URS

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SUBMITTED VIA ELECTRONIC MAIL

January 9, 2019

Ms. Danielle Miles, EIT
New York State Department of Environmental Conservation
Region 8
6274 East Avon-Lima Road
Avon, NY 14414-9516

Subject: Soil Vapor Intrusion Evaluation Work Plan
Former Bernzomatic Facility, Village of Medina, New York
NYSDEC BCP Site No. C837018

Dear Ms. Miles,

On behalf of Newell Operating Company (Newell), URS Corporation (URS), an AECOM Company, is providing this Soil Vapor Intrusion Evaluation Work Plan (SVI WP) in response to your letter of October 30, 2018, directing an SVI evaluation to assess current and potential exposures associated with the SVI pathway at the Former Bernzomatic Facility (Site, New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP) Site No. C837018, Sanborn, NY (Figure 1 – Site Location Map). NYSDEC issued the October 30, 2018 direction due to the Change of Use Notification that was submitted by Newell on September 25, 2018 regarding change in ownership of the Site[1]. This SVI WP updates the previously approved 2016 Remedial Investigation Work Plan (RIWP) Soil Vapor Intrusion Studies elements with regulatory updates and current considerations specific to the change in occupancy and use at the Site.

This SVI WP was originally submitted to NYSDEC and New York State Department of Health (NYSDOH) on November 16, 2018; NYSDEC/NYSDOH provided comments on November 28, 2018. URS provided a response to comments for NYSDEC/NYSDOH review on December 13, 2018. NYSDEC/NYSDOH accepted the responses on December 18, 2018. This SVI WP incorporates the December 13, 2018 comments and responses.

INTRODUCTION

The facility located on Site formerly consisted of a storage/assembly/office building (herein referred to as the manufacturing building) and a machining and parts washing area in an older, connected building off the northeast corner of the manufacturing building (herein referred to as the machining building). Figure 2 - Building Floor Plan (2014) presents the operations at the time of closure of the facility in 2014. Due to the detection of chlorinated volatile organic compounds (VOCs) in Site groundwater underlying the eastern portion of the facility (Figure 3 - Groundwater Analytical Results), a limited SVI study was conducted in the manufacturing building as part the 2017 Remedial Investigation. The RI SVI study identified VOC concentrations as presented on Figure 4 - Vapor Intrusion Analytical Results. Although neither of the indoor air/sub-slab vapor sample pairs had combined chlorinated VOC concentrations that triggered a New York State Department of Health (NYSDOH) Soil Vapor/Indoor Air Decision Matrix recommendation for further action, the

[1] The sale of the property to B360 Holdings LLC was recorded on October 16, 2018.

tetrachloroethene (PCE) concentration in one sub-slab vapor sample (SSV-01) resulted in a recommendation of "mitigate" to minimize current or potential exposures.

At the time of the 2017 limited SVI study, the facility was unoccupied and no operations were being performed at the site. The 2016 RIWP stated, "If the building or occupancy use is proposed to change, an SVI will be performed in occupied areas." Therefore, due to the recent change in ownership and the anticipated full-time occupancy of the facility for warehousing and manufacturing operations, NYSDEC and NYSDOH reviewed the Change in Use Notification and have requested an SVI evaluation to assess current and potential exposures associated with the SVI pathway based on these changes.

A summary of the current and change in occupancy and use of the facility, as provided by the purchaser's attorney, is provided below; the information on anticipated future use has been provided by the new owner of the facility and as such the information presented regarding schedule for use and forecast for occupancy has not been developed or verified by URS or Newell:

- Manufacturing Building:
    - "Boom Room"[2]: currently being used for warehousing and currently is occupied by three to four employees up to eight hours/day.
    - Main Room and Enclosed 4 Door Truck Dock: following title transfers anticipated to be used for manufacturing with approximately 75 employees occupying the space for eight hours/day.
- Machining Building:
    - Demo Area 1: anticipated to be demolished in spring 2019.
    - Connecting Corridor, Crane Room, and Enclosed 2 Door Truck Dock: new enclosing exterior walls anticipated to be built along the east side of these areas. Some operations are anticipated to be moved to these areas once the exterior walls are built.

Exhibit 1 - Bernzomatic Drive Medina, New York – Building Layout with Room Names, provided by purchaser's attorney, provides a schematic of the current facility layout with room names. At this time, the SVI evaluation is being conducted in the manufacturing building only. Based on the results of this proposed SVI evaluation and once demolition work has been completed, the need for additional SVI studies will be evaluated.

This SVI WP builds upon the NYSDEC-approved 2016 RIWP (Section 7.0 Soil Vapor Intrusion Studies, provided as Attachment 1) and Quality Assurance Project Plan (QAPP) which are based on NYSDEC DER-10, Technical Guidance for Site Investigation and Remediation (NYSDEC, 2010) and NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York (SVI Guidance; NYSDOH, 2006 and associated updates, provided as Attachment 2).

SCOPE OF WORK

SVI sampling described in this SVI WP will be performed to evaluate for the presence of potential Site-related VOCs at the manufacturing building. Nine sub-slab vapor samples, five indoor air

[2] The "Boom Room" is so named as it was previously a Class I, Division 2 Hazardous Location where the possibility for explosive conditions could occur. This isolated area was established separately from the main manufacturing floor to control potential hazards that could occur in that particular process area.

samples, and one outdoor air sample will be collected as part of this SVI evaluation. The indoor air and sub-slab vapor samples are located within the manufacturing building. Sample location, sample identifications, type of sample to be collected, and rationale for collecting samples is provided in attached Table 1 – Sample Summary. Sample locations are shown on Figure 5 – Post-RI SVI Evaluation Sample Locations. One indoor air duplicate sample and one sub-slab vapor duplicate sample will also be collected for quality control purposes. The locations of the duplicate samples will be determined by the field team at the time of sampling. Table 2 identifies the sample preparation and analytical method, matrix, holding time, containers, and preservatives for the SVI analyses to be performed. Table 3 shows typical QA/QC samples and reporting limits. Tables 2 and 3 are updated from the 2016 RIWP QAPP Table 1 and Table 2, respectively.

Field Methodology

Analytical requirements and methods for the proposed sampling have been updated from the previously approved RIWP/QAPP. The samples will be submitted for VOC analysis using either United States Environmental Protection Agency (USEPA) Method TO-15 or USEPA Method TO-15 low-level, as further discussed below. URS plans to use TestAmerica, a NYSDOH Environmental Laboratory Approval Program (ELAP) laboratory certified for the air and emissions category. Sampling will be conducted in accordance with the 2006 Guidance for Evaluating Soil Vapor Intrusion in the State of New York (SVI guidance, updated in May 2017) during this heating season to emulate worst-case exposure scenario and under expected normal building conditions.

In May 2017, NYSDOH issued updates to soil vapor/indoor air decision matrices. NYSDOH assigned eight VOCs to three newly revised and renamed Soil Vapor/Indoor Air Decision Matrices. In summary, the list of compounds to be analyzed for in this SVI WP includes those on the TO-15 list including the below:

NYSDOH Soil Vapor/Indoor Air Decision Matrix	**Compounds**
Matrix A	carbon tetrachloride 1,1-dichloroethene (1,1-DCE) cis-1,2-dichloroethene (cis-1,2-DCE) trichloroethene (TCE)
Matrix B	methylene chloride (MC) PCE 1,1,1-trichloroethane (1,1,1-TCA)
Matrix C	vinyl chloride (VC)

- In order to achieve reporting levels to allow for comparison to the screening levels in the May 2017 NYSDOH update, sub-slab vapor samples will be analyzed using USEPA Method TO-15 and indoor/outdoor air samples will be analyzed using modified USEPA Method TO-15 low-level.
- Sample reporting limits will meet the 1 microgram per cubic meter ($\mu g/m^3$) or lower reporting limit specified in the RI QAPP.

  In accordance with May 2017 NYSDOH Soil Vapor/Indoor Air Decision Matrix A and C, indoor and outdoor air samples for the following VOCs will meet 0.2 $\mu g/m^3$ reporting limits: TCE, cis-1,2-DCE, 1,1-DCE, carbon tetrachloride, and VC.

- A full ASP Category B data package will be prepared by the laboratory for all samples. Data validation and preparation of a Data Usability Summary Report will be completed in accordance with DER-10 Technical Guidance for Site Investigation and Remediation Section 2.2(a) and Appendix 2B, dated May 3, 2010.

A pre-sampling survey will be performed in accordance with the NYSDOH Indoor Air Quality Questionnaire and Building Inventory form (Attachment 2). The pre-sampling survey will include use of a photoionization detector (PID) capable of detecting parts per billion by volume (ppbv) levels to identify the presence of potential indoor VOC sources prior to collection of indoor air samples. This will help to ensure that potential indoor sources are documented and removed prior to collection of indoor air samples. If indoor sources are found, they will be removed and one day (i.e., approximately 24 hours) will be allowed to pass before performing indoor air sampling.

Data Evaluation

The associated sub-slab vapor, indoor air, and outdoor air results will be evaluated in conjunction with the information collected during the pre-sampling building survey to evaluate whether the data indicate evidence of a complete vapor intrusion pathway. NYSDOH's May 2017 Soil Vapor/Indoor Air Decision Matrices A, B, and C (included as Attachment 3) will be utilized in the interpretation of the analytical results. If indoor air concentrations are not attributable to indoor or outdoor air sources, are greater than the normal range of typical indoor air (i.e., background), and also contain significantly lower concentrations of the target VOCs than sub-slab vapor samples, progression to attenuation factor calculation will be performed to determine whether evidence of a complete vapor intrusion pathway exists. If the observed attenuation factor for a given compound is greater than 0.03, the data suggest that the primary source of the compound detected in indoor air is likely a non-subsurface source (i.e., an indoor air and/or outdoor air source) and the vapor intrusion pathway is considered incomplete. USEPA's June 2015 *Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air* recommends a generic soil vapor to indoor air attenuation factor of 0.03 as a reasonably conservative generic attenuation factor for use in screening sites for a potential vapor intrusion pathway. The recommended attenuation factor of 0.03 is equal to the 95th percentile value observed at sites in USEPA's vapor intrusion database. This means that the observed attenuation factor for 95 percent of the vapor intrusion sites in the USEPA database is less than 0.03. If the data indicates that the potential for exposure is a concern, actions may be recommended.

Work Plan Attachments

The following attachments are provided to this SVI WP:

- Attachment 1 includes the 2016 RIWP Section 7.0 - Soil Vapor Intrusion Studies.
- Attachment 2 includes current field form:
  - NYSDOH Indoor Air Quality Questionnaire and Building Inventory form (accessed at: https://health.ny.gov/environmental/indoors/vapor_intrusion/docs/comprehensive_bqpi.pdf).
- Attachment 3 includes the May 2017 NYSDOH Soil Vapor/Indoor Air Decision Matrices.
  - To be used in conjunction with evaluation methods discussed on pages 3 and 4 of this SVI WP.

SCHEDULE

The anticipated project schedule for the work:

- Conduct sub-slab vapor, indoor air, and outdoor air sampling approximately two weeks following NYSDEC approval of this SVI WP (pending access from current owner).
- Receive Laboratory Analysis Report from laboratory – Anticipated to be received two weeks following sample collection.
- Submit SVI Evaluation Sampling Report to NYSDEC and NYSDOH – Approximately four weeks following receipt of Laboratory Analysis Report.

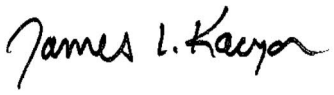
LETTER REPORT

Upon completion of the scope of work outlined above, a letter-report summarizing the results of the sampling activities will be prepared.

Please feel free to contact me via e-mail or at (716) 923-1300 if you have any questions regarding this submittal.

Sincerely yours,

URS Corporation, an AECOM Company



James L. Kaczor, PG
Task Leader
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Tables
Figures
Exhibit
Attachments

cc: Angela Martin – NYSDOH (electronic copy)
Justin Deming – NYSDOH (electronic copy)
Frank Sowers – NYSDEC (electronic copy)
Bernette Schilling – NYSDEC (electronic copy)
Kristin Jones – Newell Operating Company
Jeff Stravino - Hodgson Russ LLP
Galina Georgiew – URS
Kyle Brent - B360 Holdings LLC
Project File 25369237

Tables

Table 1

Sample Summary
Former Bernzomatic Facility - NYSDEC BCP Site No. C837018
Soil Vapor Intrusion Evaluation Work Plan
Medina, NY

Location/Sample ID	Type of Sample to be Collected	Rationale
Main Room		
SSV-01R	Sub-Slab	Re-sample Remedial Investigation sub-slab sample location SSV-01. Approximately 75 employees anticipated for up to eight hours/day.
SSV-03	Sub-Slab	Sample to define extent of elevated PCE concentrations in sub-slab vapor observed during Remedial Investigation at SSV-01. Approximately 75 employees anticipated for up to eight hours/day.
IA-03/SSV-04	Indoor Air/Sub-Slab	Sample to define extent of elevated PCE concentrations in sub-slab vapor observed during Remedial Investigation at SSV-01. Approximately 75 employees anticipated for up to eight hours/day. Obtain current indoor air results for this overall area.
SSV-05	Sub-Slab	Sample to define extent of elevated PCE concentrations in sub-slab vapor observed during Remedial Investigation at SSV-01. Approximately 75 employees anticipated for up to eight hours/day.
SSV-06	Sub-Slab	Area not previously sampled during Remedial Investigation at SSV-01. Approximately 75 employees anticipated for up to eight hours/day.
Main Room Shipping/Receiving Office		
IA-04/SSV-07	Indoor Air/Sub-Slab	Not previously sampled. Area anticipated to have at least one employee for up to eight hours/day.
Main Room 1st Floor Offices		
IA-05/SSV-08	Indoor Air/Sub-Slab	Not previously sampled. Area is located on the first floor of the building and is anticipated to have at least one employee for up to eight hours/day.
Boom Room		
IA-06/SSV-09	Indoor Air/Sub-Slab	Not previously sampled. Area anticipated to continue to be used for warehousing. Three to four employees anticipated for up to eight hours/day.
Cafeteria		
IA-07/SSV-10	Indoor Air/Sub-Slab	Not previously sampled. Area is located on the first floor, immediately west of Remedial Investigation sub-slab sample location SSV-02. Area anticipated to be used for Cafeteria space. Approximately 75 employees may have access to this area.
Outdoors		
OA-02	Outdoor Air	Outdoor ambient air sample collected concurrently with the indoor air samples to determine the extent to which outdoor sources may be influencing indoor air quality within the sampling area.
Quality Control Samples		
DUP-02	Sub-Slab	One sub-slab vapor duplicate sample will also be collected for quality control purposes.
DUP-03	Indoor Air Duplicate	One indoor duplicate sample will also be collected for quality control purposes.

SSV-XX - sub-slab vapor sample ID
IA-XX - indoor air sample ID
OA-XX - outdoor air sample ID
DUP-XX - duplicate sample ID
PCE - Tetrachloroethene

Table 2

Sample Bottle, Volume, Preservation, and Holding Time Summary
Former Bernzomatic Facility - NYSDEC BCP Site No. C837018
Soil Vapor Intrusion Evaluation Work Plan
Medina, NY

MATRIX/ANALYSIS	Sample Prep Method	Analytical Method [1]	Sample Bottles [2]				Minimum Vol Rqd	Preservation	Holding Time [3]		Comment
			Mat'l	Size	Qty	Source			Extraction	Analysis	
Air/Vapor Samples											
Sub-slab Vapor: Volatile Organics	NA	EPA TO-15 [5]	Stainless Steel	6 L [4]	1	Lab	400 mL	None	NA	30 days	Summa canister; certified clean by laboratory.
Indoor/Outdoor air samples: Volatile Organics	NA	EPA TO-15 low-level [5]	Stainless Steel	6 L [4]	1	Lab	400 mL	None	NA	30 days	Summa canister; certified clean by laboratory.

(1) Most recent version of method may be used subject to URS approval
(2) Bottles typical.
(3) Holding time calculated from day of collection, unless noted as being from time of extraction. Laboratory holding times (ASP 2005, Exhibit I) are two days shorter to allow for field handling and shippin
(4) Smaller canisters (e.g., 1.4 L "mini-cans") may be appropriate for some purposes on a case-by-case basis
(5) Sample reporting limits will meet the 1 microgram per cubic meter (µg/m3) or lower reporting limit specified in the 2016 RIWP QAPP. In accordance with May 2017 NYSDOH Soil Vapor/Indoor Air Decision Matrix A and Matrix C, indoor air and outdoor a samples for the following VOCs will meet 0.2 µg/m3 reporting limits: TCE, cis-1,2-DCE, 1,1-DCE, carbon tetrachloride, and VC.
EPA = Compendium of Methods for the Determination of Toxic Organics in Air, Second Edition (EPA/625/R-96/010b; 1999)

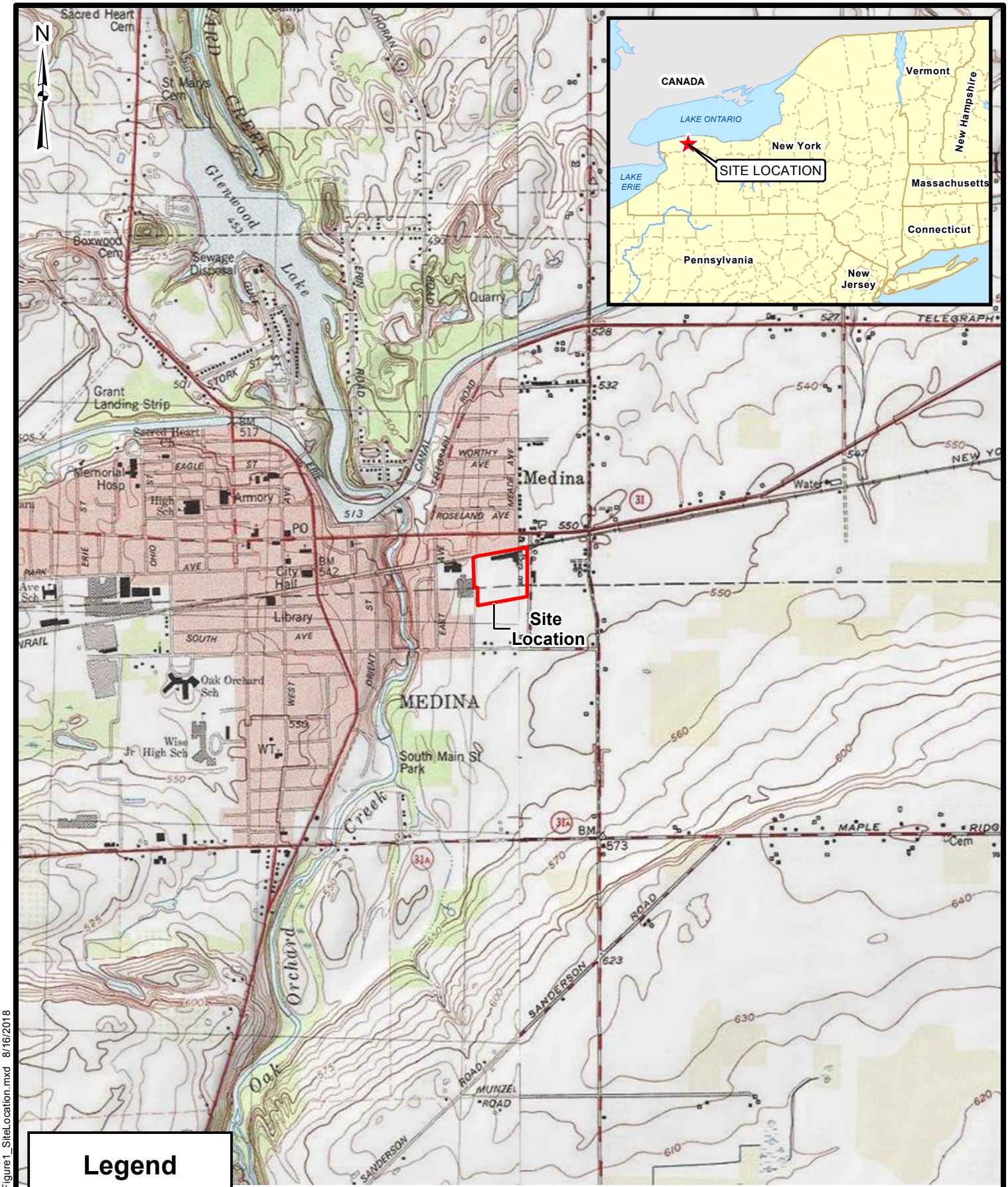
Table 3

Reporting Limits and QA/QC Sample Quantity Summary
Former Bernzomatic Facility - NYSDEC BCP Site No. C837018
Soil Vapor Intrusion Evaluation Work Plan
Medina, NY

MATRIX/ANALYSIS	Analytical Method	Laboratory	Reporting Limit -Typical (units as specified)	Field Sample Quantity	Matrix Spike (MS) or LCS	MS Duplicate or Matrix Duplicate	Field Duplicate	Equipment Blank	Trip Blank	Total Analyses
Air/Vapor Samples										
Sub-slab Vapor: Volatile Organics	EPA TO-15	Test America	0.2 - 1 µg/m^3 (1)	9	-	-	1	NA	NA	10
Indoor/Outdoor air samples: Volatile Organics	EPA TO-15 low-level	Test America	0.2 - 1 µg/m^3 (1)	6	-	-	1	NA	NA	7

Notes
(1) Sample reporting limits will meet the 1 microgram per cubic meter (µg/m3) or lower reporting limit specified in the 2016 RIWP QAPP. In accordance with May 2017 NYSDOH Soil Vapor/Indoor Air Decision Matrix A and Matrix C, indoor air and outdoor air samples for the following VOCs will meet 0.2 µg/m3 reporting limits: TCE, cis-1,2-DCE, 1,1-DCE, carbon tetrachloride, and VC.

Figures



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FORMER BERNZOMATIC FACILITY
VILLAGE OF MEDINA, NEW YORK
SITE LOCATION MAP

FIGURE 1

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N

METAL SHAVINGS STAGING TRAILER
SEALED SUMP
STORAGE OF METAL WASTE
WC
STORAGE OF RAW MATERIALS
EXTERNAL STORAGE OF EQUIP. (TEMPORARY)
LOADING DOCK
TRENCH DRAIN
SUMP
MACHINING
VIRGIN OIL SUPPLY
USED OIL STORAGE TANKS AND BERM
LOADING DOCK
WAREHOUSE STORAGE
WAREHOUSE STORAGE
WAREHOUSE STORAGE
ASSEMBLY AREA
PACKING AREA
PRINTING AREA
CAFETERIA
550-GAL. DIESEL AST
OFFICE AREA (2 FLOORS)
PARTS WASHING AREA
ACTIVE FLOOR DRAIN
FLAMMABLE PRODUCTS STORAGE (CLOSETS)
SEALED TRENCH DRAIN
MAINT. DEPT.
ELECTRIC SWITCHBOARD

50 0 50 Feet

FORMER BERNZOMATIC FACILITY
VILLAGE OF MEDINA, NEW YORK
BUILDING FLOOR PLAN
(2014)

URS

FIGURE 2

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N

GSP-19	CRIT	04/15
VOCs:		
1,2-Dichloroethene (cis)	5	11
Tetrachloroethene	5	22
Trichloroethene	5	7.7

GSP-31	CRIT	06/15
VOCs:		
1,1-Dichloroethane	5	22
1,2-Dichloroethene (cis)	5	390
1,2-Dichloropropane	1	2
Trichloroethene	5	13
Vinyl chloride	2	2.8

GSP-22	CRIT	04/15
VOCs:		
1,2-Dichloroethene (cis)	5	170
Tetrachloroethene	5	6.5
Trichloroethene	5	28
Vinyl chloride	2	7.5

MW-17	CRIT	03/17
Metals:		
Iron	300	2700
Magnesium	35000	47300
Manganese	300	2400
Sodium	20000	67200

GSP-01	CRIT	03/15
VOCs:		
Chloroform	7	50
Tetrachloroethene	5	15
Trichloroethene	5	14

SB-03	CRIT	05/14	09/15
Metals:			
Arsenic	25	121	42
Barium	1000	2600	BC
Cadmium	5	32.2	BC
Chromium	50	528	64
Lead	25	430	60
Iron	300	BC	96500
Magnesium	35000	BC	115000
Manganese	300	BC	3600
Nickel	100	BC	120
Sodium	20000	BC	31200
Dissolved Metals:			
Arsenic	25	122	BC
Barium	1000	2680	BC
Cadmium	5	32.1	BC
Chromium	50	535	BC
Lead	25	450	BC
Magnesium	35000	BC	49000
Manganese	300	BC	1400
Sodium	20000	BC	31600

GSP-02	CRIT	03/15
VOCs:		
Tetrachloroethene	5	9.9

MW-18	CRIT	03/17
Metals:		
Iron	300	6000
Manganese	300	4000
Sodium	20000	147000

GSP-04	CRIT	03/15
VOCs:		
1,2-Dichloroethene (cis)	5	72

SB-04	CRIT	05/14
VOCs:		
1,2-Dichloroethene (cis)	5	14
Tetrachloroethene	5	36
Trichloroethene	5	24
Metals:		
Arsenic	25	48
Chromium	50	122
Lead	25	63

MW-16	CRIT	03/17
Metals:		
Iron	300	950
Manganese	300	7400
Sodium	20000	332000

GSP-14	CRIT	04/15
VOCs:		
1,2-Dichloroethene (cis)	5	35
Trichloroethene	5	11
Vinyl chloride	2	8.1

MW-06	CRIT	10/14
VOCs:		
1,2-Dichloroethene (cis)	5	63
1,2-Dichloroethene (trans)	5	7.1
Tetrachloroethene	5	18
Trichloroethene	5	25

MW-10	CRIT	02/15
VOCs:		
Acetone	50	80

MW-15	CRIT	03/17
Metals:		
Iron	300	360
Manganese	300	1200
Sodium	20000	81400

MW-21	CRIT	03/17
VOCs:		
1,2-Dichloroethene (cis)	5	23
Trichloroethene	5	11
Metals:		
Iron	300	1500
Magnesium	35000	82700
Sodium	20000	1900000

MW-07	CRIT	10/14
VOCs:		
Tetrachloroethene	5	10
Trichloroethene	5	13

GSP-08	CRIT	03/15
VOCs:		
1,1,2-Trichloro-1,2,2-trifluoroethane	5	6.2
1,2-Dichloroethene (cis)	5	6.5
Trichloroethene	5	15

GSP-10	CRIT	03/15
VOCs:		
Trichloroethene	5	6.7

MW-20	CRIT	03/17
VOCs:		
Trichloroethene	5	8.6
Metals:		
Iron	300	580

GSP-26	CRIT	06/15
VOCs:		
Trichloroethene	5	13

GSP-24	CRIT	04/15
VOCs:		
1,1,1-Trichloroethane	5	21
1,1-Dichloroethane	5	87
1,1-Dichloroethene	5	8.8
1,2-Dichloroethene (cis)	5	440
Tetrachloroethene	5	7.1
Trichloroethene	5	11
Vinyl chloride	2	3.6
Xylene (total)	5	9.4

GSP-33	CRIT	06/15
VOCs:		
Trichloroethene	5	7.5

GSP-34	CRIT	06/15
VOCs:		
Trichloroethene	5	16

MW-04	CRIT	03/17
VOCs:		
1,2-Dichloroethene (cis)	5	20
Trichloroethene	5	15
Vinyl chloride	2	3.8

MW-01	CRIT	10/14	03/17
VOCs:			
1,2-Dichloroethene (cis)	5	13	15
Vinyl chloride	2	BC	15

SB-02	CRIT	05/14
Metals:		
Arsenic	25	68
Barium	1000	2700
Cadmium	5	22.6
Chromium	50	429
Lead	25	208

MW-14	CRIT	03/17
Metals:		
Iron	300	1300
Manganese	300	570
Sodium	20000	103000

GSP-25	CRIT	04/15
VOCs:		
1,2-Dichloroethene (cis)	5	32
Tetrachloroethene	5	8.8
Trichloroethene	5	7.7

GSP-21	CRIT	04/15
VOCs:		
1,2-Dichloroethene (cis)	5	5.3

MW-19	CRIT	03/17
Metals:		
Iron	300	21000
Manganese	300	8600
Sodium	20000	34200

SB-01	CRIT	05/14
VOCs:		
Tetrachloroethene	5	6.8
Trichloroethene	5	5.4
Metals:		
Arsenic	25	172
Barium	1000	1850
Cadmium	5	25.6
Chromium	50	462
Lead	25	224

MW-11	CRIT	02/15	03/17
VOCs:			
1,2-Dichloroethene (cis)	5	8.2	BC
Trichloroethene	5	18	13
Metals:			
Manganese	300	BC	1300
Sodium	20000	BC	37100

GSP-13	CRIT	03/15
VOCs:		
1,1-Dichloroethane	5	11
1,2-Dichloroethene (cis)	5	53
Tetrachloroethene	5	18
Trichloroethene	5	72
Vinyl chloride	2	3.3

GSP-17 GSP-18 GSP-16 GSP-15 GSP-30 GSP-29 GSP-28 GSP-27 GSP-03 MW-09 GSP-05 GSP-06 MW-05 MW-08 GSP-09 GSP-07 GSP-23 GSP-20 GSP-11 GSP-12 GSP-35 GSP-36 GSP-32 MW-02 MW-12 MW-03 MW-13

Legend

- At Least One Compound Exceeds Criteria
- No Compounds Exceed Criteria
- No Compounds Detected
- PH I ESA REC
- Cistern

Location ID | Criteria | Sample Date

SB-04	CRIT	05/14
VOCs:		
Trichloroethene	5	24

Parameter | Criteria Value (µg/L) | Concentration (µg/L)

Criteria: NYSDEC TOGS (1.1.1), Ambient water quality standards and guidance values and groundwater effluent limitations
Source: NYS Digital Ortho-Imagery Program, Orleans County, 2015

Note: BC = Below Criteria

100 0 100 Feet

FORMER BERNZOMATIC FACILITY
VILLAGE OF MEDINA, NEW YORK
GROUNDWATER ANALYTICAL RESULTS

URS

FIGURE 3

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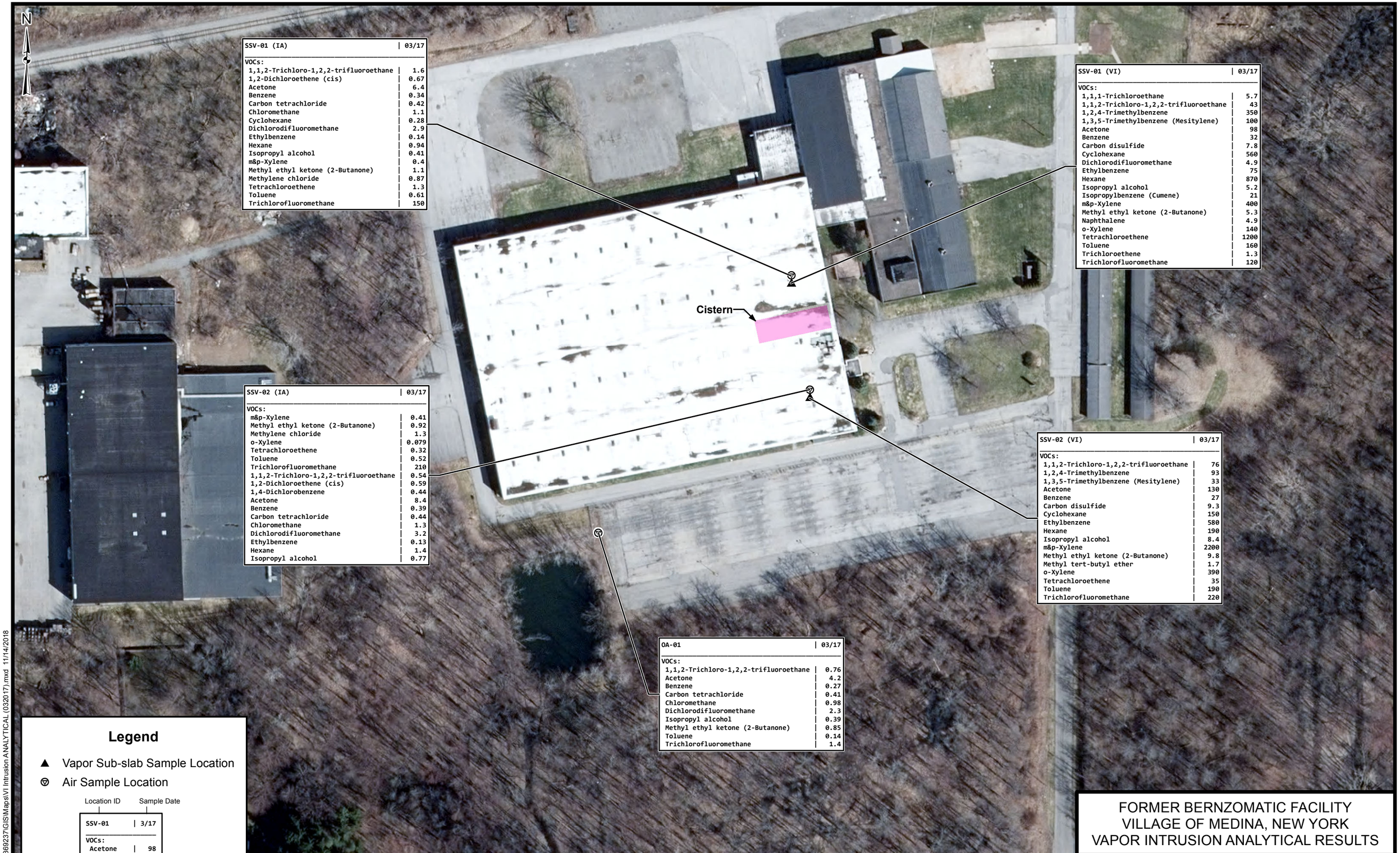


SSV-01 (IA)	03/17
VOCs:	
1,1,2-Trichloro-1,2,2-trifluoroethane	1.6
1,2-Dichloroethene (cis)	0.67
Acetone	6.4
Benzene	0.34
Carbon tetrachloride	0.42
Chloromethane	1.1
Cyclohexane	0.28
Dichlorodifluoromethane	2.9
Ethylbenzene	0.14
Hexane	0.94
Isopropyl alcohol	0.41
m&p-Xylene	0.4
Methyl ethyl ketone (2-Butanone)	1.1
Methylene chloride	0.87
Tetrachloroethene	1.3
Toluene	0.61
Trichlorofluoromethane	150

SSV-01 (VI)	03/17
VOCs:	
1,1,1-Trichloroethane	5.7
1,1,2-Trichloro-1,2,2-trifluoroethane	43
1,2,4-Trimethylbenzene	350
1,3,5-Trimethylbenzene (Mesitylene)	100
Acetone	98
Benzene	32
Carbon disulfide	7.8
Cyclohexane	560
Dichlorodifluoromethane	4.9
Ethylbenzene	75
Hexane	870
Isopropyl alcohol	5.2
Isopropylbenzene (Cumene)	21
m&p-Xylene	400
Methyl ethyl ketone (2-Butanone)	5.3
Naphthalene	4.9
o-Xylene	140
Tetrachloroethene	1200
Toluene	160
Trichloroethene	1.3
Trichlorofluoromethane	120

SSV-02 (IA)	03/17
VOCs:	
m&p-Xylene	0.41
Methyl ethyl ketone (2-Butanone)	0.92
Methylene chloride	1.3
o-Xylene	0.079
Tetrachloroethene	0.32
Toluene	0.52
Trichlorofluoromethane	210
1,1,2-Trichloro-1,2,2-trifluoroethane	0.54
1,2-Dichloroethene (cis)	0.59
1,4-Dichlorobenzene	0.44
Acetone	8.4
Benzene	0.39
Carbon tetrachloride	0.44
Chloromethane	1.3
Dichlorodifluoromethane	3.2
Ethylbenzene	0.13
Hexane	1.4
Isopropyl alcohol	0.77

SSV-02 (VI)	03/17
VOCs:	
1,1,2-Trichloro-1,2,2-trifluoroethane	76
1,2,4-Trimethylbenzene	93
1,3,5-Trimethylbenzene (Mesitylene)	33
Acetone	130
Benzene	27
Carbon disulfide	9.3
Cyclohexane	150
Ethylbenzene	580
Hexane	190
Isopropyl alcohol	8.4
m&p-Xylene	2200
Methyl ethyl ketone (2-Butanone)	9.8
Methyl tert-butyl ether	1.7
o-Xylene	390
Tetrachloroethene	35
Toluene	190
Trichlorofluoromethane	220

OA-01	03/17
VOCs:	
1,1,2-Trichloro-1,2,2-trifluoroethane	0.76
Acetone	4.2
Benzene	0.27
Carbon tetrachloride	0.41
Chloromethane	0.98
Dichlorodifluoromethane	2.3
Isopropyl alcohol	0.39
Methyl ethyl ketone (2-Butanone)	0.85
Toluene	0.14
Trichlorofluoromethane	1.4

Legend

- ▲ Vapor Sub-slab Sample Location
- ▽ Air Sample Location

Location ID | Sample Date

SSV-01	3/17
VOCs:	
Acetone	98

Parameter | Concentration ($\mu g/m^3$)

Note: IA = Indoor Air Sample
OA = Outdoor Air Sample
Source: NYS Digital Ortho-Imagery Program, Orleans County, 2015

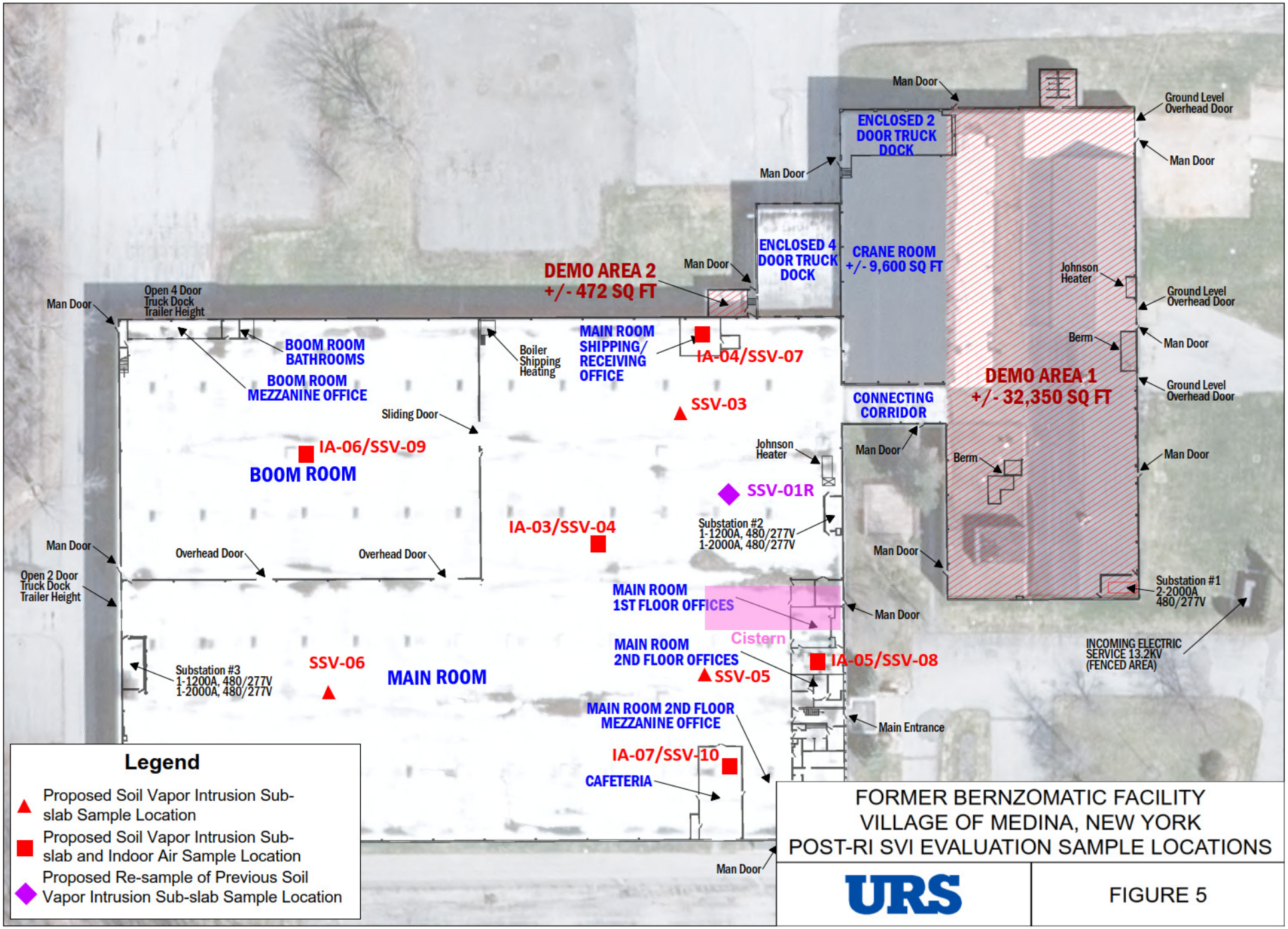
100 0 100 Feet

FORMER BERNZOMATIC FACILITY
VILLAGE OF MEDINA, NEW YORK
VAPOR INTRUSION ANALYTICAL RESULTS

URS

FIGURE 4

J:\Projects\25369237\GIS\Maps\VI Intrusion ANALYTICAL (032017).mxd 11/14/2018



FORMER BERNZOMATIC FACILITY
VILLAGE OF MEDINA, NEW YORK
POST-RI SVI EVALUATION SAMPLE LOCATIONS

URS

FIGURE 5

Base Image: Received from Barclay Damon LLP, Oct. 15, 2018

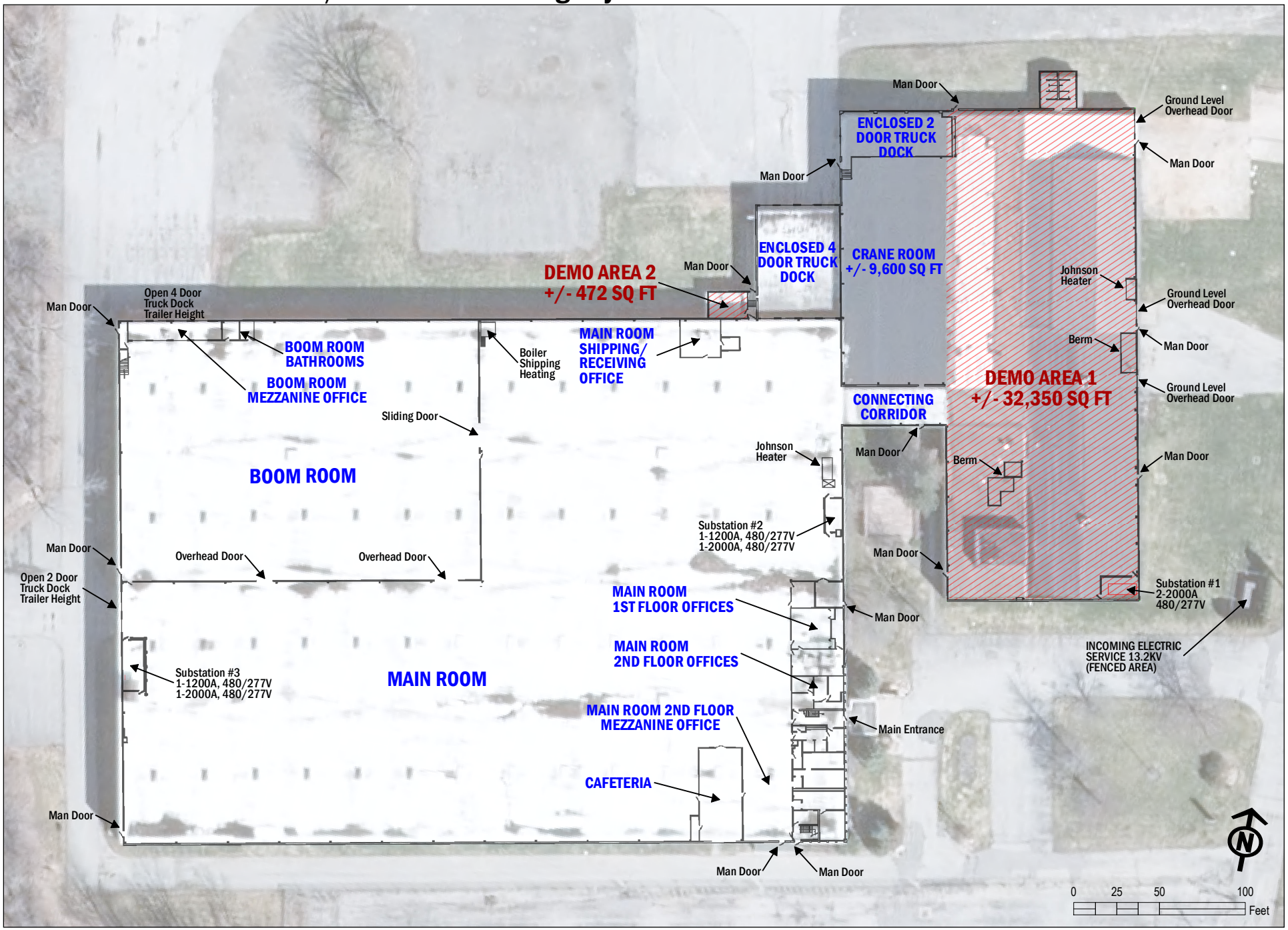
Not to Scale

Exhibit 1

Bernzomatic Drive Medina, New York – Building Layout with Room Names

Bernzomatic Drive Medina, New York - Building Layout with Room Names

Exhibit 1



Base Image: Received from Barclay Damon LLP, Oct. 15, 2018

Attachment 1

2016 Remedial Investigation Work Plan (with redline/strikeout updates effective January 2019)

- Section 7.0 Soil Vapor Intrusion Studies (Rev. 01/07/2019)

7.0 Soil Vapor Intrusion Studies

Because of the detection of chlorinated VOCs in Site groundwater, a limited SVI study will be performed. The SVI will be performed at ~~two~~ designated locations (~~north and south of the cistern area) of~~ in the new manufacturing building in the area where offices are located. The SVI is planned to be conducted in occupied areas of the new manufacturing building. The old portion of the building is not anticipated to be occupied; therefore no SVI is proposed for this portion of the building. If the building or occupancy use is proposed to change, an SVI will be performed in occupied areas. The SVI will be completed during normal operating conditions in the heating season (typically November to April).

A pre-sampling inspection and inventory will be performed in the proposed sampling areas. The inspection will evaluate the type of structure, floor layout, air flows, and physical condition of the building. This information, along with information on sources of potential indoor air contamination, will be identified on inventory forms.

A product inventory will be provided for each room to identify the presence of chemicals and products that could potentially impact the SVI evaluation. The presence and description of odors (e.g., solvents) and portable vapor monitoring equipment readings will also be noted. ~~As the building is currently unoccupied, potential active disturbances and chemicals are expected to be minimal to non-existent~~.

7.1 Building Survey and Product Inventory

As required by the SVI Guidance, a building survey will be performed to identify and minimize conditions that may interfere with the proposed testing prior to collecting samples at each structure. The building survey will evaluate the type of building structure, floor layout, air-flow patterns (e.g., using smoke tubes), and the physical condition of the buildings being studied. Information obtained during the building survey, including information on sources of potential indoor air contamination, will be identified on the NYSDOH Indoor Air Quality Questionnaire and Building Inventory Form (NYSDOH, ~~2006~~ revised 2007; Appendix B). As shown in NYSDOH Appendix B, specific information to be evaluated and noted during the building survey includes the following:

- Occupant name(s) and address;
- Owner or landlord information;
- Building characteristics (e.g., commercial/industrial, number of units/tenants, number of floors, building age, etc.);

- Construction characteristics, including foundation cracks and utility penetrations, ceiling construction and firewall separations, or other openings that may serve as preferential pathways for vapor intrusion;
- Heating, ventilation, and air conditioning systems, including the type of heating system(s), type of fuel used, presence of a boiler/furnace, presence of aboveground or underground storage tanks, type(s) of air conditioning, and the presence of air distribution ducts;
- Occupancy and the general use of each floor;
- Factors that may influence indoor air quality, including attached garages, separate heating units in the garage, petroleum-powered machines stored in the garage, workshop or craft area, smoking in the building, exhaust fans in the kitchen or bathrooms, new carpets, fresh paints, etc.; and,
- Type of water supply and sewage disposal.

A product inventory will be conducted to identify chemicals and products that may bias sampling results. Product names and chemical ingredients listed on container labels will be recorded. If the ingredients are not listed on the label, the product's exact and full name, and manufacturer information, will be recorded. Chemicals or products that are noted as being stored in a questionable manner (e.g., in an open container), that emit odor, or yield positive field screening results will need to be controlled during the indoor air quality sampling to reduce potential interferences. Control options will be discussed with the building occupant and will include removal of the container (preferred option) or tightly sealing the containers.

The presence and description of odors and portable vapor monitoring equipment readings (e.g., PID readings) will be noted. Photographs will also be taken as appropriate during the building survey. Floor plans will be sketched to indicate sub-slab soil vapor and indoor air sampling locations, possible indoor air pollution sources, and PID meter readings. The PID meter will have a detection limit of 1 part per million (ppm).

The building superintendent/facility manager will also be questioned to provide information regarding the location of any potential utilities in the locations that are to be sampled.

7.2 Sub-Slab Soil Vapor Sampling

Sub-slab soil gas samples will be collected from the newer portion of the main manufacturing building~~; see Figure 7 for approximate locations (to be finalized after mobilization and evaluation of building interior)~~.

In accordance with NYSDOH SVI Guidance (October 2006), a temporary sample point will be advanced to collect sub-slab soil gas sample at pre-selected locations. If possible, the heating/cooling system will be operated continuously to maintain a normal temperature (i.e., 65º to 75º F) for at least 24 hours prior to and during the scheduled sampling time. The samples will be collected from a depth of approximately 2 to 6 inches below the floor slab.

The following steps will be taken to collect samples:

1. A 3/8-inch diameter or maximum 1-inch diameter hole will be drilled through the building floor at the proposed sub-slab soil vapor location with a hammer drill.
2. Upon the confirmation of slab thickness, the drill bit will be advanced approximately 3 inches into the sub-slab material to create an open cavity.
3. The vapor probe will then be installed and set flush with the top of the ground surface. The annular space will be sealed using either modeling clay, beeswax, or other non-volatile emitting material and non-shrinking product.
4. Prior to collection of samples, the temporary vapor probe will be purged by drawing three volumes through the probe using a 60 mL syringe. A tracer gas will be used to verify that infiltration of building air is not occurring.
5. Teflon-lined tubing will be connected to a pre-evacuated 6-Liter (L) summa canister with an 8-hour regulator.
6. Sufficient time will be provided for the sealing material to set prior to connecting the vapor probe to a Teflon tube.
7. Upon completion of the purging, the Summa canister will be connected to the probe by Teflon-lined tubing. The flow rate will be regulated using a flow regulator to maintain a flow rate during of about 4 mL/min.
8. Upon completion of the 8-hour period, the Summa canister will be retrieved. Prior to disconnecting the Teflon tubing connections, the Summa canister valve will be closed.

During the sampling, the initial and final vacuum readings of each canister will be noted in a Field Form. In addition, smoke tubes will be used during the sub-slab sampling to confirm pressure relationships and airflow patterns, especially between floor levels and sub-slab. Upon completion of the sample collection and screening steps, each penetration hole advanced through the slab will be patched with cement or will be repaired to restore pre-sampling conditions.

7.2.1 Indoor and Outdoor Air Sampling

~~An indoor air sample is~~ Indoor air samples are proposed to be collected within the newer portion of the main manufacturing building. In addition, an outdoor ambient air sample will be collected concurrently with the indoor air sample to determine the extent to which outdoor sources may be influencing indoor air quality within the sampling area.

As specified in the SVI Guidance (NYSDOH, 2006), to reduce the potential for interference and dilution effects, the occupants (currently only the facility manager) of the building to be sampled will be requested to refrain from the activities listed below for the 24-hour period prior to and during the ambient air sampling collection:

- Opening any windows, fireplace dampers, openings or vents;
- Operating any ventilation fans unless special arrangements are made;

- Smoking in the building;
- Painting;
- Using a wood stove, fireplace, or other auxiliary heating equipment (e.g., kerosene heater);
- Operating or storing an automobile in the building or an attached garage;
- Allowing containers of gasoline or oil to remain within the building or garage area, except for fuel oil tanks;
- Cleaning, waxing or polishing furniture, floors or other woodwork with petroleum or oil-based products;
- Using air fresheners, scented candles, or odor eliminators;
- Engaging in any hobbies that use materials containing volatile chemicals;
- Using cosmetics including hairspray, nail polish, nail polish removers, perfume/cologne, etc.;
- Lawn mowing, paving with asphalt, or snow blowing;
- Applying pesticides; and,
- Using building repair or maintenance products, such as caulk or roofing tar.

Indoor air and outdoor air samples will be collected concurrently with the sub-slab soil vapor sampling. The indoor and outdoor air samples will be collected from the breathing zone height (i.e., 4 to 6 ft above the floor). The indoor air and outdoor air samples will be collected using 6-L Summa canisters over an 8-hour period, the anticipated work shift duration. A section of disposable Teflon-lined tubing will be extended from the Summa canister to collect the indoor and outdoor air samples from the breathing zone in accordance with the SVI Guidance (NYSDOH, 2006).

The field sampling team will maintain a sample log sheet summarizing the sample identification, date and time of sample collection, identification of samplers, sampling methods and devices utilized, vacuum of canisters before and after samples are collected, and sample analyses.

7.3 Site Restoration

If necessary, upon completion of soil vapor or sub-slab soil vapor sampling, URS's subcontractor will repair the carpet/floor tile to restore the work area to its previous conditions. The nature and extent of site restoration that will be required upon completion of the VI sampling will be determined on a case-by-case basis.

7.4 Soil Vapor Sample Analytical Requirements

URS plans to use TestAmerica, a NYSDOH ELAP laboratory certified for the air and emissions category. The Summa canisters will be certified clean (batch certification) by the laboratory. Air samples will be analyzed for VOCs by USEPA Method TO-15.

For indoor air samples and outdoor air samples, the required detection limit for TCE, carbon tetrachloride, cis-1,2-dichlorethene, 1,1-dichlorethene, and vinyl chloride (the ~~three~~ "Matrix 1" and "Matrix 3" compounds from the May 2017 decision matrices update to the SVI Guidance ~~compounds)~~ is 0.25~~-~~ micrograms per cubic meter ($\mu g/m^3$). For the remaining compounds, the

reporting limit will be 1.0 µg/m^3 (sub-slab soil vapor, indoor air, and outdoor air samples). The laboratory-specific detection limits and quantitation limits for TO-15 analytes are included in the QAPP.

7.4.1 Decontamination Procedures

Only dedicated equipment (canisters, tubing, etc.) will be used during sampling. All non-dedicated equipment (i.e. flow meters, etc.) will be purged with air prior to sampling. As such, no field decontamination is necessary for air sampling. Summa canisters will be decontaminated by the analytical laboratory and certification of cleanliness will be included in the analytical data report.

7.5 Reference

NYSDOH SVI Guidance (October 2006 and Updates), accessed January 2019
https://health.ny.gov/environmental/investigations/soil_gas/svi_guidance/

Attachment 2

NYSDOH Indoor Air Quality Questionnaire and Building Inventory Form

NEW YORK STATE DEPARTMENT OF HEALTH
INDOOR AIR QUALITY QUESTIONNAIRE AND BUILDING INVENTORY
CENTER FOR ENVIRONMENTAL HEALTH

This form must be completed for each residence involved in indoor air testing.

Preparer's Name _____ Date/Time Prepared _____

Preparer's Affiliation _____ Phone No._____

Purpose of Investigation_____

1. OCCUPANT:

Interviewed: Y / N

Last Name: _____ First Name: _____

Address: _____

County: _____

Home Phone: _____ Office Phone: _____

Number of Occupants/persons at this location _____ Age of Occupants _____

2. OWNER OR LANDLORD: (Check if same as occupant ___)

Interviewed: Y / N

Last Name: _____First Name: _____

Address: _____

County: _____

Home Phone: _____ Office Phone: _____

3. BUILDING CHARACTERISTICS

Type of Building: (Circle appropriate response)

Residential	School	Commercial/Multi-use
Industrial	Church	Other: _____

If the property is residential, type? (Circle appropriate response)

Ranch	2-Family	3-Family
Raised Ranch	Split Level	Colonial
Cape Cod	Contemporary	Mobile Home
Duplex	Apartment House	Townhouses/Condos
Modular	Log Home	Other:_____

If multiple units, how many? _____

If the property is commercial, type?

Business Type(s) _____

Does it include residences (i.e., multi-use)? Y / N If yes, how many? _____

Other characteristics:

Number of floors_____ Building age_____

Is the building insulated? Y / N How air tight? Tight / Average / Not Tight

4. AIRFLOW

Use air current tubes or tracer smoke to evaluate airflow patterns and qualitatively describe:

Airflow between floors

_____

_____

_____

Airflow near source

_____

_____

_____

Outdoor air infiltration

_____

_____

_____

Infiltration into air ducts

_____

_____

_____

5. BASEMENT AND CONSTRUCTION CHARACTERISTICS (Circle all that apply)

a. Above grade construction:	wood frame	concrete	stone	brick
b. Basement type:	full	crawlspace	slab	other _____
c. Basement floor:	concrete	dirt	stone	other _____
d. Basement floor:	uncovered	covered	covered with _____	
e. Concrete floor:	unsealed	sealed	sealed with _____	
f. Foundation walls:	poured	block	stone	other _____
g. Foundation walls:	unsealed	sealed	sealed with _____	
h. The basement is:	wet	damp	dry	moldy
i. The basement is:	finished	unfinished	partially finished	
j. Sump present?	Y / N			
k. Water in sump?	Y / N / not applicable			

Basement/Lowest level depth below grade: _____(feet)

Identify potential soil vapor entry points and approximate size (e.g., cracks, utility ports, drains)

_____

_____

6. HEATING, VENTING and AIR CONDITIONING (Circle all that apply)

Type of heating system(s) used in this building: (circle all that apply – note primary)

Hot air circulation	Heat pump	Hot water baseboard	
Space Heaters	Steam radiation	Radiant floor	
Electric baseboard	Wood stove	Outdoor wood boiler	Other _____

The primary type of fuel used is:

Natural Gas	Fuel Oil	Kerosene
Electric	Propane	Solar
Wood	Coal	

Domestic hot water tank fueled by: _____

Boiler/furnace located in:	Basement	Outdoors	Main Floor	Other_____
Air conditioning:	Central Air	Window units	Open Windows	None

Are there air distribution ducts present? Y / N

Describe the supply and cold air return ductwork, and its condition where visible, including whether there is a cold air return and the tightness of duct joints. Indicate the locations on the floor plan diagram.

_____

_____

_____

_____

7. OCCUPANCY

Is basement/lowest level occupied? Full-time Occasionally Seldom Almost Never

Level	**General Use of Each Floor (e.g., familyroom, bedroom, laundry, workshop, storage)**
Basement	_____
1st Floor	_____
2nd Floor	_____
3rd Floor	_____
4th Floor	_____

8. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY

a. Is there an attached garage? Y / N

b. Does the garage have a separate heating unit? Y / N / NA

c. Are petroleum-powered machines or vehicles stored in the garage (e.g., lawnmower, atv, car) Y / N / NA
Please specify_____

d. Has the building ever had a fire? Y / N When?_____

e. Is a kerosene or unvented gas space heater present? Y / N Where? _____

f. Is there a workshop or hobby/craft area? Y / N Where & Type? _____

g. Is there smoking in the building? Y / N How frequently? _____

h. Have cleaning products been used recently? Y / N When & Type? _____

i. Have cosmetic products been used recently? Y / N When & Type? _____

j. Has painting/staining been done in the last 6 months? Y / N Where & When? _____

k. Is there new carpet, drapes or other textiles? Y / N Where & When? _____

l. Have air fresheners been used recently? Y / N When & Type? _____

m. Is there a kitchen exhaust fan? Y / N If yes, where vented?_____

n. Is there a bathroom exhaust fan? Y / N If yes, where vented?_____

o. Is there a clothes dryer? Y / N If yes, is it vented outside? Y / N

p. Has there been a pesticide application? Y / N When & Type?_____

Are there odors in the building? Y / N
If yes, please describe: _____

Do any of the building occupants use solvents at work? Y / N
(e.g., chemical manufacturing or laboratory, auto mechanic or auto body shop, painting, fuel oil delivery, boiler mechanic, pesticide application, cosmetologist)

If yes, what types of solvents are used? _____

If yes, are their clothes washed at work? Y / N

Do any of the building occupants regularly use or work at a dry-cleaning service? (Circle appropriate response)

Yes, use dry-cleaning regularly (weekly) No
Yes, use dry-cleaning infrequently (monthly or less) Unknown
Yes, work at a dry-cleaning service

Is there a radon mitigation system for the building/structure? Y / N Date of Installation: _____
Is the system active or passive? Active/Passive

9. WATER AND SEWAGE

Water Supply:	Public Water	Drilled Well	Driven Well	Dug Well	Other: _____
Sewage Disposal:	Public Sewer	Septic Tank	Leach Field	Dry Well	Other: _____

10. RELOCATION INFORMATION (for oil spill residential emergency)

a. Provide reasons why relocation is recommended: _____

b. Residents choose to: remain in home relocate to friends/family relocate to hotel/motel

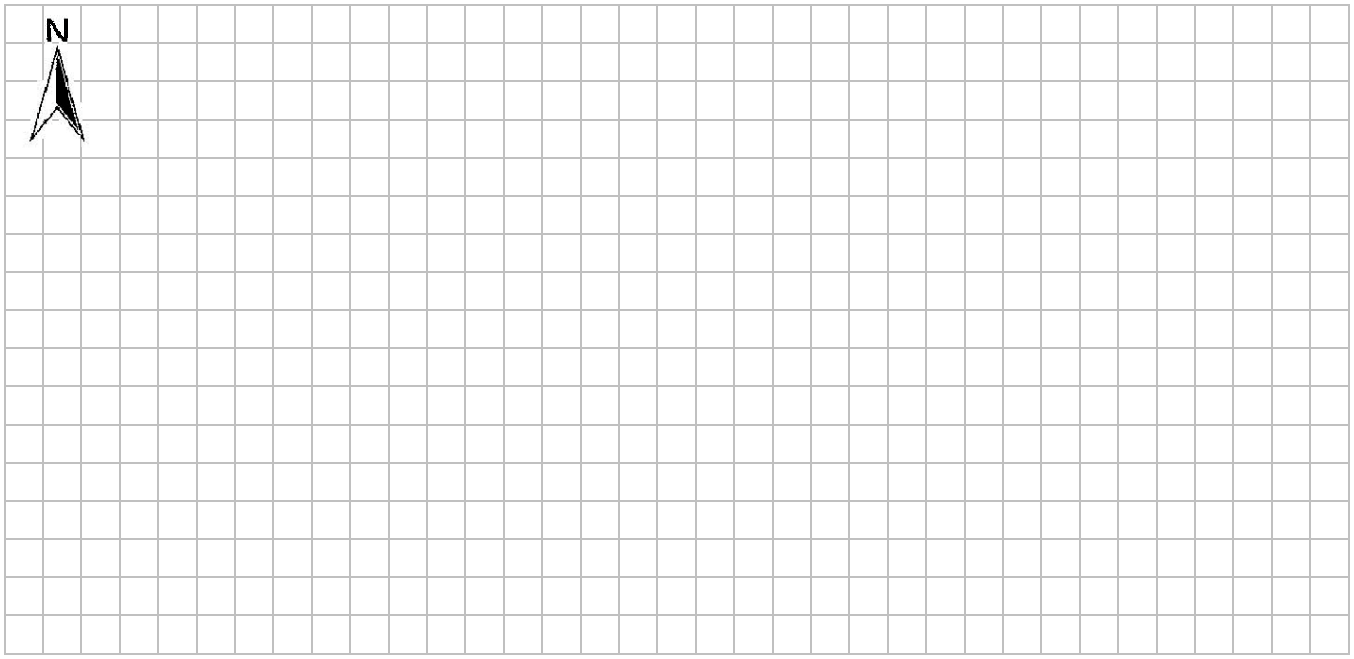
c. Responsibility for costs associated with reimbursement explained? Y / N

d. Relocation package provided and explained to residents? Y / N

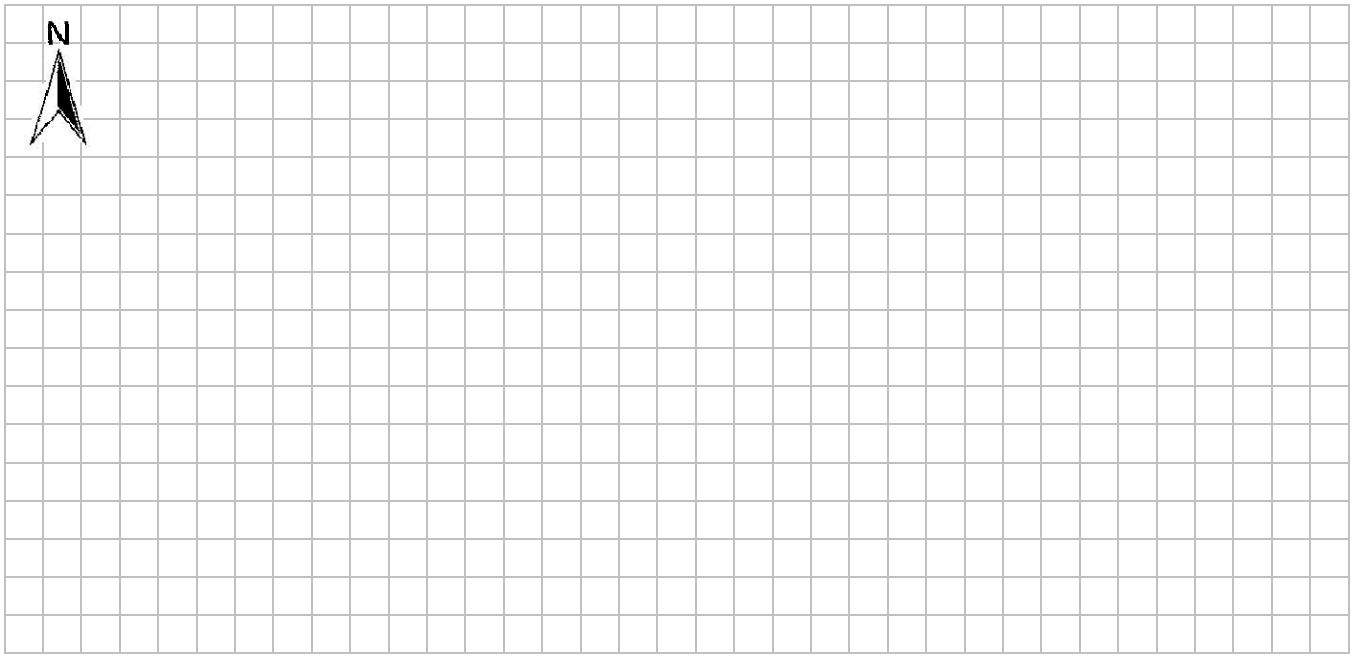
11. FLOOR PLANS

Draw a plan view sketch of the basement and first floor of the building. Indicate air sampling locations, possible indoor air pollution sources and PID meter readings. If the building does not have a basement, please note.

Basement:



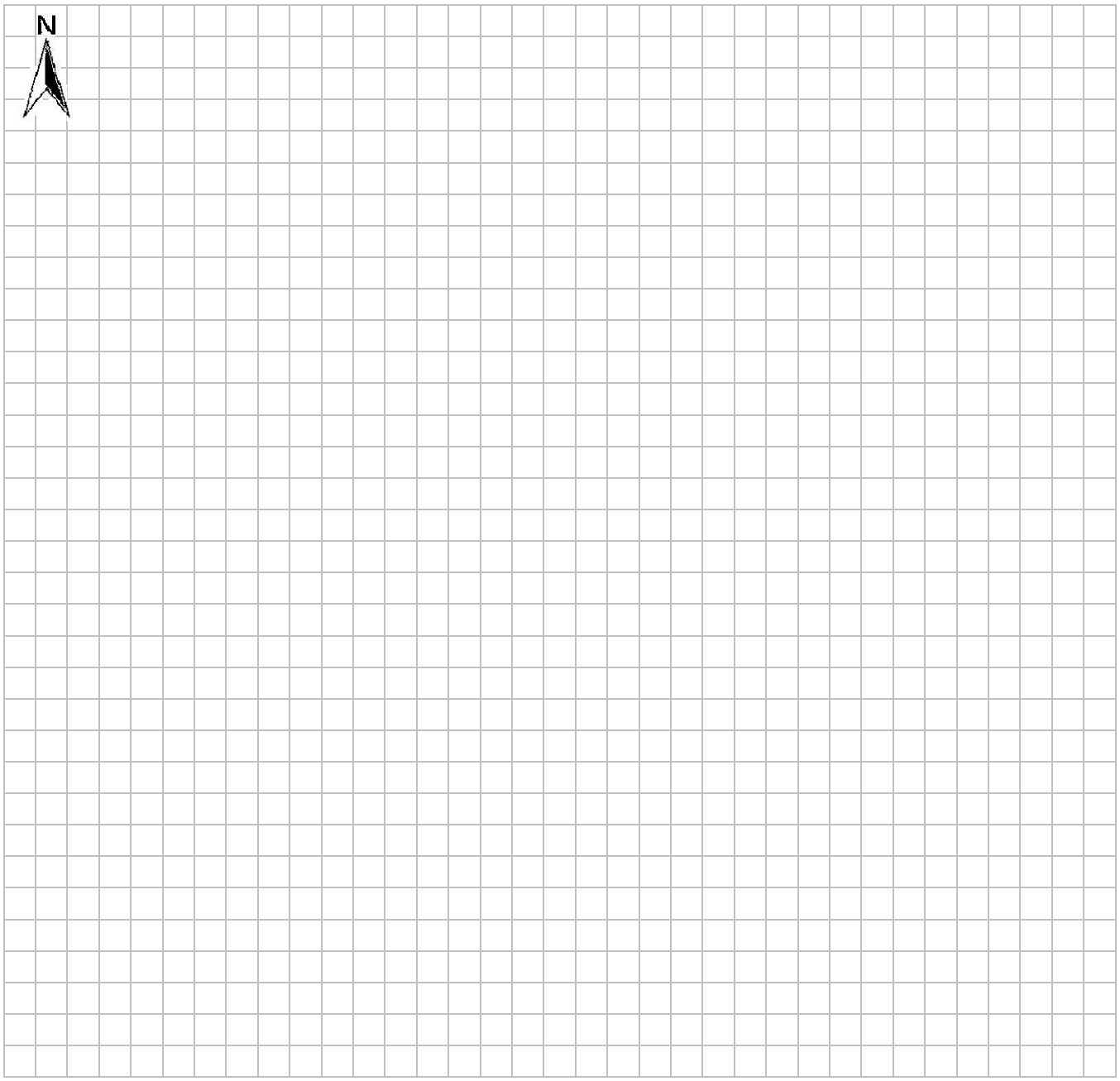
First Floor:



12. OUTDOOR PLOT

Draw a sketch of the area surrounding the building being sampled. If applicable, provide information on spill locations, potential air contamination sources (industries, gas stations, repair shops, landfills, etc.), outdoor air sampling location(s) and PID meter readings.

Also indicate compass direction, wind direction and speed during sampling, the locations of the well and septic system, if applicable, and a qualifying statement to help locate the site on a topographic map.



13. PRODUCT INVENTORY FORM

Make & Model of field instrument used: _____

List specific products found in the residence that have the potential to affect indoor air quality.

Location	Product Description	Size (units)	Condition*	Chemical Ingredients	Field Instrument Reading (units)	Photo ** Y / N

* Describe the condition of the product containers as **Unopened (UO), Used (U),** or **Deteriorated (D)**
** Photographs of the **front and back** of product containers can replace the handwritten list of chemical ingredients. However, the photographs must be of good quality and ingredient labels must be legible.

Attachment 3

May 2017 NYSDOH Soil Vapor/Indoor Air Decision Matrices

Soil Vapor/Indoor Air Matrix A

May 2017

Analytes Assigned:
Trichloroethene (TCE), *cis*-1,2-Dichloroethene (*c*12-DCE), 1,1-Dichloroethene (11-DCE), Carbon Tetrachloride

	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m^3)		
SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m^3)	< 0.2	0.2 to < 1	1 and above
< 6	1. No further action	2. No Further Action	3. IDENTIFY SOURCE(S) and RESAMPLE or MITIGATE
6 to < 60	4. No further action	5. MONITOR	6. MITIGATE
60 and above	7. MITIGATE	8. MITIGATE	9. MITIGATE

No further action: No additional actions are recommended to address human exposures.

Identify Source(s) and Resample or Mitigate: We recommend that reasonable and practical actions be taken to identify the source(s) affecting the indoor air quality and that actions be implemented to reduce indoor air concentrations to within background ranges. For example, if an indoor or outdoor air source is identified, we recommend the appropriate party implement actions to reduce the levels. In the event that indoor or outdoor sources are not readily identified or confirmed, resampling (which might include additional sub-slab vapor and indoor air sampling locations) is recommended to demonstrate that SVI mitigation actions are not needed. Based on the information available, mitigation might also be recommended when soil vapor intrusion cannot be ruled out.

Monitor: We recommend monitoring (sampling on a recurring basis), including but not necessarily limited to sub-slab vapor, basement air and outdoor air sampling, to determine whether concentrations in the indoor air or sub-slab vapor have changed and/or to evaluate temporal influences. Monitoring might also be recommended 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 based on site-, building- and analyte-specific information, 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: We recommend mitigation 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.

These general recommendations are made with consideration being given to the additional notes on page 2.

ADDITIONAL NOTES FOR MATRIX A

This matrix summarizes 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 analyte-specific, building-specific conditions (e.g., dirt floor in basement, crawl spaces, thick slabs, current occupancy, etc.), and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, collection of additional samples 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. Mitigation might be recommended when the results of multiple contaminants indicate monitoring is recommended. Proactive actions 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 might be undertaken for reasons other than public health (e.g., seeking community acceptance, reducing costs, etc.). However, actions implemented *in lieu* of sampling will typically be expected to be captured in the final engineering report and site management plan, and might not rule out the need for post-implementation sampling (e.g., to document effectiveness or to support terminating the action).

[2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of soil vapor contamination, nor does it preclude remediating contaminated soil vapor 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 0.20 microgram per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples and dirt floor soil vapor samples, a minimum reporting limit of 1 microgram per cubic meter is recommended.

[4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion 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 might 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 but not limited to the following: the identified source of the volatile chemicals, the environmental remediation program, and analyte-specific, site-specific and building-specific factors.

Soil Vapor/Indoor Air Matrix B

May 2017

Analytes Assigned:
Tetrachloroethene (PCE), 1,1,1-Trichloroethane (111-TCA), Methylene Chloride

	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m^3)		
SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m^3)	< 3	3 to < 10	10 and above
< 100	1. No further action	2. No Further Action	3. IDENTIFY SOURCE(S) and RESAMPLE or MITIGATE
100 to < 1,000	4. No further action	5. MONITOR	6. MITIGATE
1,000 and above	7. MITIGATE	8. MITIGATE	9. MITIGATE

No further action: No additional actions are recommended to address human exposures.

Identify Source(s) and Resample or Mitigate: We recommend that reasonable and practical actions be taken to identify the source(s) affecting the indoor air quality and that actions be implemented to reduce indoor air concentrations to within background ranges. For example, if an indoor or outdoor air source is identified, we recommend the appropriate party implement actions to reduce the levels. In the event that indoor or outdoor sources are not readily identified or confirmed, resampling (which might include additional sub-slab vapor and indoor air sampling locations) is recommended to demonstrate that SVI mitigation actions are not needed. Based on the information available, mitigation might also be recommended when soil vapor intrusion cannot be ruled out.

Monitor: We recommend monitoring (sampling on a recurring basis), including but not necessarily limited to sub-slab vapor, basement air and outdoor air sampling, to determine whether concentrations in the indoor air or sub-slab vapor have changed and/or to evaluate temporal influences. Monitoring might also be recommended 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 based on site-, building- and analyte-specific information, 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: We recommend mitigation 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.

These general recommendations are made with consideration being given to the additional notes on page 2.

ADDITIONAL NOTES FOR MATRIX B

This matrix summarizes 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 analyte-specific, building-specific conditions (e.g., dirt floor in basement, crawl spaces, thick slabs, current occupancy, etc.), and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, collection of additional samples 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. Mitigation might be recommended when the results of multiple contaminants indicate monitoring is recommended. Proactive actions 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 might be undertaken for reasons other than public health (e.g., seeking community acceptance, reducing costs, etc.). However, actions implemented *in lieu* of sampling will typically be expected to be captured in the final engineering report and site management plan, and might not rule out the need for post-implementation sampling (e.g., to document effectiveness or to support terminating the action).

[2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of soil vapor contamination, nor does it preclude remediating contaminated soil vapor 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 1 microgram per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples and dirt floor soil vapor samples, a minimum reporting limit of 1 microgram per cubic meter is recommended.

[4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion 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 might 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 but not limited to the following: the identified source of the volatile chemicals, the environmental remediation program, and analyte-specific, site-specific and building-specific factors.

Soil Vapor/Indoor Air Matrix C

May 2017

Analytes Assigned:
Vinyl Chloride

	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m^3)	
SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m^3)	< 0.2	0.2 and above
< 6	1. No further action	2. IDENTIFY SOURCE(S) and RESAMPLE or MITIGATE
6 to < 60	3. MONITOR	4. MITIGATE
60 and above	5. MITIGATE	6. MITIGATE

No further action: No additional actions are recommended to address human exposures.

Identify Source(s) and Resample or Mitigate: We recommend that reasonable and practical actions be taken to identify the source(s) affecting the indoor air quality and that actions be implemented to reduce indoor air concentrations to within background ranges. For example, if an indoor or outdoor air source is identified, we recommend the appropriate party implement actions to reduce the levels. In the event that indoor or outdoor sources are not readily identified or confirmed, resampling (which might include additional sub-slab vapor and indoor air sampling locations) is recommended to demonstrate that SVI mitigation actions are not needed. Based on the information available, mitigation might also be recommended when soil vapor intrusion cannot be ruled out.

Monitor: We recommend monitoring (sampling on a recurring basis), including but not necessarily limited to sub-slab vapor, basement air and outdoor air sampling, to determine whether concentrations in the indoor air or sub-slab vapor have changed and/or to evaluate temporal influences. Monitoring might also be recommended 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 based on site-, building- and analyte-specific information, 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: We recommend mitigation 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.

These general recommendations are made with consideration being given to the additional notes on page 2.

ADDITIONAL NOTES FOR MATRIX C

This matrix summarizes 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 analyte-specific, building-specific conditions (e.g., dirt floor in basement, crawl spaces, thick slabs, current occupancy, etc.), and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, collection of additional samples 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. Mitigation might be recommended when the results of multiple contaminants indicate monitoring is recommended. Proactive actions 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 might be undertaken for reasons other than public health (e.g., seeking community acceptance, reducing costs, etc.). However, actions implemented *in lieu* of sampling will typically be expected to be captured in the final engineering report and site management plan, and might not rule out the need for post-implementation sampling (e.g., to document effectiveness or to support terminating the action).

[2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of soil vapor contamination, nor does it preclude remediating contaminated soil vapor 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 0.20 microgram per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples and dirt floor soil vapor samples, a minimum reporting limit of 1 microgram per cubic meter is recommended.

[4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion 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 might 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 but not limited to the following: the identified source of the volatile chemicals, the environmental remediation program, and analyte-specific, site-specific and building-specific factors.