the southwesterly line of lands of Douglas C. and Susan Gillham and along the southwesterly line of lands of the First Tier Bank and Trust and along the southwesterly line of lands of Steven and Judith Dmytrow and along the southwesterly line of Teresa Mercer a distance of 249.72 feet to an iron stake; thence continuing along the same course, S 30° 11'32" E and along the southwesterly line of John and Helen Hammond, 65.29 feet to an iron stake; thence S 29° 33' 09" E and along the southwesterly line of Dean and Jane Burell, 63.02 feet to an iron stake; thence continuing along the same course, S 29° 33' 09" E and along the southwesterly line of other lands of Signore, Inc. as described in a deed from the Zion Evangelical Community Church to Signore, Inc., recorded in the Cattaraugus County Clerk's Office in Liber 1004 of Deeds at Page 429, 66.15 feet to an iron stake; thence N 60° 36' 46" E, 198.51 feet to an iron stake; thence continuing along the same course, N 60° 36' 46" E. 32.49 feet to the point of beginning, containing 52.5534 acres of land to be the same more or less.

BROWNFIELD EASEMENT DESCRIPTION

ALL THAT TRACT OR PARCEL OF LAND situate in the Village of Ellicottville and Town of Ellicottville, County of Cattaraugus and State of New York, being part of Lots 37, 42 and 65 of Town 4 and Range 6 of the Holland Land Company's Survey and further bounded and described as follows:

Beginning at a point on the westerly bounds of Jefferson Street (a.k.a. US Route 219), said point being located approximately 1500.6' southeasterly from the centerline of Washington Street;

Thence, along the westerly bounds of Jefferson Street, S 29°42'51" E a distance of 711.21 feet to a point on the northerly boundary line of lands now or formerly owned by J.N. Adams Development Center;

Thence, along the northerly line of J.N. Adams Development Center, the following 9 courses and distances:

1.) S 58°33'56" W a distance of 36.89 feet to a point;
2.) thence, S 59°55'13" W a distance of 50.21 feet to a point;
3.) thence, S 53°28'21" W a distance of 76.68 feet to a point;
4.) thence, S 86°35'58" W a distance of 43.13 feet to a point;
5.) thence, N 74°19'40" W a distance of 115.79 feet to a point;
6.) thence, N 68°44'43" W a distance of 148.90 feet to a point;
7.) thence, N 65°29'29" W a distance of 56.91 feet to a point;
8.) thence, S 62°23'58" W a distance of 18.42 feet to a point;
9.) thence, N 65°29'29" W a distance of 60.00 feet to a point;

Thence, leaving the northerly line of J.N. Adams Development Center, N 63°35'56" W a distance of 327.32 feet to a point;

Thence, N 08°24'03" W a distance of 227.07 feet to a point;

Thence, N 58°13'48" E a distance of 366.16 feet to a point on the westerly line of lands now or formerly owned by Dean William Burrell;

Thence, along the westerly line of Burrell, and extending past, S 29°33'09" E a distance of 86.28 feet to a point;

Thence, N 60°36'46" E a distance of 198.00 feet to the Point of Beginning.

Containing 8.43 acres of land, more or less, and being shown on a Plat prepared by E&M Engineers and Surveyors, PC, dated May 7, 2015.

E&M
Engineers and Surveyors PC

SERVING PENNSYLVANIA AND NEW YORK SINCE 1946

24 DERRICK ROAD
BRADFORD, PENNSYLVANIA 16701
TELEPHONE: (814) 362-5546
FAX: (814) 362-3023

www.emengineers.com

FREDERICK J. MORICCA III, P.L.S. No. 050681

NOTES:

1. THIS SURVEY IS SUBJECT TO SUCH FACTS AS MAY BE DISCLOSED IN A TITLE SEARCH.

2. TO BE VALID, COPIES HEREOF MUST CONTAIN THE LAND SURVEYOR'S ORIGINAL SIGNATURE AND EMBOSSED SEAL.

3. THIS SURVEY IS IN ACCORDANCE WITH THE EXISTING CODE OF PRACTICE FOR LAND SURVEYORS OF THE NEW YORK STATE ASSOCIATION OF PROFESSIONAL LAND SURVEYORS.

REVISIONS

No.	DATE	DESCRIPTION

ISKALO ELLICOTTVILLE HOLDINGS
CONTACT PERSON: MATT ROLAND
5166 MAIN STREET
WILLIAMSVILLE, NY 14221
CLIENT TELEPHONE: (716) 633-2096

BROWNFIELD CLEANUP PROGRAM

BROWNFIELD EASEMENT

VILLAGE OF ELLICOTTVILLE
CATTARAUGUS COUNTY
NEW YORK

0m 25m 50m 75m 100m
0' 30' 60' 90' 120'

SCALE: 1" = 60'	JOB NO. 15021		
H.L.C. SURVEY INFO:	LOT 19	T4	R5
DRAWN BY: JGH	BK. ---	PG. ---	
CHECKED BY: FJM	DATE: 05/07/2015		

FILE NO. D14-692

Friday, May 15, 2015 – 8:15am EST S:\2015JOBS\15021\15021 Brownfield Easement.dwg

APPENDIX B – LIST OF SITE CONTACTS

Name	Phone/Email Address
Site Owner/Remedial Party: Iskalo Ellicottville Holdings LLC	(716) 633-2096 / msroland@Iskalo.com
Qualified Env. Professional: Mr. Bart A. Klettke GZA GeoEnvironmental of New York	(716) 844-7040 / bart.klettke@gza.com
NYSDEC Project Manager: Mr. Jaspal Walia	(716) 851-7220 / jaspal.walia@dec.ny.gov
Mr. Chad Staniszewski	(716) 851-7220 Chad.Staniszewski@dec.ny.gov
NYSDEC Site Control	(518) 402-9567 / derweb@dec.ny.gov
Attorney for Remedial Party: Mr. Craig Slater	(716) 845-6760 / cslater@cslaterlaw.com

APPENDIX C
SOIL BORING AND WELL CONSTRUCTION LOGS

The locations of soil borings and monitoring wells are shown on Figures 3B and 4.

TEST PIT FIELD LOG

Project Description: Signore Inc.	Test Pit No: TP-9
Project location: 55-57 Jefferson St.	Location:
GZA Representative: Thomas Bohlen	File No: 21.0056367.40
Contractor: TREC Environmental	Date: 9/25/2012
	Weather:
Operator: Jim Agar	Ground elev.:
Make: Takeuchi Model: TB 175	

DEPTH (feet)	SAMPLE NO.	SAMPLE DEPTH	DESCRIPTION	PID
0.5			Asphalt and Subbase.	0
1			Brown GRAVEL and SAND, trace Silt, trace Clay, moist.	
1.5				
2				
2.5			Gray CLAY and SILT, trace Gravel, trace Sand, moist.	0
3				
3.5				
4				
4.5				0
5				
5.5			Brown and Gray mottled Silty CLAY, little Sand, moist.	
6				
6.5				0
7				
7.5				
8				
8.5				0
9				
9.5				
10			End of Excavation at 10 feet below ground surface.	

REMARKS:

GZA GeoEnvironmental of New York
Engineers and Scientists

TEST PIT FIELD LOG

Project Description:	Signore Inc.	Test Pit No:	TP-10
Project location:	55-57 Jefferson St.	Location:	
GZA Representative:	Thomas Bohlen	File No:	21.0056367.40
Contractor:	TREC Environmental	Date:	9/25/2012
		Weather:	
Operator:	Jim Agar	Ground elev.:	
Make: Takeuchi	Model: TB 175		

DEPTH (feet)	SAMPLE NO.	SAMPLE DEPTH	DESCRIPTION	PID
0.5			Asphalt and Subbase.	0
1			Brown GRAVEL and SAND, trace Silt, trace Clay, moist.	
1.5			Gray CLAY and SILT, trace Gravel, trace Sand, moist.	
2				
2.5				0
3				
3.5				
4				
4.5				0
5				
5.5			Brown and Gray mottled Silty CLAY, little Sand, moist.	
6				
6.5				0
7				
7.5			pipe in southeast corner of excavation damaged by excavator - unpressurized water observed to flow out of pipe into bottom of excavation	
8				
8.5			End of Excavation at 8 feet below ground surface.	0
9				
9.5				
10				

REMARKS: 1-inch microwell and roadbox installed adjacent and west of TP-9. Installed microwell with truck-mounted geoprobe rig using a blind point tip on macrocore sampler. BOW = 19' bgs., Screened 4-19', Sand Pack 2'-19', Granular Bentonite 0-2'. Well installed on 9/28/12. Water level: 9/28/12 - 8:55 - 10.81' bgs.

GZA GeoEnvironmental of New York
Engineers and Scientists

TEST PIT FIELD LOG

Project Description:	Signore Inc.	Test Pit No:	TP-11
Project location:	55-57 Jefferson St.	Location:	
GZA Representative:	Thomas Bohlen	File No:	21.0056367.40
Contractor:	TREC Environmental	Date:	9/25/2012
		Weather:	
Operator:	Jim Agar	Ground elev.:	
Make:	Takeuchi Model: TB 175		

DEPTH (feet)	SAMPLE NO.	SAMPLE DEPTH	DESCRIPTION	PID
0.5			Brown GRAVEL and SAND, trace Silt, trace Clay, moist.	0
1				
1.5				
2				
2.5			Brown and Gray mottled Silty CLAY, little Sand, trace Gravel, moist. 12-inch diameter corregated steel pipe observed in southern portion of excavation at 2' bgs.	0
3				
3.5				
4			Grades to: trace Sand.	
4.5				0
5				
5.5				
6				
6.5				0
7				
7.5			Grades to: Gray.	
8				
8.5				0.6
9				
9.5				
10			End of Excavation at 10 feet below ground surface.	

REMARKS: 1-inch microwell and roadbox installed adjacent and south of TP-10. Installed microwell with truck-mounted geoprobe rig using a blind point tip on macrocore sampler. BOW = 19.5' bgs., Screened 4.5-19.5', Sand Pack 3'-19.5', Granular Bentonite 0-3'. Well installed on 9/28/12. Water level: 9/28/12 - 9:45 - 12.22' bgs.

GZA GeoEnvironmental of New York
Engineers and Scientists

TEST PIT FIELD LOG

Project Description:	Signore Inc.	Test Pit No:	TP-12
Project location:	55-57 Jefferson St.	Location:	
GZA Representative:	Thomas Bohlen	File No:	21.0056367.40
Contractor:	TREC Environmental	Date:	9/25/2012
		Weather:	
Operator:	Jim Agar	Ground elev.:	
Make: Takeuchi	Model: TB 175		

DEPTH (feet)	SAMPLE NO.	SAMPLE DEPTH	DESCRIPTION	PID
0.5			Brown GRAVEL and SAND, trace Silt, trace Clay, moist.	0
1				
1.5				
2				
2.5				0
3				
3.5				
4				
4.5				0
5				
5.5			Grades to: large Gravel (~8-inches maximum) observed.	
6			Grades to: wet.	
6.5				0
7				
7.5				
8				
8.5			End of Excavation at 8 feet below ground surface due to hole collapse.	
9				
9.5				
10				

REMARKS:

GZA GeoEnvironmental of New York
Engineers and Scientists

TEST PIT FIELD LOG

Project Description:	Signore Inc.	Test Pit No:	TP-13
Project location:	55-57 Jefferson St.	Location:	
GZA Representative:	Thomas Bohlen	File No:	21.0056367.40
Contractor:	TREC Environmental	Date:	9/25/2012
		Weather:	
Operator:	Jim Agar	Ground elev.:	
Make: Takeuchi	Model: TB 175		

DEPTH (feet)	SAMPLE NO.	SAMPLE DEPTH	DESCRIPTION	PID
0.5			Brown GRAVEL and SAND, trace Silt, trace Clay, moist.	0
1				
1.5				
2				
2.5				0
3				
3.5			Brown and Gray mottled Silty CLAY, trace Gravel, trace Sand, moist.	
4				
4.5			Brown GRAVEL and SAND, little Silt, little Clay, wet.	0
5				
5.5				
6				
6.5				0
7				
7.5			Brown SAND, some Gravel, trace Silt, trace Clay, moist.	
8				
8.5				0
9				
9.5				
10			End of Excavation at 10 feet below ground surface.	

REMARKS: 1-inch microwell and roadbox installed adjacent and south of TP-13. Installed microwell with truck-mounted geoprobe rig using a blind point tip on macrocore sampler. BOW = 19' bgs., Screened 9-19', Sand Pack 3'-19', Granular Bentonite 0-3'. Well installed on 10/1/12. Water level: 10/1/12 - 14:45 - 9.94' bgs.

GZA GeoEnvironmental of New York
Engineers and Scientists

TEST PIT FIELD LOG

Project Description:	Signore Inc.	Test Pit No:	TP-14
Project location:	55-57 Jefferson St.	Location:	
GZA Representative:	Thomas Bohlen	File No:	21.0056367.40
Contractor:	TREC Environmental	Date:	9/26/2012
		Weather:	
Operator:	Jim Agar	Ground elev.:	
Make: Takeuchi	Model: TB 175		

DEPTH (feet)	SAMPLE NO.	SAMPLE DEPTH	DESCRIPTION	PID
0.5			Brown GRAVEL and SAND, trace Silt, trace Clay, moist.	0
1				
1.5				
2			Brown Bank-run GRAVEL (2-inches). Brown GRAVEL and SAND, trace Silt, trace Clay, moist.	
2.5				0
3				
3.5			Brown and Gray mottled Silty CLAY, trace Gravel, trace Sand, moist.	
4				
4.5				0
5				
5.5			Brown GRAVEL, some Sand, little Silt, little Clay, wet.	
6				
6.5				0
7				
7.5				
8				
8.5				0
9				
9.5				
10			End of Excavation at 10 feet below ground surface.	

REMARKS:

GZA GeoEnvironmental of New York
Engineers and Scientists

TEST PIT FIELD LOG

Project Description:	Signore Inc.	Test Pit No:	TP-15
Project location:	55-57 Jefferson St.	Location:	
GZA Representative:	Thomas Bohlen	File No:	21.0056367.40
Contractor:	TREC Environmental	Date:	9/26/2012
		Weather:	
Operator:	Jim Agar	Ground elev.:	
Make: Takeuchi	Model: TB 175		

DEPTH (feet)	SAMPLE NO.	SAMPLE DEPTH	DESCRIPTION	PID
0.5			Brown GRAVEL and SAND, trace Silt, trace Clay, moist.	0
1				
1.5				
2				
2.5				0
3				
3.5			Brown and Gray mottled Silty CLAY, trace Gravel, trace Sand, moist.	
4				
4.5			Brown GRAVEL and SAND, trace Silt, trace Clay, moist.	0
5				
5.5				
6				
6.5				0
7			Reddish Dark Brown GRAVEL and SAND, trace Silt, trace Clay, moist.	
7.5				
8				
8.5				0
9				
9.5			Grades to: wet.	
10			End of Excavation at 10 feet below ground surface.	

REMARKS: 1-inch microwell and roadbox installed adjacent and south of TP-15. Installed microwell with truck-mounted geoprobe rig using a blind point tip on macrocore sampler. BOW = 18' bgs., Screened 8-18', Sand Pack 3'-18', Granular Bentonite 0-3'. Well installed on 10/1/12. Water level: 10/1/12 - 14:05 - 9.73' bgs.

GZA GeoEnvironmental of New York
Engineers and Scientists

TEST PIT FIELD LOG

Project Description:	Signore Inc.	Test Pit No:	TP-16
Project location:	55-57 Jefferson St.	Location:	
GZA Representative:	Thomas Bohlen	File No:	21.0056367.40
Contractor:	TREC Environmental	Date:	9/26/2012
		Weather:	
Operator:	Jim Agar	Ground elev.:	
Make: Takeuchi	Model: TB 175		

DEPTH (feet)	SAMPLE NO.	SAMPLE DEPTH	DESCRIPTION	PID
0.5			Concrete (0.8' - very difficult on excavator).	0
1				
1.5			Brown GRAVEL, some Sand, trace Silt, trace Clay, moist. Large Gravel (~8-inch maximum) observed.	
2				
2.5				0
3			Brown GRAVEL and SAND, trace Silt, trace Clay, moist.	
3.5				
4				
4.5				0
5				
5.5				
6				
6.5				0
7				
7.5			Grades to: Large Gravel (~8-inches maximum) observed.	
8				
8.5				0
9			Grades to: wet.	
9.5				
10			End of Excavation at 11.5 feet below ground surface.	

REMARKS:

GZA GeoEnvironmental of New York
Engineers and Scientists

TEST PIT FIELD LOG

Project Description:	Signore Inc.	Test Pit No:	TP-17
Project location:	55-57 Jefferson St.	Location:	
GZA Representative:	Thomas Bohlen	File No:	21.0056367.40
Contractor:	TREC Environmental	Date:	9/26/2012
		Weather:	
Operator:	Jim Agar	Ground elev.:	
Make: Takeuchi	Model: TB 175		

DEPTH (feet)	SAMPLE NO.	SAMPLE DEPTH	DESCRIPTION	PID
0.5			Concrete	0
1			Brown GRAVEL and SAND, trace Silt, trace Clay, moist.	
1.5				
2				
2.5				0
3				
3.5			Brown and Gray mottled Silty CLAY, trace Gravel, trace Sand, moist.	
4			Gray Silty CLAY, moist	
4.5				0
5				
5.5			Brown GRAVEL and SAND, little Silt, little Clay, moist.	
6				
6.5				0
7				
7.5				
8				
8.5			Grades to: Large Gravel (~8-inches maximum) observed.	0
9				
9.5				
10			End of Excavation at 10 feet below ground surface.	

REMARKS:

GZA GeoEnvironmental of New York
Engineers and Scientists

TEST PIT FIELD LOG

Project Description:	Signore Inc.	Test Pit No:	TP-18
Project location:	55-57 Jefferson St.	Location:	
GZA Representative:	Thomas Bohlen	File No:	21.0056367.40
Contractor:	TREC Environmental	Date:	9/26/2012
		Weather:	
Operator:	Jim Agar	Ground elev.:	
Make: Takeuchi	Model: TB 175		

DEPTH (feet)	SAMPLE NO.	SAMPLE DEPTH	DESCRIPTION	PID
0.5			Clean Bank-Run Gravel, moist.	0
1				
1.5				
2				
2.5			Brown Silty CLAY, trace Sand, moist.	0
			End of Excavation at 2.3 feet bgs.	
3				
3.5				
4				
4.5				0
5				
5.5				
6				
6.5				0
7				
7.5				
8				
8.5				0
9				
9.5				
10			End of Excavation at 10 feet below ground surface.	

REMARKS: Test pit located within a concrete-curbed former transformer pad. Bank-Run Gravel removed from within concrete curbing to native soil at 2.3' bgs. This material sampled for SVOCs (bn), PCBs, and Metals (TAL) as per Chad Staniszewski, NYSDEC.

GZA GeoEnvironmental of New York
Engineers and Scientists

CONTRACTOR	TREC Environmental	BORING LOCATION	See Site Plan
DRILLER	Jim Agar	GROUND SURFACE ELEVATION	NM DATUM NA
START DATE 9/27/12	END DATE 9/27/12	GZA GEOENVIRONMENTAL REPRESENTATIVE:	T. Bohlen

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG	Geoprobe GH 42
CASING SIZE AND DIAMETER	2" diameter by 48" long
OVERBURDEN SAMPLING METHOD	Direct push
ROCK DRILLING METHOD	NA

DEPTH	Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	OVM (ppm)
	S-1	0-2	20	Concrete (4-inches).		0
1				Brown GRAVEL and SAND, trace Silt, trace Clay, moist.		
2						
	S-2	2-4	20			0
3						
4						
	S-3	4-6	60			0
5						
6						
	S-4	6-8	60			0
7				Brown Silty CLAY, little Sand, trace Gravel, moist.		
8						
	S-5	8-10	80			0
9						
10						
	S-6	10-12	80			0
11				Brown GRAVEL and SAND, trace Silt, trace Clay, moist. Grades to: wet.		
12						
	S-7	12-14	50			0
13						
14						
	S-8	14-16	50			0
15						
16						
	S-9	16-18	80			0
17						
18						
	S-10	18-20	80			0
19						
20				End of soil probe at 20' below ground surface.		

S - Split Spoon Sample
C - Rock Core Sample

NOTES: MiniRAE 3000 was used to field screen and headspace soil samples.

General Notes:
1) Stratification lines represent approximate boundry between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CONTRACTOR	TREC Environmental	BORING LOCATION	See Site Plan
DRILLER	Jim Agar	GROUND SURFACE ELEVATION	NM DATUM NA
START DATE 9/27/12	END DATE 9/27/12	GZA GEOENVIRONMENTAL REPRESENTATIVE:	T. Bohlen

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG	Geoprobe GH 42
CASING SIZE AND DIAMETER	2" diameter by 48" long
OVERBURDEN SAMPLING METHOD	Direct push
ROCK DRILLING METHOD	NA

DEPTH	SAMPLE INFORMATION: Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	OVM (ppm)
	S-1	0-2	90	Concrete (4-inches).		0
1				Brown and Gray mottled Silty CLAY, trace Gravel, trace Sand, moist.		
2	S-2	2-4	90			0
3				Grades to: some Gravel.		
4				Grades to: trace Gravel.		
	S-3	4-6	80			0
5						
6	S-4	6-8	80			0
7				Brown GRAVEL and SAND, trace Silt, trace Clay, moist.		
8	S-5	8-10	70			0
9				Grades to: wet.		
10	S-6	10-12	70			0
11						
12	S-7	12-14	40			0
13						
14	S-8	14-16	40			0
15						
16	S-9	16-18	50			0
17						
18	S-10	18-20	50			0
19						
20				End of soil probe at 20 feet below ground surface.		

S - Split Spoon Sample
C - Rock Core Sample

NOTES: MiniRAE 3000 was used to field screen and headspace soil samples.

General Notes:
1) Stratification lines represent approximate boundry between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CONTRACTOR	TREC Environmental	BORING LOCATION	See Site Plan
DRILLER	Jim Agar	GROUND SURFACE ELEVATION	NM DATUM NA
START DATE 9/27/12	END DATE 9/27/12	GZA GEOENVIRONMENTAL REPRESENTATIVE: T. Bohlen	

WATER LEVEL DATA

DATE	TIME	WATER	CASING
9/27/2012	12:46	9.87 (TOC)	

TYPE OF DRILL RIG	Geoprobe GH 42
CASING SIZE AND DIAMETER	2" diameter by 48" long
OVERBURDEN SAMPLING METHOD	Direct push
ROCK DRILLING METHOD	NA

DEPTH	Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	OVM (ppm)
	S-1	0-2	100	Concrete (4-inches).	1-inch diameter	0
1				Brown and Gray mottled Silty CLAY, trace Gravel, trace Sand,	microwell and roadbox	
				moist.	installed.	
2						
	S-2	2-4	100		BOW = 19' bgs.	0
3						
					Screened: 9'-19' bgs.	
4						
	S-3	4-6	95		Sand pack: 7'-19' bgs.	0
5						
					Granular bentonite:	
6					0-7' bgs.	
	S-4	6-8	95	Brown GRAVEL and SAND, trace Silt, trace Clay, moist.		0
7						
8						
	S-5	8-10	80			0
9						
10						
	S-6	10-12	80			0
11						
				Grades to: wet.		
12						
	S-7	12-14	10			0
13						
14						
	S-8	14-16	10			0
15						
16						
	S-9	16-18	60			0
17						
18						
	S-10	18-20	60			0
19						
20				End of soil probe at 20 feet below ground surface.		

S - Split Spoon Sample
C - Rock Core Sample

NOTES: MiniRAE 3000 was used to field screen and headspace soil samples.

General Notes:
1) Stratification lines represent approximate boundry between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CONTRACTOR: TREC Environmental | BORING LOCATION: See Site Plan
DRILLER: Jim Agar | GROUND SURFACE ELEVATION: NM DATUM: NA
START DATE 9/27/12 | END DATE 9/27/12 | GZA GEOENVIRONMENTAL REPRESENTATIVE: T. Bohlen

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe GH 42
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	OVM (ppm)
	S-1	0-2	95	Concrete (4-inches).		0
1				Brown GRAVEL and SAND, trace Silt, trace Clay, moist.		
2				Brown and Gray mottled Silty CLAY, trace Sand, moist.		
	S-2	2-4	95		Duplicate VOC analytical sample taken: 2'-4'.	0
3						
4						
	S-3	4-6	85			0
5				Brown GRAVEL and SAND, trace Silt, trace Clay, moist.		
6						
	S-4	6-8	85			0
7						
8						
	S-5	8-10	70			0
9						
10						
	S-6	10-12	70			0
11						
12						
	S-7	12-14	30	Grades to: wet.		0
13						
14						
	S-8	14-16	30			0
15						
16						
	S-9	16-18	50			0
17						
18						
	S-10	18-20	50			0
19						
20				End of soil probe at 20 feet below ground surface.		

S - Split Spoon Sample
C - Rock Core Sample

NOTES: MiniRAE 3000 was used to field screen and headspace soil samples.

General Notes:
1) Stratification lines represent approximate boundry between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CONTRACTOR: TREC Environmental | BORING LOCATION: See Site Plan
DRILLER: Jim Agar | GROUND SURFACE ELEVATION: NM DATUM: NA
START DATE 9/27/12 | END DATE 9/27/12 | GZA GEOENVIRONMENTAL REPRESENTATIVE: T. Bohlen

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG: Geoprobe GH 42
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	OVM (ppm)
	S-1	0-2	10	Concrete (4-inches).		0
1				Brown GRAVEL and SAND, trace Silt, trace Clay, moist.		
2						
	S-2	2-4	10			0
3						
4						
	S-3	4-6	90	Brown and Gray mottled Silty CLAY, trace Gravel, trace Sand,		0
5				moist (8-inches).		
				Brown GRAVEL and SAND, trace Silt, trace Clay, moist.		
6						
	S-4	6-8	90			0
7						
8						
	S-5	8-10	55			0
9						
10						
	S-6	10-12	55			0
11						
12				Grades to: wet.		
	S-7	12-14	50			0
13						
14						
	S-8	14-16	50			0
15						
16						
	S-9	16-18	80			0
17						
18						
	S-10	18-20	80			0
19						
20				End of soil probe at 20 feet below ground surface.		

S - Split Spoon Sample
C - Rock Core Sample

NOTES: MiniRAE 3000 was used to field screen and headspace soil samples.

General Notes:
1) Stratification lines represent approximate boundry between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CONTRACTOR	TREC Environmental	BORING LOCATION	See Site Plan
DRILLER	Jim Agar	GROUND SURFACE ELEVATION	NM DATUM NA
START DATE 9/27/12	END DATE 9/27/12	GZA GEOENVIRONMENTAL REPRESENTATIVE:	T. Bohlen

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG	Geoprobe GH 42
CASING SIZE AND DIAMETER	2" diameter by 48" long
OVERBURDEN SAMPLING METHOD	Direct push
ROCK DRILLING METHOD	NA

DEPTH	SAMPLE INFORMATION: Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	OVM (ppm)
	S-1	0-2	60	Concrete (4-inches).	1-inch diameter	0
1				Brown GRAVEL and SAND, trace Silt, trace Clay, moist	microwell and roadbox	
				Brown and Gray mottled Silty CLAY, trace Gravel, trace Sand,	installed.	
2				moist.		
	S-2	2-4	60		BOW = 20' bgs.	0
3						
					Screened: 10'-20' bgs.	
4						
	S-3	4-6	80		Sand pack: 6'-20' bgs.	0
5						
					Granular bentonite:	
6					0-6' bgs.	
	S-4	6-8	80			0
7				Brown GRAVEL and SAND, trace Silt, trace Clay, moist.		
8						
	S-5	8-10	85			0
9						
10						
	S-6	10-12	85			0
11						
12				Grades to: wet.		
	S-7	12-14	20			0
13						
14						
	S-8	14-16	20			0
15						
16						
	S-9	16-18	90			0
17						
18						
	S-10	18-20	90			0
19						
20				End of soil probe at 20 feet below ground surface.		

S - Split Spoon Sample
C - Rock Core Sample

NOTES: MiniRAE 3000 was used to field screen and headspace soil samples.

General Notes:
1) Stratification lines represent approximate boundry between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CONTRACTOR	TREC Environmental	BORING LOCATION	See Site Plan
DRILLER	Jim Agar	GROUND SURFACE ELEVATION	NM DATUM NA
START DATE 9/27/12	END DATE 9/27/12	GZA GEOENVIRONMENTAL REPRESENTATIVE:	T. Bohlen

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG	Geoprobe GH 42
CASING SIZE AND DIAMETER	2" diameter by 48" long
OVERBURDEN SAMPLING METHOD	Direct push
ROCK DRILLING METHOD	NA

DEPTH	Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	OVM (ppm)
	S-1	0-2	60	Concrete (4-inches).		0
1				Brown GRAVEL and SAND, trace Silt, trace Clay, moist (8-inches).		
2				Brown Silty CLAY, trace Gravel, trace Sand, moist.		
	S-2	2-4	60			0
3						
4				Brown GRAVEL and SAND, trace Silt, trace Clay, moist		
	S-3	4-6	70	Brown Silty CLAY, trace Gravel, trace Sand, moist.		0
5						
6						
	S-4	6-8	70			0
7				Brown GRAVEL and SAND, trace Silt, trace Clay, moist		
8						
	S-5	8-10	40			0
9						
10						
	S-6	10-12	40			0
11						
12				Grades to: wet.		
	S-7	12-14	45			0
13						
14						
	S-8	14-16	45			0
15						
16						
	S-9	16-18	50			0
17						
18						
	S-10	18-20	50			0
19						
20				End of soil probe at 20 feet below ground surface.		

S - Split Spoon Sample
C - Rock Core Sample

NOTES: MiniRAE 3000 was used to field screen and headspace soil samples.

General Notes:
1) Stratification lines represent approximate boundry between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CONTRACTOR	TREC Environmental	BORING LOCATION	See Site Plan
DRILLER	Jim Agar	GROUND SURFACE ELEVATION	NM DATUM NA
START DATE 9/27/12	END DATE 9/27/12	GZA GEOENVIRONMENTAL REPRESENTATIVE:	T. Bohlen

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG	Geoprobe GH 42
CASING SIZE AND DIAMETER	2" diameter by 48" long
OVERBURDEN SAMPLING METHOD	Direct push
ROCK DRILLING METHOD	NA

DEPTH	SAMPLE INFORMATION: Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	OVM (ppm)
	S-1	0-2		Concrete (4-inches).	1-inch diameter	0
1				Brown GRAVEL and SAND, trace Silt, trace Clay, moist.	microwell and roadbox	
				Brown and Gray mottled Silty CLAY, trace Gravel, trace Sand,	installed.	
2				moist.		
	S-2	2-4		Brown GRAVEL and SAND, trace Silt, trace Clay, moist.	BOW = 19' bgs.	0
3				Brown and Gray mottled Silty CLAY, trace Gravel, trace Sand,		
				moist.	Screened: 9'-19' bgs.	
4						
	S-3	4-6			Sand pack: 6'-19' bgs.	0
5						
					Granular bentonite:	
6					0-6' bgs.	
	S-4	6-8				0
7						
				Brown GRAVEL and SAND, trace Silt, trace Clay, moist.		
8						
	S-5	8-10				0
9						
10						
	S-6	10-12				0
11						
				Grades to: wet.		
12						
	S-7	12-14				0
13						
14						
	S-8	14-16				0
15						
16						
	S-9	16-18				0
17						
18						
	S-10	18-20				0
19						
20				End of soil probe at 20 feet below ground surface.		

S - Split Spoon Sample
C - Rock Core Sample

NOTES: MiniRAE 3000 was used to field screen and headspace soil samples.

General Notes:
1) Stratification lines represent approximate boundry between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CONTRACTOR	TREC Environmental	BORING LOCATION	See Site Plan
DRILLER	Jim Agar	GROUND SURFACE ELEVATION	NM DATUM NA
START DATE 9/27/12	END DATE 9/27/12	GZA GEOENVIRONMENTAL REPRESENTATIVE: T. Bohlen	

WATER LEVEL DATA

DATE	TIME	WATER	CASING
9/27/2012	17:40	10.82 (TOC)	

TYPE OF DRILL RIG	Geoprobe GH 42
CASING SIZE AND DIAMETER	2" diameter by 48" long
OVERBURDEN SAMPLING METHOD	Direct push
ROCK DRILLING METHOD	NA

DEPTH	Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	OVM (ppm)
	S-1	0-2	80	Concrete (4-inches).	1-inch diameter	0
1				Brown GRAVEL and SAND, trace Silt, trace Clay, moist.	microwell and roadbox	
				Brown and Gray motled Silty CLAY, trace Gravel, trace Sand,	installed.	
2				moist.		
	S-2	2-4	80		BOW = 19' bgs.	0
3						
					Screened: 9'-19' bgs.	
4				Brown GRAVEL and SAND, trace Silt, trace Clay, moist.		
	S-3	4-6	70		Sand pack: 3'-19' bgs.	0
5						
					Granular bentonite:	
6					0-3' bgs.	
	S-4	6-8	70			0
7						
				Brown and Gray mottled Silty CLAY, trace Gravel, trace Sand,		
8				moist.		
	S-5	8-10	85			0
9						
				Brown GRAVEL and SAND, trace Silt, trace Clay, moist.		
10						
	S-6	10-12	85			0
11						
12						
	S-7	12-14	10			0
13						
				Grades to: wet.		
14						
	S-8	14-16	10			0
15						
16						
	S-9	16-18	40			0
17						
18						
	S-10	18-20	40			0
19						
20				End of soil probe at 20 feet below ground surface.		

S - Split Spoon Sample
C - Rock Core Sample

NOTES: MiniRAE 3000 was used to field screen and headspace soil samples.

General Notes:
1) Stratification lines represent approximate boundry between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CONTRACTOR	TREC Environmental	BORING LOCATION	See Site Plan
DRILLER	Jim Agar	GROUND SURFACE ELEVATION	NM DATUM NA
START DATE 9/28/12	END DATE 9/28/12	GZA GEOENVIRONMENTAL REPRESENTATIVE:	T. Bohlen

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG	Geoprobe GH 42
CASING SIZE AND DIAMETER	2" diameter by 48" long
OVERBURDEN SAMPLING METHOD	Direct push
ROCK DRILLING METHOD	NA

DEPTH	Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	OVM (ppm)
	S-1	0-2	70	Concrete (4-inches).	1-inch diameter	0
1				Brown GRAVEL and SAND, trace Silt, trace Clay, moist.	microwell and roadbox	
				Brown and Gray mottled Silty CLAY, trace Gravel, trace Sand,	installed.	
2				moist.		
	S-2	2-4	70	Gray CLAY and SILT, moist.	BOW = 20' bgs.	0
3						
					Screened: 10'-20' bgs.	
4						
	S-3	4-6	100		Sand pack: 4'-20' bgs.	0
5				Brown and Gray mottled Silty CLAY, trace Gravel, trace Sand,		
				moist.	Granular bentonite:	
6					0-4' bgs.	
	S-4	6-8	100			0
7						
8						
	S-5	8-10	100			0
9						
10						
	S-6	10-12	100			0
11						
				Brown GRAVEL and SAND, trace Silt, trace Clay, moist.		
12						
	S-7	12-14	100	Grades to: wet (4-inches).		0
13				Grades to: moist.		
14						
	S-8	14-16	100			0
15						
16						
	S-9	16-18	90	Grades to: wet.		0
17						
18						
	S-10	18-20	90			0
19						
20				End of soil probe at 20 feet below ground surface.		

S - Split Spoon Sample
C - Rock Core Sample

NOTES: MiniRAE 3000 was used to field screen and headspace soil samples.

General Notes:
1) Stratification lines represent approximate boundry between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CONTRACTOR	TREC Environmental	BORING LOCATION	See Site Plan
DRILLER	Jim Agar	GROUND SURFACE ELEVATION	NM DATUM NA
START DATE 9/28/12	END DATE 9/28/12	GZA GEOENVIRONMENTAL REPRESENTATIVE: T. Bohlen	

WATER LEVEL DATA

DATE	TIME	WATER	CASING
9/28/2012	14:50	12.58	Top of roadbox

TYPE OF DRILL RIG	Geoprobe GH 42
CASING SIZE AND DIAMETER	2" diameter by 48" long
OVERBURDEN SAMPLING METHOD	Direct push
ROCK DRILLING METHOD	NA

DEPTH	Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	OVM (ppm)
	S-1	0-2	30	Concrete (4-inches).	1-inch diameter	0
1				Brown GRAVEL and SAND, trace Silt, trace Clay, moist.	microwell and roadbox	
				Brown and Gray mottled Silty CLAY, trace Gravel, trace Sand,	installed.	
2				moist.		
	S-2	2-4	30		BOW = 20' bgs.	0
3						
					Screened: 10'-20' bgs.	
4						
	S-3	4-6	100		Sand pack: 3'-20' bgs.	0
5						
					Granular bentonite:	
6					0-3' bgs.	
	S-4	6-8	100			0
7						
8						
	S-5	8-10	100			0
9						
				Brown GRAVEL and SAND, trace Silt, trace Clay, moist.		
10						
	S-6	10-12	100			0
11						
12				Grades to: wet (4-inches).		
	S-7	12-14	90	Grades to: moist.		0
13						
				Grades to: wet.		
14						
	S-8	14-16	90			0
15						
16						
	S-9	16-18	40			0
17						
18						
	S-10	18-20	40			0
19						
20				End of soil probe at 20 feet below ground surface.		

S - Split Spoon Sample
C - Rock Core Sample

NOTES: MiniRAE 3000 was used to field screen and headspace soil samples.

General Notes:
1) Stratification lines represent approximate boundry between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CONTRACTOR	TREC Environmental	BORING LOCATION	See Site Plan
DRILLER	Jim Agar	GROUND SURFACE ELEVATION	NM DATUM NA
START DATE 9/28/12	END DATE 9/28/12	GZA GEOENVIRONMENTAL REPRESENTATIVE: T. Bohlen	

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG	Geoprobe GH 42
CASING SIZE AND DIAMETER	2" diameter by 48" long
OVERBURDEN SAMPLING METHOD	Direct push
ROCK DRILLING METHOD	NA

DEPTH	Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	OVM (ppm)
	S-1	0-2	60	Concrete (4-inches).		0
1				Brown GRAVEL and SAND, trace Silt, trace Clay, moist.		
2						
	S-2	2-4	60			0
3						
				Gray CLAY and SILT, moist.		
4						
	S-3	4-6	55			0
5						
6						
	S-4	6-8	55	Brown and Gray mottled Silty CLAY, trace Gravel, trace Sand,		0
7				moist.		
8						
	S-5	8-10	10			0
9						
10						
	S-6	10-12	10			0
11						
				Grades to: wet (4-inches).		
12				Brown GRAVEL and SAND, trace Silt, trace Clay, moist.		
	S-7	12-14	100	Grades to: wet.		0
13						
14						
	S-8	14-16	100			0
15						
				Grades to: little Silt, little Clay.		
16						
	S-9	16-18	70			0
17						
18						
	S-10	18-20	70			0
19						
20				End of soil probe at 20 feet below ground surface.		

S - Split Spoon Sample
C - Rock Core Sample

NOTES: MiniRAE 3000 was used to field screen and headspace soil samples.

General Notes:
1) Stratification lines represent approximate boundry between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CONTRACTOR	TREC Environmental	BORING LOCATION	See Site Plan
DRILLER	Jim Agar	GROUND SURFACE ELEVATION	NM DATUM NA
START DATE 9/28/12	END DATE 9/28/12	GZA GEOENVIRONMENTAL REPRESENTATIVE:	T. Bohlen

WATER LEVEL DATA

DATE	TIME	WATER	CASING
9/28/2012	14:55	2.62 TOC	

TYPE OF DRILL RIG	Geoprobe GH 42
CASING SIZE AND DIAMETER	2" diameter by 48" long
OVERBURDEN SAMPLING METHOD	Direct push
ROCK DRILLING METHOD	NA

DEPTH	Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	OVM (ppm)
	S-1	0-2	0	Concrete (6-inches).	1-inch diameter	0
1				approximate 4-inch void under concrete	microwell and roadbox	
					installed.	
2						
	S-2	2-4	0	NO RECOVERY	BOW = 20' bgs.	0
3						
					Screened: 10'-20' bgs.	
4						
	S-3	4-6	100	Brown and Gray mottled Silty CLAY, trace Gravel, trace Sand,	Sand pack: 6'-20' bgs.	0
5				moist.		
					Granular bentonite:	
6					0-6' bgs.	
	S-4	6-8	100			0
7						
8						
	S-5	8-10	30	Brown GRAVEL and SAND, little Silt, little Clay, wet.		0
9						
10						
	S-6	10-12	30			0
11						
				Brown Silty CLAY, trace Gravel, trace Sand, wet.		
12				Brown GRAVEL and SAND, little Silt, little Clay, wet.		
	S-7	12-14	100	Brown and Gray mottled Silty CLAY, trace Gravel, trace Sand, wet.		0
13						
				Grades to: moist.		
14						
	S-8	14-16	100			0
15						
				Brown GRAVEL and SAND, trace Silt, trace Clay, wet.		
16						
	S-9	16-18	100			0
17						
18						
	S-10	18-20	100			0
19						
20				End of soil probe at 20 feet below ground surface.		

S - Split Spoon Sample
C - Rock Core Sample

NOTES: MiniRAE 3000 was used to field screen and headspace soil samples.

General Notes:
1) Stratification lines represent approximate boundry between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CONTRACTOR	TREC Environmental	BORING LOCATION	See Site Plan
DRILLER	Jim Agar	GROUND SURFACE ELEVATION	NM DATUM NA
START DATE 10/1/12	END DATE 10/1/2012	GZA GEOENVIRONMENTAL REPRESENTATIVE:	T. Bohlen

WATER LEVEL DATA

DATE	TIME	WATER	CASING
10/1/2012	10:30	8.32 TOC	

TYPE OF DRILL RIG	Geoprobe GH 42
CASING SIZE AND DIAMETER	2" diameter by 48" long
OVERBURDEN SAMPLING METHOD	Direct push
ROCK DRILLING METHOD	NA

DEPTH	Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	OVM (ppm)
	S-1	0-2	80	Concrete (7-inches).	1-inch diameter	0
1				Brown and Gray mottled Silty CLAY, trace Gravel, trace Sand,	microwell and roadbox	
				moist.	installed.	
2						
	S-2	2-4	80		BOW = 20' bgs.	0
3						
					Screened: 5'-20' bgs.	
4						
	S-3	4-6	70		Sand pack: 1'-20' bgs.	0
5						
					Granular bentonite:	
6					0-1' bgs.	
	S-4	6-8	70			0
7						
8				Brown GRAVEL and SAND, trace Silt, trace Clay, moist.		
	S-5	8-10	90	Grades to: wet.		0
9						
10				Grades to: little Silt, little Clay, moist.		
	S-6	10-12	90			0
11						
12						
	S-7	12-14	50	Grades to: wet.		0
13						
14						
	S-8	14-16	50			0
15						
				Grades to: trace Silt, trace Clay.		
16						
	S-9	16-18	70			0
17						
18						
	S-10	18-20	70			0
19						
20				End of soil probe at 20 feet below ground surface.		

S - Split Spoon Sample
C - Rock Core Sample

NOTES: MiniRAE 3000 was used to field screen and headspace soil samples.

General Notes:
1) Stratification lines represent approximate boundry between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CONTRACTOR	TREC Environmental	BORING LOCATION	See Site Plan
DRILLER	Jim Agar	GROUND SURFACE ELEVATION	NM DATUM NA
START DATE 10/1/12	END DATE 10/1/12	GZA GEOENVIRONMENTAL REPRESENTATIVE:	T. Bohlen

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG	Geoprobe GH 42
CASING SIZE AND DIAMETER	2" diameter by 48" long
OVERBURDEN SAMPLING METHOD	Direct push
ROCK DRILLING METHOD	NA

DEPTH	Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	OVM (ppm)
	S-1	0-2	100	Concrete (4-inches).		0
1				Brown and Gray mottled Silty CLAY, trace Gravel, trace Sand, moist.		
2						
	S-2	2-4	100			0
3						
4						
	S-3	4-6	100			0
5						
6						
	S-4	6-8	100			0
7				Brown GRAVEL and SAND, trace Silt, trace Clay, moist.		
8						
	S-5	8-10	70	Grades to: wet.		0
9						
10						
	S-6	10-12	70			0
11						
12						
	S-7	12-14	80			0
13						
14						
	S-8	14-16	80			0
15						
16						
	S-9	16-18	50			0
17						
18						
	S-10	18-20	50			0
19						
20				End of soil probe at 20 feet below ground surface.		

S - Split Spoon Sample
C - Rock Core Sample

NOTES: MiniRAE 3000 was used to field screen and headspace soil samples.

General Notes:
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2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CONTRACTOR	TREC Environmental	BORING LOCATION	See Site Plan
DRILLER	Jim Agar	GROUND SURFACE ELEVATION	NM DATUM NA
START DATE 10/1/12	END DATE 10/1/12	GZA GEOENVIRONMENTAL REPRESENTATIVE:	T. Bohlen

WATER LEVEL DATA

DATE	TIME	WATER	CASING
10/1/2012	13:25	11.93 TOC	

TYPE OF DRILL RIG	Geoprobe GH 42
CASING SIZE AND DIAMETER	2" diameter by 48" long
OVERBURDEN SAMPLING METHOD	Direct push
ROCK DRILLING METHOD	NA

DEPTH	Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	OVM (ppm)
	S-1	0-2	50	Concrete (5-inches).	1-inch diameter	0
1				Brown GRAVEL and SAND, trace Silt, trace Clay, moist.	microwell installed.	
2	S-2	2-4	50		BOW = 19.2' bgs.	0
3				Brown and Gray mottled Silty CLAY, trace Gravel, trace Sand,	Screened: 9.2'-19.2' bgs.	
4				moist.		
	S-3	4-6	95		Sand pack: 5'-19.2' bgs.	0.2
5					Granular bentonite:	
6					0-5' bgs.	
	S-4	6-8	95			0
7					Roadbox not installed	
8					at this location (coring	
	S-5	8-10	100	Grades to: wet.	equipment off-Site	0
9					9/28/12).	
10	S-6	10-12	100	Brown GRAVEL and SAND, trace Silt, trace Clay, wet.		0
11						
12	S-7	12-14	100			0
13						
14	S-8	14-16	100			0
15						
16	S-9	16-18	80			0
17						
18	S-10	18-19.2	80			0
19				Refusal at 19.2 feet below ground surface.		
20						

S - Split Spoon Sample
C - Rock Core Sample

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2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CONTRACTOR	TREC Environmental	BORING LOCATION	See Site Plan
DRILLER	Jim Agar	GROUND SURFACE ELEVATION	NM DATUM NA
START DATE 10/1/12	END DATE 10/1/12	GZA GEOENVIRONMENTAL REPRESENTATIVE:	T. Bohlen

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG	Geoprobe GH 42
CASING SIZE AND DIAMETER	2" diameter by 48" long
OVERBURDEN SAMPLING METHOD	Direct push
ROCK DRILLING METHOD	NA

DEPTH	SAMPLE INFORMATION: Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	OVM (ppm)
	S-1	0-2	90	Topsoil		0
1				Brown Silty CLAY, trace Sand, moist.		
2						
	S-2	2-4	90			0
3						
4						
	S-3	4-6	100			0
5				Grades to: Brown and Gray mottled.		
6						
	S-4	6-8	100			0
7						
8						
	S-5	8-10	100			0
9						
10				Brown GRAVEL and SAND, trace Silt, trace Clay, moist.		
	S-6	10-12	100			0
11						
12						
	S-7	12-14	80			0
13						
14						
	S-8	14-16	80			0
15						
16				Grades to: wet.		
	S-9	16-18	60			0
17						
18						
	S-10	18-20	60			0
19						
20				End of soil probe at 20 feet below ground surface.		

S - Split Spoon Sample
C - Rock Core Sample

NOTES: MiniRAE 3000 was used to field screen and headspace soil samples.

General Notes:
1) Stratification lines represent approximate boundry between soil types, transitions may be gradual.
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CONTRACTOR: TREC Environmental
DRILLER: Jim Agar
START DATE 10/2/12 END DATE 10/2/12
BORING LOCATION: See Site Plan
GROUND SURFACE ELEVATION: NM DATUM: NA
GZA GEOENVIRONMENTAL REPRESENTATIVE: T. Bohlen

WATER LEVEL DATA

DATE	TIME	WATER	CASING
10/2/2012	9:20	18.82 TOR	

TYPE OF DRILL RIG: Geoprobe GH 42
CASING SIZE AND DIAMETER: 2" diameter by 48" long
OVERBURDEN SAMPLING METHOD: Direct push
ROCK DRILLING METHOD: NA

DEPTH	Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	OVM (ppm)
	S-1	0-2	60	Topsoil	1-inch diameter	0
1				Brown Silty CLAY, trace Sand, moist.	microwell installed.	
					Stick-up = 3.25'	
2						
	S-2	2-4	60	Brown GRAVEL and SAND, trace Silt, trace Clay, moist.	BOW = 19' bgs.	0
3						
					Screened: 9'-19' bgs.	
4						
	S-3	4-6	80		Sand pack: 3'-19' bgs.	0
5						
					Granular bentonite:	
6					0-3' bgs.	
	S-4	6-8	80			0
7						
8						
	S-5	8-10	80			0
9						
10						
	S-6	10-12	80			0
11				Grades to: wet.		
12						
	S-7	12-14	50			0
13						
14						
	S-8	14-16	50			0
15						
16						
	S-9	16-18	40			0
17						
18						
	S-10	18-20	40			0
19						
20				End of soil probe at 20 feet below ground surface.		

S - Split Spoon Sample
C - Rock Core Sample

NOTES: MiniRAE 3000 was used to field screen and headspace soil samples.

General Notes:
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2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CONTRACTOR	TREC Environmental	BORING LOCATION	See Site Plan
DRILLER	Jim Agar	GROUND SURFACE ELEVATION	NM DATUM NA
START DATE 10/2/12	END DATE 10/2/12	GZA GEOENVIRONMENTAL REPRESENTATIVE:	T. Bohlen

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG	Geoprobe GH 42
CASING SIZE AND DIAMETER	2" diameter by 48" long
OVERBURDEN SAMPLING METHOD	Direct push
ROCK DRILLING METHOD	NA

DEPTH	Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	OVM (ppm)
	S-1	0-2	60	Topsoil		0
1				Brown Silty CLAY, trace Sand, moist.		
2	S-2	2-4	60			0
3						
4	S-3	4-6	60			0
5						
6	S-4	6-8	60			0
7				Brown GRAVEL and SAND, trace Silt, trace Clay, moist.		
8	S-5	8-10	100	Brown and Gray mottled Silty CLAY, trace Gravel, trace Sand, moist.		0
9						
10	S-6	10-12	100			0
11						
12	S-7	12-14	100			0
13				Brown GRAVEL and SAND, trace Silt, trace Clay, moist.		
14	S-8	14-16	100			0
15						
16	S-9	16-18	80			0
17						
18	S-10	18-20	80			0
19				Grades to: wet.		
20				End of soil probe at 20 feet below ground surface.		

S - Split Spoon Sample
C - Rock Core Sample

NOTES: MiniRAE 3000 was used to field screen and headspace soil samples.

General Notes:
1) Stratification lines represent approximate boundry between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CONTRACTOR	TREC Environmental	BORING LOCATION	See Site Plan
DRILLER	Jim Agar	GROUND SURFACE ELEVATION	NM DATUM NA
START DATE 10/2/12	END DATE 10/2/12	GZA GEOENVIRONMENTAL REPRESENTATIVE:	T. Bohlen

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG	Geoprobe GH 42
CASING SIZE AND DIAMETER	2" diameter by 48" long
OVERBURDEN SAMPLING METHOD	Direct push
ROCK DRILLING METHOD	NA

DEPTH	SAMPLE INFORMATION: Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	OVM (ppm)
	S-1	0-2	70	Topsoil		0
1				Brown Silty CLAY, trace Sand, moist.		
2	S-2	2-4	70			0
3						
4	S-3	4-6	95			0
5						
6	S-4	6-8	95			0
7						
8	S-5	8-10	100	Grades to: Brown and Gray mottled.		0
9						
10	S-6	10-12	100			0
11						
12	S-7	12-14	100			0
13						
14	S-8	14-16	100			0
15				Brown GRAVEL and SAND, trace Silt, trace Clay, moist.		
16	S-9	16-18	80			0
17						
18	S-10	18-20	80			0
19						
20				End of soil probe at 20 feet below ground surface.		

S - Split Spoon Sample
C - Rock Core Sample

NOTES: MiniRAE 3000 was used to field screen and headspace soil samples.

General Notes:
1) Stratification lines represent approximate boundry between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

CONTRACTOR	TREC Environmental	BORING LOCATION	See Site Plan
DRILLER	Jim Agar	GROUND SURFACE ELEVATION	NM DATUM NA
START DATE 10/2/12	END DATE 10/2/12	GZA GEOENVIRONMENTAL REPRESENTATIVE:	T. Bohlen

WATER LEVEL DATA

DATE	TIME	WATER	CASING

TYPE OF DRILL RIG	Geoprobe GH 42
CASING SIZE AND DIAMETER	2" diameter by 48" long
OVERBURDEN SAMPLING METHOD	Direct push
ROCK DRILLING METHOD	NA

DEPTH	SAMPLE INFORMATION: Sample Number	DEPTH (FT)	RECOVERY (%)	SAMPLE DESCRIPTION	NOTES	OVM (ppm)
	S-1	0-2	50	Topsoil		0
1				Brown and Gray mottled Silty CLAY, trace Sand, moist.		
2	S-2	2-4	50			0
3						
4	S-3	4-6	80			0
5				Brown GRAVEL and SAND, trace Silt, trace Clay, moist.		
6	S-4	6-8	80			0
7						
8	S-5	8-10	60			0
9						
10	S-6	10-12	60			0
11						
12	S-7	12-14	40			0
13						
14	S-8	14-16	40			0
15						
16	S-9	16-18	50			0
17				Grades to: wet.		
18	S-10	18-20	50			0
19						
20				End of soil probe at 20 feet below ground surface.		

S - Split Spoon Sample
C - Rock Core Sample

NOTES: MiniRAE 3000 was used to field screen and headspace soil samples.

General Notes:
1) Stratification lines represent approximate boundry between soil types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

APPENDIX D – EXCAVATION WORK PLAN (EWP)

D-1 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 B.

Table D-1: Notifications*

NYSDEC Project Manager	(716) 851-7200
NYSDEC Regional HW Engineer	(716) 851-7200
NYSDEC Site Control	(518) 402-9553

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

This notification will include:

- A detailed description of the work to be performed, including the location and areal extent of 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 H 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-2 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 Sections 6 and 7 of this Appendix.

D-3 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-4 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. Community air monitoring for VOCs and particulates will be performed during all ground intrusive activities in accordance with the NYSDOH's Generic Community Air Monitoring Plan and Fugitive Dust and Particulate Monitoring guidance. These reference documents are included as Appendix J.

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-5 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.

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-6 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-7 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 landscaping berms, or as backfill for subsurface utility lines.

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.

Material reuse on site will comply with the requirements of NYSDEC DER 10 Section 5.4(e)4. See Table 2 below:

Table 2 - Reuse of Soil [for Paragraph 5.4(e)4]

Soil on the Site Meets:	**Reuse on the Site:**	**Off-site Export & Reuse:**
Unrestricted Soil SCGs	Without restrictions	Without restrictions
Meets the Applicable Use-based and Groundwater Protection SCG and where Appropriate Protection of Ecological Resources Soil SCGs for a Site w/ an IC & SMP.	As backfill within the area of the site subject to the IC.	Not Allowed, unless going to a site with IC subject to a 6 NYCRR Part 360 Beneficial Use Determination (BUD).

D-8 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-9 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). Imported soils must be comprised of soil or other unregulated material as set forth in 6NYCRR Part 360, and must not exceed the applicable soil cleanup objectives/soil quality standards for the Site. Based on an evaluation of the land use, protection of groundwater and protection of ecological resources criteria, the resulting soil quality standards for the Site are defined as the Part 375 Soil Cleanup Objectives (SCOs) for Restricted Residential Site Use, and are listed in the table referenced as Appendix 5 at the end of this section. Soils that meet 'exempt' fill requirements under 6 NYCRR Part 360, but do not meet backfill 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. NYSDOT-approved aggregate sources may be imported to the Site, provided that they also meet the backfill quality standards established in 6NYCRR 375-6.7(d). A current list of NYSDOT-approved aggregate sources can be found at https://www.dot.ny.gov/divisions/engineering/technical-services/materials-bureau/fine-coarse-aggregates.

Analytical data is required to demonstrate that the imported material complies with the Part 375 SCOs for Restricted Residential Site Use. The NYSDEC may issue a site specific exemption from the analytical testing requirements, based upon documentation of the origin and composition of the material. All of the testing data must be reported to the NYSDEC for approval to import soil to the Site. The table below lists the number of soil samples to be analyzed for soil imported to the Site, according to quantity of soil to be imported. Soil samples will be analyzed for the following:

- TCL and CP-51 list VOCs via USEPA SW-846 Test Method 8260
- TCL SVOCs via USEPA SW-846 Test Method 8270
- TAL Metals via USEPA SW-846 Test Methods 6010/7470
- PCBs via USEPA SW-846 Test Method 8082
- Pesticides via USEPA SW-846 Test Method 8081

Recommended Number of Soil Samples for Soil Imported To or Exported From a Site			
Contaminant	**VOCs**	**SVOCs, Inorganics & PCBs/Pesticides**	
Soil Quantity (cubic yards)	**Discrete Samples**	**Composite**	**Discrete Samples/Composite**
0-50	1	1	3-5 discrete samples from different locations in the fill being provided will comprise a composite sample for analysis
50-100	2	1	
100-200	3	1	
200-300	4	1	
300-400	4	2	
400-500	5	2	
500-800	6	2	
800-1000	7	2	
> 1000	Add an additional 2 VOC and 1 composite for each additional 1000 Cubic yards or consult with DER		

Trucks entering the site with imported soils will be securely covered with tight fitting covers. Imported soils will be stockpiled separately from excavated materials, on 6-mil plastic sheeting, and will be covered with similar plastic sheeting to prevent dust releases. Materials may be stockpiled in any location on-site which is feasible and safely accessed given the construction activities, which does not block or cover monitoring wells. Prior to stockpiling activities, as an added precaution, a silt fence will be installed around the entire perimeter of the area where the stockpiling will occur. The silt fence will be maintained while the stockpiled soil is present in that area of the Site. Weekly inspections will be completed to insure the silt fence remains intact and operating as designed. Materials will be stockpiled to a maximum height of 7 feet above grade and at a maximum slope of 0.5, with at least 3 feet between the silt fence and the start of the slope.

Appendix 5
Allowable Constituent Levels for Imported Fill or Soil
Subdivision 5.4(e)

Source: This table is derived from soil cleanup objective (SCO) tables in 6 NYCRR 375. Table 375-6.8(a) is the source for unrestricted use and Table 375-6.8(b) is the source for restricted use.

Note: For constituents not included in this table, refer to the contaminant for supplemental soil cleanup objectives (SSCOs) in the Commissioner Policy on *Soil Cleanup Guidance*. If an SSCO is not provided for a constituent, contact the DER PM to determine a site-specific level.

Constituent	Unrestricted Use	Residential Use	Restricted Residential Use	Commercial or Industrial Use	If Ecological Resources are Present
Metals					
Arsenic	13	16	16	16	13
Barium	350	350	400	400	433
Beryllium	7.2	14	47	47	10
Cadmium	2.5	2.5	4.3	7.5	4
Chromium, Hexavalent[1]	1 [3]	19	19	19	1 [3]
Chromium, Trivalent[1]	30	36	180	1500	41
Copper	50	270	270	270	50
Cyanide	27	27	27	27	NS
Lead	63	400	400	450	63
Manganese	1600	2000	2000	2000	1600
Mercury (total)	0.18	0.73	0.73	0.73	0.18
Nickel	30	130	130	130	30
Selenium	3.9	4	4	4	3.9
Silver	2	8.3	8.3	8.3	2
Zinc	109	2200	2480	2480	109
PCBs/Pesticides					
2,4,5-TP Acid (Silvex)	3.8	3.8	3.8	3.8	NS
4,4'-DDE	0.0033 [3]	1.8	8.9	17	0.0033 [3]
4,4'-DDT	0.0033 [3]	1.7	7.9	47	0.0033 [3]
4,4'-DDD	0.0033 [3]	2.6	13	14	0.0033 [3]
Aldrin	0.005	0.019	0.097	0.19	0.14

Alpha-BHC	0.02	0.02	0.02	0.02	0.04 [4]
Beta-BHC	0.036	0.072	0.09	0.09	0.6
Chlordane (alpha)	0.094	0.91	2.9	2.9	1.3
Delta-BHC	0.04	0.25	0.25	0.25	0.04 [4]
Dibenzofuran	7	14	59	210	NS
Dieldrin	0.005	0.039	0.1	0.1	0.006
Endosulfan I	2.4[2]	4.8	24	102	NS
Endosulfan II	2.4[2]	4.8	24	102	NS
Endosulfan sulfate	2.4[2]	4.8	24	200	NS
Endrin	0.014	0.06	0.06	0.06	0.014
Heptachlor	0.042	0.38	0.38	0.38	0.14
Lindane	0.1	0.1	0.1	0.1	6
Polychlorinated biphenyls	0.1	1	1	1	1

Constituent	Unrestricted Use	Residential Use	Restricted Residential Use	Commercial or Industrial Use	If Ecological Resources are Present
Semi-volatile Organic Compounds					
Acenaphthene	20	98	98	98	20
Acenaphthylene	100	100	100	107	NS
Anthracene	100	100	100	500	NS
Benzo(a)anthracene	1	1	1	1	NS
Benzo(a)pyrene	1	1	1	1	2.6
Benzo(b)fluoranthene	1	1	1	1.7	NS
Benzo(g,h,i)perylene	100	100	100	500	NS
Benzo(k)fluoranthene	0.8	1	1.7	1.7	NS
Chrysene	1	1	1	1	NS
Dibenz(a,h)anthracene	0.33 [3]	0.33 [3]	0.33 [3]	0.56	NS
Fluoranthene	100	100	100	500	NS
Fluorene	30	100	100	386	30
Indeno(1,2,3-cd)pyrene	0.5	0.5	0.5	5.6	NS
m-Cresol(s)	0.33 [3]	0.33 [3]	0.33 [3]	0.33 [3]	NS
Naphthalene	12	12	12	12	NS
o-Cresol(s)	0.33 [3]	0.33 [3]	0.33 [3]	0.33 [3]	NS
p-Cresol(s)	0.33	0.33	0.33	0.33	NS
Pentachlorophenol	0.8 [3]	0.8 [3]	0.8 [3]	0.8 [3]	0.8 [3]
Phenanthrene	100	100	100	500	NS
Phenol	0.33 [3]	0.33 [3]	0.33 [3]	0.33 [3]	30
Pyrene	100	100	100	500	NS
Volatile Organic Compounds					
1,1,1-Trichloroethane	0.68	0.68	0.68	0.68	NS
1,1-Dichloroethane	0.27	0.27	0.27	0.27	NS
1,1-Dichloroethene	0.33	0.33	0.33	0.33	NS
1,2-Dichlorobenzene	1.1	1.1	1.1	1.1	NS
1,2-Dichloroethane	0.02	0.02	0.02	0.02	10
1,2-Dichloroethene(cis)	0.25	0.25	0.25	0.25	NS
1,2-Dichloroethene(trans)	0.19	0.19	0.19	0.19	NS
1,3-Dichlorobenzene	2.4	2.4	2.4	2.4	NS
1,4-Dichlorobenzene	1.8	1.8	1.8	1.8	20
1,4-Dioxane	0.1 [3]	0.1 [3]	0.1 [3]	0.1 [3]	0.1
Acetone	0.05	0.05	0.05	0.05	2.2
Benzene	0.06	0.06	0.06	0.06	70
Butylbenzene	12	12	12	12	NS
Carbon tetrachloride	0.76	0.76	0.76	0.76	NS
Chlorobenzene	1.1	1.1	1.1	1.1	40
Chloroform	0.37	0.37	0.37	0.37	12
Ethylbenzene	1	1	1	1	NS
Hexachlorobenzene	0.33 [3]	0.33 [3]	1.2	3.2	NS
Methyl ethyl ketone	0.12	0.12	0.12	0.12	100
Methyl tert-butyl ether	0.93	0.93	0.93	0.93	NS
Methylene chloride	0.05	0.05	0.05	0.05	12

Volatile Organic Compounds (continued)					
Propylbenzene-n	3.9	3.9	3.9	3.9	NS
Sec-Butylbenzene	11	11	11	11	NS
Tert-Butylbenzene	5.9	5.9	5.9	5.9	NS
Tetrachloroethene	1.3	1.3	1.3	1.3	2
Toluene	0.7	0.7	0.7	0.7	36
Trichloroethene	0.47	0.47	0.47	0.47	2
Trimethylbenzene-1,2,4	3.6	3.6	3.6	3.6	NS
Trimethylbenzene-1,3,5	8.4	8.4	8.4	8.4	NS
Vinyl chloride	0.02	0.02	0.02	0.02	NS
Xylene (mixed)	0.26	1.6	1.6	1.6	0.26

All concentrations are in parts per million (ppm)
NS = Not Specified

Footnotes:
[1] The SCO for Hexavalent or Trivalent Chromium is considered to be met if the analysis for the total species of this contaminant is below the specific SCO for Hexavalent Chromium.
[2] The SCO is the sum of endosulfan I, endosulfan II and endosulfan sulfate.
[3] For constituents where the calculated SCO was lower than the contract required quantitation limit (CRQL), the CRQL is used as the Track 1 SCO value.
[4] This SCO is derived from data on mixed isomers of BHC.

D-10 STORMWATER POLLUTION PREVENTION

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-11 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.

APPENDIX E – FIELD SAMPLING PLAN

GROUNDWATER MONITORING

The monitoring wells and analyses have been selected to provide data needed to meet the following objectives:

- Evaluation of the effectiveness of the injection on transforming dissolved-phase VOC mass, by observation of the effect of the injection on dissolved phase VOC concentrations;
- Evaluation of potential co-solvency and biosurfactant effects on dissolved-phase VOC mass, by observation of an initial effect of the injection on dissolved phase VOC concentrations;
- Evaluation of the effectiveness of the OC additive in transforming any residual VOC source mass, by observation of the longer-term effect of the injection on dissolved phase VOC concentrations; and,
- Evaluation of geochemical cVOC attenuation parameters and degradation signatures.

For the sampling events, a water quality meter and flow-through cell will be used to collect field measurements for pH, specific conductance, dissolved oxygen (DO), turbidity, oxygen reduction potential (ORP) and temperature. Disposable polyethylene tubing and a variable speed low-flow sampling pump will be utilized during the sampling events. Groundwater generated during the well purging will be discharged to the ground surface at the well from which it was generated.

Sampling Locations

In conjunction with the spring and fall semi-annual groundwater sampling events at the Signore BCP Site, groundwater samples will be collected from 11 existing monitoring locations, EW-1.25, EW-1.5, EW-2.5, MW-1I, MW-5S, SP-32, SP-37, SP-38, SP-43, SP-45, and TP-11 (Figure 4), using low-flow sampling techniques. A peristaltic pump, disposable polyethylene tubing and a water quality meter with flow through cell will be used to collect water quality readings, including temperature, specific conductance, pH, turbidity, oxygen reduction potential (ORP), and dissolved oxygen (DO).

Groundwater pumping rates used during the sampling may vary at each monitoring location in order to establish a relatively constant head within the sampling location. Once a constant head is established within the monitoring well, the flow rate will be maintained during the sampling period to purge approximately three well volumes of groundwater. Samples will be collected for analysis when water quality readings stabilize.

In addition to VOC analysis, a subset of groundwater samples will be collected from six (6) locations, EW-1.25, SP-32, SP-37, SP-38, SP-43, and SP-45, for the following analytical methodologies:

- TOC: SM-5310B

- Chloride: EPA 300.0
- Nitrate: EPA 300.0
- Sulfate: EPA 300.0
- Methane: RSK-175
- Ethane: RSK-175
- Ethene: RSK-175
- Dissolved Iron: SW-846, 6010C
- Dissolved Manganese: SW-846, 6010C

These geochemical and natural attenuation parameters will be collected in conjunction with the spring and fall semi-annual groundwater sampling events following additive injection. During the second year following injection, the geochemical/natural attenuation parameters will again be collected in conjunction with the spring and fall semi-annual groundwater sampling events. Subsequently, in the 3rd, 4th, and 5th years following remedial injection (as appropriate based upon analytical results), groundwater samples for these additional analyses will be collected annually, in conjunction with the spring groundwater sampling events.

Analyses

Each of the groundwater quality samples collected during the semi-annual monitoring events will be submitted to an ELAP and NYSDEC approved analytical laboratory for analysis of VOCs by EPA Method 8260C. The analytical data packages will be submitted to Data Validation Services (DVS) for review and development of data usability summary reports (DUSRs).

APPENDIX F – QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN

FORMER SIGNORE SITE
ELLICOTTVILLE, NEW YORK

BROWNFIELD CLEANUP PROGRAM

SITE NO. C905034

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1.0 INTRODUCTION

1.1 PURPOSE AND OBJECTIVE

This Quality Assurance Project Plan (QAPP) has been developed for the Site Management Plan (SMP) associated with the Former Signor Brownfield Cleanup Program (BCP) Site No. C905034 located at 55-57 Jefferson Street, Ellicottville, New York. This QAPP presents the project scope, objectives, organization, planned activities, sampling procedures, data quality objectives and quality assurance/quality control (QA/QC) procedures.

Protocols for sample collection, sample handling and storage, equipment decontamination, chain-of-custody procedures, etc. are described in Section 3. This QAPP was developed in general accordance with the requirements of Section 2.4 of the NYSDEC DER-10/Technical Guidance for Site Investigation and Remediation, effective June 18, 2010 (NYSDEC DER-10).

1.2 PROJECT BACKGROUND

As described in more detail in Section 2.3 of this SMP, the Former Signore property is located at 55 - 57 Jefferson Street, in the Town and Village of Ellicottville, in Cattaraugus County, New York. This property is approximately 55 acres in size. This larger 55-acre parcel is referred to herein as the Signore Property. NYSDEC only accepted 8.43 acres of the approximately 55-acre Signore Property into the BCP. The 8.43 acres was the focus of the on-site activities completed and is designated herein the Signore BCP Site. Site investigations and remedial measures have been completed with NYSDEC oversight. Additional soil sampling and groundwater sampling is anticipated as part of the site redevelopment and lont-term groundwater monitoring as described in this SMP.

1.3 PROJECT DESCRIPTION

This QAPP is the quality control basis for the scope of work, which is further described in the Excavation Work Plan of the Site Management Plan.

2.0 SITE INVESTIGATION PROCEDURES AND RATIONALE

The BCP Site has been remediated to Track 2 cleanup standards. Shallow soil/fill containing constituents remain at the Site at concentrations slightly above unrestricted SCOs. Therefore, future excavation activities require certain monitoring and other protocols which could include sampling. Environmental sampling, if warranted, would be performed in conjunction with the removal actions for the following purposes:

- characterization of "clean" backfill materials; and
- characterization of soil and waters (if present) for disposal purposes.
- confirmation sampling of excavation sidewalls and bottom, if additional volumes of impacted material is encountered requiring removal;

Environmental sampling and other field activities will be performed in general accordance with the NYSDEC DER-10 guidance document.

General field activities are described in the following sections and described in further detail in the Remedial Work Plan (RWP).

2.1 AIR SURVEILLANCE AND MONITORING

Air surveillance screening for total volatile organics and particulates for health and safety concerns will be performed with a portable organic vapor meter (OVM) equipped with a photoionization detector (PID) that is using a 10.6 electron volt (eV) bulb and dust monitors placed both upwind and downwind of intrusive work sites. Monitoring will be performed during invasive activities such as soil/fill excavation. The OVM will also be used to field screen samples. Additional details are presented in the Site-specific Health and Safety Plan and RWP, which includes the NYSDOH generic Community Air Monitoring Plan (CAMP).

2.2 SOIL SAMPLING

Soil/fill sampling will occur during any site improvement activities where evidence of contamination is observed or when soils are planned for off-site disposal. This may include, but is not limited to, activities involving excavation and removal of impacted soil/fill, confirmatory sampling, and waste characterization. Samples will be collected and transferred to sample containers as soon as possible after being retrieved from the subsurface (i.e., excavator bucket).

The excavator will be decontaminated by the subcontractor prior to arrival on-Site. During remedial activities, decontamination will be accomplished using steam cleaning or high pressure hot water to wash equipment prior to moving to the next location. Stainless steel sampling devices will be cleaned manually with non-phosphate detergent (i.e., alconox) wash and potable water followed by a potable water rinse or a second steam cleaning followed by a distilled/deionized water rinse. Equipment will be similarly cleaned prior to leaving the Site.

Soil/fill samples, with the exception of those for VOCs, will be homogenized using a "coning and quartering" procedure. The soil will be removed from the sampling equipment and transferred to a clean surface (metal foil, steel pan, bowl, etc.). Observed debris, such as bricks, large stones, organics, etc. will be removed from the sample. The soil will be mixed to provide a more homogeneous sample for lab analysis. The soil will be scraped from the sides, corners, and bottom of the clean surface, rolled to the middle, and thoroughly mixed until the material appears homogenous. An aliquot of this pile will then be transferred to the required sample containers, slightly tamped-down, filled to near the top of the container, and sealed with the appropriate cap. Soil or sediment on the threads of the container will be removed prior to placing the cap on the sample container. Soil samples for VOC analysis will be collected and directly placed into one unpreserved 2 oz jar per sample location.

Soil screening will be performed in two ways: by holding the probe of the OVM directly over the sample once it is retrieved from the subsurface and again by headspace screening after a representative portion of the soil samples has been placed in plastic bags, allowed to warm to ambient temperature, and placing the tip of the OVM into the plastic bag. The OVM used will be equipped with a PID that is using a 10.6 eV bulb.

The OVM will be calibrated daily, in accordance to manufacturer's requirements using a standard gas. Prior to screening, the headspace soil samples will be allowed to equilibrate to ambient temperature. For headspace screening, a hole will be made in the sample bag and the tip of the OVM inserted into the bag, and the peak response will be recorded. A response of less than 1 part per million (ppm), using this method, is not considered significant and will be reported as not detected. A blank will be run between test samples to check that extraneous contamination was not carried over.

2.3 EQUIPMENT DECONTAMINATION

To avoid cross contamination, non-disposable sampling equipment (defined as any piece of re-usable equipment which may contact a sample) will be decontaminated according to the following procedures outlined below.

2.3.1 Non-Dedicated Reusable Equipment

Non-dedicated reusable equipment such as stainless steel mixing bowls; pumps used for groundwater evacuation (and sampling, if applicable) etc. will require field decontamination. Acids and solvents will not be used in the field decontamination of such equipment. Decontamination typically involves scrubbing/washing with a laboratory grade detergent (e.g. alconox) to remove visible contamination, followed by potable (tap) water and analyte-free water rinses. Tap water may be used from any treated municipal water system; the use of an untreated potable water supply is not an acceptable substitute. Equipment should be allowed to dry prior to use. Steam cleaning or high pressure hot water cleaning may be used in the initial removal of gross, visible contamination. Tubing will not be re-used (new tubing will be used for each well).

2.3.2 Disposable Sampling Equipment

Disposable sampling equipment will not be field-decontaminated; equipment may be rinsed with laboratory-provided analyte-free water prior to use. Disposable spoons or spatulas purchased from non-environmental equipment vendors (such as restaurant supply houses) will be decontaminated by scrubbing/washing with a laboratory grade detergent followed by potable water and Analyte-free water rinse; or by using steam or high pressure hot water rinse, followed by analyte free water rinse. The equipment will be allowed to air dry prior to use.

2.3.3 Heavy Equipment

Certain heavy equipment such as, excavator buckets, etc. may be used to obtain samples. Such equipment will be subject to high pressure hot water or steam cleaning between uses. A member of the sampling team will visually inspect the equipment to check that visible contamination has been removed by this procedure prior to sampling. Such equipment will be cleaned between excavation locations. Decontamination between excavation samples at a single location will be performed using alconox and water to clean the samplers. Samples submitted for analysis will not include material, which has been in direct contact with the excavator bucket.

2.4 STORAGE AND DISPOSAL OF WASTE GENERATED DURING SITE IMPROVEMENT ACTIVITIES

The sampling methods and equipment have been selected to limit both the need for decontamination and the volume of waste material to be generated. Investigation-derived material (e.g., decon sediments and water) generated during this project shall be presumed to be non-hazardous waste and will be characterized for off-site disposal at a permitted and NYSDEC-approved waste disposal facility.

Personal protective equipment and disposable sampling equipment will be placed in plastic garbage bags for disposal as a non-hazardous solid waste.

Decontamination Fluids

Wash water and rinse water, including detergent, may be generated during Site work. Non-phosphate detergent and water rinse will be disposed off-Site along with water generated from excavations if present.

3.0 SAMPLE HANDLING

3.1 SAMPLE IDENTIFICATION/LABELING

Samples will be assigned a unique identification using the sample location or other sample-specific identifier. Sample identification will be limited to seven alphanumeric characters to be consistent with the limitations of the laboratory tracking/reporting software. The general sample identification format follows.

SW - XX - Y-Y

Where:

SW = Type of sample (i.e., Side Wall, Excavation Bottom)

XX = Numeric character indicating the number from which the sample was obtained.

Y-Y = Depth of the sample.

Quality control (QC) field duplicate samples will be submitted blind to the laboratory; a fictitious sample identification will be created using the same system as the original. The sample identifications (of the original sample and its field duplicate) will be marked in the project specific field book and on the copy of the chain-of-custody kept by the sampler and copied to the project manager. Sample containers will be labeled in the field prior to the collection of samples. Affixed to each sampling container will be a non-removable label on which the following information will be recorded with permanent water-proof ink:

- Site name and location;
- Sample identification code;
- Date and time;
- Sampler's initials;
- Preservative; and
- Requested analyses.

3.2 SAMPLES, BOTTLES, PRESERVATION, AND HOLDING TIME

Table 1 specifies the analytical method, matrix, holding time, containers, and preservatives for the various analyses to be completed. Sample bottle requirements and holding times are discussed further below.

3.2.1 Sample Bottles

The selection of sample containers used to collect samples is based on the criteria of sample matrix, analytical method, potential contaminants of concern, reactivity of container material with the sample, QA/QC requirements and regulatory protocol requirements. Sample bottles will be provided by the analytical laboratory and will conform to the requirements of USEPA's Specifications and Guidance for Contaminant-Free sample Containers.

3.2.2 Holding Times

Holding times are judged from the verified time of sample receipt (VTSR) by the laboratory; samples will be shipped from the field to arrive at the lab no later than 48 hours from the time of sample collection. Holding time requirements will be those specified in the NYSDEC ASP; it should be noted that for some analyses, these holding times are more stringent than the holding time for the corresponding USEPA method.

Although trip blanks are prepared in the analytical laboratory and shipped to the Site prior to the collection of environmental samples, for the purposes of determining holding time conformance, trip blanks will be considered to have been generated on the same day as the environmental samples with which they are shipped and delivered. Procurement of bottles and blanks will be scheduled to prevent trip blanks from being stored for excessive periods prior to their return to the laboratory; the goal is that trip blanks should be held for no longer than one week prior to use.

3.3 CHAIN OF CUSTODY AND SHIPPING

A chain-of-custody form will trace the path of sample containers from the project site to the laboratory. Sample/bottle tracking sheets or the chain-of-custody will be used to track the containers from the laboratory to the containers' destination. The project manager will notify the laboratory of upcoming field sampling events and the subsequent transfer of samples. This notification will include information concerning the number and type of samples, and the anticipated date of arrival. Insulated sample shipping containers (typically coolers) will be provided by the laboratory for shipping samples. All sample bottles within each shipping container will be individually labeled with an adhesive identification label provided by the laboratory. Project personnel receiving the sample containers from the laboratory will check each cooler for the condition and integrity of the bottles prior to field work.

Once the sample containers are filled, they will be immediately placed in the cooler with ice (in plastic bags to prevent leaking) or synthetic ice packs to maintain the samples at 4 ^{o}C. The field sampler will indicate the sample designation/location number in the space provided on the chain-of-custody form for each sample. The chain of custody forms will be signed and placed in a sealed plastic bag in the cooler. The completed shipping container will be closed for transport with nylon strapping, or a similar shipping tape, and two paper seals will be affixed to the lid. The seals must be broken to open the cooler and will indicate tampering if the seals are broken before receipt at the laboratory. The cooler will be shipped either by laboratory-provided courier or by an overnight delivery service to the laboratory. When the laboratory receives the coolers, the custody seals will be checked and lab personnel will sign the chain-of-custody form.

4.0 QUALITY ASSURANCE/QUALITY CONTROL PROTOCOLS

This section describes the analytical methods, principles and procedures that will be used to generate quality data. These protocols include laboratory calibration, field equipment calibration, QC sample collection and analysis, quantitative evaluation of data quality protocols and data qualification, if necessary.

4.1 ANALYTICAL METHODS, PROCEDURES & CALIBRATION

4.1.1 Methods

Analytical methods to be used during this project are presented in the NYSDEC Analytical Services Protocol (ASP), June 2005. Specific methods and references for each parameter are shown in Table 1. The sample preservation and holding time requirements are also identified in Table 1. Quantification and detections limits for all analysis are those specified under the appropriate test methods.

It is the laboratory's responsibility to be familiar with this document, procedures and deliverables pertaining to the Site work. The laboratory selected to perform the analytical testing will be certified by the NYSDOH Environmental Laboratory Approval Program and Contract Laboratory Protocol certified.

4.1.2 Laboratory Instrumentation & Equipment

Laboratory instruments and equipment will be calibrated following SW-846 analytical methods protocol. Initial calibrations will be performed before samples analysis. Calibration checks will be performed at the frequencies specified in each analytical method.

4.1.3 Field Equipment

Field equipment will be used during various activities of the project and during the collection of environmental samples. The field equipment to be used may include the following.

Field equipment used includes:

- OVM with a photoionization detector.
- Electronic water level indicator.
- Multi-gas meter (CO, LEL, O_2, and H_2S).
- Particulate monitor

Field equipment will be cleaned and calibrated prior to use. The Operating and Maintenance (O&M) manuals for the field equipment will be kept in the field when in use and a copy will be retained in project files.

Calibration and standardization for the field equipment during project use will be in accordance with the manufacturer's recommendations, and will be recorded in the field log book. If instrument performance or data fall outside acceptable limits, then corrective actions will be taken. These actions may include recalibration of instruments, acquiring new standards, replacing equipment or repairing equipment. Subcontractors providing analytical services should perform their own internal laboratory audits and calibration procedures with data review conducted at a frequency so that errors and problems are detected early, thus avoiding the prospect of redoing large segments of work.

4.2 QUALITY CONTROL SAMPLES

4.2.1 Analytical Equipment

The analytical methods to be utilized (see Table 1) for laboratory sample analysis address the quality control to be used and the frequency of replicates, blanks and calibration standards for laboratory analytical equipment.

Table 1
Summary of Sample Methods, Container, Preservation and Holding Time Requirements
Quality Assurance Project Plan
Former Signore Site
Ellicottville, New York
Brownfield Cleanup Program
Site No. C905034

Analysis	Method	Holding Time (days)		Containers		Preservative
		To Extraction	To Analyze	Number	Type	
Soil Samples						
Volatile Organic Compounds	SW-846 8260B		14	2	L	Cool
Semivolatile Organic Compounds	SW-846 8270C	14	40	2 *	J	Cool
PCBs	SW-846 8082	14	365		J	Cool
Metals	SW-846 6010B/7470A		180 (28 for Hg)		J	Cool
Pesticides	SW-846 8082	14	40		J	Cool
Herbicides	SW-846 8151	14	40		J	Cool
Aqueous Samples						
Volatile Organic Compounds	SW-846 8260B		14	3	G	Cool
Semivolatile Organic Compounds	SW-846 8270C	7	40	1	H	Cool
PCBs	SW-846 8080	7	365	1	H	Cool
Metals	SW-846 6010B/7470A	7	180 (28 for Hg)	1	I	HNO3
Pesticides	SW-846 8082	7	40	1	H	Cool
Herbicides	SW-846 8151	7	40	1	H	Cool

Notes:
Container Types
G - 40 ml glass, Teflon septum cap liner, HCL
H - 1L glass, Teflon cap liner
I - 250 ml, polyethylene, Teflon cap liner
J - 8 oz. wide mouth glass, Teflon cap liner
L - 2 oz. glass widemouth with Teflon cap liner
M - 1 liter vacuum canister
Preservatives
Cool - Cool to 4 degrees Celsius
HNO3 - Nitric Acid to <2 pH
NaOH - Sodium Hydroxide to >12pH
HCl - Hydrochloric acid to pH<2
* - Semi-volatiles, PCBs, metals pesticides, and herbicides analyses can take place from two 8 ounce glass widemouth jar with a teflon lined cap.

4.2.2 Field Samples

Field quality control samples will consist of trip blanks, sample duplicate, matrix spike and matrix spike duplicate. Trip blanks, for VOCs only, will consist of analyte free reagent grade water in VOC sampling containers to be used for the project. Trip blanks will be prepared at the laboratory, sealed, transported to the Site and returned without being opened to assess contamination that may have occurred during transport. Trip blanks will be submitted at a rate of one per sampling event when VOCs are shipped to the laboratory.

Field duplicate samples are used to assess the variability of a matrix at a specific sampling point and to assess the reproducibility of the sampling method. For soil samples, these samples are separate aliquots of the same sample; prior to dividing the sample into "sample" and "duplicate" aliquots, the samples are homogenized (except for the VOC aliquots, which are not homogenized). Aqueous field duplicate samples are second samples collected from the same location, at the same time, in the same manner as the first, and placed into a separate container. Each duplicate sample will be analyzed for the same parameters as the original sample collected that day. The blind field duplicate Relative Percent Difference (RPD) objective will be $\pm$50% percent RPD for all matrices. Field duplicates will be collected at a frequency of 1 per 20 environmental samples for both matrices (aqueous and non-aqueous) and test parameters.

Matrix spike/matrix spike duplicate (MS/MSD) samples are used to assess the laboratory method’s accuracy and precision. These samples are spiked with known quantities of target analytes at the laboratory. The samples are collected at a frequency of five percent (1 in 20).

5.0 DATA DOCUMENTATION

5.1 FIELD NOTEBOOK

Field notebooks will be initiated at the start of on-Site work, in addition to field forms that will be filled out summarizing field work and become part of the project file. The field notebook will include the following daily information for Site activities:

- Date;
- Meteorological conditions (temperature, wind, precipitation);
- Site conditions (e.g., dry, damp, dusty, etc.);
- Identification of crew members (GZA and subcontractor present) and other personnel (e.g., agency or site owner) present;
- Description of field activities;
- Location(s) where work is performed;
- Problems encountered and corrective actions taken;
- Records of field measurements or descriptions recorded; and,
- Notice of modifications to the scope of work.

5.2 FIELD REPORTING FORMS

Field reporting forms (or their equivalent) to be utilized during the remediation may include the following:

- Excavation Log;
- Sample Collection Log;
- Chain of Custody Form; and
- Calibration Log.

These forms, when completed, will become part of the project file.

6.0 CORRECTIVE ACTIONS

If instrument performance or data fall outside acceptable limits, then corrective actions will be taken. These actions may include recalibration or standardization of instruments, acquiring new standards, replacing equipment, repairing equipment, and reanalyzing samples or redoing sections of work. Subcontractors providing analytical services should perform their own internal laboratory audits and calibration procedures with data review conducted at a frequency so that errors and problems are detected early, thus avoiding the prospect of redoing large segments of work.

Situations related to this project requiring corrective action will be documented and made part of the project file. For each measurement system identified requiring corrective action, the responsible individual for initiating the corrective action and also the individual responsible for approving the corrective action, if necessary, will be identified. As part of its total quality management program, GZA makes the results of laboratory audits and data validation reports available to the analytical laboratories. The laboratories are therefore made aware of non-critical items and areas where improvement may be made in subsequent NYSDEC ASP work.

7.0 DATA REDUCTION, VALIDATION, AND REPORTING

The guidance followed to perform quality data validation, and the methods and procedures outlined herein pertain to initiating and performing data validation, as well as reviewing data validation performed by others (if applicable). An outline of the data validation process is presented here, followed by a description of data validation review summaries.

7.1 LABORATORY DATA REPORTING AND REDUCTION

The laboratory will meet the applicable documentation, data reduction, and reporting protocols as specified in the 2005 revision of the NYSDEC ASP CLP. Laboratory data reports for non-CLP data will conform to NYSDEC Category B deliverable requirements. With full CLP documentation, deliverables will include, but not be limited to:

Organics	**Inorganics**
Chains of Custody	Chains of Custody
Blanks	Blanks
Holding Times	Holding Times
Internal Standards	Furnace AA QC
Laboratory Duplicates	CRDL Standards
Tentatively Identified Compounds	ICP Serial Dilutions
GC/MS Instrument Performance Check	Laboratory Control Samples
System Monitoring Compound Recovery	Laboratory Duplicates
Matrix Spike & Matrix Spike Duplicates	ICP Interference Check
GC/MS Tuning	Spiked Sample Recovery
Surrogate Recoveries	

Copies of the laboratory's generic Quality Assurance Plan (QAP) will be on file at GZA. The laboratory's QAP will indicate the standard methods and practices for obtaining and assessing data, and how data are reduced from the analytical instruments to a finished report, indicating levels of review along the way.

In addition to the hard copy of the data report, the laboratory will be asked to provide the sample data in spreadsheet form to minimize possible transcription errors resulting from the manual transcription of data.

7.2 DATA VALIDATION AND DATA USABILITY SUMMARY REPORT

CLP data will be validated by a data validation subcontractor. Data validation will be performed in accordance with guidelines established in Appendix 2B of the NYSDEC DER-10. Where necessary and appropriate, supplemental validation criteria may be derived from the EPA Functional Guidelines (USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, EPA-540/R-94/012, February 1993; and USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA-540/R-94/013, February, 1994).

Data Usability Summary Reports (DUSRs) will consist of text results of the review and marked up copies of Form I (results with qualifiers applied by the validator). Validation will consist of target and non-target compounds with corresponding method blank data, spike and surrogate recoveries, sample data, and a final note of validation decision or qualification, along with any pertinent footnote references. Qualifiers applied to the data will be documented in the report text.

There may be some analyses for which there is no established USEPA or NYSDEC data validation protocol. In such cases, validation will be based on the EPA Region II SOPs and EPA Functional Guidelines as much as possible, as well as the laboratory's adherence to the technical requirements of the method, and the professional judgment of the validator. The degree of rigor in such validation will correspond to the nature of the data and the significance of the data and its intended use. Unless otherwise requested, non-CLP data (e.g., total organic carbon) is not subject to validation.

1.3 FIELD DATA

Field chemistry data collected during air monitoring, and soil screening (e.g., OVM readings), will be presented on field logs and provided in the appendices of the report.

8.0 PERFORMANCE AND SYSTEM AUDITS

An audit of the laboratory(s) during the BCP work will not be performed unless warranted by a problem(s) that cannot be resolved by any other means, or at the discretion of GZA or NYSDEC.

9.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

Monthly project status reporting to the NYSDEC will include aspects of quality control that were pertinent during the month's activities. Problems revealed during review of the month's activities will be documented and addressed. These reports will include a description of completed and on-going activities, and an indication how each task is progressing relative to the project schedule.

The project manager, through task managers, will be responsible for verifying that records and files related to this project are stored appropriately and are retrievable.

The laboratory will submit memoranda or correspondence related to quality control of this project's samples as part of its deliverables package.

APPENDIX G – HEALTH AND SAFETY PLAN

1. CLIENT/SITE/PROJECT INFORMATION		
Client: Iskalo Ellicottville Holding LLC		
Site Address: 55-57 Jefferson Street, Ellicottville, NY		
Site Description, Work Environment: Currently vacant and Inactive former manufacturing facility. Work environment is primarily outdoors in open air.		
Job/Project #:	Estimated Start Date:	Estimated Finish Date:
Site is Covered by the Following Regulations:	OSHA HAZWOPER Standard ☒	Mine Safety and Health Administration ☐
	OSHA Construction Regulations ☒	None of these ☐

2. EMERGENCY INFORMATION		
Hospital Name: Bertrand Chaffee Hospital		Hospital #: (716) 592-2891
Hospital Address: 224 East Main Steet, Springville, NY		Directions and Street Map Attached: ☒ Yes
Local Fire #: 911 or	Local Ambulance #: 911 or	Local Police #: 911 or
WorkCare Incident Intervention Services:	**For non-emergencies, if an employee becomes hurt or sick call 888-449-7787**	
Other Emergency Contact(s):	Phone #'s:	
Site-Specific Emergency Preparedness/Response Procedures/Concerns:		

- All EHS Events (incidents, first aid, near misses, unsafe acts/conditions, fires, chemical spills, property damage, extraordinary safe behaviors) must be reported immediately to the Project Manager, and within 24hours to the EHS Event Reporting Portal at www.kelleronline.com/portal. Username gempl1; Password 4Incidents!.
- In the event of a chemical release greater than 5 gallons, site personnel will evacuate the affected area and relocate to an upwind location. The GZA Field Safety Officer and client site representative shall be contacted immediately.
- Site work shall not be conducted during severe weather, including high winds and lightning. In the event of severe weather, stop work, lower any equipment (drill rigs), and evacuate the affected area.

3. SUB-SURFACE WORK, UNDERGROUND UTILITY LOCATION	
Will subsurface explorations be conducted as part of this work? ☒ Yes ☐ No	
Site property ownership where underground explorations will be conducted on:	Public Access Property ☐ Yes ☒ No Private Property ☒ Yes ☐ No
Have Necessary Underground Utility Notifications for Subsurface Work Been Made?	☐ Yes ☒ Yet to be conducted
Specify Clearance Date & Time, Dig Safe Clearance I.D. #, And Other Relevant Information: Drilling sub-contractors will be calling in the UFPO	
IMPORTANT! For subsurface work, prior to the initiation of ground penetrating activities, personnel to assess whether the underground utility clearance (UUC) process has been completed in an manner that appears acceptable, based on participation/ confirmation by other responsible parties (utility companies, subcontractor, client, owner, etc.), for the following:	

Electric:	☐ Yes	☐ No	☐ NA	☐ Other________________
Fuel (gas, petroleum, steam):	☐ Yes	☐ No	☐ NA	☐ Other________________
Communication:	☐ Yes	☐ No	☐ NA	☐ Other________________
Water:	☐ Yes	☐ No	☐ NA	☐ Other________________
Sewer:	☐ Yes	☐ No	☐ NA	☐ Other________________
Other:________________	☐ Yes	☐ No	☐ NA	☐ Other________________
Comments:				

4. SCOPE OF WORK	
Any OSHA PERMIT-REQUIRED CONFINED SPACE entry? ☐ **YES** ☒ **NO** If yes, use Site Specific H&S Plan/Confined Space Entry Permit for that portion of the work	**Any INDOOR fieldwork?** ☐ **YES** ☐ **NO** If yes, explain:
General project description, and phase(s) or work to which this H&S Plan applies.	Any ground-disturbing work that is completed on-site.
Specific Tasks Performed by:	
Concurrent Tasks to be Performed by Subcontractors (List Subcontractors by Name):	
Concurrent Tasks to be Performed by Others:	

5. SITE-SPECIFIC OVERVIEW OF H&S HAZARDS/MITIGATIONS (NOTE: Based on Hazard Assessment, Section 10)	
Describe the major hazards expected to be present at the jobsite, and describe the safety measures to be implemented for worker protection. Use brief abstract statements or more detailed narrative as may be appropriate.	
ON-SITE HAZARDS:	**HAZARD MITIGATIONS:**
Site Traffic	Use of Hi-Vis Safety vests and traffic cones.
Underground Utilities	Review of site drawings, ground disturbance approval from facility management, UFPO clearance.
Heavy equipment operations by subcontractor	Communication, safe working distances, high visibility vests.
Slips, trips, and fall hazards	Pay special attention while walking on uneven surfaces; do not walk with hands in pockets, general overall awareness and housekeeping. Identify hazards within work area prior to commencement of work activities. Maintain a safe distance from excavations and monitor for conditions of instability/cave-in.
Soil vapor	Screen the breathing zone for the presence of organic vapors.
Groundwater / Porewater	Wear appropriate PPE when site groundwater or porewater is encountered in any excavation work.
Soil	Wear appropriate PPE when site soils are encountered during excavation work.

6. HEALTH AND SAFETY EQUIPMENT AND CONTROLS

AIR MONITORING INSTRUMENTS

- ☒ PID Type: Lamp Energy: eV
- ☐ FID Type:
- ☐ Carbon Monoxide Meter
- ☐ Hydrogen Sulfide Meter
- ☐ O_2/LEL Meter
- ☒ Particulate (Dust) Meter
- ☒ Calibration Gas Type Isobutylene
- ☐ Others:

Note: Ensure instruments have been properly calibrated

OTHER H&S EQUIPMENT & GEAR

- ☒ Fire Extinguisher
- ☒ Caution Tape
- ☒ Traffic Cones or Stanchions
- ☒ Warning Signs or Placards
- ☒ Decon Buckets, Brushes, etc.
- ☐ Portable Ground Fault Interrupter (GFI)
- ☐ Lockout/Tagout Equipment
- ☐ Ventilation Equipment
- ☐ Others:

PERSONAL PROTECTIVE EQUIPMENT

- ☐ Respirator Type:
- ☐ Resp-Cartridge Type:
- ☒ Hardhat
- ☒ Outer Gloves Type: Nitrile (Disposable)
- ☐ Inner Gloves Type:
- ☒ Steel-toed boots/shoes
- ☐ Coveralls Type:
- ☐ Outer Boots Type:
- ☒ Eye Protection with side shields
- ☐ Face Shield
- ☒ Traffic Vest
- ☐ Personal Flotation Device (PFD)
- ☐ Fire Retardant Clothing
- ☐ EH (Electrical Hazard) Rated Boots, Gloves, etc.
- ☒ Noise/Hearing Protection
- ☐ Others:

Discuss/Clarify, as Appropriate:

7. AIR MONITORING ACTION LEVELS

Is air monitoring to be performed for this project? Yes ☒ **No** ☐

Make sure air monitoring instruments are in working order and have been calibrated prior to use. Depending on project-specific requirements, periodic field calibration checks may be necessary during the day of instrument use.

ACTION LEVELS FOR OXYGEN DEFICIENCY AND EXPLOSIVE ATMOSPHERIC HAZARDS (Action levels apply to occupied work space in general work area)

☐ **Applicable, See Below.** ☒ **Not Applicable**

Parameter	Response Actions for Elevated Airborne Hazards
Oxygen	**At 19.5% or below** – Exit area, provide adequate ventilation, or proceed to Level B, or discontinue activities Verify presence of adequate oxygen (approx. 12% or more) before taking readings with LEL meter. Note: If oxygen levels are below 12%, LEL meter readings are not valid.
LEL	**Less than 10% LEL** – Continue working, continue to monitor LEL levels **Greater than or Equal to 10% LEL** – Discontinue work operations and immediately withdraw from area. Resume work activities ONLY after LEL readings have been reduced to less than 10% through passive dissipation, or through active vapor control measures.

ACTION LEVELS FOR INHALATION OF TOXIC/HAZARDOUS SUBSTANCES (Action levels are for sustained breathing zone concentrations)

☒ **Applicable, See Below.** ☐ **Not Applicable**

Air Quality Parameters (Check all that apply)	Remain in Level D or Modified D	Response Actions for Elevated Airborne Hazards
☒ VOCs	0 to 5 ppm	From 5 ppm to 10 ppm: Proceed to Level C, or Ventilate, or Discontinue Activities

		If greater than 10 ppm: Proceed to Level B, or, Ventilate, or Discontinue Activities
☐ Carbon Monoxide	0 to 35 ppm	At greater than 35 ppm, exit area, provide adequate ventilation, proceed to Level B, or discontinue activities.
☐ Hydrogen Sulfide	0 to 10 ppm	At greater than 10 ppm, exit area, provide adequate ventilation, proceed to Level B, or discontinue activities
☒ Dust	0 to mg/m^3	
☐		
SPECIAL INSTRUCTIONS/COMMENTS REGARDING AIR MONITORING (IF APPLICABLE)		

8. H&S TRAINING/QUALIFICATIONS FOR FIELD PERSONNEL

- ☒ Project-Specific H&S Orientation (Required for All Projects/Staff)
- ☒ OSHA 40-Hour HAZWOPER/8 Hour Refreshers
- ☒ Hazard Communication (for project-specific chemical products)
- ☒ First Aid/CPR (at least one individual on site)
- ☒ General Construction Safety Training
- ☐ Lockout/Tagout Training
- ☐ Electrical Safety Training
- ☐ Bloodborne Pathogen Training
- ☐ Fall Protection Training
- ☒ Trenching & Excavation
- ☐ Current Medical Clearance Letter
- ☐
- ☐
- ☐

Discuss/Clarify, as needed:

9. PROJECT PERSONNEL - ROLES AND RESPONSIBILITIES

ON-SITE PERSONNEL:

Name(s)	Project Title/Assigned Role	Telephone Numbers
	Site Supervisor	Work: Cell:
	Field Safety Officer	Work: Cell:
	First Aid Personnel	Work: Cell:
	Project Team Members	Cell:

Site Supervisors and Project Managers (SS/PM): Responsibility for compliance with Health and Safety programs, policies, procedures and applicable laws and regulations is shared by all management and supervisory personnel. This includes the need for effective oversight and supervision of project staff necessary to control the Health and Safety aspects of on-site activities.

Site Safety Officer (SSO): The SSO is responsible for implementation of the Site Specific Health and Safety Plan.

First Aid Personnel: At least one individual who has current training and certification in basic first aid and cardiopulmonary resuscitation (CPR) must be present during on-site activities involving multiple personnel.

Project Team: Follow instructions relayed by the HASP and manager on-site.

OTHER PROJECT PERSONNEL:

Name	Project Title/Assigned Role	Telephone Numbers

	Associate/Principal-in-Charge	Work: Cell:
	Project Manager	Work: Cell:
	Health and Safety Coordinator (HSC)	Work: Cell:
	EHS Director	Work: Cell:

Principal-in-Charge: Responsible of overall project oversight, including responsibility for Health and Safety.
Project Manager: Responsible for day-to-day project management, including Health and Safety.
Health and Safety Coordinator: General Health and Safety guidance and assistance.
EHS Director: H &S technical and regulatory guidance, assistance regarding H&S policies and procedures.

10. HAZARD ASSESSMENT (CHECK ALL THAT APPLY)

A. GENERAL FIELDWORK HAZARDS

- ☐ Confined Space Entry (STOP – Use Confined Space Entry HASP)
- ☒ Abandoned or vacant building/Enclosed Spaces
- ☒ Significant Slip/Trip/Fall Hazards
- ☐ Unsanitary/Infectious Hazards
- ☐ Poisonous Plants
- ☐ Biting/Stinging Insects
- ☐ Feral Animal Hazards
- ☐ Water/Wetlands Hazards
- ☐ Remote Locations/Navigation/Orientation hazards
- ☒ Heavy Traffic or Work Alongside a Roadway
- ☒ Weather-Related Hazards
- ☒ Motor vehicle operation Hazards
- ☒ Heavy Equipment Hazards
- ☐ Structural Hazards (i.e. unsafe floors/stairways/roof)
- ☐ Demolition/Renovation
- ☒ Presence of Pedestrians or the General Public
- ☐ Overhead Hazards (i.e. falling objects, overhead power lines)
- ☒ Portable Hand Tools or Power Tools
- ☒ Significant Lifting or Ergonomic Hazards
- ☐ Electrical Hazards (i.e. Equipment 120 Volts or Greater, Work Inside Electrical Panels, or Maintenance of Electrical Equipment)
- ☐ Other Stored energy Hazards (i.e. Equipment with High Pressure or Stored Chemicals)
- ☐ Fire and/or Explosion Hazard
- ☒ Elevated Noise Levels
- ☐ Excavations/Test Pits
- ☐ Explosives or Unexploded Ordinance/MEC
- ☐ Long Distance or Overnight Travel
- ☐ Personal Security or High Crime Area Hazards
- ☐ Working Alone
- ☐ Ionizing Radiation or Non-Ionizing Radiation
- ☒ Chemical/Exposure Hazards (See Part B for Details)
- ☐ Other:

B. CHEMICAL/EXPOSURE HAZARDS

☐ No chemical hazards anticipated	☐ Methane
☐ Hydrogen Sulfide (H2S)	☐ Chemicals Subject to OSHA Hazard Communication (Note: For commercial chemical products, attach MSDSs if applicable)
☐ Cyanides, Hydrogen Cyanide (HCN)	☐ Containerized Waste, Chemicals in Piping & Process Equipment
☐ Carbon Monoxide	☒ Emissions from Gasoline-, Diesel-, Propane-fired Engine, Heater, Similar Equipment
☐ Herbicides, Pesticide, Fungicide, Animal Poisons	☒ General Work Site Airborne Dust Hazards
☐ Metals, Metal Compounds	☒ Volatile Organic Compounds (VOCs), BTEX
☐ Corrosives, Acids, Caustics, Strong Irritants	☒ Chlorinated Organic Compounds
☐ Polychlorinated Biphenyls (PCBs)	☒ Fuel Oil, Gasoline, Petroleum Products, Waste Oil
☐ Polycyclic Aromatic Hydrocarbons (PAHs)	☐ Asbestos
☐ Compressed Gases	☐ Oxygen Deficiency, Asphyxiation Hazards
☐ Flammable/Combustible Liquids	☐ Other:
☐ Radiation Hazards (i.e. radioactive sealed/open source, x-rays, ultra violet, infrared, radio-frequency, etc.)	

11. PLAN ACKNOWLEDGEMENT AND APPROVALS		
Employee Plan Acknowledgement		
I have read, understood, and agree to abide by the information set forth in this Safety and Accident Prevention Plan. I will follow guidance in this plan and in the Health and Safety Program Manual. I understand the training and medical monitoring requirements covered by the work outlined in this plan and have met those requirements.		
Employee Name	Employee Signature	Date
Subcontractor Employee Plan Acknowledgement		
This plan has been prepared solely for the purpose of protecting the health and safety of future workerss. Subcontractors, visitors, and others at the site must refer to their organization's health and safety program or site-specific HASP for their protection. Subcontractor employees may use this plan for general informational purposes only. Subcontractor firms are obligated to comply with safety regulations applicable to their work, and understand this plan covers GZA activities only.		
Subcontractor Employee Name	Subcontractor Employee Signatures	Date

Site-Specific Health and Safety Plan Approval Signatures			
The following individuals indicate their acknowledgement and/or approval of the contents of this Site Specific H&S Plan based on their understanding of project work activities, associated hazards and the appropriateness of health and safety measures to be implemented.			
Signatory	Employee Name	Employee Signature	Date
Preparer:			
EHS Reviewer:			
PIC Approval:			

Directions to 224 E Main St, Springville, NY 14141-1443

Total Time: 29 mins, Total Distance: 19.66 mi

	Distance
A 1. **Start at 55 JEFFERSON ST, ELLICOTTVILLE going toward MARTHA ST**	go **0.24** mi
2. Turn R on **E WASHINGTON ST(US-219)**	go **0.46** mi
3. Continue to follow **US-219**	go **0.53** mi
4. Turn L on **ROUTE 219 N(US-219)**	go **14.44** mi
5. Continue to follow **US-219**	go **2.22** mi
6. Bear R on **WAVERLY ST(CR-121)**	go **1.01** mi
7. Bear R on **W MAIN ST(RT-39)**	go **0.75** mi
B 8. **Arrive at 224 E MAIN ST, SPRINGVILLE, on the L**	

Time: 29 mins, Distance: 19.66 mi

When using any driving directions or map, it's a good idea to do a reality check and make sure the road still exists, watch out for construction, and follow all traffic safety precautions. This is only to be used as an aid in planning.

APPENDIX H

SITE MANAGEMENT FORMS

Summary of Green Remediation Metrics for Site Management

Site Name: ________________________________Site Code: _____________________
Address: __________________________________City: _________________________
State: _____________ Zip Code: _________County: _______________________

Initial Report Period (Start Date of period covered by the Initial Report submittal)
Start Date: _____________________

Current Reporting Period
Reporting Period From: ______________________To: ___________________________

Contact Information
Preparer's Name: ___________________________ Phone No.: ____________________
Preparer's Affiliation: ____________________________________

I. Solid Waste Generation: Quantify the management of solid waste generated on-site.

	Current Reporting Period (tons)	**Total to Date (tons)**
Total waste generated on-site		
OM&M generated waste		
Of that total amount, provide quantity:		
Transported off-site to landfills		
Transported off-site to other disposal facilities		
Transported off-site for recycling/reuse		
Reused on-site		

Provide a description of any implemented waste reduction programs for the site in the space provided on Page 3.

II. Transportation/Shipping: Quantify the distances travelled for delivery of supplies, shipping of laboratory samples, and the removal of waste.

	Current Reporting Period (miles)	**Total to Date (miles)**
Standby Engineer/Contractor		
Laboratory Courier/Delivery Service		
Waste Removal/Hauling		

Provide a description of all mileage reduction programs for the site in the space provided on Page 3. Include specifically any local vendor/services utilized that are within 50 miles of the site.

Description of green remediation programs reported above (Attach additional sheets if needed)
Waste Generation:
Transportation/Shipping:
Other:

CERTIFICATION BY CONTRACTOR
I, ____________________________ (**Name**) do hereby certify that I am ______________________ (**Title**) of the Company/Corporation herein referenced and contractor for the work described in the foregoing application for payment. According to my knowledge and belief, all items and amounts shown on the face of this application for payment are correct, all work has been performed and/or materials supplied, the foregoing is a true and correct statement of the contract account up to and including that last day of the period covered by this application. ____ **Date** **Contractor**

APPENDIX I

GUIDANCE FOR EVALUATING SOIL VAPOR INTRUSION

FINAL

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

October 2006

Prepared by:

NEW YORK STATE DEPARTMENT OF HEALTH
Center for Environmental Health
Bureau of Environmental Exposure Investigation

Soil Vapor Intrusion Guidance Release History

October 2006 — Current version
February 2005 — Public comment draft

Contact Information

Comments and questions on the guidance may be sent to the following:

New York State Department of Health
Bureau of Environmental Exposure Investigation
Flanigan Square, Room 300
547 River Street
Troy, New York 12180-2216

Email: BEEI@health.state.ny.us
Telephone: 1-800-458-1158, extension 27850

New York State Departments of Health and Environmental Conservation — Web Sites on Soil Vapor Intrusion

This guidance, policy documents, training documents, fact sheets, etc. are available to the public on the following web sites:

New York State Department of Health
http://www.health.state.ny.us/environmental/indoors/vapor_intrusion

New York State Department of Environmental Conservation
http://www.dec.state.ny.us/website/der/guidance/vapor/index.html

As new information becomes available (e.g., revisions or amendments to the guidance, new fact sheets, etc.), these web sites will be updated accordingly.

Preface

This guidance has been prepared by the New York State Department of Health (NYSDOH) in consultation with the New York State Department of Environmental Conservation (NYSDEC) — collectively referred to as "the State" throughout this document. It is intended as general guidance for parties evaluating soil vapor intrusion in the State of New York. The guidance is not a regulation, rule or requirement.

The guidance describes the State's methodology for evaluating soil vapor intrusion at a site. It reflects our experience in conducting soil vapor intrusion investigations and presents a reasonable and practical approach to identifying and addressing current and potential human exposures to contaminated subsurface vapors associated with known or suspected volatile chemical contamination. The approach presented is analogous to the approach taken when investigating contamination in other environmental media (e.g., groundwater, soil, etc.) and addressing corresponding exposure concerns.

The guidance is organized into five sections:

Section 1 introduces the concept of soil vapor intrusion, associated human exposure issues, factors affecting soil vapor intrusion, factors affecting indoor air quality, and the general approach recommended to evaluating vapor intrusion;

Section 2 provides guidance on collecting appropriate and relevant data that can be used to identify current or potential human exposures;

Section 3 discusses how the investigation data are evaluated, recommends actions based on the evaluation, and presents tools that are used when determining appropriate actions to address exposures;

Section 4 provides an overview of soil vapor intrusion mitigation methods and basic recommendations pertaining to their selection for use, installation and design, post-mitigation testing, operation, maintenance and monitoring, termination of operation, and annual certification; and

Section 5 describes outreach techniques commonly used to inform the community about soil vapor intrusion issues.

The State recommends that the guidance be considered anywhere soil vapor intrusion is evaluated in the State of New York — whether the evaluation is undertaken voluntarily by a corporation, a municipality, or private citizen, or whether it is performed under one of the State's environmental remediation programs.

<u>PLEASE NOTE</u>:

- While soil vapor intrusion can also occur with "naturally-occurring" subsurface gases (e.g., radon, methane and hydrogen sulfide), the document discusses soil vapor intrusion in terms of environmental contamination only.
- The guidance document addresses soil vapor intrusion. However, vapor intrusion can also occur through direct volatilization of contaminants from groundwater into indoor air. This can occur when, for example, a basement slab is in contact with contaminated groundwater, contaminated groundwater enters (floods) a basement or crawl space, or contaminated groundwater enters a sump pit drainage system. In such cases, volatile

chemicals can be transferred directly from groundwater to indoor air without the intervening contamination of soil vapor. Although exposures of this nature are not discussed in this guidance, they should be addressed on a site-specific and building-specific basis.

- Throughout the guidance references are made to specific brands of field equipment. These references are for discussion purposes only and are intended to be illustrative. They should not be interpreted as endorsements by the State of any one company or their products.

ACRONYMNS and ABBREVIATIONS

ASTM	American Society for Testing and Materials
ATSDR	Agency for Toxic Substance and Disease Registry
BASE	Building Assessment and Survey Evaluation
BTSA	[NYSDOH] Bureau of Toxic Substance Assessment
CME	Continuing Medical Education
CSEMs	Case Studies in Environmental Medicine
DUSR	Data Usability Summary Report
ELAP	Environmental Laboratory Approval Program
EPA	United States Environmental Protection Agency
GC	Gas Chromatograph
HEI	Health Effects Institute
HVAC	Heating, Ventilating and Air-conditioning
mcg/m^3	micrograms per cubic meter
MeCl	Methylene Chloride
MEK	Methyl Ethyl Ketone; 2-Butanone
MTBE	Methyl-*tert*-Butyl Ether
NAPL	Non-Aqueous Phase Liquid
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OM&M	Operation, Maintenance and Monitoring
OSHA	Occupational Safety and Health Administration
OVM	Organic Vapor Monitor
PCBs	Polychlorinated Biphenyls
PCE	Tetrachloroethene or Perchloroethylene
PID	Photoionization Detector
QA/QC	Quality Assurance/Quality Control
RIOPA	Relationship of Indoor, Outdoor, and Personal Air
SF_6	Sulfur Hexafluoride
SSD	Sub-slab Depressurization System
SIM	Selective Ion Monitoring
SMD	Sub-Membrane Depressurization
SVE	Soil Vapor Extraction
SVOCs	Semi-volatile Organic Compounds
TAL	Target Analyte List
TCA	Trichloroethane
TCDD	Tetrachlorodibenzo-*p*-Dioxin Equivalents
TCE	Trichloroethene
TCL	Target Compound List
VOCs	Volatile Organic Compounds

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Section 1: Introduction

This section introduces the concept of soil vapor intrusion, associated human exposure issues, factors affecting soil vapor intrusion, factors affecting indoor air quality, and the general approach to evaluating vapor intrusion.

1.1 Soil vapor intrusion

The phrase "soil vapor intrusion" refers to the process by which volatile chemicals migrate from a subsurface source into the indoor air of buildings. Soil vapor, also referred to as soil gas, is the air found in the pore spaces between soil particles (Figure 1.1). Primarily because of a difference between interior and exterior pressures, soil vapor can enter a building through cracks or perforations in slabs or basement floors and walls, and through openings around sump pumps or where pipes and electrical wires go through the foundation. For example, heating, ventilation or air-conditioning (HVAC) systems and/or the operation of large mechanical appliances (e.g., exhaust fans, dryers, etc.) may create a negative pressure that can draw soil vapor into the building. This intrusion is similar to how radon gas enters buildings from the subsurface.

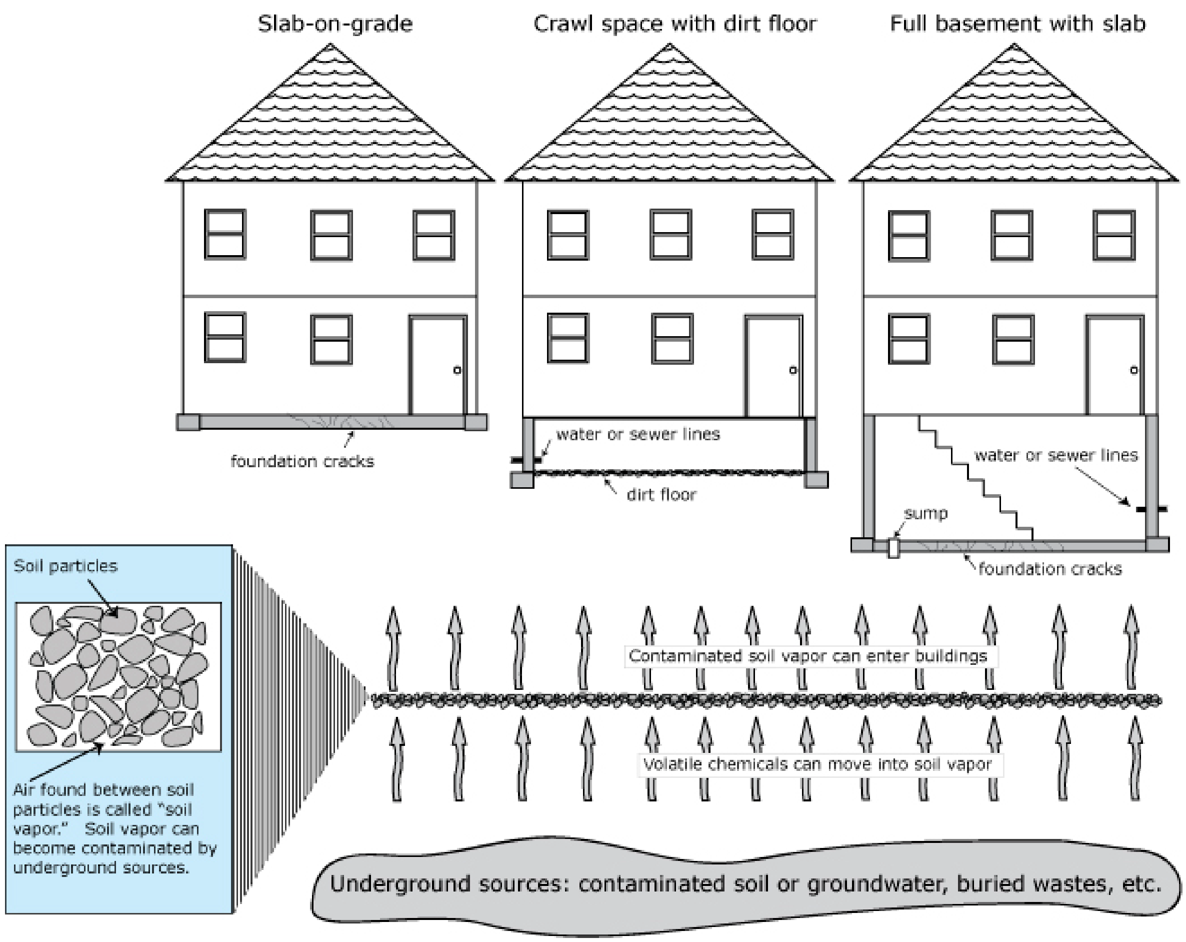

Figure 1.1
Generalized diagram of soil vapor intrusion

Soil vapor can become contaminated when chemicals evaporate from subsurface sources. Chemicals that can emit vapors are called "volatile chemicals." Volatile chemicals include volatile organic compounds (VOCs), some semi-volatile organic compounds (SVOCs), and some inorganic substances such as elemental mercury. Subsurface sources of volatile chemicals can include the following:

a. groundwater or soil that contains volatile chemicals;

b. non-aqueous phase liquid (NAPL);

c. buried wastes; and

d. underground storage tanks or drums.

If soil vapor is contaminated and enters a building, indoor air quality may be affected.

When contaminated vapors are present in the zone directly next to or under the foundation of a building, vapor intrusion is possible. Soil vapor can enter a building whether the building is old or new, or whether it is on a slab or has a crawl space or basement (Figure 1.1). However, the subsurface source of the contaminated vapor (e.g., contaminated soil or groundwater) does not need to be directly beneath a structure to contaminate the vapor immediately beneath the building's foundation (as suggested in Figure 1.1).

1.2 Soil vapor intrusion and human exposure

Humans can be exposed to contaminated soil vapor when the vapor is drawn into the building due to pressure differences [Section 1.1] and mixed with the indoor air. Inhalation is the primary route of exposure, or the manner in which the volatile chemicals, once in the indoor air, actually enter the body.

Both current and potential exposures are considered when evaluating soil vapor intrusion at sites (i.e., locations of suspected or known environmental contamination). *Current* exposures exist when vapor intrusion is documented in an occupied building. *Potential* exposures exist when volatile chemicals are present in the vapor phase beneath a building, but have not affected indoor air quality due to current site conditions. Potential exposures also exist when there is a chance that contaminated soil vapors may move beneath existing buildings not currently affected, when indoor air is affected but the building is currently unoccupied, or when there is a chance that new buildings can be built over existing subsurface vapor contamination.

Exposure to a volatile chemical due to vapor intrusion does not necessarily mean that health effects will occur. Whether or not a person experiences health effects depends on several factors, including the length of exposure (short-term or acute versus long-term or chronic), the amount of exposure (i.e., dose), the frequency of exposure, the toxicity of the volatile chemical and the individual's sensitivity to the chemical.

1.3 Factors affecting soil vapor migration and intrusion

Predicting the extent of soil vapor contamination from soil or groundwater contamination, as well as the potential for human exposure from soil vapor intrusion into buildings, is complicated by factors that can affect soil vapor migration and intrusion. For example, soil vapor contaminant plumes may not mimic groundwater contaminant plumes since different factors affect the migration pattern of each medium. In addition to the operation of HVAC systems, the operation of kitchen vents in restaurants or of elevators in office buildings may induce pressure gradients that result in the migration of vapor-phase contaminants away from a groundwater source of vapors and toward these buildings. This is similar to when the pumping of production wells or water supply wells draws contaminated groundwater away from its natural flow path.

Factors that can affect soil vapor migration and intrusion generally fall into two categories: environmental and building factors. Examples of environmental factors are provided in Table 1.1, and examples of building factors in Table 1.2. These factors are considered when conducting an investigation of the soil vapor intrusion pathway [Section 2] and when evaluating the results [Section 3].

Table 1.1 Environmental factors that may affect soil vapor intrusion

Environmental Factor	**Description**
Soil conditions	Generally, dry, coarse-grained soils facilitate the migration of subsurface vapors and wet, fine-grained or highly organic soils retard migration.
Volatile chemical concentrations	The potential for vapor intrusion generally increases with increasing concentrations of volatile chemicals in groundwater or subsurface soils, as well as with the presence of NAPL.
Source location	The potential for vapor intrusion generally decreases with increasing distance between the subsurface source of vapor contamination and overlying buildings. For example, the potential for vapor intrusion associated with contaminated groundwater decreases with increasing depth to groundwater.
Groundwater conditions	Volatile chemicals dissolved in groundwater may off-gas to the vadose zone from the surface of the water table. If contaminated groundwater is overlain by clean water (upper versus lower aquifer systems or significant downward groundwater gradients), then vapor phase migration or partitioning of the volatile chemicals is unlikely. Additionally, fluctuations in the groundwater table may results in contaminant smear zones. The "smear zone" is the area of subsurface soil contamination within the range of depths where the water table fluctuates. Chemicals floating on top of the water table, such as petroleum components, can sorb onto soils within this zone as the water table fluctuates. Sorption of chemicals can influence their gaseous and aqueous phase diffusion in the subsurface, and ultimately the rate at which they migrate.
Surface confining layer	A surface confining layer (e.g., frost layer, pavement or buildings) may temporarily or permanently retard the migration of subsurface vapors to outdoor air. Confining layers can also prevent rainfall from reaching subsurface soils, creating relatively dry soils that further increase the potential for soil vapor migration.
Fractures in bedrock and/or tight clay soils	Fractures in bedrock and desiccation fractures in clay can increase the potential for vapor intrusion beyond that expected for the bulk, unfractured bedrock or clay matrix by facilitating vapor migration (in horizontal and vertical directions) and movement of contaminated groundwater along spaces between fractures.
Underground conduits	Underground conduits (e.g., sewer and utility lines, drains or tree roots, septic systems) with highly permeable bedding materials relative to native materials can serve as preferential pathways for vapor migration due to relatively low resistance to flow.
Weather conditions	Wind and barometric pressure changes and thermal differences between air and surrounding soils may induce pressure gradients that affect soil vapor intrusion.
Biodegradation processes	Depending upon environmental conditions (e.g., soil moisture, oxygen levels, pH, mineral nutrients, organic compounds, and temperature), the presence of appropriate microbial populations, and the degradability of the volatile chemical of concern, biodegradation in the subsurface may reduce the potential for vapor intrusion. For example, readily biodegradable chemicals in soil vapor may not migrate a significant distance from a source area while less degradable chemicals may travel farther.

Table 1.2 Building factors that may affect vapor intrusion

Building Factor	Description
Operation of HVAC systems, fireplaces, and mechanical equipment (e.g., clothes dryers or exhaust fans/vents)	Operation may create a pressure differential between the building or indoor air and the surrounding soil that induces or retards the migration of vapor-phase contaminants toward and into the building. Vapor intrusion can be enhanced as the air vented outside is replaced.
Heated building	When buildings are closed up and heated, a difference in temperature between the inside and outdoor air induces a stack effect, venting warm air from higher floors to the outside. Vapor intrusion can be enhanced as the air is replaced in the lower parts of the building.
Air exchange rates	The rate at which outdoor air replenishes indoor air may affect vapor migration into a building as well the indoor air quality. For example, newer construction is typically designed to limit the exchange of air with the outside environment. This may result in the accumulation of vapors within a building.
Foundation type	Earthen floors and fieldstone walls may serve as preferential pathways for vapor intrusion.
Foundation integrity	Expansion joints or cold joints, wall cracks, or block wall cavities may serve as preferential pathways for vapor intrusion.
Subsurface features that penetrate the building's foundation	Foundation perforations for subsurface features (e.g., electrical, gas, sewer or water utility pipes, sumps, and drains) may serve as a preferential pathway for vapor intrusion.

1.4 Factors affecting indoor air quality

Chemicals are a part of our everyday life. They are found in the household products we use and in items we bring into our homes. As such, chemicals are found in indoor air of homes not affected by intrusion of contaminated soil vapor. Examples of alternate sources of volatile chemicals in indoor air are given in Table 1.3. Similarly, volatile chemicals can be in the outdoor air that enters a home or place of business. Certain commercial and industrial facilities, such as gasoline stations and dry cleaners, and vehicle exhaust are examples of possible sources of volatile chemicals in outdoor air.

Commonly found concentrations of these chemicals in indoor and outdoor air are referred to as "background levels." These levels are generally determined from the results of samples collected in homes, offices and outdoor areas not known to be affected by external sources of volatile chemicals (for example, a home not known to be near a chemical spill, a hazardous waste site, a dry-cleaner, or a factory). Background sources of volatile chemicals are considered when conducting an investigation of the soil vapor intrusion pathway [Section 2] and when evaluating the results [Section 3].

Table 1.3 Alternate sources of volatile chemicals in indoor air

Source	**Description**
Outdoor air	Outdoor sources of pollution can affect indoor air quality due to the exchange of outdoor and indoor air in buildings through natural ventilation, mechanical ventilation or infiltration. Outdoor sources of volatile compounds include automobiles, lawn mowers, oil storage tanks, dry cleaners, gasoline stations, industrial facilities, etc.
Attached or underground garages	Volatile chemicals from sources stored in the garage (e.g., automobiles, lawn mowers, oil storage tanks, gasoline containers, etc.) can affect indoor air quality due to the exchange of air between the garage and indoor space.
Off-gassing	Volatile chemicals may off-gas from building materials (e.g., adhesives or caulk), furnishings (e.g., new carpets or furniture), recently dry-cleaned clothing, or areas (such as floors or walls) contaminated by historical use of volatile chemicals in a building. Volatile chemicals may also off-gas from contaminated groundwater that infiltrates into the basement (e.g., at a sump) or during the use of contaminated domestic well water (e.g., at a tap or in a shower).
Household products	Household products include, but are not limited to, cleaners, mothballs, cigarette smoke, paints, paint strippers and thinners, air fresheners, lubricants, glues, solvents, pesticides, fuel oil storage, and gasoline storage.
Occupant activities	For example, in non-residential settings, the use of volatile chemicals in industrial or commercial processes or in products used for building maintenance. In residential settings, the use of products containing volatile chemicals for hobbies (e.g., glues, paints, etc.) or home businesses. People working at industrial or commercial facilities where volatile chemicals are used may bring the chemicals into their home on their clothing.
Indoor emissions	These include, but are not limited to, combustion products from gas, oil and wood heating systems that are vented outside improperly, as well as emissions from industrial process equipment and operations.

1.5 General approach to evaluating soil vapor intrusion

Since no two sites are exactly alike, the approach to evaluating soil vapor intrusion is dependent upon site-specific conditions. A thorough understanding of the site, including its history of use, characteristics (e.g., geology, geography, identified environmental contamination, etc.) and potentially exposed populations, is used to develop an investigation plan. Existing information is reviewed to determine what data are available and what additional data should be collected (i.e., to guide the investigation). In addition, factors affecting soil vapor migration and intrusion [Section 1.3] and indoor air quality [Section 1.4] are also considered when both conducting an investigation [Section 2] and evaluating the results [Section 3].

This data gathering and review process should be repeated until each of the following questions can be answered:

[1] Are subsurface vapors contaminated (i.e., soil vapor as defined in Section 1.1, including vapors located immediately beneath the foundation or slab of a building)? If so, what are the nature and extent of contamination? What is/are the source(s) of the contamination?

[2] What are the current and potential exposures to contaminated subsurface vapors via soil vapor intrusion?

[3] What actions, if any, should be taken to prevent or mitigate exposures related to soil vapor intrusion and to remediate subsurface vapor contamination?

When determining what actions, if any, are appropriate to mitigate current or prevent future human exposures, all information known about a site is considered (i.e., a "whole picture" approach is taken) because each site presents its own unique set of circumstances. This information includes, but is not limited to, the following: nature and extent of contamination in all environmental media, factors affecting vapor migration and intrusion, current and future site uses, off-site land uses, presence of alternate sources of volatile chemicals, and completed or proposed remedial actions.

Actions taken to minimize or prevent exposures typically do not preclude the site from being used for a desired purpose or from being developed. If appropriate, mitigation systems can be installed at existing buildings or installed during the construction of new buildings. In many cases, installation of mitigation systems on new buildings may be a prudent, proactive action. The costs associated with installing a system at the time of a building's construction are often considerably less than the costs associated with retrofitting a system to the building after construction is completed. Furthermore, in many parts of New York State, the mitigation system would also address concerns about human exposures to radon. To learn more about radon in New York State, please refer to the Radon: Frequently Asked Questions Fact Sheet in Appendix H or visit the NYSDOH's web site at http://www.health.state.ny.us/nysdoh/radon/radonhom.htm or contact the NYSDOH's Radon Program at 1-800-458-1158.

1.6 Conceptual site model

In accordance with the NYSDEC's *Draft DER-10 Technical Guidance for Site Investigation and Remediation* (NYSDEC 2002), subsurface vapors and soil vapor intrusion should be included in an overall conceptual model for the site. As described in the NYSDEC's technical guidance, a conceptual site model should be used to develop a general understanding of the site to evaluate potential risks to public health and the environment and to assist in identifying and setting priorities for the activities to be conducted at the site. The conceptual site model also identifies potential sources of contamination, types of contaminants and affected media, release mechanisms and potential contaminant pathways, and actual/potential human and environmental receptors.

The components of a conceptual site model specific to soil vapor intrusion are provided throughout Section 1 of the guidance. The general approach for evaluating soil vapor intrusion described in Section 1.5 is analogous to the development of a conceptual site model specific to soil vapor intrusion. For additional information about the use of conceptual site models in the investigation and remediation of sites or a description of the conceptual site model process, the reader is referred to the NYSDEC's technical guidance.

1.7 Applicability of guidance

This guidance should be considered anywhere soil vapor intrusion is evaluated in the State of New York, whether the evaluation is being undertaken voluntarily by a corporation, a municipality, or private citizen, or under one of the state's environmental remediation programs.

1.7.1 Residential and non-residential settings

The guidance should be followed in residential and non-residential settings where people may be exposed involuntarily to chemicals from soil vapor intrusion.

1.7.2 Chlorinated and non-chlorinated volatile chemical sites

The guidance should be used when evaluating soil vapor intrusion at chlorinated and non-chlorinated volatile chemical sites, including petroleum hydrocarbon sites and manufactured gas plant sites. While the likelihood for exposures related to soil vapor intrusion may differ between sites due to site-specific conditions and chemical-specific properties, the extent of volatile chemical contamination and the nature of the contamination, these factors should be considered when developing the conceptual site model and implementing an investigation plan (as discussed in Sections 1.5 and 1.6). For example, if the conceptual site model suggests that soil vapor intrusion is not a concern at a petroleum hydrocarbon site due to biodegradation, the work plan might include the measurement of select bioparameters (e.g., oxygen, carbon dioxide, methane, etc.), along with the petroleum hydrocarbons, at varying depths to demonstrate bioattenuation in the vadose. The work plan might include sub-slab vapor sampling as well to demonstrate that conditions beneath nearby buildings are also resulting in bioattenuation of the petroleum hydrocarbons.

1.7.3 Current, new and past remedial sites

As discussed in the NYSDEC's Program Policy *DER-13: Strategy for Prioritizing Vapor Intrusion Evaluations at Remedial Sites in New York* (NYSDEC 2006), the soil vapor intrusion pathway will be evaluated at all completed, current and future remedial sites New York State. This soil vapor intrusion guidance document complements the NYSDEC's policy by providing recommendations on how to evaluate soil vapor intrusion. The combined goal of the policy and guidance documents is to conduct soil vapor intrusion evaluations as efficiently and effectively as possible at all remedial sites in New York.

1.8 Updates to the guidance

The investigation, evaluation, mitigation and remediation of soil vapor are evolving disciplines and this guidance document will be updated periodically, as appropriate. The history of the document's release is provided on the inside of the cover page. In addition, changes to the document are noted in Appendix A. The current version of the document supercedes previous versions. The current version of the guidance is available on the NYSDOH's web site (*http://www.health.state.ny.us/environmental/indoors/vapor_intrusion/*) or by contacting the NYSDOH's Bureau of Environmental Exposure Investigation [see Contact Information on the inside of the cover page]. Revisions or amendments to the guidance will be posted on the NYSDOH's web site.

Section 2: Investigation of the Soil Vapor Intrusion Pathway

Soil vapor is an environmental medium, like groundwater and soil, that should be characterized during the investigation of a site. This section provides guidance on collecting appropriate and relevant data that can be used to identify current or potential human exposures to contaminated subsurface vapors associated with a site. As discussed in Section 1.5, no two sites are exactly alike. Site-specific and/or building-specific conditions may warrant modifying the recommendations herein. Therefore, guidance provided in this section is presented in terms of general steps and strategies that should be applied when approaching an investigation of soil vapor intrusion.

2.1 Sites at which an investigation is appropriate

Data collected to date do not support the use of pre-determined concentrations of volatile chemicals (i.e., screening criteria) in either groundwater or soil to trigger a soil vapor intrusion investigation. Therefore, although the level of investigation may vary, the pathway should be investigated at any site with the following:

a. an existing subsurface source (e.g., on the basis of preliminary environmental sampling) or likely subsurface source (e.g., on the basis of known previous land uses) of volatile chemicals [Section 1.1]; and

b. existing buildings or the possibility that buildings may be constructed near a subsurface source of volatile chemicals.

2.2 Types of samples

The following are types of samples that are collected to investigate the soil vapor intrusion pathway:

a. subsurface vapor samples:

   1. *soil vapor* samples (i.e., soil vapor samples not beneath the foundation or slab of a building) and

   2. *sub-slab vapor* samples (i.e., soil vapor samples immediately beneath the foundation or slab of a building);

b. crawl space air samples;

c. indoor air samples; and

d. outdoor air samples.

The types of samples that should be collected depend upon the specific objective(s) of the sampling, as described below.

2.2.1 Soil vapor

Soil vapor samples are collected to determine whether this environmental medium is contaminated, characterize the nature and extent of contamination, and identify possible sources of the contamination. Our experience to date indicates soil vapor results alone typically cannot be relied upon to rule out sampling at nearby buildings. For example, concentrations of volatile chemicals in sub-slab vapor samples have been substantially higher (e.g., by a factor of 100 or more) than concentrations found in nearby soil vapor samples (e.g., collected at 8 feet below grade near the building). This may be due to differences in factors such as soil moisture content and pressure gradients. Therefore, exposures are evaluated primarily based on sub-slab vapor, indoor air and outdoor air sampling results and soil vapor results are primarily used as a tool to guide these investigations.

Soil vapor sampling results are also used when evaluating the effectiveness of direct or indirect measures to remediate contaminated subsurface vapors. (Soil vapor extraction is an example of a direct remedial measure, and groundwater pumping and treating an indirect measure.)

2.2.2 Sub-slab vapor

Sub-slab vapor samples are collected to characterize the nature and extent of soil vapor contamination immediately beneath a building with a basement foundation and/or a slab-on-grade. Sub-slab vapor sampling results are used in conjunction with indoor air and outdoor air sampling results when evaluating the following:

a. *current* human exposures;

b. the potential for *future* human exposures (e.g., if the structural integrity of the building changes or the use of the building changes); and

c. site-specific attenuation factors (i.e., the ratio of indoor air to sub-slab vapor concentrations).

Sub-slab vapor samples are often collected after soil vapor characterization and/or other environmental sampling (e.g., soil and groundwater characterization) indicate they are warranted. Sub-slab samples are typically collected concurrently with indoor and outdoor air samples. However, outside of the heating season, sub-slab vapor samples may be collected independently depending on the sampling objective (e.g., to characterize the extent of subsurface vapor contamination outside of the heating season to develop a more comprehensive, focused investigation plan for the heating season).

2.2.3 Crawl space air

Similar to sub-slab vapor samples, crawl space air samples are collected to characterize the nature and extent of contamination immediately beneath a building with a crawl space foundation. Crawl space air sampling results are used in conjunction with indoor air and outdoor air sampling results when evaluating the following:

a. *current* human exposures; and

b. the potential for *future* human exposures (e.g., if the structural integrity of the building changes or the use of the building changes).

2.2.4 Indoor air

Indoor air samples are collected to characterize exposures to air within a building, including those with earthen floors. Indoor air sampling results are used when evaluating the following:

a. *current* human exposures;

b. the potential for *future* exposures (e.g., if a currently vacant building should become occupied); and

c. site-specific attenuation factors (e.g., the ratio of indoor air to sub-slab vapor concentrations).

Indoor air samples are often collected after subsurface vapor characterization and other environmental sampling (e.g., soil and groundwater characterization) indicate they are warranted. When indoor air samples are collected, concurrent sub-slab vapor, crawl space air (if applicable) and outdoor air samples are collected to evaluate the indoor air results appropriately. However, indoor air and outdoor air samples, without sub-slab vapor samples, may be collected when confirming the effectiveness of a mitigation system [Section 4].

In addition, site-specific situations may warrant collecting indoor air samples prior to characterizing subsurface vapors and/or without concurrent sub-slab vapor sampling to examine immediate inhalation hazards. Examples of such situations may include, but are not limited to, the following:

a. in response to a spill event to qualitatively and/or quantitatively characterize the contamination;

b. if high readings are obtained in a building when screening with field equipment (e.g., a photoionization detector (PID), an organic vapor analyzer, or an explosimeter) and the source is unknown;

c. if significant odors are present and the source needs to be characterized; or

d. if groundwater beneath the building is contaminated, the building is prone to groundwater intrusion or flooding (e.g., sump pit overflows), and subsurface vapor sampling is not feasible. In these situations, the collection of water samples from the sump may also be appropriate.

2.2.5 Outdoor air

Outdoor air samples are collected to characterize site-specific background outdoor air conditions. Outdoor air samples should be collected simultaneously with indoor air samples to evaluate the potential influence, if any, of outdoor air on the indoor air sampled. Outdoor air samples may also be collected concurrently with soil vapor samples to identify potential outdoor air interferences associated with infiltration of outdoor air into the sampling apparatus while the soil vapor was collected.

2.3 Phase of a site investigation in which to sample

There is no single phase (e.g., preliminary site characterization or remedial investigation) of a site investigation during which sampling to evaluate the soil vapor intrusion pathway is appropriate. Initiation of investigation activities for this specific purpose should be determined on a site-by-site basis. However, if exposures due to soil vapor intrusion appear likely at any point during the investigation, evaluation of this exposure pathway should not be delayed.

If the locations of likely source areas are reasonably known, sampling earlier during the investigation of a site rather than later is recommended because of the iterative nature of the sampling process [Section 2.5]. However, if current site conditions are not well-defined, then sampling after contamination in other environmental media (e.g., groundwater and soil) has been characterized may be considered. In the latter scenario, groundwater, soil and other site information may be used to guide an investigation of the soil vapor intrusion pathway, such as selecting locations for subsurface vapor samples based on likely migration pathways and source areas [Sections 2.6.1 and 2.6.2]. At a minimum, depth to groundwater and soil stratigraphy should be identified prior to collecting soil vapor samples.

Sampling may be delayed at parcels that are undeveloped or contain unoccupied buildings provided

a. characterization of the parcel is not needed to
    1. address exposures in the surrounding area;
    2. design remedial measures for subsurface vapor contamination; or
    3. monitor or confirm the effectiveness of remedial measures; and
b. measures are in place that assure that the parcel will not be developed, or buildings occupied, without addressing exposure concerns [Section 3.6].

If exposures due to soil vapor intrusion appear likely, and a delay of sampling is contemplated, the State (i.e., the NYSDEC and NYSDOH) should be informed of the contemplated delay and the rationale for the delay. Furthermore, the party contemplating the delay should consider any comments the State may have on the information provided.

2.4 Time of year in which to sample

2.4.1 Soil vapor

Soil vapor samples are collected at any time during the year. Often, sampling is completed during the summer so the results can be used as a tool when selecting buildings to be sampled during the heating season.

2.4.2 Buildings

Sub-slab vapor samples and, unless immediate sampling is appropriate, indoor air samples are typically collected during the heating season because soil vapor intrusion is more likely to occur when a building's heating system is in operation and doors and windows are closed. In New York State, heating systems are generally expected to be operating routinely from November 15th to March 31st. However, these dates are not absolute; the timeframe for sampling may vary depending on factors such as the location of the site (e.g., upstate versus downstate) and the weather conditions for a particular year.

A soil vapor intrusion investigation at a building may be conducted outside of the heating season if the concern for vapor intrusion is greater during another time of year. This may occur at certain industrial buildings, for instance, where HVAC systems are actively managed to control the ratio of recirculated indoor air to make-up air from outside the building. Information about the site and potentially affected structures, including the factors discussed in Section 1.3, should be considered in determining the timing of an investigation.

Samples may be collected at any time of year if exposures due to soil vapor intrusion appear likely. However, samples collected at times when soil vapor intrusion is not expected to have its greatest effect on indoor air quality (typically, samples collected outside of the heating season) should not be used to rule out exposures. For example, results indicating "no further action" or "monitoring required" should be verified when soil vapor intrusion is believed to be most likely to ensure these actions are protective throughout the year.

2.5 Number of sampling rounds

Investigating the soil vapor intrusion pathway usually involves more than one round of subsurface vapor, indoor air and/or outdoor air sampling, for reasons such as the following:

a. to characterize the nature and extent of subsurface vapor contamination (similar to the delineation of groundwater contamination) and to address corresponding exposure concerns;

b. to evaluate fluctuations in concentrations due to

    1. different weather conditions (e.g., seasonal effects),

    2. changes in building conditions (e.g., various operating conditions of a building's HVAC system),

    3. changes in source strength, or

    4. vapor migration or contaminant biodegradation processes (particularly when degradation products may be more toxic than the parent compounds); or

c. to confirm sampling results or the effectiveness of mitigation or remedial systems.

Overall, as discussed in Section 1.5, successive rounds of sampling should be conducted until the following questions can be answered:

a. Are subsurface vapors contaminated? If so, what are the nature and extent of contamination? What is/are the source(s) of the contamination?

b. What are the current and potential exposures to contaminated subsurface vapors?

c. What actions, if any, are appropriate to prevent or mitigate exposures and to remediate subsurface vapor contamination?

Toward this end, multiple rounds of sampling may be appropriate to characterize the nature and extent of subsurface vapor contamination such that

a. both potential and current exposures are addressed [Section 2.6];

b. measures can be designed to remediate subsurface vapor contamination, either directly (e.g., SVE system) or indirectly (e.g., soil excavation or groundwater remediation), given that monitoring and mitigation are considered temporary measures implemented to address exposures related to vapor intrusion until contaminated environmental media are remediated [Section 3.4]; and

c. the effectiveness of remedial measures can be monitored and confirmed (e.g., endpoint sampling) [Section 4.5].

2.6 Sampling locations

The general approach for selecting sampling locations as part of a soil vapor intrusion investigation is similar to the approach for the investigation of other environmental media (e.g., soil and groundwater). Sampling locations should be selected with consideration of the conceptual site model [Section 1.6]. These locations should be selected to meet the stated objectives of the sampling program. Additionally, similar to the investigation of soil and groundwater, it is typical to start at a known or suspected source and work outward. The specific approach, however, will be dependent upon site-specific and building-specific conditions.

2.6.1 Soil vapor

If available, existing environmental data (e.g., groundwater and soil data) and site background information should be used to select locations for sampling soil vapor as part of a vapor intrusion investigation. Locations will vary depending upon surface features (e.g., presence or absence of buildings, areas of pavement, or vacant lot) and subsurface characteristics (e.g., soil stratigraphy, buried structures, utility corridors, or clay lenses), as well as the specific purpose of the sampling. Therefore, a figure illustrating proposed sampling locations (with respect to both areal position and depth), actual locations sampled in the field, and relevant on-site and off-site features should be included in all sampling work plans and reports.

Examples of how locations may vary given the specific purpose of the sampling follow. They include general guidelines that should be followed when selecting soil vapor sampling locations:

a. to evaluate the **potential for current on-site or off-site exposures**, samples should be collected

   1. in the vicinity of a building's foundation [see special sampling consideration at the end of Section 2.6.1 if sampling around a building with no surrounding surface confining layer], as well as between the building's foundation and the source (if known and not located beneath the building),
   2. along the site's perimeter, and
   3. at a depth comparable to the depth of foundation footings (determined on a building-specific or site-specific basis) or at least 1 foot above the water table in areas where the groundwater table is less than 6 feet below grade;

b. to evaluate the **potential for future exposures if development** on a known or suspected contaminated area on-site or off-site is possible, representative samples should be collected

   1. in areas with either known or suspected subsurface sources of volatile chemicals, in areas where elevated readings were obtained with field equipment during previous environmental investigations, and in areas of varying concentrations of contamination in the upper groundwater,
   2. in a grid pattern across the area (at an appropriate spacing interval for the size of the area) if information is limited for the area, and
   3. at multiple depths from the suspected subsurface source, or former source, to a depth comparable to the expected depth of foundation footings;

c. to evaluate the **potential for off-site soil vapor contamination**, samples should be collected

   1. along the site's perimeter,

   2. in areas of potential subsurface sources of vapor contamination (e.g., a groundwater plume that has migrated off-site), and

   3. at a depth comparable to the depth of foundation footings (determined on a site-specific basis) or at least 1 foot above the water table in areas where the groundwater table is less than 6 feet below grade;

d. to evaluate on-site and off-site **preferential migration pathways** in areas with low permeability soils, samples should be collected

   1. along preferential soil vapor flow paths, such as sewer lines, utility corridors, trenches, pipelines, and other subsurface structures that are likely to be bedded with higher permeability materials, and

   2. at depths corresponding to these subsurface features (will depend on site-specific conditions);

e. to characterize on-site or off-site **contamination in the vadose zone**, samples should be collected

   1. in areas with either known or suspected sources of volatile chemicals, in areas where elevated readings were obtained with field equipment (e.g., PID) during previous soil and groundwater investigations, and in areas of varying concentrations of contamination in the upper groundwater regime, and

   2. at appropriate depths associated with these areas (will depend on site-specific conditions); and

f. to investigate the **influence of contaminated groundwater or soil on soil vapor** and to characterize the **vertical profile** of contamination, samples should be collected from clusters of soil vapor probes at varying depths in the vadose zone [Figure 2.2, Section 2.7.1] and preferably in conjunction with the collection of groundwater or soil samples.

Soil vapor samples collected at depths shallower than 5 feet below grade may be prone to negative bias due to infiltration of outdoor air. Therefore, samples from these depths should be collected only if appropriate (based on site-specific conditions), and sampling procedures and results should be reviewed accordingly. The depth of sampling near buildings with slab-on-grade foundations is dependent upon site-specific conditions (e.g., building surrounded by grassy or surface confining layer).

When collecting soil vapor samples around a building with no surrounding surface confining layer (e.g., pavement or sidewalk), samples should be located in native or undisturbed soils away from fill material surrounding the building (approximately 10 feet away from the building) to avoid sampling in an area that may be influenced by the building's operations. For example, operation of HVAC systems, fireplaces, or mechanical equipment (e.g., clothes dryers or exhaust fans/vents) in a building may exacerbate the infiltration of outdoor air into the vadose zone adjacent to the building. As a result, soil vapor samples collected in uncovered areas adjacent to the building may not be representative.

Investigations of soil vapor contamination should proceed outward from known or suspected subsurface sources, as appropriate, on an areal basis until the nature and extent of subsurface vapor contamination has been characterized and human exposures have been addressed.

2.6.2 Sub-slab vapor

Existing environmental data (e.g., soil vapor, groundwater and soil data), site background information, and building construction details (e.g., basement, slab-on-grade, or multiple types of foundations, HVAC systems, etc.) should be considered when selecting buildings and locations within buildings for sub-slab vapor sampling.

At a minimum, these general guidelines should be followed when selecting buildings to sample for sub-slab vapors:

a. buildings, including residential dwellings, located above or directly adjacent to known or suspected areas of subsurface volatile chemical contamination should be sampled;

b. buildings in which screening with field equipment (e.g., PID, ppbRAE, Jerome Mercury Vapor Analyzer, etc.) suggests a completed migration pathway, such as when readings are above background and from unidentified sources or when readings show increasing gradients, should be sampled; and

c. buildings within known or suspected areas of subsurface volatile chemical contamination that are used or occupied by sensitive population groups (e.g., daycare facilities, schools, nursing homes, etc.) should be given special consideration for sampling.

Investigations of sub-slab vapor and/or indoor air contamination should proceed outward from known or suspected sources, as appropriate, on an areal basis until the nature and extent of subsurface vapor contamination has been characterized and potential and current human exposures have been addressed. In cases of widespread vapor contamination and depending upon the basis for making decisions (e.g., a "blanket mitigation" approach within a specified area of documented vapor contamination [Section 3.3.1]), a representative number of buildings from an identified study area, rather than each building, may be sampled. Prior to implementation, this type of sampling approach should be approved by State agency personnel.

Within a building, sub-slab vapor samples should be collected

a. in at least one central location away from foundation footings, and

b. from the soil or aggregate immediately below the basement slab or slab-on-grade.

The number of sub-slab vapor samples that should be collected in a building depends upon the number of slabs (e.g., multiple slabs-on-grade in a large warehouse) and foundation types (e.g., combined basement and slab-on-grade in a residence). At least one sub-slab vapor sample should be collected from each representative area.

2.6.3 Indoor air

Existing environmental data (e.g., soil vapor, groundwater and soil data), site background information, and building construction details (e.g., basement, slab-on-grade, or multiple types of foundations; number and operation of HVAC systems; elevator shafts; tunnels or other confined-space entry points; etc.) should be considered when selecting buildings and locations within buildings for indoor air sampling. Indoor air samples are typically collected concurrently with sub-slab vapor and outdoor air samples [Section 2.2.4].

At a minimum, these general guidelines should be followed when selecting buildings to sample for indoor air:

a. where sub-slab vapor samples were collected without indoor air samples, buildings in which elevated concentrations of contaminants were measured in sub-slab vapor samples should be sampled;

b. buildings, including residential dwellings, located above or directly adjacent to known or suspected subsurface sources of volatile chemicals or known soil vapor contamination should be sampled;

c. buildings in which screening with field equipment (e.g., PID, ppbRAE, Jerome Mercury Vapor Analyzer, etc.) suggests a completed migration pathway, such as when readings are above background and from unidentified sources or when readings show increasing gradients, should be sampled; and

d. buildings within known or suspected areas of subsurface volatile chemical contamination that are used or occupied by sensitive population groups (e.g., daycare facilities, schools, nursing homes, etc.) should be given special consideration for sampling.

To characterize contaminant concentration trends and potential exposures, indoor air samples should be collected

a. from the crawl space area,

b. from the basement (where vapor infiltration is suspected, such as near sump pumps or indoor wells, or in a central location) at a height approximately three feet above the floor to represent a height at which occupants normally are seated and/or sleep,

c. from the lowest level living space (in centrally-located, high activity use areas) at a height approximately three feet above the floor to represent a height at which occupants normally are seated and/or sleep, and

d. if in a commercial setting (e.g., a strip mall), from multiple tenant spaces at a height approximately three feet above the floor to represent a height at which occupants normally are seated.

These locations are illustrated in Figure 2.1.

Investigations of indoor air contamination should proceed outward from known or suspected subsurface sources, as appropriate, on an areal basis until potential and current human exposures associated with soil vapor intrusion have been addressed. In cases of widespread vapor contamination and depending upon the basis for making decisions (e.g., a "blanket mitigation" approach within a specified area of documented vapor contamination), a representative number of buildings from an identified study area, rather than each building, may be sampled. Prior to implementation, this type of sampling approach should be approved by State agency personnel.

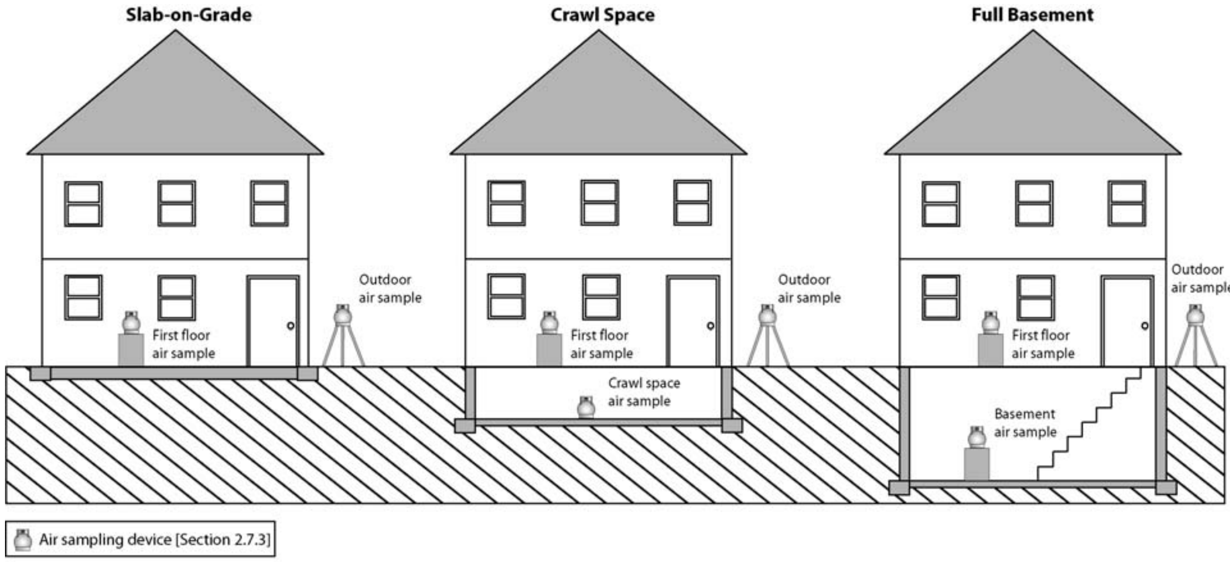

Figure 2.1
Schematic of indoor and outdoor air sampling locations

2.6.4 Outdoor air

Typically, an outdoor air sample is collected outside of each building where an indoor air sample is collected. However, if several buildings are being sampled within a localized area, representative outdoor air samples may be appropriate. For example, one outdoor air sample may be sufficient for three houses being sampled in a cul-de-sac. Outdoor air samples should be collected from a representative upwind location, away from wind obstructions (e.g., trees or bushes), and at a height above the ground to represent breathing zones (3 to 5 feet) [Figure 2.1]. A representative sample is one that is not biased toward obvious sources of volatile chemicals (e.g., automobiles, lawn mowers, oil storage tanks, gasoline stations, industrial facilities, etc.). For buildings with HVAC systems that draw outdoor air into the building, an outdoor air sample collected near the outdoor air intake may be appropriate.

2.7 Sampling protocols

The procedures recommended here may be modified depending on site-specific conditions, the sampling objectives, or emerging technologies and methodologies. Alternative sampling procedures should be described thoroughly and proposed in a work plan submitted for review by the State. The State will review and comment on the proposed procedure and consider the efficacy of the alternative sampling procedure based on the objectives of investigation. In all cases, work plans should thoroughly describe the proposed sampling procedure. Similarly, the procedures that were implemented in the field should be documented and included in the final report of the sampling results.

2.7.1 Soil vapor

Soil vapor probe installations [Figure 2.2] may be permanent, semi-permanent or temporary. In general, permanent or semi-permanent installations are preferred for data consistency reasons and to ensure outdoor air infiltration does not occur. Temporary probes should only be used if measures are taken to ensure that an adequate surface seal is created to prevent outdoor air infiltration and if tracer gas is used at every sampling location. [See Section 2.7.5 for additional information about the use of tracer gas when collecting soil vapor samples.] Soil vapor implants or probes should be constructed in the same manner at all sampling locations to minimize possible discrepancies. The following procedures should be included in any permanent construction protocol:

a. implants should be installed using an appropriate method based on site conditions (e.g., direct push, manually driven, auger — if necessary to attain the desired depth or if sidewall smearing is a concern, etc.);

b. porous, inert backfill material (e.g., glass beads, washed #1 crushed stone, etc.) should be used to create a sampling zone 1 to 2 feet in length;

c. implants should be fitted with inert tubing (e.g., polyethylene, stainless steel, nylon, Teflon®, etc.) of the appropriate size (typically 1/8 inch to 1/4 inch diameter) and of laboratory or food grade quality to the surface;

d. soil vapor probes should be sealed above the sampling zone with a bentonite slurry for a minimum distance of 3 feet to prevent outdoor air infiltration and the remainder of the borehole backfilled with clean material;

e. for multiple probe depths, the borehole should be grouted with bentonite between probes to create discrete sampling zones or separate nested probes should be installed [Figure 2.2]; and

f. steps should be taken to minimize infiltration of water or outdoor air and to prevent accidental damage (e.g., setting a protective casing around the top of the probe tubing and grouting in place to the top of bentonite, sloping the ground surface to direct water away from the borehole like a groundwater monitoring well, etc.).

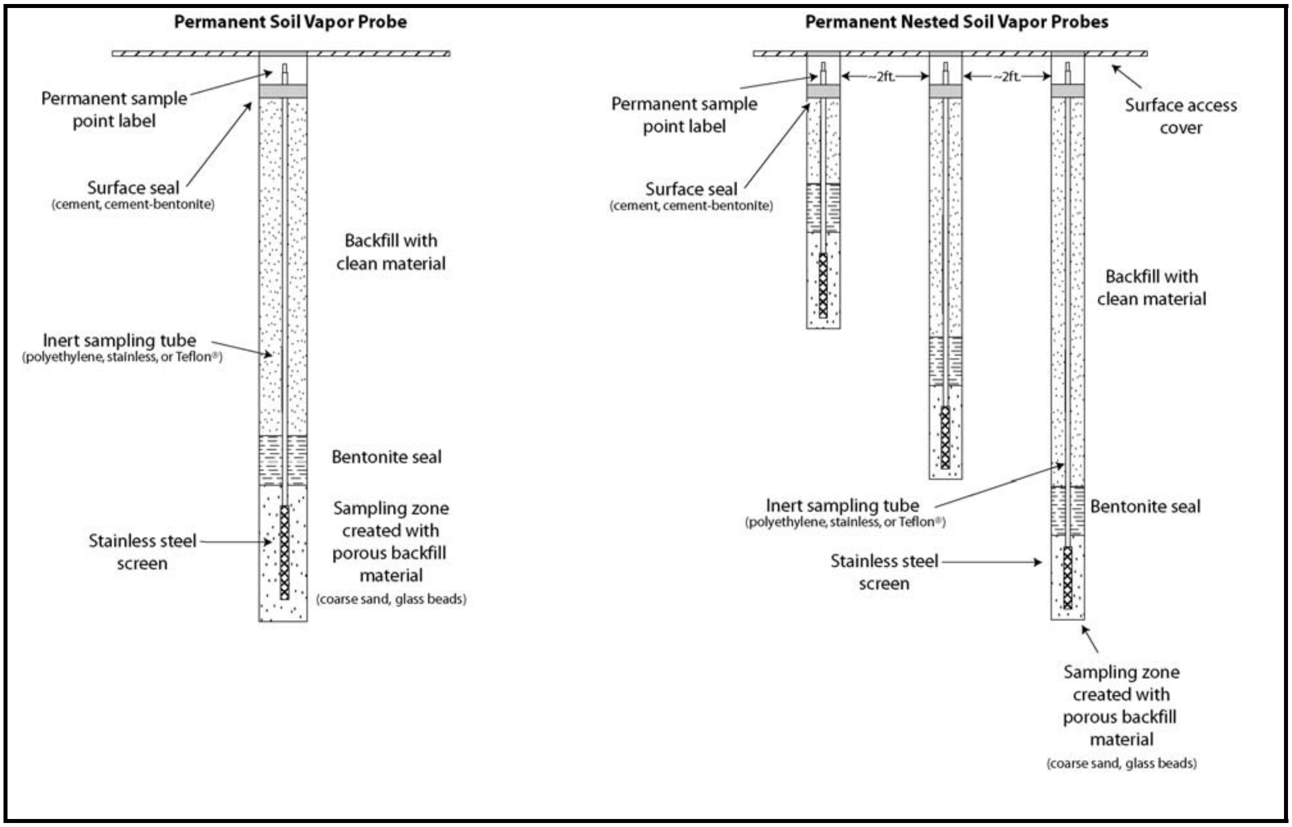

Figure 2.2

Schematics of a generic permanent soil vapor probe
and permanent nested soil vapor probes

[Note: Many variations exist and may be proposed in a work plan. Proposed installations should meet the sampling objectives and requirements of the analytical methods.]

To obtain representative samples and to minimize possible discrepancies, soil vapor samples should be collected in the following manner at all locations:

a. at least 24 hours after the installation of permanent probes and shortly after the installation of temporary probes, one to three implant volumes (i.e., the volume of the sample probe and tube) should be purged prior to collecting the samples;

b. flow rates for both purging and collecting should not exceed 0.2 liters per minute to minimize outdoor air infiltration during sampling;

c. samples should be collected, using conventional sampling methods, in an appropriate container — one which

    i. meets the objectives of the sampling (e.g., investigation of areas where low or high concentrations of volatile chemicals are expected; to minimize losses of volatile chemicals that are susceptible to photodegradation),

    ii. is consistent with the sampling and analytical methods (e.g., low flow rate; Summa® canisters if analyzing by using EPA Method TO-15), and

    iii. is certified clean by the laboratory;

d. sample size depends upon the volume of that will achieve minimum reporting limits [Section 2.9]; and

e. a tracer gas (e.g., helium, butane, sulfur hexafluoride, etc.) should be used when collecting soil vapor samples to verify that adequate sampling techniques are being implemented (i.e., to verify infiltration of outdoor air is not occurring) [Section 2.7.5].

In some cases, weather conditions may present certain limitations on soil vapor sampling. For example, condensation in the sample tubing may be encountered during winter sampling due to low outdoor air temperatures. Devices, such as tube warmers, may be used to address these conditions. Anticipated limitations to the sampling should be discussed prior to the sampling event so appropriate measures can be taken to address these difficulties and produce representative and reliable data.

When soil vapor samples are collected, the following actions should be taken to document local conditions during sampling that may influence interpretation of the results:

a. if sampling near a commercial or industrial building, uses of volatile chemicals during normal operations of the facility should be identified;

b. outdoor plot sketches should be drawn that include the site, area streets, neighboring commercial or industrial facilities (with estimated distance to the site), outdoor air sampling locations (if applicable), and compass orientation (north);

c. weather conditions (e.g., precipitation and outdoor temperature) should be noted for the past 24 to 48 hours; and

d. any pertinent observations should be recorded, such as odors and readings from field instrumentation.

Additional information that could be gathered to assist in the interpretation of the results includes barometric pressure, wind speed and wind direction.

The field sampling team should maintain a sample log sheet summarizing the following:

a. sample identification,

b. date and time of sample collection,

c. sampling depth,

d. identity of samplers,

e. sampling methods and devices,

f. purge volumes,

g. volume of soil vapor extracted,

h. if canisters used, the vacuum before and after samples were collected,

i. apparent moisture content (dry, moist, saturated, etc.) of the sampling zone, and

j. chain of custody protocols and records used to track samples from sampling point to analysis.

2.7.2 Sub-slab vapor

During colder months, heating systems should be operating to maintain normal indoor air temperatures (i.e., 65 – 75 °F) for at least 24 hours prior to and during the scheduled sampling time. Prior to installation of the sub-slab vapor probe, the building floor should be inspected and any penetrations (cracks, floor drains, utility perforations, sumps, etc.) should be noted and recorded. Probes should be installed at locations where the potential for ambient air infiltration via floor penetrations is minimal.

Sub-slab vapor probe installations [Figure 2.3] may be permanent, semi-permanent or temporary. A vacuum should not be used to remove drilling debris from the sampling port. Sub-slab implants or probes should be constructed in the same manner at all sampling locations to minimize possible discrepancies. The following procedures should be included in any construction protocol:

a. permanent recessed probes should be constructed with brass or stainless steel tubing and fittings;
b. temporary probes should be constructed with inert tubing (e.g., polyethylene, stainless steel, nylon, Teflon®, etc.) of the appropriate size (typically 1/8 inch to 1/4 inch diameter), and of laboratory or food grade quality;
c. tubing should not extend further than 2 inches into the sub-slab material;
d. porous, inert backfill material (e.g., glass beads, washed #1 crushed stone, etc.) should be added to cover about 1 inch of the probe tip for permanent installations; and
e. the implant should be sealed to the surface with non-VOC-containing and non-shrinking products for temporary installations (e.g., permagum grout, melted beeswax, putty, etc.) or cement for permanent installations.

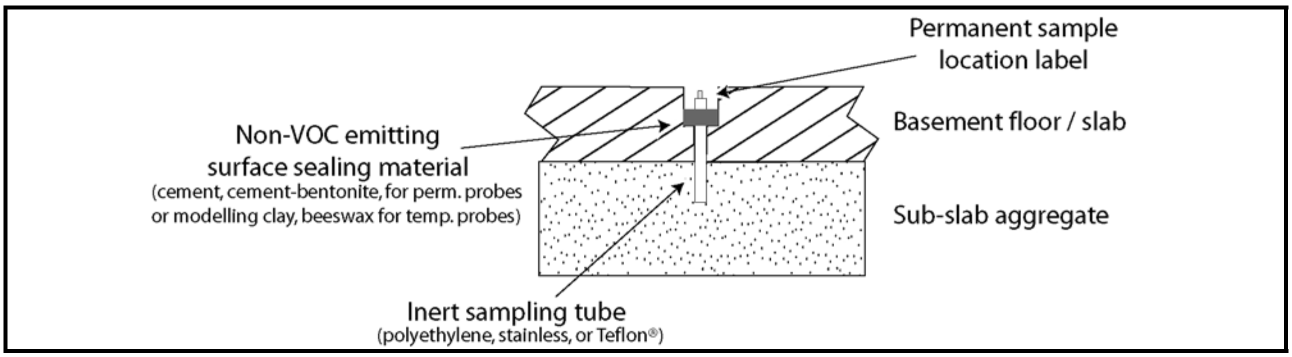

Figure 2.3

Schematic of a generic sub-slab vapor probe

[Note: Many variations exist and may be proposed in a work plan. Proposed installations should meet the sampling objectives and requirements of the analytical methods.]

To obtain representative samples that meet the data quality objectives, sub-slab vapor samples should be collected in the following manner:

a. after installation of the probes, one to three volumes (i.e., the volume of the sample probe and tube) must be purged prior to collecting the samples to ensure samples collected are representative;

b. flow rates for both purging and collecting must not exceed 0.2 liters per minute to minimize ambient air infiltration during sampling; and

c. samples should be collected, using conventional sampling methods, in an appropriate container — one which

    i. meets the objectives of the sampling (e.g., investigation of areas where low or high concentrations of volatile chemicals are expected; to minimize losses of volatile chemicals that are susceptible to photodegradation),

    ii. is consistent with the sampling and analytical methods (e.g., low flow rate; Summa® canisters if analyzing by using EPA Method TO-15), and

    iii. is certified clean by the laboratory;

d. sample size depends upon the volume of that will achieve minimum reporting limits [Section 2.9], the flow rate, and the sampling duration; and

e. ideally, samples should be collected over the same period of time as concurrent indoor and outdoor air samples.

When sub-slab vapor samples are collected, the following actions should be taken to document conditions during sampling and ultimately to aid in the interpretation of the sampling results [Section 3]:

a. historic and current storage and uses of volatile chemicals should be identified, especially if sampling within a commercial or industrial building (e.g., use of volatile chemicals in commercial or industrial processes and/or during building maintenance);

b. the use of heating or air conditioning systems during sampling should be noted;

c. floor plan sketches should be drawn that include the floor layout with sampling locations, chemical storage areas, garages, doorways, stairways, location of basement sumps or subsurface drains and utility perforations through building foundations, HVAC system air supply and return registers, compass orientation (north), footings that create separate foundation sections, and any other pertinent information should be completed;

d. outdoor plot sketches should be drawn that include the building site, area streets, outdoor air sampling locations (if applicable), compass orientation (north), and paved areas;

e. weather conditions (e.g., precipitation and indoor and outdoor temperature) and ventilation conditions (e.g., heating system active and windows closed) should be reported; and

f. any pertinent observations, such as spills, floor stains, smoke tube results, odors and readings from field instrumentation (e.g., vapors via PID, ppbRAE, Jerome Mercury Vapor Analyzer, etc.), should be recorded.

Additional documentation that could be gathered to assist in the interpretation of the results includes information about air flow patterns and pressure relationships obtained by using smoke tubes or other devices (especially between floor levels and between suspected contaminant sources and other areas), the barometric pressure and photographs to accompany floor plan sketches.

The field sampling team should maintain a sample log sheet summarizing the following:

a. sample identification,
b. date and time of sample collection,
c. sampling depth,
d. identity of samplers,
e. sampling methods and devices,
f. soil vapor purge volumes,
g. volume of soil vapor extracted,
h. if canisters used, vacuum of canisters before and after samples collected,
i. apparent moisture content (dry, moist, saturated, etc.) of the sampling zone, and
j. chain of custody protocols and records used to track samples from sampling point to analysis.

2.7.3 Indoor air

[Reference: NYSDOH's *Indoor Air Sampling & Analysis Guidance (February 1, 2005)*]

During colder months, heating systems should be operating to maintain normal indoor air temperatures (i.e., 65 – 75 °F) for at least 24 hours prior to and during the scheduled sampling time. If possible, prior to collecting indoor samples, a pre-sampling inspection [Section 2.11.1] should be performed to evaluate the physical layout and conditions of the building being investigated, to identify conditions that may affect or interfere with the proposed sampling, and to prepare the building for sampling. This process is described in Section 2.11.1.

In general, indoor air samples should be collected in the following manner:

a. sampling duration should reflect the exposure scenario being evaluated without compromising the detection limit or sample collection flow rate (e.g., an 8 hour sample from a workplace with a single shift versus a 24 hour sample from a workplace with multiple shifts). To ensure that air is representative of the locations sampled and to avoid undue influence from sampling personnel, samples should be collected for at least 1 hour. If the goal of the sampling is to represent average concentrations over longer periods, then longer duration sampling periods may be appropriate. Typically, 24 hour samples are collected from residential settings;
b. personnel should avoid lingering in the immediate area of the sampling device while samples are being collected;
c. sample flow rates must conform to the specifications in the sample collection method and, if possible, should be consistent with the flow rates for concurrent outdoor air and sub-slab samples; and
d. samples must be collected, using conventional sampling methods, in an appropriate container — one which

i. meets the objectives of the sampling (e.g., investigation of areas where low or high concentrations of volatile chemicals are expected; to minimize losses of volatile chemicals that are susceptible to photodegradation),

ii. is consistent with the sampling and analytical methods (e.g., low flow rate; Summa® canisters if analyzing by using EPA Method TO-15), and

iii. is certified clean by the laboratory.

At sites with tetrachloroethene contamination, passive air monitors that are specifically analyzed for tetrachloroethene (i.e., "perc badges") are commonly used to collect indoor and outdoor air samples. If site characterization activities indicate that degradation products of tetrachloroethene also represent a vapor intrusion concern, perc badges may be used to indicate the likelihood of vapor intrusion (i.e., by using tetrachloroethene as a surrogate) followed, as appropriate, by more comprehensive sampling and laboratory analyses to quantify both tetrachloroethene and its degradation products. Perc badge samples ideally should be collected over a twenty-four hour period, but for no less than eight hours.

The following actions should be taken to document conditions during indoor air sampling and ultimately to aid in the interpretation of the sampling results [Section 3]:

a. historic and current uses and storage of volatile chemicals should be identified, especially if sampling within a commercial or industrial building (e.g., use of volatile chemicals in commercial or industrial processes and/or during building maintenance);

b. a product inventory survey documenting sources of volatile chemicals present in the building during the indoor air sampling that could potentially influence the sample results should be completed [Section 2.11.2];

c. the use of heating or air conditioning systems during sampling should be noted;

d. floor plan sketches should be drawn that include the floor layout with sampling locations, chemical storage areas, garages, doorways, stairways, location of basement sumps or subsurface drains and utility perforations through building foundations, HVAC system supply and return registers, compass orientation (north), footings that create separate foundation sections, and any other pertinent information should be completed;

e. outdoor plot sketches should be drawn that include the building site, area streets, outdoor air sampling locations (if applicable), compass orientation (north), and paved areas;

f. weather conditions (e.g., precipitation and indoor and outdoor temperature) and ventilation conditions (e.g., heating system active and windows closed) should be reported; and

g. any pertinent observations, such as spills, floor stains, smoke tube results, odors and readings from field instrumentation (e.g., vapors via PID, ppbRAE, Jerome Mercury Vapor Analyzer, etc.), should be recorded.

Additional documentation that could be gathered to assist in the interpretation of the results includes information about air flow patterns and pressure relationships obtained by using smoke tubes or other devices (especially between floor levels and between suspected contaminant sources and other areas), the barometric pressure and photographs to accompany floor plan sketches.

The field sampling team should maintain a sample log sheet summarizing the following:

a. sample identification,
b. date and time of sample collection,
c. sampling height,
d. identity of samplers,
e. sampling methods and devices,
f. depending upon the method, volume of air sampled,
g. if canisters are used, vacuum of canisters before and after samples collected, and
h. chain of custody protocols and records used to track samples from sampling point to analysis.

2.7.4 Outdoor air

Outdoor air samples should be collected simultaneously with indoor air samples to evaluate the potential influence, if any, of outdoor air on indoor air quality. They may also be collected simultaneously with soil vapor samples to identify potential outdoor air interferences associated with infiltration of outdoor air into the sampling apparatus while the soil vapor was collected. To obtain representative samples that meet the data quality objectives, outdoor air samples should be collected in a manner consistent with that for indoor air samples (described in Section 2.7.3).

The following actions should be taken to document conditions during outdoor air sampling and ultimately to aid in the interpretation of the sampling results [Section 3]:

a. outdoor plot sketches should be drawn that include the building site, area streets, outdoor air sampling locations, the location of potential interferences (e.g., gasoline stations, factories, lawn movers, etc.), compass orientation (north), and paved areas;
b. weather conditions (e.g., precipitation and outdoor temperature) should be reported; and
c. any pertinent observations, such as odors, readings from field instrumentation, and significant activities in the vicinity (e.g., operation of heavy equipment or dry cleaners) should be recorded.

2.7.5 Tracer gas

When collecting soil vapor samples as part of a vapor intrusion evaluation, a tracer gas serves as a quality assurance/quality control measure to verify the integrity of the soil vapor probe seal. Without the use of a tracer, there is no way to verify that a soil vapor sample has not been diluted by outdoor air.

Depending on the nature of the contaminants of concern, a number of different compounds can be used as a tracer. Typically, sulfur hexafluoride (SF_6) or helium are used as tracers because they are readily available, have low toxicity, and can be monitored with portable measurement devices. Butane and propane (or other gases) could also be used as a tracer in some situations. Compounds other than those mentioned here may be appropriate, provided they meet project-specific data quality objectives. Where applicable, steps should be taken to ensure that the gas used by the laboratory to clean the air sampling container is different from the gas used as a tracer during sampling (e.g., helium).

The protocol for using a tracer gas is straightforward: simply enrich the atmosphere in the immediate vicinity of the area where the probe intersects the ground surface with the tracer gas, and measure a vapor sample from the probe for the presence of high concentrations (> 10%) of the tracer. A cardboard box, a plastic pail, or even a garbage bag can serve to keep the tracer gas in contact with the probe during the testing. If there are concerns about infiltration of ambient air through other parts of the sampling train (such as around the fittings, not just at the probe/ground interface), then consideration should be given to ensuring that the tracer gas is in contact with the entire sampling apparatus. In these cases, field personnel may prefer to use a liquid tracer — soaking paper towels with a liquid tracer and placing the towels around the probe/ground interface, around fittings, and/or in the corner of a shroud.

There are two basic approaches to testing for the tracer gas:

1. include the tracer gas in the list of target analytes reported by the laboratory; or
2. use a portable monitoring device to analyze a sample of soil vapor for the tracer prior to and after sampling for the compounds of concern. (Note that the tracer gas samples can be collected via syringe, Tedlar® bag etc. They need not be collected in Summa® canisters or minicans.)

The advantage of the second approach is that the real time tracer sampling results can be used to confirm the integrity of the probe seals prior to formal sample collection.

Figure 2.4 depicts common methods for using tracer gas. In examples a, b and c, the tracer gas is released in the enclosure prior to initially purging the sample point. Care should be taken to avoid excessive purging prior to sample collection. Care should also be taken to prevent pressure build-up in the enclosure during introduction of the tracer gas. Inspection of the installed sample probe, specifically noting the integrity of the surface seal and the porosity of the soil in which the probe is installed, will help to determine the tracer gas setup. Figure 2.4a may be most effective at preventing tracer gas infiltration, however, it may not be appropriate in some situations depending on site-specific conditions. Figures 2.4b and 2.4c may be sufficient for probes installed in tight soils with well-constructed surface seals. Figure 2d provides an example of using a liquid tracer. In all cases, the same tracer gas application should be used for all probes at any given site.

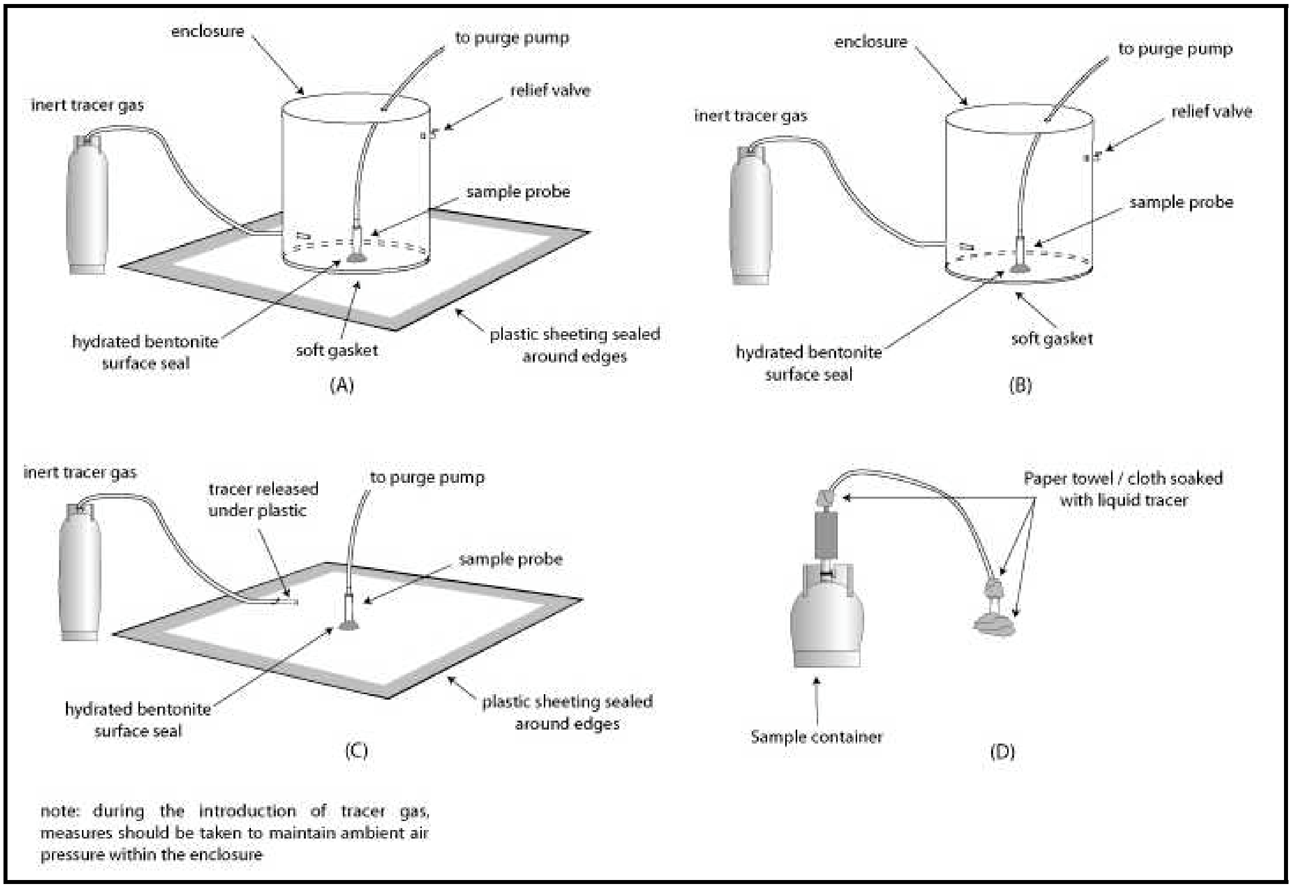

Figure 2.4
Schematics of generic tracer gas applications when collecting soil vapor samples

Because minor leakage around the probe seal should not materially affect the usability of the soil vapor sampling results, the mere presence of the tracer gas in the sample should not be a cause for alarm. Consequently, portable field monitoring devices with detection limits in the low ppm range are more than adequate for screening samples for the tracer. If high concentrations (> 10%) of tracer gas are observed in a sample, the probe seal should be enhanced to reduce the infiltration of outdoor air.

Where permanent or semi-permanent sampling probes are used, tracer gas samples should be collected at each of the sampling probes during the initial stages of a soil vapor sampling program. If the results of the initial samples indicate that the probe seals are adequate, reducing the number of locations at which tracer gas samples are employed may be considered. At a minimum, tracer gas samples should be collected with at least 10% of the soil vapor samples collected in subsequent sampling rounds. When using permanent soil vapor probes as part of a long-term monitoring program, annual testing of the probe integrity is recommended. Where temporary probes are used, tracer gas should be used at every sampling location, every time.

2.8 Quality assurance / quality control (QA / QC)

[Reference: NYSDOH's *Indoor Air Sampling & Analysis Guidance (February 1, 2005)*]

In general, appropriate QA/QC procedures should be followed during all aspects of sample collection and analysis to ensure that sampling error is minimized and high quality data are obtained. Sampling team members should avoid actions (e.g., fueling vehicles, using permanent marking pens, wearing freshly dry-cleaned clothing or personal fragrances, etc.) which can cause sample interference in the field. Portable air monitoring equipment or field instrumentation should be properly maintained, calibrated and tested to ensure validity of measurements. Air sampling equipment should be stored, transported and between samples decontaminated in a manner consistent with the best environmental consulting practices to minimize problems such as field contamination and cross-contamination. Samples should be collected using certified clean sample devices. Where applicable, steps should be taken to ensure that the gas used by the laboratory to clean the sample device is different from the gas used as a tracer during sampling (e.g., helium). Samples should meet sample holding times and temperatures, and should be delivered to the analytical laboratory as soon as possible after collection. In addition, laboratory accession procedures should be followed, including field documentation (sample collection information and locations), chain of custody, field blanks, field sample duplicates and laboratory duplicates, as appropriate.

Some methods call for collecting samples in duplicate (e.g., indoor air sampling using passive sampling devices for tetrachloroethene) to assess errors. Duplicate and/or split samples should be collected in accordance with the sampling and analytical methods being implemented.

For certain regulatory programs, a Data Usability Summary Report (DUSR) or equivalent report may be required to determine whether or not the data, as presented, meets the site or project specific criteria for data quality and data use. This requirement may dictate the level of QC and the category of data deliverable to request from the laboratory. Guidance on preparing these reports is available by contacting the NYSDEC's Division of Environmental Remediation.

New York State Public Health Law requires laboratories analyzing environmental samples collected from within New York State to have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. If ELAP certification is not currently required for an analyte (e.g., trichloroethene), the analysis should be performed by a laboratory that has ELAP certification for similar compounds in air and uses analytical methods with minimum reporting limits similar to background (e.g., tetrachloroethene via EPA Method TO-15). Questions about a laboratory's current certification status should be directed to an ELAP representative at 518-485-5570 or by email at elap@health.state.ny.us.

The work plan should state that all samples that will be used to make decisions on appropriate actions to address exposures and environmental contamination will be analyzed by an ELAP-certified laboratory. The name of the laboratory should also be provided. Similarly, the name of the laboratory that was used should be included in the report of the sampling results. For samples collected and tested in the field for screening purposes by using field testing technology, the qualifications of the field technician should be documented in the work plan.

2.9 Analytical methods

[Reference: NYSDOH's *Indoor Air Sampling & Analysis Guidance (February 1, 2005)*]

Proposed analytical procedures should be identified in work plans. Similarly, the analytical procedures that were used and corresponding reporting limits should be identified when reporting the sampling results. When selecting an appropriate analytical method, the data quality objectives should be considered. As described in Section 3, comparing sampling results for volatile chemicals with background concentrations and with indoor air/sub-slab vapor matrices are critical components of the data evaluation process. Therefore, samples should be analyzed by methods that can achieve minimum reporting limits to allow for comparison of the results with background levels and with the levels presented in the matrices [Section 3.4.2]. If there are additional data quality objectives, they should be considered also. Typically, a minimum reporting limit of 1 microgram per cubic meter (1 mcg/m^3) or less is sufficient for most analytes. Examples of commonly used analytical methods include the following:

a. EPA Method TO-15 for a wide range of VOCs (e.g., samples from evacuated canisters),

b. NYSDOH Method 311-9 for tetrachloroethene (i.e., samples from perc badges),

c. EPA Method TO-17 for VOCs (e.g., samples collected with sorbent tubes), and

d. EPA Method TO-15 for VOCs with selective ion monitoring (SIM) (e.g., to achieve minimum reporting limits lower than those achieved with Method TO-15 alone).

The laboratory should verify that they are capable of detecting the appropriate analytes and can report them at the appropriate reporting limit.

2.9.1 Subsurface vapor

Soil vapor and sub-slab vapor samples should be analyzed for a wide range of volatile chemicals during the first round of sampling (at a minimum) — unless it can be demonstrated that an abbreviated or site-specific analyte list is appropriate. This is analogous to analyzing groundwater samples for a suite of compounds (e.g., EPA's target analyte list/target compound list (TAL/TCL) chemicals) during the initial rounds of site characterization. Based on the initial sampling results, development and application of a site-specific analyte list may be considered for analysis of subsequent soil vapor and sub-slab vapor samples.

If a site-specific analyte list is developed, it should include the following:

a. volatile chemicals which have been previously detected in environmental media (e.g., soil, groundwater and air) at the site;

b. volatile chemicals which are known or demonstrated constituents of the contamination in question (e.g., petroleum products or tars from former manufactured gas plants); and

c. expected degradation products of the chemicals mentioned in a or b.

A site-specific analyte list might also include indicator compounds to assist in identifying and differentiating subsurface sources of volatile chemical contamination. The following are examples of indicator compounds that have been included in site-specific analyte lists given the nature of the contamination or type of site:

a. gasoline: benzene, toluene, ethylbenzene, xylenes, trimethylbenzene isomers, individual C-4 to C-8 aliphatics (e.g., hexane, cyclohexane, dimethylpentane, 2,2,4-trimethylpentane, etc.), and appropriate oxygenate additives (e.g., methyl-*tert*-butyl ether, ethanol, etc.);

b. middle distillate fuels (#2 fuel oil, diesel and kerosene): n-nonane, n-decane, n-undecane, n-dodecane, ethylbenzene, xylenes, trimethylbenzene isomers, tetramethylbenzene isomers, naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene;

c. manufactured gas plant sites: trimethylbenzene isomers, tetramethylbenzene isomers, thiopenes, indene, indane, and naphthalene;

d. natural gas: propane, propene, butane, iso-butane, methylbutane, and n-pentane with lower levels of higher molecular weight aliphatic, olefinic, and some aromatic compounds; and

e. solvent-using industries: the solvent and its expected degradation products (e.g., tetrachloroethene, trichloroethene, dichloroethene(s), and vinyl chloride).

2.9.2 Indoor air

Indoor and outdoor air samples should be analyzed for a wide range of volatile chemicals if there are no existing data for subsurface vapors — unless it can be demonstrated that an abbreviated or site-specific analyte list is appropriate. If indoor air sampling is appropriate based on the levels of volatile chemicals in subsurface vapors, analysis of indoor air samples specifically for those volatile chemicals may be considered.

2.9.3 Outdoor air

Outdoor air samples should be analyzed in a manner consistent with corresponding indoor air samples.

2.10 Field laboratories and mobile gas chromatographs (GCs)

Use of field laboratories and mobile GCs as screening tools when collecting soil vapor samples may be considered on a site-specific basis. However, without ELAP certification, screening tools such as these are not acceptable when collecting sub-slab vapor, indoor air and outdoor air samples for the purpose of evaluating exposures related to soil vapor intrusion. ELAP certification for a particular laboratory does not indicate mobile laboratory or GC certification. Mobile laboratories and GCs have specific certification requirements through ELAP. Questions regarding a mobile laboratory's certification should be directed to the laboratory itself.

2.11 Surveys and pre-sampling building preparation

[Reference: NYSDOH's *Indoor Air Sampling & Analysis Guidance (February 1, 2005)*]

2.11.1 Pre-sampling building inspection and preparation

A pre-sampling inspection should be performed prior to each sampling event to identify and minimize conditions that may interfere with the proposed testing. The inspection should evaluate the type of structure, floor layout, air flows and physical conditions of the building(s) being studied. This information, along with information on sources of potential indoor air contamination [Section 2.11.2], should be identified on a building inventory form. An example of a building inventory form is given in Appendix B. Items to be included in the building inventory include the following:

a. construction characteristics, including foundation cracks and utility penetrations or other openings that may serve as preferential pathways for vapor intrusion;
b. presence of an attached garage;
c. recent renovations or maintenance to the building (e.g., fresh paint, new carpet or furniture);
d. mechanical equipment that can affect pressure gradients (e.g., heating systems, clothes dryers or exhaust fans);
e. use or storage of petroleum products (e.g., fuel containers, gasoline operated equipment and unvented kerosene heaters); and
f. recent use of petroleum-based finishes or products containing volatile chemicals.

Each room on the floor of the building being tested and on lower floors, if possible, should be inspected. This is important because even products stored in another area of a building can affect the air of the room being tested.

The presence and description of odors (e.g., solvent, moldy) and portable vapor monitoring equipment readings (e.g., PIDs, ppbRAE, Jerome Mercury Vapor Analyzer, etc.) should be noted and used to help evaluate potential sources. This includes taking readings near products stored or used in the building. Where applicable, readings should be provided in units that denote the calibration gas (e.g., isobutylene-equivalent ppm, benzene-equivalent ppm, etc.).

Potential interference from products or activities releasing volatile chemicals should be controlled to the extent practicable. Removing the source from the indoor environment prior to testing is the most effective means of reducing interference. Ensuring that containers are tightly sealed may be sufficient. When testing for volatile organic compounds, containers should be tested with portable vapor monitoring equipment to determine whether compounds are leaking. The inability to eliminate potential interference may be justification for not testing, especially when testing for similar compounds at low levels. The investigator should consider the possibility that chemicals may adsorb onto porous materials and may take time to dissipate.

In some cases, the goal of the testing is to evaluate the impact from products used or stored in the building (e.g., pesticide misapplications, school renovation projects). If the goal of the testing is to determine whether products are an indoor volatile chemical contaminant source, the removing these sources does not apply.

Once interfering conditions are corrected (if applicable), ventilation may be appropriate prior to sampling to minimize residual contamination in the indoor air. If ventilation is appropriate, it should be completed 24 hours or more prior to the scheduled sampling time. Where applicable, ventilation can be accomplished by operating the building's HVAC system to maximize outside air intake. Opening windows and doors, and operating exhaust fans may also help or may be appropriate if the building has no HVAC system.

Air samples are sometimes designed to represent typical exposure in a mechanically ventilated building and the operation of HVAC systems during sampling should be noted on the building inventory form [Appendix B]. When samples are collected, the building's HVAC system should be operating in a manner consistent with normal operating conditions when the building is occupied (e.g., schools, businesses, etc.). Unnecessary building ventilation should be avoided within 24 hours prior to and during sampling. During colder months, heating systems should be operating to maintain normal indoor air temperatures (i.e., 65 – 75 °F) for at least 24 hours prior to and during the scheduled sampling time.

Depending upon the goal of the indoor air sampling, some situations may warrant deviation from the above protocol regarding building ventilation. In such cases, building conditions and sampling efforts should be understood and noted within the framework and scope of the investigation.

To avoid potential interferences and dilution effects, occupants should make a reasonable effort to avoid the following for 24 hours prior to sampling:

a. opening any windows, fireplace dampers, openings or vents;

b. operating ventilation fans unless special arrangements are made;

c. smoking in the building;

d. painting;

e. using a wood stove, fireplace or other auxiliary heating equipment (e.g., kerosene heater);

f. operating or storing automobile in an attached garage;

g. allowing containers of gasoline or oil to remain within the house or garage area, except for fuel oil tanks;

h. cleaning, waxing or polishing furniture, floors or other woodwork with petroleum- or oil-based products;

i. using air fresheners, scented candles or odor eliminators;

j. engaging in any hobbies that use materials containing volatile chemicals;

k. using cosmetics including hairspray, nail polish, nail polish removers, perfume/cologne, etc.;

l. lawn mowing, paving with asphalt, or snow blowing;

m. applying pesticides;

n. using building repair or maintenance products, such as caulk or roofing tar; and

o. bringing freshly dry-cleaned clothing or furnishings into the building.

2.11.2 Product inventory

The primary objective of the product inventory is to identify potential air sampling interference by characterizing the occurrence and use of chemicals and products throughout the building, keeping in mind the goal of the investigation and site-specific contaminants of concern. For example, it is not appropriate to provide detailed information for each individual container of like items. However, it is appropriate to indicate that "20 bottles of perfume" or "12 cans of latex paint" were present with containers in good condition. This information is used to help formulate an indoor environment profile.

An inventory should be provided for each room on the floor of the building being tested and on lower floors, if possible. This is important because even products stored in another area of a building can affect the air of the room being tested.

The presence and description of odors (e.g., solvent, moldy) and portable vapor monitoring equipment readings (e.g., PIDs, ppbRAE, Jerome Mercury Vapor Analyzer, etc.) should be noted and used to help evaluate potential sources. This includes taking readings near products stored or used in the building. Where applicable, readings should be provided in units that denote the calibration gas (e.g., isobutylene-equivalent ppm, benzene-equivalent ppm, etc.).

Products in buildings should be inventoried every time air is tested to provide an accurate assessment of the potential contribution of volatile chemicals. If available, chemical ingredients of interest (e.g., analyte list) should be recorded for each product. If the ingredients are not listed on the label, record the product's exact and full name, and the manufacturer's name, address and telephone number, if available. In some cases, material Safety Data Sheets may be useful for identifying confounding sources of volatile chemicals in air. Adequately documented photographs of the products and their labeled ingredients can supplement the inventory and facilitate recording the information.

2.12 Role of modeling

At sites where there is a potential for human exposures to subsurface contamination due to soil vapor intrusion (as described in Section 2.1), use of modeling as the sole means of evaluating potential exposures should be avoided. The limitations of modeling (e.g., exclusion of preferential migration pathways) introduce uncertainty as to whether human exposure is occurring, in absence of actual field data. Conclusions drawn from modeling should be verified with actual field data. For example, if modeling results indicate indoor air concentrations are predicted to be below applicable guidelines or levels of concern, indoor air and/or sub-slab vapor sampling would be appropriate to verify a conclusion that mitigation or other actions are not needed.

Modeling may, however, be used as a tool in the evaluation process. Examples of situations in which modeling may be used as a tool include, but are not limited to, the following:

a. to help identify potential migration pathways on the basis of site-specific conditions;

b. to estimate potential exposures when field samples cannot be collected (e.g., access to collect the samples is denied or buildings have not yet been constructed over the subsurface contamination); and

c. to identify a preferred order for sampling buildings by predicting expected indoor air concentrations within each of the buildings if there are numerous buildings overlying the subsurface contamination.

Use of any model at a site should be discussed with the agencies prior to the model's development and application. If a model is used, it should incorporate site-specific parameters (e.g., attenuation factors, soil conditions, concentrations of volatile chemicals, depth to subsurface source, characteristics of subsurface source, and foundation slab thickness) as much as possible. Furthermore, both the limitations of the model (e.g., exclusion of preferential migration pathways) and the sensitivity of the variables in the model should be understood and identified with the modeling results.

Section 3: Data Evaluation and Recommendations for Action

Section 3 describes the process by which data obtained during the investigation are evaluated. The goals of the evaluation are as follows:

a. to determine what volatile chemicals, if any, are present in the investigated media;

b. to identify the likely cause(s) of their presence; and

c. to identify completed and potential human exposures whether actions to address exposures should be taken.

Also discussed are actions typically recommended based on the evaluation. Actions to remediate the source(s) of soil vapor contamination, such as soil excavation or air-sparge/soil vapor extraction systems, are beyond the scope of this guidance and are not included.

3.1 Data quality

Before the data are evaluated, their representativeness and reliability should be verified. To assess analytical errors and the usability of the data, a qualified person should review the analytical data package and all associated QA/QC information to make sure that

a. the data package is complete;

b. holding times have been met;

c. the QC data fall within the protocol limits and specifications;

d. the data have been generated using established and agreed upon analytical protocols;

e. the raw data confirm the results provided in the data summary sheets and QC verification forms; and

f. correct data qualifiers have been used.

As discussed in Section 2.8, for sites in an environmental remediation program (e.g., State Superfund), a DUSR or equivalent report should be generated in accordance with NYSDEC guidance and should be submitted for regulatory review and approval.

If the investigation was not completed in accordance with the guidelines set forth in Section 2, additional investigation may be appropriate to either replace or complement the existing data. For example, product inventories [Section 2.11.2] filled out incompletely or incorrectly may need to be redone (and in some cases with additional air sampling) so that likely sources of volatile chemicals in the indoor air can be identified and appropriate actions to mitigate exposures can be recommended.

3.2 Overview

The results of individual soil vapor, sub-slab vapor, indoor air and outdoor air samples are not reviewed in isolation. Rather, they are evaluated with the consideration of several additional factors, which include the following:

a. the nature and extent of contamination in *all* environmental media;

b. factors that affect vapor migration and intrusion;

c. completed or proposed remedial actions;

d. sources of volatile chemicals;

e. background levels of volatile chemicals in air;

f. relevant standards, criteria and guidance values; and

g. past, current and future land uses.

These factors are described in detail in this subsection.

3.2.1 Nature and extent of contamination in all environmental media

The type of volatile chemicals present and the extent of contamination in all environmental media — including soil, groundwater, subsurface vapors, indoor air and outdoor air — is considered when evaluating the data. Trends in environmental data (e.g., groundwater monitoring results show concentrations of volatile chemicals are decreasing) are also considered. This information is used to identify possible sources of contamination and migration pathways, as well as to recommend appropriate actions to address exposures.

3.2.2 Factors that affect vapor migration and intrusion

As discussed in Section 1.3, there are numerous site-specific environmental factors [Table 1.1] and building factors [Table 1.2] that can affect soil vapor migration and intrusion. This information is used to identify possible sources of contamination and migration pathways, as well as to recommend appropriate actions to address exposures.

3.2.3 Sources of volatile chemicals

An understanding of the likely sources of the chemicals is crucial for determining appropriate actions to address exposure, as well as identifying the parties responsible for implementing the actions. Volatile chemicals that are not site-related may be present in the investigated media for reasons such as the following:

a. *subsurface vapors* — misuse, misapplication, or improper disposal of the chemicals to the subsurface, unidentified subsurface sources of vapor contamination, presence of septic systems (where products, such as cleaning agents or degreasers, may be disposed), biodegradation of natural organic matter in soil, infiltration into the subsurface from a building under positive pressure in which the chemicals are heavily used (i.e., reverse process from soil vapor intrusion), etc.;

b. *indoor air* — use and storage (current or historic) of volatile chemical-containing products, off-gassing from building materials or new furnishings, use of contaminated groundwater during private well usage, infiltration of outdoor air containing volatile chemicals, etc. [Table 1.3]; and

c. *outdoor air* — emissions from automobiles, lawn mowers, oil storage tanks, gasoline stations, dry cleaners or other commercial/industrial facilities, etc. [Table 1.3].

Site-related chemicals may also be present for these same reasons. Information about household products and their ingredients are available on web sites, such as the National Institute of Health's site at http://householdproducts.nlm.nih.gov.

3.2.4 Background levels of volatile chemicals in air

Chemicals are part of our everyday life [Section 1.4]. As such, they are found in the indoor air of buildings not affected by intrusion of contaminated soil vapor. They are also found in the outdoor air that enters a home or place of business. Commonly found concentrations of these chemicals in indoor and outdoor air are referred to as "background levels." Background levels of volatile chemicals are one of the factors considered when evaluating sampling results at a site [Section 3.3.2 – 3.3.4]. Estimates of background levels come from studies where air samples were collected in homes, offices and outdoor areas.

Several studies have been conducted, both nationally and in the State of New York, to provide information on indoor and outdoor air background levels in a variety of settings (e.g., residential or commercial buildings). Each of these studies offers useful information and has its own limitations. Each database provides statistical measures of background levels and the criteria used to select sampling locations. The criteria in some of the studies required that sampling locations not be located near known sources of volatile chemicals (for example, not near a chemical spill, hazardous waste site, dry-cleaner, or factory). The criteria may also have included checking containers of volatile chemicals in or near the building to make sure they are tightly closed or removing those products before samples are taken. Depending on the criteria for site selection and sampling conditions, statistical measures of background levels in a given study may differ from what would be expected if indoor air were sampled in randomly selected homes.

The background databases that are used for evaluating indoor and outdoor air data are introduced below. A more detailed description of each database along with statistical measures of background levels are provided in Appendix C.

a. *NYSDOH 2003: Study of Volatile Organic Chemicals in Air of Fuel Oil Heated Homes*

   Results of indoor and outdoor air samples collected from 104 single-family fuel oil heated homes throughout New York State. Samples collected in evacuated canisters and analyzed for 69 aromatic, aliphatic, and halogenated hydrocarbons, and ketones by modified EPA Method TO-15. Limitations: only fuel oil heated homes were included, homes were not randomly selected, and five boroughs of New York City were excluded.

b. *EPA 2001: Building Assessment and Survey Evaluation (BASE) Database*

   Study of measured concentrations of volatile organic compounds from 100 randomly selected public and commercial office buildings. Samples collected by evacuated canisters and/or tube methodologies. Limitations: only represents office settings, two methodologies used for sampling and analysis that are not completely overlapping and do not show agreement in results in some cases.

c. *NYSDOH 1997: Control Home Database*

   Indoor and outdoor air samples compiled from 53 residences in New York State that were considered "control Homes" with neighborhood, construction, and occupancy similar to potentially impacted homes that were being investigated at the time. Limitations: multiple methodologies for sampling and analysis, small sample size, and varying detection limits often higher than current background levels.

d. *EPA 1988: National Ambient Volatile Organic Compounds (VOCs) Data Base Update*

   Published and unpublished air data compiled by the EPA in 1988. The document includes data from studies between 1970 to 1987. The database covers more than

300 chemicals in indoor and outdoor settings. Limitations: data are compiled from numerous studies with limitations on selection or screening criteria, data are 20-35 years old, indoor air data include both residential and office spaces, sample size for some analytes is very small (less than 10). Outdoor air data include rural, suburban, urban, source dominated and remote locations.

e. *Health Effects Institute (HEI) 2005: Relationship of Indoor, Outdoor, and Personal Air (RIOPA)*

Indoor, outdoor and personal air concentrations of 18 VOCs, 10 carbonyl compounds and particulate matter (PM2.5) were measured in 100 homes in each of 3 cities between the summer of 1999 and the spring of 2001. Limitations: limited numbers of VOCs, passive organic vapor badge method is subject to sampling bias in stationary versus mobile locations, the passive organic vapor badge method is only approved for tetrachloroethene in New York State.

Among the databases, the Upper Fence (see *NOTE below) values from the NYSDOH Fuel Oil Study data may be used as initial benchmarks when evaluating residential indoor air (see Appendix C.1) and the 90th percentile values from the EPA BASE data for indoor air in office and commercial buildings (see Appendix C.2). These initial benchmark values should be considered along with the overall distribution of results in the background database to characterize sampling results from a single building or from multiple buildings in a community. The Health Effects Institute 2005 database and the older NYSDOH and EPA databases can also provide useful information on the range of concentrations found in air. The database or combination of databases that best represents site-specific conditions should be used as the basis for comparison. State agency personnel should review and have the opportunity to comment on the proposed use of other databases or subsets of data within a database for evaluating test results.

*NOTE: The Upper Fence is calculated as 1.5 times the interquartile range (difference between the 25th and 75th percentile values) above the 75th percentile value. It is a boundary estimate used to account for outliers in the data.

3.2.5 <u>Relevant standards, criteria and guidance values</u>

a. *Subsurface vapors*

The State of New York does not have any standards, criteria or guidance values for concentrations of volatile chemicals in subsurface vapors (either soil vapor or sub-slab vapor).

b. *Indoor and outdoor air*

The NYSDOH has developed several guidelines for chemicals in air. The development process is initiated for specific situations. For example, in New York State, particularly in New York City, dry cleaners are often located in apartment buildings. Because air in buildings mixes to some extent and the dry cleaning chemical tetrachloroethene (PCE) is volatile, it may migrate to residential apartments. When the NYSDOH became aware of this problem and how widespread it is, the NYSDOH developed an air guideline for PCE of 100 micrograms per cubic meter (mcg/m^3). In addition to PCE, the NYSDOH has developed guidelines for methylene chloride (also referred to as dichloromethane) and trichloroethene (TCE) in air, as well as dioxin and polychlorinated biphenyls (PCBs) in indoor air. Each guideline went through a peer review process, in which expert scientists outside of the NYSDOH reviewed the technical documentation that describes the scientific basis for the guidance value. The peer reviewers provided technical comments on the data and methods used to derive the guidelines, each of which were addressed by the NYSDOH. Upon completion of the reviews and responses to comments, the guidelines were finalized.

Air guideline values derived by the NYSDOH are summarized in Table 3.1. Additional information about these guidelines is provided in the following:

- Appendix D — overview of how the NYSDOH develops air guidelines; and
- Appendix H — copies of fact sheets that discuss the air guidelines for PCE and TCE.

The purpose of a guideline is to help guide decisions about the nature of efforts to reduce exposure to the chemical. Reasonable and practical actions should be taken to reduce exposures when indoor air levels are above background, even when they are below the guideline. The urgency to complete these actions increases with indoor air levels, particularly when air levels are above the guideline, and additional actions taken if the initial actions do not sufficiently reduce levels. In all cases, the specific corrective actions to be taken depend on a case-by-case evaluation of the situation. The goal of the recommended actions is to reduce chemical levels in indoor air to as close to background as practical.

Table 3.1 Air guideline values derived by the NYSDOH

Chemical		Air Guideline Value (mcg/m^3)	Reference
methylene chloride (also referred to as dichloromethane)	MeCl	60	1
polychlorinated biphenyls	PCBs	1*	2,3
tetrachlorodibenzo-*p*-dioxin equivalents	TCDD	0.00001*	3,4
tetrachloroethene	PCE	100	5
trichloroethene	TCE	5	6,7

*The guideline is specific to indoor air.

References:
[1] NYSDOH. 1988. Letter from N. Kim to T. Allen, Division of Air, New York State Department of Environmental Conservation. November 28, 1988.
[2] NYSDOH. 1985. Binghamton State Office Building (BSOB) Re-Entry Guidelines: PCBs. Document 1330P. Albany, NY: Bureau of Toxic Substance Assessment.
[3] NYSDOH. 1988. Letter from D. Axelrod to J. Egan, New York State Office of General Services. March 8, 1988.
[4] NYSDOH. 1984. Re-Entry Guidelines. Binghamton State Office Building. Document 0549P. Albany, NY: Bureau of Toxic Substance Assessment.
[5] NYSDOH. 1997. Tetrachloroethene Ambient Air Criteria Document. Albany, NY: Bureau of Toxic Substance Assessment.
[6] NYSDOH. 2003. Letter from N. Kim to D. Desnoyers, Division of Environmental Remediation, New York State Department of Environmental Conservation. October 31, 2003. [Provided in Appendix D.]
[7] NYSDOH. 2006. Final Report: Trichloroethene (TCE) Air Criteria Document. Center for Environmental Health, Bureau of Toxic Substance Assessment. Troy, NY.

3.2.6 Completed or proposed remedial actions

The status and effectiveness of actions taken to remediate environmental contamination (e.g., soil removal, groundwater treatment, soil vapor extraction, etc.) are considered when making decisions pertaining to additional sampling and the selection of mitigation actions. For example,

a. if a comparison of pre-remediation and post-remediation subsurface vapor sampling results indicates negligible improvement in the quality of subsurface vapors,

    1. additional sampling may be appropriate to document a decreasing trend in subsurface vapor concentrations;

    2. termination of mitigation system operations may not be appropriate without additional sampling; or

    3. additional remedial actions may be appropriate to address contaminated subsurface vapors;

b. when monitoring a building is appropriate, it may be more cost-effective to install a mitigation system if subsurface contamination is wide-spread and is expected to take many years to remediate; and

c. if exposures in an on-site building will be addressed concurrently by a method selected to remediate subsurface contamination (e.g., a soil vapor extraction system), installation of a mitigation system may be redundant. However, if the remedial system is not expected to be operational in the immediate future, or if it is not expected to mitigate indoor air levels in a reasonable time frame, a mitigation system may still be appropriate. [Refer to Section 4.1 for a description of the appropriate use of concurrent techniques.]

3.2.7 Past, current and future land uses

Past, current and future land uses are considered when evaluating the investigation data and determining appropriate actions for further investigation or measures to address exposures. For example,

a. if the parcel or buildings were historically used for commercial or industrial purposes (e.g., gasoline station, automotive repair facility, electroplating facility, etc.), but are currently used for residential purposes or commercial or industrial purposes where volatile chemicals are not used in current operations, off-gassing of volatile chemicals from building materials [Table 1.3] or additional subsurface sources should be considered;

b. subsurface vapor sampling of a parcel that is undeveloped or contains unoccupied buildings may be appropriate based on the data evaluation. However, sampling may be delayed as discussed in Section 2.3;

c. air sampling of a building may be appropriate based on the data evaluation. However, provisions may be put in place to defer sampling until occupancy of the building is expected; or

d. if actions should be taken to mitigate exposures related to soil vapor intrusion should the site be developed, the appropriate mitigation method will depend upon the proposed land use — a parking lot, recreational field, single-family home, commercial building, high-rise building with underground parking, occupied or unoccupied building, etc. — since each presents a different exposure scenario.

3.3 Sampling results and recommended actions

This subsection describes the process for evaluating sampling results. It also describes actions that may be recommended based on the evaluation. The evaluation procedures and actions described may not be directly applicable to samples collected as part of an emergency response. For guidance on how to proceed in such situations, refer to Section 3.5.

3.3.1 Soil vapor

If soil vapor samples are collected from locations where there are no known sources of volatile chemicals, we do not expect the chemicals to reach detectable levels in the samples. However, concentrations of volatile chemicals in soil vapor are commonly detected. This is likely due to several factors, including infiltration of outdoor air into the subsurface (to a limited extent) and background interferences (similar to indoor and outdoor air [Section 3.2.4]).

New York State currently does not have any standards, criteria or guidance values for concentrations of compounds in soil vapor. Additionally, there are currently no databases available of background levels of volatile chemicals in soil vapor. In the absence of this information, soil vapor sampling results are reviewed "as a whole," in conjunction with the results of other environmental sampling and the site conceptual model, to identify trends and spatial variations in the data [Section 3.2.1]. To put some perspective on the data, soil vapor results might be compared to background outdoor air levels [Section 3.2.4], site-related outdoor air sampling results, or the NYSDOH's guidelines for volatile chemicals in air [Table 3.1].

These comparisons are used to

a. identify areas of relatively elevated concentrations of volatile chemicals in soil vapor;
b. select buildings for sub-slab vapor, indoor air and outdoor air sampling;
c. identify possible sources of subsurface vapor contamination;
d. monitor the progress, or verify the completion, of efforts to remediate subsurface vapor contamination (either directly or indirectly); and
e. characterize the nature and extent of subsurface vapor contamination.

When determining appropriate actions, the following should also be considered:

a. Soil vapor results may not indicate a traditional plume-like pattern of contamination (as is often described for groundwater). Rather, the nature and extent of contamination may follow a "hit and miss" pattern.

b. Our experience to date indicates soil vapor results alone typically cannot be relied upon to rule out sampling at nearby buildings. For example, concentrations of volatile chemicals in sub-slab vapor samples have been substantially higher (e.g., by a factor of 100 or more) than concentrations found in nearby soil vapor samples (e.g., collected at 8 feet below grade near the building). This may be due to differences in factors such as soil moisture content and pressure gradients. Therefore, exposures are evaluated primarily based on sub-slab vapor, indoor air and outdoor air sampling results and soil vapor results are primarily used as a tool to guide these investigations.

There are no concentrations of volatile chemicals in soil vapor that automatically trigger action or no further action. Based on the comparisons and considerations described, the following actions may be recommended:

a. *No further soil vapor sampling*

The nature and extent of subsurface vapor contamination has been adequately characterized with respect to addressing exposures and designing measures to remediate subsurface vapor contamination (either directly or indirectly).

Sub-slab vapor samples, rather than soil vapor samples, will be used to identify potential exposures and to characterize the nature and extent of subsurface vapor contamination since soil vapor results are not following a consistent pattern (i.e., hit and miss).

b. *Additional soil vapor sampling*

To characterize the nature and extent of subsurface vapor contamination if soil vapor results are following a consistent pattern (e.g., traditional plume-like pattern).

To identify possible sources of subsurface vapor contamination.

To verify sampling results that appear inconsistent with previous sampling and/or the current understanding of the site [Sections 3.2.1 and 3.2.2].

To resample locations where results may have been invalidated by short-circuiting (outdoor air infiltration), cross contamination, or other problems.

To monitor the progress, or verify the completion, of efforts to remediate subsurface vapor contamination (either directly or indirectly).

c. *Sub-slab vapor, indoor air and outdoor air sampling*

Generally, if soil vapor results are fairly consistent throughout the study area, buildings closest to the site are sampled first. The investigation then proceeds outward, as appropriate, on an areal basis until potential and current human exposures have been adequately addressed. If there is an area of relatively elevated concentrations of volatile chemicals in soil vapor (when looking at the soil vapor results as a whole), then the buildings in this area are also sampled.

d. *Address exposures related to soil vapor intrusion*

Provisions on parcels may be appropriate so that the parcel will not be developed or buildings occupied without addressing exposure concerns [Sections 2.3 and 3.6].

As discussed previously, soil vapor sampling results alone typically do not drive actions to mitigate exposures in existing buildings. Rather, they guide sampling efforts in buildings. However, a "blanket mitigation" approach may be taken provided the nature and extent of soil vapor contamination has been sufficiently characterized. A "blanket mitigation" approach is where an area is defined within which each building may be offered a mitigation system. The offer is made regardless of what actions may be appropriate based on an evaluation of air results (e.g., no further action or monitoring).

Notes:

a. The recommended actions may be modified or supported upon consideration of the factors given in Section 3.2.

b. Additional sampling may become appropriate based on the migration of subsurface contamination (e.g., contaminated groundwater or vapors) or if environmental monitoring indicates a change in chemical constituents (e.g., the production of degradation products that may be more toxic than the parent compounds).

3.3.2 Sub-slab vapor

The goals of collecting sub-slab vapor samples are to identify potential and current (when collected concurrently with indoor and outdoor air samples) exposures associated with soil vapor intrusion and to characterize the nature and extent of subsurface vapor contamination. As discussed in Sections 3.2.5 and 3.3.1, New York State currently does not have any standards, criteria or guidance values for concentrations of compounds in sub-slab vapor. Additionally, there are no databases available of background levels of volatile chemicals in subsurface vapors.

The detection of volatile chemicals in sub-slab vapor samples does not necessarily indicate soil vapor intrusion is occurring or actions should be taken to address exposures. When making these decisions, the State considers the following:

a. the sampling results — sub-slab vapor, indoor air, outdoor air, soil vapor;

b. background concentrations of volatile chemicals in indoor air;

c. the NYSDOH's guidelines for volatile chemicals in air [Table 3.1];

d. human health risks (i.e., cancer and non-cancer health effects) associated with exposure to the volatile chemical in air;

e. attenuation factors (i.e., the ratio of indoor air to sub-slab vapor concentrations),

f. the NYSDOH's decision matrices [described in Section 3.4], and

g. the factors described in Section 3.2.

Based on this evaluation, the following actions may be recommended:

a. *No further action*

   When the volatile chemical is not detected in the indoor air and sub-slab sample results are not expected to substantially affect indoor air quality.

b. *Take reasonable and practical actions to identify source(s) and reduce exposures*

   The concentration detected in the indoor air sample is likely due to indoor and/or outdoor sources rather than soil vapor intrusion given the concentration detected in the sub-slab vapor sample. Therefore, steps should be taken to identify potential source(s) and to reduce exposures accordingly (e.g., by keeping containers tightly capped or by storing volatile organic compound-containing products in places where people do not spend much time, such as a garage or outdoor shed). Resampling may be recommended to demonstrate the effectiveness of actions taken to reduce exposures.

c. *Resampling*

Resampling may also be recommended when the results are not consistent with the conceptual site model. For example, when the sub-slab vapor results of a building do not indicate a need to take action, but the sub-slab vapor results of adjacent buildings indicate a need to take actions to address exposures related to soil vapor intrusion.

Resampling may be appropriate if samples were collected outside of the heating season. As discussed in Section 2.4.2, results obtained outside of the heating season should not be used to rule out exposures related to soil vapor intrusion.

d. *Monitoring*

Monitoring, including sub-slab vapor, basement air, lowest occupied living space air, and outdoor air sampling, may be recommended to determine whether concentrations in indoor air or sub-slab vapor have changed. It is also recommended to determine what affect, if any, active soil and groundwater remediation techniques (e.g., chemical oxidation, air sparging, etc.) may be having on subsurface vapor and indoor air quality. The type and frequency of monitoring is determined on a site-specific and building-specific basis, taking into account applicable environmental data and building operating conditions.

e. *Mitigate*

Mitigation may be appropriate to minimize current or potential exposures associated with soil vapor intrusion. Mitigation methods are described in Section 4.

Notes:

a. The recommended actions may be modified or supported upon consideration of the factors given in Section 3.2.

b. Additional sampling may be appropriate based on the migration of subsurface contamination (e.g., contaminated groundwater or vapors) or if environmental monitoring indicates a change in chemical constituents (e.g., the production of degradation products that may be more toxic than the parent compounds).

c. Monitoring and mitigation measures to address exposures related to soil vapor intrusion are considered interim measures implemented until contaminated environmental media (e.g., soil, groundwater and/or soil vapor) are remediated.

d. Actions more protective of human health may be proposed. For example, such a decision may be based on a comparison of the costs associated with resampling or monitoring to the costs associated with installation and monitoring of a mitigation system.

e. Additional sampling associated with post-mitigation testing, operation, maintenance and monitoring activities, and termination of mitigation system operations is described in Section 4.

3.3.3 Indoor air

Indoor air samples are used to assess current exposures to volatile chemicals in air. The detection of volatile chemicals in indoor air samples does not necessarily indicate soil vapor intrusion is occurring or actions should be taken to address exposures. When making these decisions, the State considers the following:

a. the sampling results — sub-slab vapor, indoor air, outdoor air, soil vapor;

b. background concentrations of volatile chemicals in indoor air;

c. the NYSDOH's guidelines for volatile chemicals in air [Table 3.1];

d. human health risks (i.e., cancer and non-cancer health effects) associated with exposure to the volatile chemical in air;

e. attenuation factors (i.e., the ratio of indoor air to sub-slab vapor concentrations), and

f. the NYSDOH's decision matrices [described in Section 3.4], and

g. the factors described in Section 3.2.

When evaluating indoor air data, the results are compared to background levels of volatile chemicals in indoor air [Section 3.2.4], the NYSDOH's guidelines for volatile chemicals in air [Table 3.1], the NYSDOH's decision matrices [Section 3.4], and human health risks (i.e., cancer and non-cancer health effects) associated with exposure to the volatile chemical in air. This helps to put the results into perspective and to determine the need for action and the urgency with which actions should be taken. As discussed in Section 3.2.5, the urgency to complete reasonable and practical actions to reduce exposures increases with indoor air levels, particularly when air levels are above a guideline.

Generally, if the results are comparable to background levels, then no further action is needed to address *current* human exposures. However, additional sampling may be appropriate if

a. samples were collected at times when vapor intrusion is not expected to have its greatest effect on indoor air quality (typically, samples collected outside of the heating season). As discussed in Section 2.4, these results may not be used to rule out exposures related to soil vapor intrusion;

b. the potential for exposures related to soil vapor intrusion should be monitored based on the sub-slab vapor results [Section 3.3.2]; and/or

c. subsurface conditions change over time (e.g., due to the migration of contaminated groundwater or vapors).

If the concentrations of volatile chemicals are not consistent with background levels, then the likely cause of the exposure should be determined. Understanding the source is crucial for selecting the best method to address exposures. For example, although a volatile chemical may be detected in the sub-slab vapor sample, the results may indicate that indoor air effects are more likely to be coming from products stored in the building or from outdoor air rather than from contaminated soil vapors. Therefore, a sub-slab depressurization system to minimize exposures associated with soil vapor intrusion may not be appropriate.

As discussed in Sections 1.4 and 3.2.3, volatile chemicals may be present in the indoor air due to any one, or a combination, of the following:

a. the indoor environment itself and/or building characteristics;

b. off-gassing of volatile chemicals from contaminated water that may enter the building at the tap or shower head, or during flooding events, or contaminated water that rests in a sump or a subsurface drain;

c. outdoor sources; and/or

d. migration from the subsurface (i.e., soil vapor intrusion).

To determine the likely cause, the following assessment is completed:

a. qualitative and quantitative comparisons are made between the types and concentrations of the contaminants found in the indoor air sample(s) and those found in the outdoor air and sub-slab vapor sample;

b. qualitative and quantitative comparisons are made between indoor air results obtained in different locations of the building (e.g., different floors or rooms);

c. indoor air results are compared to the product inventory to evaluate the extent to which indoor sources are affecting indoor air quality; and

d. the indoor air quality questionnaire and building inventory form is reviewed to identify potential preferential pathways for soil vapor intrusion into the building, potential outdoor sources of volatile chemicals to the outdoor air (e.g., gasoline station or dry cleaner), and routes of air distribution within the building (e.g., HVAC system operations, airflow observations, etc.).

If a likely source or multiple sources can be identified from the available information, one or more of the following actions may be recommended given the source:

a. *Indoor source or building characteristics*

   Products containing volatile chemicals should be tightly capped. Alternatively, the products can be stored in places where people do not spend much time, such as a garage or outdoor shed. If the products are no longer needed, consideration should be given to disposing of them properly (e.g., hazardous waste cleanup days). The list of products and corresponding readings from field instrumentation provided in the product inventory [Appendix B] can help identify products that may be contributing to the levels that were detected in the indoor air.

   If exposures are assumed to be associated with off-gassing of new building materials, paint, etc., resampling may be appropriate to confirm this assumption or to confirm that actions taken to address these exposures have been effective.

b. *Off-gassing from contaminated groundwater within the building*

   Measures should be taken to prevent contaminated groundwater from entering the house (e.g., filter on private well supply, sealed sump, etc.).

c. *Outdoor source*

   No further action to address exposures related to soil vapor intrusion, unless the evaluation for soil vapor intrusion cannot be completed until outdoor interferences are addressed.

d. *Soil vapor intrusion*

Depending upon the relationship between indoor air concentrations and sub-slab vapor concentrations and the results of environmental sampling in the area, resampling, monitoring or mitigation may be recommended by the State.

1. Resampling, including sub-slab vapor, basement air, lowest occupied living space air, and outdoor air sampling, may be recommended when the results are not consistent with the conceptual site model. For example, when indoor air results are comparable or higher than the corresponding sub-slab vapor results and the results do not appear to be due to building characteristics or alternate sources (either indoor or outdoor).

2. Monitoring, including sub-slab vapor, basement air, lowest occupied living space air, and outdoor air sampling, may be recommended to determine whether concentrations in indoor air or sub-slab vapor have changed. It is also recommended to determine what affect, if any, active soil and groundwater remediation techniques (e.g., chemical oxidation, air sparging, etc.) may be having on subsurface vapor and indoor air quality. The type and frequency of monitoring is determined on a site-specific and building-specific basis, taking into account applicable environmental data and building operating conditions.

3. Methods to mitigate exposures related to soil vapor intrusion are described in Section 4.

The party responsible for implementing the recommended actions will differ depending upon several factors, including the identified source of the volatile chemicals, the environmental remediation program, and site-specific and building-specific conditions. For example, to the extent that all site data and site conditions demonstrate that soil vapor intrusion is not occurring and that the potential for soil vapor intrusion to occur is not likely, the vapor intrusion investigation would be considered complete. In general, if indoor exposures represent a concern due to indoor sources, then the State will provide guidance to the property owner and/or tenant on ways to reduce their exposure. If indoor exposures represent a concern due to outdoor sources, then the NYSDEC will decide who is responsible for further investigation and any necessary remediation. Depending upon the outdoor source, this responsibility may or may not fall upon the party conducting the soil vapor intrusion investigation.

Likely sources may not be evident given the information available. Therefore, the above recommendations cannot be made. This situation most often arises for the following reasons:

a. Interfering indoor sources are identified. However, the possibility of vapor intrusion cannot be ruled out due to the concentrations of the same volatile chemicals detected in the sub-slab vapor sample. Differentiating the contribution of each source is not possible.

b. Indoor air samples were collected without concurrent outdoor air and sub-slab vapor samples. Depending upon other information that may be available (e.g., building inventory and well-characterized subsurface vapor contamination), identifying likely sources and recommending appropriate actions may not be possible.

c. All appropriate air samples are collected. However, the indoor air quality questionnaire and building inventory forms are filled out incompletely or incorrectly. The contribution of indoor sources cannot be evaluated.

When the source(s) of volatile chemicals to indoor air cannot be identified with confidence, resampling is typically recommended with corrections made as appropriate. For example, using the three scenarios presented above:

a. resampling occurs after interferences are removed;

b. concurrent indoor air, outdoor air and sub-slab vapor samples are collected; and

c. an indoor air quality questionnaire and building inventory form is filled out completely and correctly when samples are collected.

Notes: See notes presented in Section 3.3.2.

3.3.4 Outdoor air

Outdoor air sampling results are primarily used to evaluate the extent to which outdoor air may be contributing to the levels of volatile chemicals detected in indoor air. However, people are also exposed to the outdoor air and the outdoor air results are indicative of outdoor air conditions. As such, outdoor air results are also reviewed to determine whether outdoor air conditions present a potential concern that requires further investigation.

As discussed in Sections 1.4 and 3.2.3, volatile chemicals may be present in outdoor air due to emissions from automobiles, lawn mowers, oil storage tanks, gasoline stations, and dry cleaners or other commercial and industrial facilities. To determine what extent, if any, outdoor air is affecting indoor air quality, indoor air results are compared to outdoor air results. To determine whether outdoor air conditions present a potential concern that requires further investigation, the State looks at the data set as a whole and considers the following:

a. background concentrations of volatile chemicals in outdoor air;

b. the NYSDOH's guidelines for volatile chemicals in air [Table 3.1];

c. human health risks (i.e., cancer and non-cancer health effects) associated with exposure to the volatile chemical in air; and

d. the factors described in Section 3.2.

3.4 Decision matrices

3.4.1 Overview

Decision matrices are risk management tools, developed by the NYSDOH in conjunction with other agencies, to provide guidance on a case-by-case basis about actions that should be taken to address current and potential exposures related to soil vapor intrusion. The matrices are intended to be used when evaluating the results from buildings with full slab foundations. The matrices encapsulate the data evaluation processes and actions recommended to address exposures discussed in Sections 3.3.2 and 3.3.3. The general format of a decision matrix is shown in Table 3.2.

Table 3.2 General format of a decision matrix

	Indoor Air Concentration of Volatile Chemical (mcg/m³)		
Sub-slab Vapor Concentration of Volatile Chemical (mcg/m³)	Concentration Range 1	Concentration Range 2	Concentration Range 3
Concentration Range 1	ACTION	ACTION	ACTION
Concentration Range 2	ACTION	ACTION	ACTION
Concentration Range 3	ACTION	ACTION	ACTION

Indoor air and sub-slab vapor concentration ranges in a matrix are selected based on a number of considerations in addition to health risks. For example, factors that are considered when selecting the ranges include, but are not limited to, the following:

a. human health risks (i.e., cancer and non-cancer health effects) associated with exposure to the volatile chemical in air;

b. the NYSDOH's guidelines for volatile chemicals in air [Table 3.1];

c. background concentrations of volatile chemicals in air [Section 3.2.4];

d. analytical capabilities currently available; and

e. attenuation factors (i.e., the ratio of indoor air to sub-slab vapor concentrations).

3.4.2 Matrices

The NYSDOH has developed two matrices, which are included at the end of Section 3.4, to use as tools in making decisions when soil vapor may be entering buildings. The first decision matrix was originally developed for TCE and the second for PCE. As summarized in Table 3.3, four chemicals have been assigned to the two matrices to date.

Table 3.3 Volatile chemicals and their decision matrices

Chemical	**Soil Vapor/Indoor Air Matrix***
Carbon tetrachloride	Matrix 1
Tetrachloroethene (PCE)	Matrix 2
1,1,1-Trichloroethane (1,1,1-TCA)	Matrix 2
Trichloroethene (TCE)	Matrix 1

*The decision matrices are available at the end of Section 3.4.

Because the matrices are risk management tools and consider a number of factors, the NYSDOH intends to assign chemicals to one of these two matrices, if possible. For example, if a chemical other than those already assigned to a matrix is identified as a chemical of concern during a soil vapor intrusion investigation, assignment of that chemical into one of the existing decision matrices will be considered by the NYSDOH. Factors that will be considered in assigning a chemical to a matrix include, but are not limited to, the following:

a. human health risks, including such factors as a chemical's ability to cause cancer, reproductive, developmental, liver, kidney, nervous system, immune system or other effects, in animals and humans and the doses that may cause those effects;

b. the data gaps in its toxicologic database;

c. background concentrations of volatile chemicals in indoor air [Section 3.2.4]; and

d. analytical capabilities currently available.

If the NYSDOH determines that the assignment of the chemical into an existing matrix is inappropriate, then the NYSDOH will either modify an existing matrix or develop a new matrix.

To use the matrices appropriately as a tool in the decision-making process, the following should be considered:

a. The matrices are generic. As such, it may be appropriate to modify a recommended action to accommodate building-specific conditions (e.g., dirt floor in basement, crawl spaces, etc.) and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, resampling may be recommended when the matrix indicates "no further action" for a particular building, but the results of adjacent buildings (especially sub-slab vapor results) indicate a need to take actions to address exposures related to soil vapor intrusion. Additionally, actions more protective of public health than those specified within the matrix may be proposed at any time. For example, the party implementing the actions may decide to install sub-slab depressurization systems on buildings where the matrix indicates "no further action" or "monitoring." Such an action is usually undertaken for reasons other than public health (e.g., seeking community acceptance, reducing excessive costs, etc.).

b. Indoor air concentrations detected in samples collected from the building's basement or, if the building has a slab-on-grade foundation, from the building's lowest occupied living space should be used.

c. Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of vapor contamination, nor does it preclude remediating contaminated soil vapors or the source of soil vapor contamination.

d. When current exposures are attributed to sources other than vapor intrusion, the agencies should be provided documentation(e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix and to support assessment and follow-up by the agencies.

3.4.3 Description of recommended actions

Actions recommended in the matrix are based on the relationship between sub-slab vapor concentrations and corresponding indoor air concentrations. They are intended to address both potential and current human exposures and include the following:

a. *No further action*

When the volatile chemical is not detected in the indoor air sample and the concentration detected in the corresponding sub-slab vapor sample is not expected to substantially affect indoor air quality.

b. *Take reasonable and practical actions to identify source(s) and reduce exposures*

The concentration detected in the indoor air sample is likely due to indoor and/or outdoor sources rather than soil vapor intrusion given the concentration detected in the sub-slab vapor sample. Therefore, steps should be taken to identify potential source(s) and to reduce exposures accordingly (e.g., by keeping containers tightly capped or by storing volatile chemical-containing products in places where people do not spend much time, such as a garage or shed). Resampling may also be recommended to demonstrate the effectiveness of actions taken to reduce exposures.

d. *Monitor*

Monitoring, including sub-slab vapor, basement air, lowest occupied living space air, and outdoor air sampling, is appropriate to determine whether concentrations in the indoor air or sub-slab vapor have changed. Monitoring may also be appropriate to determine whether existing building conditions (e.g., positive pressure HVAC systems) are maintaining the desired mitigation endpoint and to determine whether changes are appropriate.

The type and frequency of monitoring is determined on a site-specific and building-specific basis, taking into account applicable environmental data and building operating conditions.

e. *Mitigate*

Mitigation is appropriate to minimize current or potential exposures associated with soil vapor intrusion. Methods to mitigate exposures related to soil vapor intrusion are described in Section 4.

f. *Monitor / Mitigate*

Monitoring or mitigation may be recommended after considering the magnitude of sub-slab vapor and indoor air concentrations along with building- and site-specific conditions.

Soil Vapor / Indoor Air Matrix 1

October 2006

	INDOOR AIR CONCENTRATION of COMPOUND (mcg / m^3)			
SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg / m^3)	< 0.25	0.25 to < 1	1 to < 5.0	5.0 and above
< 5	1. No further action	2. Take reasonable and practical actions to identify source(s) and reduce exposures	3. Take reasonable and practical actions to identify source(s) and reduce exposures	4. Take reasonable and practical actions to identify source(s) and reduce exposures
5 to < 50	5. No further action	6. MONITOR	7. MONITOR	8. MITIGATE
50 to < 250	9. MONITOR	10. MONITOR / MITIGATE	11. MITIGATE	12. MITIGATE
250 and above	13. MITIGATE	14. MITIGATE	15. MITIGATE	16. MITIGATE

No further action:
Given that the compound was not detected in the indoor air sample and that the concentration detected in the sub-slab vapor sample is not expected to significantly affect indoor air quality, no additional actions are needed to address human exposures.

Take reasonable and practical actions to identify source(s) and reduce exposures:
The concentration detected in the indoor air sample is likely due to indoor and/or outdoor sources rather than soil vapor intrusion given the concentration detected in the sub-slab vapor sample. Therefore, steps should be taken to identify potential source(s) and to reduce exposures accordingly (e.g., by keeping containers tightly capped or by storing volatile organic compound-containing products in places where people do not spend much time, such as a garage or outdoor shed). Resampling may be recommended to demonstrate the effectiveness of actions taken to reduce exposures.

MONITOR:
Monitoring, including sub-slab vapor, basement air, lowest occupied living space air, and outdoor air sampling, is needed to determine whether concentrations in the indoor air or sub-slab vapor have changed. Monitoring may also be needed to determine whether existing building conditions (e.g., positive pressure heating, ventilation and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined on a site-specific and building-specific basis, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

MITIGATE:
Mitigation is needed to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system, and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building-specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

MONITOR / MITIGATE:
Monitoring or mitigation may be recommended after considering the magnitude of sub-slab vapor and indoor air concentrations along with building- and site-specific conditions.

See additional notes on page 2.

ADDITIONAL NOTES FOR MATRIX 1

This matrix summarizes the minimum actions recommended to address current and potential exposures related to soil vapor intrusion. To use the matrix appropriately as a tool in the decision-making process, the following should be noted:

[1] The matrix is generic. As such, it may be appropriate to modify a recommended action to accommodate building-specific conditions (e.g., dirt floor in basement, crawl spaces, etc.) and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, resampling may be recommended when the matrix indicates "no further action" for a particular building, but the results of adjacent buildings (especially sub-slab vapor results) indicate a need to take actions to address exposures related to soil vapor intrusion. Additionally, actions more protective of public health than those specified within the matrix may be proposed at any time. For example, the party implementing the actions may decide to install sub-slab depressurization systems on buildings where the matrix indicates "no further action" or "monitoring." Such an action is usually undertaken for reasons other than public health (e.g., seeking community acceptance, reducing excessive costs, etc.).

[2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of vapor contamination, nor does it preclude remediating contaminated soil vapors or the source of soil vapor contamination.

[3] Appropriate care should be taken during all aspects of sample collection to ensure that high quality data are obtained. Since the data are being used in the decision-making process, the laboratory analyzing the environmental samples must have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. Furthermore, samples should be analyzed by methods that can achieve a minimum reporting limit of 0.25 microgram per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples, a minimum reporting limit of 5 micrograms per cubic meter is recommended for buildings with full slab foundations, and 1 microgram per cubic meter for buildings with less than a full slab foundation.

[4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion to occur is considered to be the greatest (i.e., worst-case conditions). If samples are collected at other times (typically, samples collected outside of the heating season), then resampling during worst-case conditions may be appropriate to verify that actions taken to address exposures related to soil vapor intrusion are protective of human health.

[5] When current exposures are attributed to sources other than soil vapor intrusion, the agencies should be given documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix box and to support agency assessment and follow-up.

[6] The party responsible for implementing the recommended actions will differ depending upon several factors, including the identified source of the volatile chemicals, the environmental remediation program, and site-specific and building-specific conditions. For example, to the extent that all site data and site conditions demonstrate that soil vapor intrusion is not occurring and that the potential for soil vapor intrusion to occur is not likely, the soil vapor intrusion investigation would be considered complete. In general, if indoor exposures represent a concern due to indoor sources, then the State will provide guidance to the property owner and/or tenant on ways to reduce their exposure. If indoor exposures represent a concern due to outdoor sources, then the NYSDEC will decide who is responsible for further investigation and any necessary remediation. Depending upon the outdoor source, this responsibility may or may not fall upon the party conducting the soil vapor intrusion investigation.

Soil Vapor / Indoor Air Matrix 2

October 2006

SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg / m^3)	**INDOOR AIR CONCENTRATION of COMPOUND (mcg / m^3)**			
	< 3	3 to < 30	30 to < 100	100 and above
< 100	1. No further action	2. Take reasonable and practical actions to identify source(s) and reduce exposures	3. Take reasonable and practical actions to identify source(s) and reduce exposures	4. Take reasonable and practical actions to identify source(s) and reduce exposures
100 to < 1,000	5. MONITOR	6. MONITOR / MITIGATE	7. MITIGATE	8. MITIGATE
1,000 and above	9. MITIGATE	10. MITIGATE	11. MITIGATE	12. MITIGATE

No further action:
Given that the compound was not detected in the indoor air sample and that the concentration detected in the sub-slab vapor sample is not expected to significantly affect indoor air quality, no additional actions are needed to address human exposures.

Take reasonable and practical actions to identify source(s) and reduce exposures:
The concentration detected in the indoor air sample is likely due to indoor and/or outdoor sources rather than soil vapor intrusion given the concentration detected in the sub-slab vapor sample. Therefore, steps should be taken to identify potential source(s) and to reduce exposures accordingly (e.g., by keeping containers tightly capped or by storing volatile organic compound-containing products in places where people do not spend much time, such as a garage or outdoor shed). Resampling may be recommended to demonstrate the effectiveness of actions taken to reduce exposures.

MONITOR:
Monitoring, including sub-slab vapor, basement air, lowest occupied living space air, and outdoor air sampling, is needed to determine whether concentrations in the indoor air or sub-slab vapor have changed. Monitoring may also be needed to determine whether existing building conditions (e.g., positive pressure heating, ventilation and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined on a site-specific and building-specific basis, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

MITIGATE:
Mitigation is needed to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system, and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building-specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

MONITOR / MITIGATE:
Monitoring or mitigation may be recommended after considering the magnitude of sub-slab vapor and indoor air concentrations along with building- and site-specific conditions.

See additional notes on page 2.

ADDITIONAL NOTES FOR MATRIX 2

This matrix summarizes the minimum actions recommended to address current and potential exposures related to soil vapor intrusion. To use the matrix appropriately as a tool in the decision-making process, the following should be noted:

[1] The matrix is generic. As such, it may be appropriate to modify a recommended action to accommodate building-specific conditions (e.g., dirt floor in basement, crawl spaces, etc.) and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, resampling may be recommended when the matrix indicates "no further action" for a particular building, but the results of adjacent buildings (especially sub-slab vapor results) indicate a need to take actions to address exposures related to soil vapor intrusion. Additionally, actions more protective of public health than those specified within the matrix may be proposed at any time. For example, the party implementing the actions may decide to install sub-slab depressurization systems on buildings where the matrix indicates "no further action" or "monitoring." Such an action is usually undertaken for reasons other than public health (e.g., seeking community acceptance, reducing excessive costs, etc.).

[2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of vapor contamination, nor does it preclude remediating contaminated soil vapors or the source of soil vapor contamination.

[3] Appropriate care should be taken during all aspects of sample collection to ensure that high quality data are obtained. Since the data are being used in the decision-making process, the laboratory analyzing the environmental samples must have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. Furthermore, samples should be analyzed by methods that can achieve a minimum reporting limit of 3 micrograms per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples, a minimum reporting limit of 5 micrograms per cubic meter is recommended.

[4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion to occur is considered to be the greatest (i.e., worst-case conditions). If samples are collected at other times (typically, samples collected outside of the heating season), then resampling during worst-case conditions may be appropriate to verify that actions taken to address exposures related to soil vapor intrusion are protective of human health.

[5] When current exposures are attributed to sources other than soil vapor intrusion, the agencies should be given documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix box and to support agency assessment and follow-up.

[6] The party responsible for implementing the recommended actions will differ depending upon several factors, including the identified source of the volatile chemicals, the environmental remediation program, and site-specific and building-specific conditions. For example, to the extent that all site data and site conditions demonstrate that soil vapor intrusion is not occurring and that the potential for soil vapor intrusion to occur is not likely, the soil vapor intrusion investigation would be considered complete. In general, if indoor exposures represent a concern due to indoor sources, then the State will provide guidance to the property owner and/or tenant on ways to reduce their exposure. If indoor exposures represent a concern due to outdoor sources, then the NYSDEC will decide who is responsible for further investigation and any necessary remediation. Depending upon the outdoor source, this responsibility may or may not fall upon the party conducting the soil vapor intrusion investigation.

3.5 Emergency response

The NYSDOH's staff are responsible for recommending that residents relocate in cases where there may be health risks resulting from exposure to petroleum spills. These roles and responsibilities are outlined in Environmental Health Manual Technical Reference and Procedural Items BTSA-01. Air sampling is appropriate in some cases for demonstrating that spill cleanup and engineering controls have been effective in reducing indoor air impacts and associated health risks to residents. At a minimum, air samples are collected from the basement, first floor and from outdoors. Whether sub-slab or soil gas samples will be taken is evaluated on a case-by-case basis. Air testing data are sometimes used as the basis for ending emergency relocation financial support. For additional information, please contact the NYSDOH's Bureau of Toxic Substance Assessment by calling 1-800-458-1158.

Emergency actions not related to petroleum spills are handled on a case-by-case basis.

3.6 Parcels that are undeveloped or contain unoccupied buildings

If investigation of a parcel that is undeveloped or contains unoccupied buildings is being delayed until the site is being developed or occupied, measures should be in place that assure the State that no development or occupation will occur without addressing the exposures. Institutional controls may be used for this purpose. An institutional control is any non-physical means of enforcing a restriction on the use of real property that

a. limits human or environmental exposure,

b. provides notice to potential owners, operators or members of the public, or

c. prevents actions that would interfere with the effectiveness of remedial actions or with the effectiveness and/or integrity of operation, maintenance or monitoring activities at a site.

An institutional control that is often used is an environmental easement. An environmental easement is an enforced mechanism used for property where the remedial actions leave residual contamination that makes the property suitable for some, but not all uses, or includes engineering controls that must be maintained for the easement to be effective. The purpose of the easement is to ensure that such use restrictions or engineering controls remain in place. An environmental easement

a. can only be created by the property owner (the *grantor*) through a written instrument recorded in the appropriate county recording office. It can only be granted to the State (the *grantee*) and can only be extinguished or amended by a written instrument executed by the Commissioner of the Department of Environmental Conservation and duly recorded;

b. is binding upon all subsequent owners and occupants of the property. The deed or deeds for the property (as well as any other written instruments conveying any interest in the property) must contain a prominent notice that it is subject to an environmental easement; and

c. may be enforced in perpetuity against the *grantor*, subsequent owners of the property, lessees, and any person using the property by its grantor, by the State, or by the municipality in which the property is located.

If these actions cannot be implemented, alternative measures should be in place that assure the State that the parcel will not be developed or buildings occupied without addressing the exposure concerns. For example, arrangements should be made for the town, village or city to notify the appropriate party when new construction or tenants are proposed for the parcel (e.g., permit applications and grants) or ownership of the parcel changes.

Section 4: Soil Vapor Intrusion Mitigation

As discussed in Section 1.1, soil vapor can enter a building through cracks or perforations in slabs or basement floors and walls, and through openings around sump pumps or where pipes and electrical wires go through the foundation primarily because of a difference between interior and exterior pressures. This intrusion is similar to how radon gas enters buildings from the subsurface. Fortunately, given this similarity, well-established techniques for mitigating exposures to radon may also be used to mitigate exposures related to soil vapor intrusion.

Once it is determined that steps should to be taken to address exposures associated with soil vapor intrusion, they should be implemented with all due expediency. This section provides an overview of:

a. methods of mitigation,

b. installation and design of mitigation systems,

c. post-mitigation testing,

d. operation, maintenance and monitoring of mitigation systems,

e. termination of mitigation system operations, and

f. annual certification.

Mitigation is considered to be an interim measure to address exposures until contaminated environmental media are remediated, or until mitigation is no longer needed to address exposures related to soil vapor intrusion.

4.1 Methods of mitigation

The most effective mitigation methods involve sealing infiltration points and actively manipulating the pressure differential between the building's interior and exterior (on a continuous basis). As discussed in the following subsections, the appropriate method to use will largely depend upon the building's foundation design. Furthermore, buildings having more than one foundation design feature (e.g., a basement under one portion of the house and a crawl space beneath the remainder) may require a combination of mitigation methods. This section describes methods of mitigation that are expected to be the most reliable options under a wide range of circumstances. Occasionally, there are site-specific or building-specific conditions under which alternative methods (such as HVAC modification, sealing, room pressurization, passive ventilation systems, or vapor barriers) may be more appropriate. Such mitigation proposals may be considered on a case-by-case basis.

4.1.1 Buildings with a basement slab or slab-on-grade foundation

In conjunction with *sealing* potential subsurface vapor entry points, an active *sub-slab depressurization system* (SSD system) is the preferred mitigation method for buildings with a basement slab or slab-on-grade foundation. A SSD system uses a fan-powered vent and piping to draw vapors from the soil beneath the building's slab (i.e., essentially creating a vacuum beneath the slab) and discharge them to the atmosphere. This results in lower sub-slab air pressure relative to indoor air pressure, which prevents the infiltration of sub-slab vapors into the building.

The most common approach to achieving depressurization beneath the slab is to insert the piping through the floor slab into the crushed rock or soil underneath. However, the EPA, in their "Consumer's Guide to Radon Reduction" (EPA 402-K-03-002; revised February 2003), lists the following approaches as ways to reduce radon levels in a building, either in place of the more common sub-slab suction point method or in conjunction with that method:

a. *Drain tile suction* — Some houses have drain tiles or perforated pipe to direct water away from the foundation of the house. Suction on these tiles or pipes is often effective;

b. *Sump hole suction* — If the building has a sump pump to remove unwanted water, the sump can be capped so that it can continue to drain water and serve as the location for piping. If the sump is not used as the suction or extraction point, the associated wiring and piping should be sealed and an air-tight cover should be installed to enhance the performance of the SSD system; and

c. *Block wall suction* — If the building has hollow block foundation walls, the void network within the wall may be depressurized by drawing air from inside the wall and venting it to the outside. This method is often used in combination with sub-slab depressurization.

The depressurization approach, or combination of approaches, selected for a building should be determined on a building-specific basis due to building-specific features that may be conducive to a specific depressurization approach. For example, if the contaminants are entering the building through a block wall, block wall suction in conjunction with traditional sub-slab depressurization may be more effective at minimizing exposures related to soil vapor intrusion rather than sub-slab depressurization alone.

Although sealing is not a reliable mitigation technique on its own, it can significantly improve the effectiveness of a SSD system since it limits the flow of subsurface vapors into the building. All joints, cracks and other penetrations of slabs, floor assemblies and foundation walls below or in contact with the ground surface should be sealed with materials that prevent air leakage.

If the State concurs that a SSD system is not a practicable alternative or that exposures will be mitigated concurrently by a method selected to remediate subsurface contamination, alternative mitigation methods may be considered, such as the following:

a. *HVAC modification* — a technique where the building's HVAC system is modified to avoid depressurization of the building relative to underlying and surrounding soil (i.e., to maintain a positive pressure within the building); and

b. S*oil vapor extraction (SVE) system* — a technique used to remediate contaminated subsurface soil vapor. SVE systems use high flow rates, induced vacuum or both to collect and remove contamination, while SSD systems use a minimal flow rate to effect the minimum pressure gradient (see the EPA's technical guidance documents for recommended gradients; Section 4.2.3) needed to reverse air flow across a building's foundation. Depending upon the SVE system's design, the system may also serve to mitigate exposures. For example, the SVE system's radius of influence includes the subsurface beneath affected buildings or horizontal legs of the system will be installed beneath affected buildings. However, complications can arise if the SVE system is no longer effective at remediating contaminated vapors, exposures should still be mitigated due to residual vapor contamination.

4.1.2 Buildings with a crawl space foundation

A *soil vapor retarder* with *sub-membrane depressurization (SMD) system* is the preferred mitigation method for buildings with a crawl space foundation. A soil vapor retarder is a synthetic membrane or other comparable material that is placed on the ground in the crawl space to retard the flow of soil vapors into the building. A SMD system is similar to a SSD system. It uses a fan-powered vent and piping to draw vapors from beneath the soil vapor retarder and discharge them to the atmosphere. This results in lower air pressure beneath the membrane relative to air pressure in the crawl space, which prevents the infiltration of subsurface vapors into the building.

If the State concurs that a soil vapor retarder with a SMD system is not a practicable alternative or that exposures will be mitigated concurrently by a method selected to remediate subsurface contamination, alternative mitigation methods may be considered, such as the following:

a. *HVAC modification* — a technique where the building's HVAC system is modified to avoid depressurization of the building relative to the crawl space;

b. C*rawl space ventilation with sealing* — a technique that uses a fan to draw air out of the crawl space; and

c. *SVE system* [Section 4.1.1].

4.1.3 Buildings with dirt floor basements

Either a SSD system with a newly poured slab or a SMD system with a soil vapor retarder may be used. However, the former method is preferred.

4.1.4 Buildings with multiple foundation types

Mitigation in a building with a combination of foundations should be achieved by applying the specific methods described previously [Sections 4.1.1 through 4.1.3] to the corresponding foundation segments of the building. Special consideration should be given to the points at which different foundation types join, since additional soil vapor entry routes exist in such locations. Often, the various systems can be installed and connected to a common depressurization system and fan.

4.1.5 Undeveloped parcels

If sampling results indicate a mitigation system is recommended to address exposures in buildings that may be constructed, then a SSD system with sealing, or a SMD system with a soil vapor retarder, or a combination of these methods is recommended, as appropriate to the design of the proposed buildings.

4.1.6 Additional references

The following documents provide additional information on selecting an appropriate mitigation method:

a. *A Consumer's Guide to Radon Reduction*
EPA [EPA 402-K-03-002, revised February 2003]

This document provides assistance in selecting a qualified radon mitigation contractor to reduce the radon levels in a home, determining an appropriate radon reduction method, and maintaining a radon reduction system. It is available at the EPA's web site: http://www.epa.gov/iaq/radon/pubs/index.html; and

b. *Reducing Radon in Schools: A Team Approach*
EPA [EPA 402-R-94-008, April 1994]

This document will provide assistance in determining the best way to reduce elevated radon levels found in a school. It provides guidance on the process of confirming a radon problem, selecting the best mitigation strategy, and directing the efforts of a multidisciplinary team assembled to address elevated radon levels in a way that will contribute to the improvement of the overall indoor air quality of the school. Copies can be ordered from the EPA's Indoor Air Quality Information Clearinghouse at 1-800-438-4318.

4.2 Design and installation of mitigation systems

Once a mitigation method is selected, it should be designed and installed. The components of the design and installation of mitigation systems, the procedures for specific mitigation techniques, and references for technical guidance are provided in the following subsections.

4.2.1 General recommendations

Systems should be designed and installed by a professional engineer or environmental professional. In most areas of the state, there are contractors who have met certain requirements and are trained to identify and fix radon problems in buildings. To obtain the names of local contractors, contact the NYSDOH's Radon Program at 1-800-458-1158, extension 27556, or visit the National Radon Safety Board's web site (www.nrsb.org) or National Environmental Health Association's web site (www.neha.org).

Typically, the party responsible for remediating the site is responsible for arranging design and installation activities. If no responsible party is available, the State will arrange for the design and installation of the system. All design and installation activities should be documented and reported to the agencies. Furthermore, once a mitigation system is installed, an information package should be given to the building's owner and tenants, if applicable, to facilitate their understanding of the system's operation, maintenance and monitoring [Section 5.6].

With the exception of SVE systems, the mitigation methods introduced in Section 4.1 are not intended to remediate the source of subsurface vapors (e.g., contaminated groundwater, soil, etc.). Rather, they are designed to minimize the infiltration of subsurface vapors into a building. For consistency in implementing the techniques in residential buildings, mitigation systems should be designed and installed in accordance with the following:

a. *Standard Practice for Installing Radon Mitigation Systems in Existing Low-rise Residential Buildings* (ASTM E-2121)

American Society for Testing and Materials (ASTM) International [ASTM E-2121-03, February 10, 2003]

This document applies to existing buildings. The purpose of this document is to provide radon mitigation contractors with uniform standards that will ensure quality and effectiveness in the design, installation, and evaluation of radon mitigation systems in detached and attached residential buildings three stories or less in height. Information on how to obtain a copy of this standard is available in Appendix E; and

b. *Model Standards and Techniques for Control of Radon in New Residential Buildings* EPA [EPA 402-R-94-009, March 1994]

This document applies to new construction and contains information on how to incorporate radon reduction techniques and materials in residential construction. A copy of this document is provided in Appendix F.

4.2.2 System-specific recommendations

Basic design and installation recommendations for mitigation systems follow. These are based upon recommendations and requirements given by the EPA for mitigating exposures related to radon intrusion (for additional information see EPA's web site on radon at http://www.epa.gov/iaq/radon/pubs/index.html).

a. *Sealing* — To improve the effectiveness of depressurization and ventilation systems and to limit the flow of subsurface vapors into the building, materials that prevent air leakage should be used, such as elastomeric joint sealant (as defined in ASTM C920-87), compatible caulks, non-shrink mortar, grouts, expanding foam, "Dranjer" drain seals, or airtight gaskets. Some effective sealants may contain volatile organic compounds; in some situations, this may be a consideration in choosing an appropriate sealing material.

b. *Soil vapor retarder (membrane)* —

1. To retard the infiltration of subsurface vapors into the building and enhance the performance of a SMD system, a minimum 6 mil (or 3 mil cross-laminated) polyethylene or equivalent flexible sheeting material should be used.

2. The sheet should cover the entire floor area and be sealed at seams (with at least a 12 inch overlap) and penetrations, around the perimeter of interior piers and to the foundation walls.

3. Enough of the sheeting should be used so it will not be pulled away from the walls when the depressurization system is turned on and the sheet is drawn down.

4. If a membrane is installed in areas that may have future foot traffic (e.g., a dirt floor in a basement), consideration should be given to also installing a wearing surface such as sand or stone to protect the integrity of the membrane. Additionally, a layer of fine sand may be prudent beneath the membrane to protect it from penetrations by sharp objects in the dirt floor.

c. *Depressurization systems —*

1. The systems should be designed to avoid the creation of other health, safety, or environmental hazards to building occupants (e.g., backdrafting of natural draft combustion appliances).

2. The systems should be designed to minimize soil vapor intrusion effectively while minimizing excess energy usage, to avoid compromising moisture and temperature controls and other comfort features, and to minimize noise.

3. To evaluate the potential effectiveness of a SSD before it is installed, a diagnostic test (commonly referred to as a "communication" test) should be performed to measure the ability of a suction field and air flow to extend through the material beneath the slab. This test is commonly conducted by applying suction on a centrally located hole drilled through the concrete slab and simultaneously observing the movement of smoke downward into small holes drilled in the slab at locations separated from the central suction hole. A similar quantitative evaluation may also be performed by using a digital micromanometer or comparable instrument. Depending on test results, multiple suction points may be needed to achieve the desired effectiveness of the system.

4. Passive systems (i.e., a SSD system without a vent fan) are not as effective as active systems and their performance varies depending upon ambient temperatures and wind conditions. Therefore, active systems should be used to ensure exposures are being addressed.

5. The vent fan and discharge piping should not be located in or below a livable or occupied area of the building to avoid entry of extracted subsurface vapors into the building in the event of a fan or pipe leak.

6. To avoid entry of extracted subsurface vapors into the building, the vent pipe's exhaust should be
   i. above the eave of the roof (preferably, above the highest eave of the building at least 12 inches above the surface of the roof),
   ii. at least 10 feet above ground level,
   iii. at least 10 feet away from any opening that is less than 2 feet below the exhaust point, and
   iv. 10 feet from any adjoining or adjacent buildings, or HVAC intakes or supply registers.

7. Rain caps, if used, should be installed so as not to increase the potential for extracted subsurface vapors to enter the building.

8. To avoid accidental changes to the system that could disrupt its function, the depressurization system should be labeled clearly. An example of such labeling is shown in Figure 5.1.

9. A warning device or indicator should be installed to alert building occupants if the active system stops working properly. Examples of system failure warning devices and indicators include the following: a liquid gauge (e.g., a

manometer), a sound alarm, a light indicator, and a dial (needle display) gauge. The warning device or indicator should be placed where it can be easily heard or seen. The party installing the system should verify the warning device or indicator is working properly. Building occupants should be made aware of the warning device or indicator (what it is, where it is located, how it works, how to read/understand it, and what to do if it indicates the system is not working properly).

d. *HVAC systems* — HVAC systems should be carefully designed, installed and operated to avoid depressurization of basements and other areas in contact with the soil.

e. *Crawl space ventilation* —

1. Ventilation systems should be designed to avoid the creation of other health, safety, or environmental hazards to building occupants (e.g., backdrafting of natural draft combustion appliances).

2. Openings and cracks in floors above the crawl space that would permit conditioned air to pass into or out of the occupied spaces of the building, should be identified, closed and sealed.

f. *SVE systems designed to also mitigate exposures* —

1. The systems should be designed to avoid the creation of other health, safety, or environmental hazards to building occupants (e.g., backdrafting of natural draft combustion appliances).

2. To avoid reentry of soil vapor into the building(s), the exhaust point should be located away from the openings of buildings and HVAC air intakes. Depending upon the concentrations of volatile chemicals in subsurface vapors and the expected mass removal rate, treatment (e.g., via carbon filters) of the SVE system effluent may be appropriate to minimize outdoor air effects.

3. The SVE system's radius of influence should adequately address buildings requiring mitigation, as well as subsurface sources requiring remediation. If it does not, additional actions may be appropriate. For example, if the radius of influence does not completely extend beneath a building, a complementary air monitoring program may be appropriate to confirm that exposures are being addressed adequately while the SVE system is operating.

4.2.3 Technical guidance

To address exposures effectively in larger buildings, some of the same techniques used in residential buildings can be scaled up in size, number, or performance (e.g., adjustments in the size and air movement capacity of the vent pipe fan, or installation of multiple suction points through the slab instead of a single point). The design of the techniques may also be modified (e.g., installation of horizontal pipes beneath the building instead of a single suction point).

Detailed technical guidance on designing and installing mitigation systems in residential and non-residential buildings is provided in various documents, such as the following, released by the EPA and others:

a. References provided in ASTM's E-2121 (see Appendix E for information on how to obtain a copy) and the EPA's *Model Standards and Techniques for Control of Radon in New Residential Buildings* (Appendix F);

b. *Radon Reduction Techniques for Existing Detached Houses: Technical Guidance (Third Edition) for Active Soil Depressurization Systems*
EPA [EPA 625/R-93-011, October 1993]

   This technical guidance document has been prepared to serve as a comprehensive aid in the detailed selection, design, installation, and operation of indoor radon reduction measures for existing houses based on active soil depressurization techniques. It is intended for use by radon mitigation contractors, building contractors, concerned homeowners, state and local officials and other interested persons. Copies can be ordered from the EPA's Indoor Air Quality Information Clearinghouse at 1-800-438-4318;

c. *Protecting Your Home From Radon: A Step-by-Step Manual for Radon Reduction*
Kladder *et al.*, 1993

   This manual is designed to provide sufficient information to a homeowner to make many of the basic repairs that can significantly reduce radon levels in the home;

d. *Building Radon Out: A Step-by-Step Guide on How to Build Radon-Resistant Homes*
EPA [EPA 402-K-01-002, April 2001]

   This fully illustrated guide contains all the information needed in one place to educate home builders about radon-resistant new construction (RRNC), including the following: basic questions and detailed answers about radon and RRNC, specific planning steps before installing a system, detailed installation instructions with helpful illustrations, tips and tricks when installing a system, marketing know-how when dealing with homebuyers, and architectural drawings. This document is available at the EPA's web site: http://www.epa.gov/iaq/radon/pubs/index.html; and

e. *Radon Prevention in the Design and Construction of Schools and Other Large Buildings*
EPA [EPA 625-R-92-016, June 1994]

   It is typically easier and much less expensive to design and construct a new building with radon-resistant and/or easy-to-mitigate features, than to add these features after the building is completed and occupied. Specific guidelines on how to incorporate radon prevention features in the design and construction of schools and other large buildings are detailed in this manual. Copies can be ordered from the EPA's Indoor Air Quality Information Clearinghouse at 1-800-438-4318. This document is also available on the EPA Office of Research and Development's web site: http://www.epa.gov/ORD/NRMRL/pubs/625r92016/625r92016.htm.

4.3 Post-mitigation or confirmation testing

Once a mitigation system is installed, its effectiveness and proper installation should be confirmed. The party that installed the system should conduct post-mitigation testing and for developing a post-mitigation testing plan. Minimum objectives for post-mitigation testing associated with specific mitigation methods are provided in the following subsections. All post-mitigation testing activities should be documented and reported to the agencies.

4.3.1 SSD systems with sealing

a. Reasonable and practical actions should be taken to identify and fix leaks. With the depressurization system operating, smoke tubes are used to check for leaks through concrete cracks, floor joints, and at the suction point. Any leaks identified should be resealed until smoke is no longer observed flowing through the opening.

b. Once a depressurization system is installed, its operation may compete with the proper venting of fireplaces, wood stoves and other combustion or vented appliances (e.g., furnaces, clothes dryers, and water heaters), resulting in the accumulation of exhaust gases in the building and the potential for carbon monoxide poisoning. Therefore, in buildings with natural draft combustion appliances, the building should be tested for backdrafting of the appliances. Backdrafting conditions should be corrected before the depressurization system is placed in operation.

c. The distance that a pressure change is induced in the sub-slab area (i.e., a pressure field extension test) should be conducted. Analogous to a communication test, this test is commonly conducted by operating the depressurization system and simultaneously observing the movement of smoke downward into small holes (e.g., 3/8 inch) drilled through the slab at sufficient locations to demonstrate that a vacuum is being created beneath the entire slab. A similar quantitative evaluation may also be performed by using a digital micromanometer or comparable instrument. If adequate depressurization is not occurring, the reason (e.g., improper fan operation) should be identified and corrected.

d. Adequate operation of the warning device or indicator should be confirmed.

e. Except as indicated below, post-mitigation indoor and outdoor air sampling should be conducted in all buildings where pre-mitigation samples were collected and in all buildings where physical data suggest possible impediments to comprehensive sub-slab communication of the depressurization system (i.e., locations with wet or dense sub-slab soils, multiple foundations and footings, minimal pressure differentials between the interior and sub-slab). Generally, indoor and outdoor air sampling locations, protocols and analytical methods should be consistent between pre-mitigation and post-mitigation sampling, where applicable. In buildings with basements, post-mitigation indoor air sampling from the basement alone (i.e., without a concurrent indoor air sample from the first floor) is recommended in most circumstances.

   Typically, post-mitigation sampling should be conducted no sooner than 30 days after installing a depressurization system. If the system is installed outside of the heating season or at the end of a season, post-mitigation air sampling may be postponed until the heating season.

   In cases of widespread mitigation due to vapor contamination and depending upon the basis of making decisions (e.g., a "blanket mitigation" approach within a specified area of documented vapor contamination [Section 3.3.1]), a representative number of buildings from an identified study area, rather than each building, may be sampled. Prior to implementation, this type of post-mitigation sampling approach should be approved by State agency personnel.

In newly constructed buildings, a site-specific and building-specific indoor air sampling plan is recommended due to potential interferences caused by the off-gassing of volatile chemicals in new building materials (e.g., paints, carpets, furniture, etc. [Section 1.4]). In these situations, if indoor air sampling is appropriate samples should be

i. collected while the system is operational but before potentially interfering factors are brought into the building,

ii. analyzed for a targeted list of volatile chemicals based on previous environmental sampling (e.g., groundwater, soil, soil vapor, etc.), and/or

iii. collected while the system is operational but after potentially interfering factors have had an opportunity to off-gas.

If post-mitigation sampling results do not indicate a significant decrease in the concentrations of volatile chemicals previously believed to be present in the indoor air due to soil vapor intrusion, the reason (e.g., indoor or outdoor sources, improper operation of the mitigation system, etc.) should be identified and corrected as appropriate.

4.3.2 SMD systems with soil vapor retarder

a. Reasonable and practical actions should be taken to identify and fix leaks. With the depressurization system operating, smoke tubes are used to check for leaks in the membrane at seams, edge seals and at locations where the sheet was sealed around obstructions. Any leaks identified should be resealed until smoke is no longer observed flowing through the opening.

b. Backdrafting conditions should be evaluated and corrected [Section 4.3.1].

c. Adequate operation of the warning device or indicator should be confirmed.

d. Post-mitigation indoor and outdoor air testing should be conducted in buildings where pre-mitigation samples were collected [as discussed in Section 4.3.1].

4.3.3 HVAC modifications

a. Check the building for positive pressure conditions (e.g., verify a pressure controller is maintaining the desired pressure differential and/or measure the pressure differential between the sub-slab and indoor air by using field instruments).

b. Backdrafting conditions should be evaluated and corrected [Section 4.3.1].

c. Adequate operation of the warning device or indicator, if applicable, should be confirmed.

d. Post-mitigation indoor and outdoor air testing should be conducted in buildings where pre-mitigation samples were collected [Section 4.3.1].

4.3.4 Crawl space ventilation and sealing

a. Reasonable and practical actions should be taken to identify and fix leaks. With the ventilation system operating, smoke tubes are used to check for leaks in openings and cracks in floors above the crawl space that were sealed during installation of the system. Any leaks identified should be resealed until smoke is no longer observed flowing through the opening.

b. Backdrafting conditions should be evaluated and corrected [Section 4.3.1].

c. Adequate operation of the warning device or indicator, if applicable, should be confirmed.

d. Post-mitigation indoor and outdoor air testing should be conducted in buildings where pre-mitigation samples were collected [as discussed in Section 4.3.1].

4.3.5 SVE systems designed to also mitigate exposures

a. Backdrafting conditions should be evaluated and corrected [Section 4.3.1].

b. The distance that a pressure change is induced in the sub-slab area should be conducted. This may be done by operating the SVE system and simultaneously observing the movement of smoke downward into small holes (e.g., 3/8 inch) drilled through the building's slab at sufficient locations to demonstrate that a vacuum is being created beneath the entire slab.

c. Adequate operation of the warning device or indicator, if applicable, should be confirmed.

d. Post-mitigation indoor and outdoor air testing should be conducted in buildings where pre-mitigation samples were collected [Section 4.3.1].

4.4 Operation, maintenance and monitoring of mitigation systems

When mitigation systems are implemented at a site, the operation, maintenance and monitoring (OM&M) protocols for the systems should be included in a site-specific site management plan (formerly referred to as operation, maintenance and monitoring plan). The party that installed the system should conduct OM&M activities and should develop the site management plan. Recommendations for minimum OM&M activities associated with specific mitigation methods are provided in the following subsections. Also included is a discussion of non-routine maintenance. All routine and non-routine OM&M activities should be documented and reported to the agencies.

4.4.1 SSD and SMD systems

Routine maintenance should commence within 18 months after the system becomes operational, and should occur every 12 to 18 months thereafter. Based upon a demonstration of the system's reliability, the State recommends that, if a different frequency is desired, a petition describing the alternative frequency and the reasons that frequency is preferred be submitted to the State. Any comments the State may have on the petition should be considered before the frequency is altered.

During routine maintenance, the following activities (at a minimum) should be conducted:

a. a visual inspection of the complete system (e.g., vent fan, piping, warning device or indicator, labeling on systems, soil vapor retarder integrity, etc.),

b. identification and repair of leaks [Sections 4.3.1 and 4.3.2], and

c. inspection of the exhaust or discharge point to verify no air intakes have been located nearby.

As appropriate preventative maintenance (e.g., replacing vent fans), repairs and/or adjustments should be made to the system to ensure its continued effectiveness at mitigating exposures related to soil vapor intrusion. The need for preventative maintenance will depend upon the life expectancy and warranty for the specific part, as well as visual observations over time. The need for repairs and/or adjustments will depend upon the results of a specific activity compared to that obtained when system operations were initiated.

If significant changes are made to the system or when the system's performance is unacceptable, the system may need to be redesigned and restarted. Many, if not all, of the post-mitigation testing activities, as described in Sections 4.3.1 and/or 4.3, may be appropriate. The extent of such activities will primarily depend upon the reason for the changes and the documentation of sub-slab depressurization.

Generally, air monitoring is not recommended if the system has been installed properly and is maintaining a vacuum beneath the entire slab.

In addition to the routine OM&M activities described here, the building's owner and tenants are given information packages that explains the system's operation, maintenance and monitoring [Section 5.6]. Therefore, at any time during the system's operation, the building's owner or tenants may check that the system is operating properly.

4.4.2 Other mitigation systems

For other mitigation systems (e.g., HVAC modifications, crawl space ventilation, etc.), routine maintenance activities are generally comparable to post-mitigation testing activities [Section 4.3]. Activities typically include a visual inspection of the complete system, and identification and repair of leaks. System performance checks, such as air stream velocity measurements of ventilation systems, also should be performed.

As appropriate, preventative maintenance (e.g., replacing filters, cleaning lines, etc.), repairs and/or adjustments should be made to the system to ensure its continued effectiveness at mitigating exposures related to soil vapor intrusion. If significant changes are made to the system or when the system's performance is unacceptable, redesigning and restarting the system may be appropriate[Section 4.4.1].

Air monitoring, such as periodic sub-slab vapor, indoor air and outdoor air sampling, may be appropriate to determine whether existing building conditions are maintaining the desired mitigation endpoint and to determine whether changes are appropriate. The type and frequency of monitoring is determined based upon site-specific and building-specific conditions, taking into account applicable environmental data, building operating conditions, and the mitigation method employed.

4.4.3 Non-routine maintenance

Non-routine maintenance may also be appropriate during the operation of a mitigation system. Examples of such situations include the following:

a. the building's owners or occupants report that the warning device or indicator indicates the mitigation system is not operating properly;

b. the mitigation system becomes damaged; or

c. the building has undergone renovations that may reduce the effectiveness of the mitigation system.

Activities conducted during non-routine maintenance visits will vary depending upon the reason for the visit. In general, building-related activities may include examining the building for structural or HVAC system changes, or other changes that may affect the performance of the depressurization system (e.g., new combustion appliances, deterioration of the concrete slab, or significant changes to any of the building factors listed in Table 1.2). Depressurization system-related activities may include examining the operation of the warning device or indicator and the vent fan, or the extent of sub-slab depressurization. Repairs or adjustments should be made to the system as appropriate. If appropriate, the system should be redesigned and restarted [Section 4.4.1].

4.5 Termination of mitigation system operations

Mitigation systems should not be turned off, until the State receives, and has had the opportunity to comment on, a proposal to turn off mitigation systems. The party seeking to turn off the mitigation systems should consider any comments the State may have on the proposal, except in emergency situations. Systems should remain in place and operational until they are no longer needed to address current or potential exposures related to soil vapor intrusion. This determination should be based upon several factors, including the following:

a. subsurface sources (e.g., groundwater, soil, etc.) of volatile chemical contamination in subsurface vapors have been remediated based upon an evaluation of appropriate post-remedial sampling results;

b. residual contamination, if any, in subsurface vapors is not expected to affect indoor air quality significantly based upon soil vapor and/or sub-slab vapor sampling results;

c. residual contamination, if any, in subsurface vapors is not affecting indoor air quality when active mitigation systems are turned off based upon indoor air, outdoor air and sub-slab vapor sampling results at a representative number of buildings; and

d. there is no "rebound" effect for which additional mitigation efforts would be appropriate observed when the mitigation system is turned off for prolonged periods of time. This determination should be based upon indoor air, outdoor air and/or sub-slab vapor sampling from the building over a time period, determined by site-specific conditions.

Given the prevalence of radon throughout the State of New York, consideration should be given to leaving the system in place and operating to address exposures related to radon intrusion after concurrence is reached that the system is no longer needed to mitigate exposures related to soil vapor intrusion. This action should be done only with permission of the property owner and after the property owner is aware of their responsibilities in operating, monitoring and maintaining the system for this specific purpose. If the property owner declines the offer, the system should be shut down and, if requested, removed in a timely manner.

4.6 Annual certification and notification recommendations

Mitigation systems are considered engineering controls, defined as any physical barrier or method employed to

1. actively or passively contain, stabilize, or monitor hazardous waste or petroleum,
2. restrict the movement of hazardous waste or petroleum to ensure the long-term effectiveness of remedial actions, or
3. eliminate potential exposure pathways to hazardous waste or petroleum.

Therefore, depending upon the remedial program, submission of an annual certification to the State may be required. This certification must be prepared and submitted by a professional engineer or environmental professional and affirm that the engineering controls are in place, are performing properly and remain effective. This requirement of certification remains in effect until the State provides notification, in writing, that this certification is no longer needed.

If a property owner declines a mitigation system, the party responsible for arranging the design and installation of the system should renew the offer on an annual basis, unless they demonstrate environmental conditions have changed such that a system is no longer needed.

Section 5: Community Outreach

While community outreach is an essential component of the investigation and remediation of any site, it is particularly critical when evaluating soil vapor intrusion at a site due to the following:

a. a heightened awareness by environmental professionals and the general public (both nationally and state-wide) for the importance of soil vapor intrusion;

b. the relatively complicated nature of the exposure pathway (e.g., chemicals in groundwater or soil ending up in the indoor air of buildings versus contaminated groundwater entering the house through the use of a private well);

c. the unknowns associated with the evolving science of investigating, evaluating, and mitigating exposures related to soil vapor intrusion; and

d. the relatively complicated nature of mitigating the exposure pathway (e.g., the design, installation and operation of a sub-slab depressurization system in a home versus an immediate switch from using private well water to using bottled water).

When people have been or may be exposed to contamination, providing them with accurate and timely information about those exposures is extremely important. This information should include details about the types of chemicals, the levels of exposure, and possible health effects from those exposures. In addition, information should include details about the planning and progress of the investigation and remediation efforts. Techniques commonly used to inform the community about soil vapor intrusion issues are described in this section. The type, or types, of techniques selected for a site will vary depending upon the community's needs, site-specific conditions and remedial program-specific requirements.

5.1 Site contact list

A contact list contains names, addresses and telephone numbers of individuals and organizations with interest or involvement in a site. They may be affected by or interested in the site, or have information that staff needs to make effective remedial decisions. Contact lists typically include residents near the site, elected officials, appropriate federal, state, and local government contacts, local media, organized environmental groups and the responsible party, as well as local businesses, civic and recreational groups, religious facilities, school district officials, and all staff (NYSDEC, NYSDOH, county health department, EPA, etc.) involved in the site. The checklist provided in Appendix G.1 will help to identify who should be included in a particular site's contact list.

With respect to soil vapor intrusion, the site contact list is often used to

a. send a fact sheet announcing a proposed investigation in the area, a major project decision or proposal, the project's status or progress, a public meeting or availability session, or the availability of documents in the repositories;

b. contact building owners and tenants to arrange sampling dates and times and to transmit sampling results (in written form and/or verbally); and

c. provide community members with verbal updates on the project's status or progress.

The member of the project team (defined as the NYSDEC, NYSDOH, responsible party, etc.) that develops and maintains the site contact list is determined on a site-specific and/or program-specific basis. Development and revision of the contact list are ongoing activities throughout the site's investigation and remediation. Guidance on how to create a site contact list is provided in Appendix G.1.

5.2 Project staff contact sheet

As implied by the name, this is a summary of the contact information for staff working on the site that can be handed out to the community. Often included on the sheet are the name, title, affiliation, role or area of expertise, address, telephone number, email address, facsimile number for each staff member. The contact sheet provides the community with a quick reference on whom to call with questions, comments or concerns about the site. Project staff may also use the site contact sheet to direct inquiries to the most appropriate person. This is particularly useful when there are many agencies working on the site and many issues, such as site investigation, health studies, medical outreach, etc., being addressed.

The site contact sheet should be handed out at public meetings or availability sessions, when door-to-door visits and sampling are conducted, and in conjunction with other appropriate outreach activities. The sheet should be developed early on in the process and kept up-to-date. The member of the project team that develops and maintains the staff contact sheet is determined on a site-specific and/or program-specific basis.

5.3 Fact sheets

A fact sheet is a written summary of important information about a site. It presents information in clear and concise terms for the community. Fact sheets aid consistent distribution of information and citizens' understanding of significant issues associated with site-related activities. With respect to soil vapor intrusion, fact sheets are often used to

a. announce a proposed soil vapor intrusion investigation in the area, either as a stand-alone activity or in conjunction with the site's overall investigation;

b. summarize the results of an investigation and the anticipated next steps in the process;

c. invite the public to a meeting or availability session to discuss the proposed investigation, the results of a recently completed investigation, the anticipated next steps, etc.; and

d. provide additional information on topics associated with soil vapor intrusion, such as specific air guidelines for volatile chemicals.

The member of the project team that plans, develops and distributes the fact sheet is determined on a site-specific and/or program-specific basis. Factors to consider when designating the lead include the site's remedial program, the expected content of the fact sheet, and the relationship of various team members with the community. For example, if the community strongly distrusts the responsible party and wants to know how the state is determining that their actions are appropriate, the state should be the lead. A combination of team members may also be suitable.

All team members should be included in reviewing and finalizing the fact sheet. Once the state approves the fact sheet, it may be released to the public. Timely distribution of the fact sheet is important. Sufficient time should be allowed in the development and review schedule to ensure that the fact sheet is distributed — *and that it is received* — before the critical activity takes place. Specific timeframes for release include the following:

a. 2 weeks prior to a public meeting or availability session, or commencement of field activities;

b. within 24 hours of receiving a specific request for an available fact sheet from the community (e.g., members of the community that did not receive a copy of the fact sheet in the mail);

c. if applicable, before a comment period begins (otherwise a 30-day comment period becomes, in reality, a 25-day comment period); and

d. if appropriate, concurrently with letters to the community explaining sampling results.

Copies of fact sheets commonly used to supplement discussions related to soil vapor intrusion are provided in Appendix H. They are also available from the NYSDOH's soil vapor intrusion web page: http://www.health.state.ny.us/environmental/indoors/vapor_intrusion/. Additional guidance on how to plan, develop and distribute fact sheets is provided in Appendix G.2.

5.4 Public gatherings

The following are several types of public gatherings where project staff can meet with the community:

a. Traditional Public Meetings: Project staff generally present information and answer questions. Citizens are encouraged to ask questions and provide comments;

b. Public Availability Sessions: The session is held in a casual setting, without a formal agenda and presentation. Staff generally conduct an availability session about a specific aspect of a site, which it publicizes ahead of time. The format promotes detailed individual or small group discussion between staff and the public. An availability session may be targeted to a specific subgroup of the overall community. For example, a session may be held where project staff meet with building owners and tenants to discuss their individual sampling results;

c. Public Forum: The forum is held in a casual setting, without a formal presentation. Typically, the format is one of "question and answer" — a panel of project staff (or, if applicable, outside experts) answer questions asked by community members in an open discussion; and

d. Other: Project staff may be invited to give presentations or to make themselves available for questions at community group meetings, such as community or neighborhood board meetings, school board meetings, etc.

If appropriate, a combination of the above may be used. The type, or combination of types, of gathering (if any) selected should be decided based on site-specific, program requirements and community-specific conditions, such as the following:

a. Is the investigation limited to on-site buildings, to a localized area of off-site buildings, or to the off-site neighborhood surrounding the site?;

b. Is the soil vapor investigation being performed as part of ongoing site investigation activities (and consequently ongoing outreach activities), or is this issue being revisited at a site where remediation was considered "complete?";

c. What type of outreach has the community favored in the past?;

d. What are the objectives of the meeting? Can one meeting type accomplish each of the objectives or are different meeting types needed on successive days (e.g., public meeting followed by an availability session)?; and

e. Who is the desired audience? Should the meeting be held in the afternoon to accommodate an elderly population and repeated in the evening for people who work during normal business hours?

The member of the project team that coordinates and implements the gathering is determined on a site-specific and/or program-specific basis. Factors to consider when designating the lead include the site's remedial program, the expected subject of the meeting, and the relationship of various team members with the community. A combination of team members may also be appropriate.

Additional guidance on how to plan and conduct a public meeting and an availability session is provided in Appendices G.3 and G.4.

5.5 Letters transmitting results

When indoor air and/or sub-slab vapor samples are collected from within or beneath a building, a letter providing the sampling results and the conclusions drawn from the data evaluation should be transmitted to the building's owner. If the building is a rental property, the transmittal letter should be sent to the tenants residing in the areas where the samples were collected and a copy to the property owner/landlord. In some cases where responsible parties are carrying out indoor air sampling, access agreements are commonly executed between such a party and the property owner. Consequently, the transmittal letter may be sent to the property owner, and where feasible by prior arrangement with the property owner and/or tenant, with a copy to the tenant.

A transmittal letter should include the following (as applicable):

a. the address of the building sampled;

b. the date samples were collected;

c. the type of samples collected (e.g., sub-slab vapor, indoor air and outdoor air);

d. indoor air sampling locations (e.g., basement, crawl space, first floor living room, etc.)

e. who collected the samples (e.g., the state, or [Consultant Name] on behalf of [Responsible Party name], etc.);

f. why samples were collected (e.g., to evaluate the potential for exposures associated with soil vapor intrusion);

g. the site name and number (usually included in the subject line);

h. the compound(s) or group of compounds of concern (e.g., trichloroethene or volatile organic compounds);

i. an overview of the sampling results (e.g., a table summarizing compounds detected in each sample and/or a figure illustrating sampling locations and corresponding results);

j. copies of the laboratory sheets for each sample collected and the completed building questionnaire/inventory;

k. a statement of the conclusions drawn and the next steps (e.g., soil vapor intrusion appears to be the likely source of volatile chemicals in your indoor air and we would like to install a sub-slab depressurization system to minimize exposures);

l. if applicable, what information should be shared with employees and/or patrons of the facility (e.g., the transmittal letter and enclosed fact sheets, a situation-specific fact sheet and cover memorandum, etc.);

m. contact information for project staff; and

n. fact sheets that supplement information provided in the letter.

The member of the project team that transmits the letter is typically the member that conducted the investigation. A representative of each member should be copied on each transmittal. For example, for investigations conducted by the state, letters are transmitted by the NYSDOH; state and local agencies, as well as a representative for the responsible party (or other non-agency project staff), should be copied. For investigations conducted by the responsible party, the responsible party should transmit letters that have been reviewed and approved by the state, and copy state and local agency representatives.

The level of detail provided in the letter will depend upon who transmits the letter. For example, letters written by the NYSDOH may recommend actions to reduce exposures to indoor sources (i.e., not site-related sources) of volatile chemicals, or address expected risks associated with an identified exposure. Letters transmitted by a responsible party generally focus on site-related contamination and their identified next steps. These letters generally refer the recipients to the state for questions regarding non-site-related compounds and health concerns. For additional guidance on the content of the transmittal letters, contact the NYSDOH's Bureau of Environmental Exposure Investigation at 1-800-458-1158, extension 27850.

Timely distribution of the transmittal letter is important. Generally, final (i.e., verified) sampling results from the laboratory are available 6 to 8 weeks after the samples are submitted. As soon as they are available, final results should be forwarded to the team member that is transmitting them. Sufficient time should be allowed in the development and review schedule to ensure that the letter is transmitted within 2 weeks after final results are available.

If there is significant community interest in the sampling results, reasonable attempts should be made to inform the building owners and tenants of their results verbally in addition to sending a transmittal letter. Other interested community members, such as residents, press and elected officials, may be given an overview of the investigation results and the conclusions drawn *after* each building owner and tenant has been notified.

5.6 Soil vapor intrusion mitigation information

Once a mitigation system (e.g., sub-slab depressurization system) is installed in a building, an information package should be given to the building's owner and tenants, if applicable, to facilitate their understanding of the system's operation, maintenance and monitoring. This package should include the following:

a. a description of the mitigation system installed and its basic operating principles;

b. how the owner or tenant can check that the system is operating properly;

c. how the system will be maintained and monitored and by whom;

d. a list of appropriate actions for the owner or tenant to take if the system's warning device or indicator (e.g., pressure gauge, alarm, etc.) indicates system degradation or failure; and

e. contact information (e.g., names, telephone numbers, etc.) if the owner or tenant has questions, comments or concerns.

The building's owner should also receive the following information:

a. any building permits required by local codes;

b. copies of contracts and warranties; and

c. a description of the proper operating procedures of any mechanical or electrical system installed, including manufacturer's operation and maintenance instructions and warranties.

Wherever possible, illustrations should be provided. For example, pictures of a manometer under normal operating conditions [Figure 5.1], as well as drawings or schematics showing the system at work [Figure 5.2].

The member of the project team who provides this information is the member who installed the mitigation system.

Figure 5.1
Manometer indicating the SSD system is operating properly.

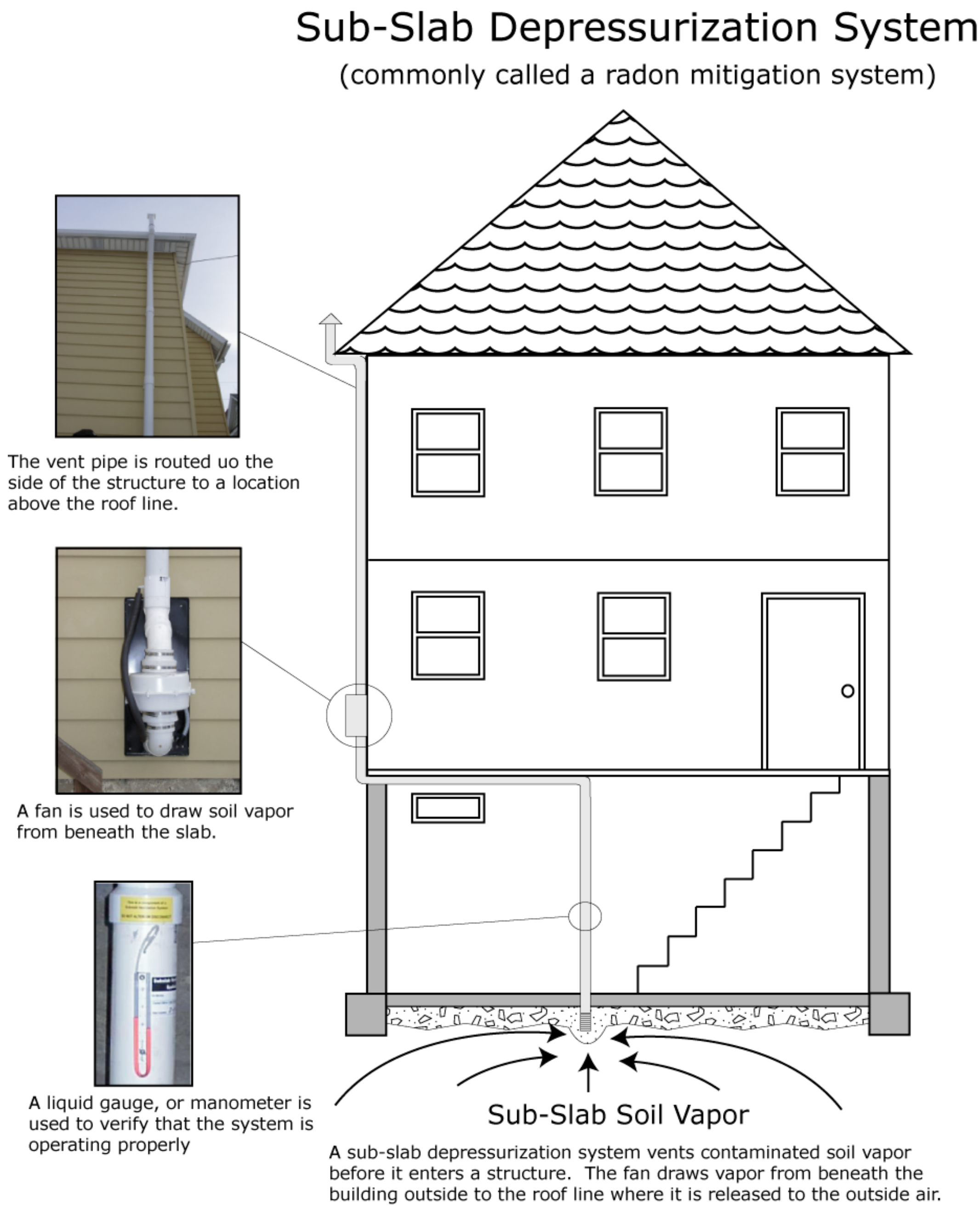

Figure 5.2
Example of an illustration showing how a SSD system works.

5.7 Toll-free "800" numbers

Toll-free information numbers provide quick, easy access for people who have questions, comments or concerns about a site. At a minimum, the NYSDOH site project manager's name and the following "800" number should be shared with the community in fact sheets and transmittal letters, at public gatherings, when samples are collected, and with other outreach techniques for their use if they have health-related questions, concerns or comments related to soil vapor intrusion at the site.

NYSDOH
Center for Environmental Health
Bureau of Environmental Exposure Investigation
Toll-free Information Line

1-800-458-1158, ext. 27850

Note: The "800" number is an *information* line — not a "*hotline*" — because callers may not receive immediate response, such as on nights or weekends.

Similarly, applicable toll-free numbers setup and maintained by other project team members should also be shared with the community whenever appropriate. Additional information on the use of toll-free "800" numbers as an outreach tool is provided in Appendix G.5.

5.8 Door-to-door visits

Door-to-door visits involve gathering or distributing site information by meeting individuals at their residences or businesses. Typically, this outreach technique is used to supplement other communication, such as telephone calls and letters. With respect to soil vapor intrusion, project staff may visit residents near a site to provide information, answer questions, or obtain permission for activities on private properties. All team members should be aware of the specifics of the door-to-door visits (e.g., who will be conducting the visits, the reason, the dates, etc.).

Additional information on conducting door-to-door visits is provided in Appendix G.6.

5.9 Document repositories

A document repository is a collection of documents and other information developed during the investigation and remediation of a site. It is located in a convenient, public facility, such as a library, so that affected and interested members of the public can easily access and review important information about the site. A repository is maintained through the site's operation and maintenance phase, or until its release from the applicable remedial program.

A site document repository helps the public review

a. documents about which the state is seeking public comment;
b. studies, reports and other information; and
c. complete versions of documents summarized in fact sheets, meeting presentations or media releases (summaries should note the locations of local repositories where the complete documents are available).

The member of the project team that establishes and maintains the document repository is determined on a site-specific and/or program-specific basis. Additional guidance on how to establish and maintain a document repository is provided in Appendix G.7.

5.10 Medical community outreach

Outreach to the medical community is an activity or combination of activities undertaken to assist local health care providers in caring for people who have concerns about site-specific environmental exposures. The goal of this type of outreach is to assist the individual provider by giving him/her much of the site-specific information related to the contaminants and to provide information about the site itself. This type of outreach is undertaken whenever the NYSDOH and/or other health agencies determine that the site-specific contaminants may be unfamiliar to the local medical community. Conversely, this outreach can be undertaken when community members express the concern that their health care providers may be unfamiliar with potential adverse health effects related to contaminants at the site.

The targeted audience for this type of outreach consists of specific groups of health care providers most likely to treat people with concerns about potential environmental exposures. Some examples of targeted groups of specialists could include any combination of the following: Family Practice, Internal Medicine, Preventive Medicine, Oncology, Neurology, Allergy, Pediatrics, Obstetrics, Dermatology and Emergency Medicine. Likewise, materials can be sent to medical and nursing schools, residency programs, and medical libraries if they are located nearby. Developing the targeted list of health-care providers is a cooperative effort between local and state departments of health, with input from the community as well.

The NYSDOH, in partnership with the Agency for Toxic Substance and Disease Registry (ATSDR) and the local health department, can conduct these activities, which could include any one or a combination of the following:

a. announcements made at public meetings that the NYSDOH Center for Environmental Health will mail out information packets to individual physicians at the request of any concerned citizen;

b. an article placed in a local newspaper, or, if applicable, in a newsletter periodically sent to residents, stating that the NYSDOH Center for Environmental Health will mail out packets to individual physicians at the request of any concerned citizen. The NYSDOH "800" number and two NYSDOH contact names would be given;

c. an article submitted to the newsletter of the local county medical society, stating that the NYSDOH and the ATSDR have information to help providers with questions about site-related contamination in the area of the site. The NYSDOH "800" number and two NYSDOH contact names would be given; and

d. materials sent to medical and nursing schools, residency programs, and medical libraries if they are located nearby.

Local and state departments of health, and ATSDR, have developed appropriate outreach materials. The information packets should contain a letter to the physician, site-specific fact sheets, brochures, and booklets about potential exposures and about the contaminants in the area of the site. As an example, here is a list of fact sheets and pamphlets that an information packet for a site with PCE and TCE as contaminants of concern might contain:

a. a letter of explanation to the provider, including the NYSDOH "800" number to call for access to more information, as well as two NYSDOH contacts with whom to speak initially;

b. a site-specific fact sheet written for the community, explaining various site-related issues;

c. a compact disc of ATSDR case studies in environmental medicine (CSEMs), with opportunities for earning many free continuing medical education (CME) credits through the Centers for Disease Control and Prevention;

d. a hard copy of both the "Trichloroethylene (TCE) Toxicity" and "Taking an Environmental Exposure History" case studies;

e. two small "quick reference guides" produced by ATSDR about evaluating environmental exposures and doing an exposure history;

f. a NYSDOH fact sheet on Trichloroethene (TCE) in indoor and outdoor air;

g. an ATSDR fact sheet on Trichloroethylene (TCE);

h. a NYSDOH fact sheet on Tetrachloroethene (PERC) in indoor and outdoor air; and

i. an ATSDR fact sheet on Tetrachloroethylene (PERC).

For additional information on this outreach tool, please contact the NYSDOH Center for Environmental Health's Outreach and Education Unit at 1-800-458-1158, extension 27530.

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APPENDIX J

COMMUNITY AIR MONITORING PLAN

Appendix 1A
New York State Department of Health
Generic Community Air Monitoring Plan

Overview

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

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

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

Community Air Monitoring Plan

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

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

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

VOC Monitoring, Response Levels, and Actions

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

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

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

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

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

Particulate Monitoring, Response Levels, and Actions

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

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

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

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

December 2009

Appendix 1B
Fugitive Dust and Particulate Monitoring

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

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

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

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

(a) Objects to be measured: Dust, mists or aerosols;
(b) Measurement Ranges: 0.001 to 400 mg/m3 (1 to 400,000 :ug/m3);
(c) Precision (2-sigma) at constant temperature: +/- 10 :g/m3 for one second averaging; and +/- 1.5 g/m3 for sixty second averaging;
(d) Accuracy: +/- 5% of reading +/- precision (Referred to gravimetric calibration with SAE fine test dust (mmd= 2 to 3 :m, g= 2.5, as aerosolized);
(e) Resolution: 0.1% of reading or 1g/m3, whichever is larger;
(f) Particle Size Range of Maximum Response: 0.1-10;
(g) Total Number of Data Points in Memory: 10,000;
(h) Logged Data: Each data point with average concentration, time/date and data point number
(i) Run Summary: overall average, maximum concentrations, time/date of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration and time/date occurrence, averaging (logging) period, calibration factor, and tag number;
(j) Alarm Averaging Time (user selectable): real-time (1-60 seconds) or STEL (15 minutes), alarms required;
(k) Operating Time: 48 hours (fully charged NiCd battery); continuously with charger;
(l) Operating Temperature: -10 to 50^{o} C (14 to 122^{o} F);
(m) Particulate levels will be monitored upwind and immediately downwind at the working site and integrated over a period not to exceed 15 minutes.

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

5. The action level will be established at 150 ug/m3 (15 minutes average). While conservative,

this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m3, the upwind background level must be confirmed immediately. If the working site particulate measurement is greater than 100 ug/m3 above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see paragraph 7). Should the action level of 150 ug/m3 continue to be exceeded work must stop and DER must be notified as provided in the site design or remedial work plan. The notification shall include a description of the control measures implemented to prevent further exceedances.

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

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

(a) Applying water on haul roads;
(b) Wetting equipment and excavation faces;
(c) Spraying water on buckets during excavation and dumping;
(d) Hauling materials in properly tarped or watertight containers;
(e) Restricting vehicle speeds to 10 mph;
(f) Covering excavated areas and material after excavation activity ceases; and
(g) Reducing the excavation size and/or number of excavations.

Experience has shown that the chance of exceeding the 150ug/m3 action level is remote when the above-mentioned techniques are used. When techniques involving water application are used, care must be taken not to use excess water, which can result in unacceptably wet conditions. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

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

APPENDIX K

RESPONSIBILITIES OF OWNER AND REMEDIAL PARTY

As both the Site owner and the remedial party, Iskalo Ellicottville Holdings LLC is responsible for implementing the Site Management Plan for Former Signore, Inc., Site # C905034.