AVERY DENNISON

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September 29, 2017 by email

Daniel R. Lanners, P.E.
Project Manager
New York State Department of Environmental Conservation
Division of Environmental Remediation, Remedial Bureau C
625 Broadway, 11th Floor
Albany, NY 12233-7014
Email: daniel.lanners@dec.ny.gov

Re: SVI Work Plan
Avery Dennison – Orangeburg Facility
NYSDEC Site No. 344072
Orangeburg, Rockland County, NY

Dear Mr. Lanners,

Please find attached a Soil Vapor Intrusion Investigation Work Plan, as requested by New York State Department of Environmental Protection (NYSDEC) in it's September 22, 2017 letter to Avery Dennison Corporation (ADC). ADC anticipates an opportunity to perform the requested indoor air and soil gas sampling event when the manufacturing operation and associated vapor collection system and thermal oxidizer are shut down for the Thanksgiving holiday. As discussed in our August 9, 2017 meeting in Albany, ADC has an urgent business need to complete this scope of work during the upcoming 2017/2018 heating season. Therefore, ADC respectfully requests NYSDEC's prompt review of the attached Work Plan.

If you have any questions or comments, please do not hesitate to call.

Sincerely,

Bruce Martin

Bruce Martin
Manager, Remediation Services
Avery Dennison Corporation

cc: Chris Turner, The Johnson Company

SOIL VAPOR INTRUSION INVESTIGATION WORK PLAN

Avery Dennison Corporation Facility
524 Route 303
Orangeburg, Rockland County, New York
NYSDEC Site No. 344072

Prepared for:
Avery Dennison Corporation
8080 Norton Parkway
Mentor, Ohio 44060

Prepared by:
The Johnson Company, Inc.
100 State Street, Suite 600
Montpelier, Vermont 05602
Project No.: 1-0145-15

September 2017

The Johnson Company

ENVIRONMENTAL SCIENCE AND
ENGINEERING SOLUTIONS

PARTNERS FOR SMART THINKING
AND CREATIVE STRATEGIES

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I, Christopher M. Turner, certify that I am currently a Qualified Environmental Professional as defined in 6 NYCRR Part 375 and that this Work 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).

Chris Tyler M Turner — 9/29/2017

Christopher M. Turner — Date Signed

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1.0 INTRODUCTION

This Soil Vapor Intrusion Investigation Work Plan (the Work Plan) was prepared by The Johnson Company, Inc. (JCO) for the Avery Dennison Corporation (ADC) facility at 529 Route 303 in Orangeburg, Rockland County, New York (the Site; see Figure 1-1). The Work Plan is submitted by ADC to the New York State Department of Environmental Protection (NYSDEC) as requested by NYSDEC in its September 22, 2017 letter to ADC. The Work Plan was prepared in accordance with New York State Department of Environmental Conservation (NYSDEC) *DER-10: Technical Guidance for Site Investigation and Remediation* (NYSDEC, 2010), New York State Department of Health (NYSDOH) *Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (NYSDOH, 2006), and subsequent updates to the NYSDOH guidance (NYSDOH, 2017).

This Work Plan was developed to further investigate the potential occurrence of soil vapor intrusion of volatile organic compounds (VOCs) in a mixed-use manufacturing and office building. Results from previous subsurface investigations showed VOCs were detected in environmental samples collected from other areas of the Site, and in some soil gas samples collected beneath the building, as described in Section 2. Planned activities include concurrent collection of sub-slab soil vapor and indoor air samples, and an updated survey for building use information relevant to assessing potential soil vapor intrusion of VOCs. The planned work will augment results from soil gas sampling performed beneath the manufacturing area in 2008; and results from a soil vapor intrusion investigation performed in 2016 and 2017, which addressed, in particular, the portion of the building used for office space. This Work Plan expands that scope of work to include a larger portion of the manufacturing area.

2.0 SITE DESCRIPTION AND HISTORY

ADC owns and operates a 55,000 square-foot facility that contains office space, warehouse space, and manufacturing operations (the Facility) located on approximately 8.3 acres of land at 524 Route 303 in Orangeburg, Rockland County, New York (the Site; see Figure 1-1). Current manufacturing operations at the Facility consist of fabric coating and associated finishing operations including ironing, slitting, cutting, and tubing of fabric in preparation for off-site label printing. Supporting warehousing, facility maintenance, shipping/receiving, and office operations are also performed at the Facility.

The Facility is registered as a Large Quantity Generator of hazardous waste; its waste streams include spent coatings (solvent and water-based) and waste solids (i.e., drum liners, rags, etc.). Chemicals in use at the Facility include solvents, solvent-based coatings and coating additives, lubricant and machining oils, and maintenance and cleaning supplies. Three solvents are used in bulk quantities at the Facility and are stored in three registered underground storage tanks (USTs): methyl ethyl ketone (MEK) (10,000 gallon UST), toluene (10,000 gallon UST), and isopropyl alcohol (5,000 gallon UST). The USTs are located in the northwestern portion of the Site and were installed in 1998 (ERM, 2008b).

The Facility was reportedly constructed in the 1950s or 1960s and was previously occupied by Spencer Packaging Company and Paxar Corporation (Paxar). A June 6, 2006 United States Environmental Protection Agency (USEPA) Resource Conservation and Recovery Act (RCRA) Database record for the Property lists chlorinated solvents tetrachloroethene (PCE), trichloroethene (TCE), and 1,1,1-trichloroethane (1,1,1-TCA) as components of hazardous wastes historically generated at the Property (ERM, 2008a). ADC purchased the Site from Paxar in 2007 and has continued to use the Facility for the coating and finishing of fabrics. ADC personnel describe the use of chlorinated solvents after the 2007 purchase of the Site from Paxar as limited to small quantities within a laboratory setting.

During the period from 2007 through 2014, ADC conducted an environmental investigation at the Site that included a Phase I environmental site assessment followed by collection and analysis of soil, groundwater, and sub-slab soil gas samples and hydrogeologic characterization. Environmental sampling locations are shown on Figure 2-1. Phase I assessment findings identified volatile organic compounds (VOCs) as the primary constituents of concern at the Property. The VOCs used in the largest quantities at the Facility since the 1970s are MEK, toluene, and isopropyl alcohol.

Investigation results show VOC concentrations in soil are below NYSDEC Soil Cleanup Objectives (SCOs) for unrestricted use. Groundwater monitoring performed over a period of seven years, from 2007 to 2014, showed three VOCs detected above New York State Ambient Water Quality Standards (AWQS) -1,1-dichloroethane (1,1-DCA); 1,1-dichloroethene (1,1-DCE), and 1,1,1-TCA - outside the northwestern corner of the Facility, in the immediate vicinity of former USTs and former scupper drains identified as areas of potential concern by the Phase I site assessment. Concentrations of those compounds in groundwater did not show increasing trends over seven years of monitoring, and were not detected in downgradient wells at concentrations exceeding AWQS. Hydraulic gradients indicate a southeastern groundwater flow direction across the Site.

Figure 2-2 shows concentrations of chlorinated VOCs[1] detected in sub-slab soil vapor samples collected beneath the Facility in November 2008. Four chlorinated VOCs included in current NYSDOH soil vapor intrusion decision matrices were detected in the November 2008 sub-slab soil gas samples: TCE and carbon tetrachloride from Matrix A; and PCE and 1,1,1-TCA from Matrix B (NYSDOH, 2006; 2017). PCE was detected in a greater number of samples and at higher concentrations than the other NYSDOH Matrix compounds. The data shows concentrations of those constituents in sub-slab soil vapor were greatest beneath the western (manufacturing) portion of the Facility and generally decrease in an eastward direction toward the non-manufacturing portion of the Facility.

[1] Results for VOCs on the 2016-2017 soil vapor intrusion investigation target analyte list are shown on Figure 2-2.

NYSDOH-matrix VOCs that are detected in soil gas are generally not present in groundwater downgradient from the Facility; where VOCs are detected, the measured concentrations do not exceed AWQS. Over a seven-year period of groundwater monitoring in the area downgradient from the Facility from 2007 to 2014, PCE was detected in only one groundwater sample, and at a concentration below the laboratory reporting limit. 1,1-DCE, cis-DCE, and TCE were each detected in two downgradient wells, but at concentrations below AWQS. Carbon tetrachloride, and 1,1,1-TCA were not detected in groundwater downgradient from the facility. These results support that a significant source of VOCs is not present beneath the Facility.

ADC and JCO submitted a draft Environmental Investigation Report to NYSDEC in April 2015 and met with NYSDEC and NYSDOH in Albany on May 4, 2015. At that meeting, NYSDEC indicated no further action would likely be required to address VOCs in soil and groundwater at the Site. NYSDEC subsequently requested additional investigation of the soil vapor intrusion pathway; ADC performed that additional investigation in 2016 and 2017 (JCO, 2016A, 2016B, 2017).

The 2016/2017 vapor intrusion investigation included four co-located sub-slab soil gas and indoor air sampling locations in the office area of the Facility, and one location in the manufacturing area where the TCE concentration in sub-slab soil gas was highest in 2008 (near SG-5, see Figure 2-2). Concurrent soil gas and indoor air sampling was performed during the winter heating season in early 2016 and again in 2017 during periods of typical Facility use, during which a vapor collection system[2] operates in the manufacturing area. When operating, the vapor collection system extracts approximately 25,000 to 30,000 standard cubic feet per minute (SCFM) of air from the vicinity of selected manufacturing equipment for treatment by a

[2] The vapor collection system feeds into an exterior regenerative thermal oxidizer (RTO) located adjacent to the southern exterior of the Facility.

regenerative thermal oxidizer (RTO) located outside the southern exterior of the Facility (JCO, 2016B).

Table 2-1 and Figure 2-3 show results from sub-slab soil gas and indoor air sampling in March 2016 and January 2017. VOC concentrations detected in sub-slab soil gas and indoor air samples from both sampling events are below current USEPA risk-based screening levels. With respect to the current NYSDOH soil vapor intrusion decision matrices, the March 2016 results fall into the "no further action" category or are inconclusive[3], with the exception of carbon tetrachloride. In March 2016, carbon tetrachloride was detected in three of the five indoor air samples, and in the corresponding outdoor air sample, at concentrations above the lowest NYSDOH Matrix A concentration threshold of 0.2 micrograms per kilogram ($\mu g/m^3$). In January 2017, carbon tetrachloride was also detected in one indoor air sample and in the corresponding outdoor air sample, but at concentrations that fall into the "no further action" matrix category. Indoor air samples collected from location IA-5 on both sampling dates had elevated detection limits due to the presence of non-target analyte solvents (e.g., toluene, MEK, and isopropyl alcohol) from the manufacturing process at the time of sampling; therefore, applying the IA-5 results to the NYSDOH matrices is not conclusive.

On August 9, 2017, ADC and JCO met with NYSDEC and NYSDOH to discuss regulatory closure for the Site. NYSDEC reiterated its 2015 assessment that no additional action would be required to address VOCs in soil and groundwater. In a September 22, 2017 letter to ADC, NYSDEC requested the soil vapor intrusion investigation already performed be expanded to include additional sampling locations in the manufacturing area and a soil gas and indoor air sampling event to be performed during the winter heating season when the vapor collection system is not operating. This Work Plan describes the expanded SVI Investigation requested in NYSDEC's September 22, 2017 letter.

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[3] Inconclusive NYSDOH matrix comparisons include TCE at location IA-1, and carbon tetrachloride and vinyl chloride at location IA-3. These compounds were not detected in the indoor air samples; however, laboratory reporting limits were greater than the lowest "no further action" concentration bracket in the applicable NYSDOH matrix.

3.0 SCOPE OF WORK

The primary objective of this Work Plan is to generate data and building use information usable for assessing potential soil vapor intrusion (SVI) in the Facility. This Scope of Work (SOW) includes collection of co-located sub-slab soil gas and indoor air samples at ten locations distributed throughout both the manufacturing and non-manufacturing portions of the Facility. The investigation methods and sample analyses to be used are the same as those used for the previous SVI investigation performed at the Facility in 2016 and 2017.

Figures 3-1 and 3-2 show the planned sub-slab soil vapor and indoor air sampling locations. The rationale for selection of sampling locations is provided in Section 3.2 and Section 3.4 for sub-slab soil vapor and indoor air, respectively. All samples will be analyzed for ten (10) VOCs including PCE, TCE and common degradation products of those compounds: cis-1,2-dichloroethene (cis-1,2-DCE), trans-1,2-dichlorothene (trans-1,2-DCE), 1,1-DCE, and vinyl chloride; and carbon tetrachloride, 1,1,1-trichloroethane (1,1,1-TCA), 1,1-dichloroethane (1,1-DCA), and 1,2-dichloroethane (1,2-DCA). The selection of target analytes and laboratory reporting limits is described in Section 3.5 and in Table 3-1.

In addition to soil vapor and indoor air sampling, the SOW includes supporting tasks, specifically: installation and leak testing of sub-slab soil vapor sampling devices, collection of an outdoor (ambient) air sample, and conducting an updated building survey to identify potential indoor sources of VOCs and to obtain information about ventilation and heating system operation in the Facility during the period prior to, and during, sample collection.

3.1 BUILDING SURVEY

JCO will perform a building use survey and record observations that are potentially relevant to indoor air quality in the manufacturing and non-manufacturing portions of the Facility, as described in NYSDOH soil vapor intrusion guidance (NYSDOH, 2006; 2017). The building use survey will include three primary components, described below in Sections 3.1.1 through 3.1.3.

3.1.1 Use and Storage of Products Containing VOCs

JCO will document the presence and approximate quantity of products containing VOCs within the non-manufacturing portion of the Facility, and record observations using the NYSDOH Indoor Air Quality Questionnaire and Building Inventory Form (NYSDOH, 2007) - see Appendix A. The non-manufacturing area of the Facility includes laboratory areas, restroom facilities, break rooms, and office space. In addition, JCO will request copies of Safety Data Sheets for products containing VOCs that are used or stored in the portion of the Facility that is used for manufacturing.

3.1.2 HVAC System Operation

JCO will document the types of heating systems (e.g., forced hot air, radiant hot water, etc.) used in the manufacturing and non-manufacturing portions of the facility, and interview facility maintenance personnel regarding changes in HVAC system operation, e.g., make-up air, positive or negative building pressure, etc., since the previous survey was conducted in 2016. JCO's observations and information obtained from maintenance personnel will be recorded on the NYSDOH Indoor Air Quality Questionnaire and Building Inventory Form (NYSDOH, 2007) – see Appendix A.

JCO will interview Facility personnel for updated information regarding the VOC vapor collection system and thermal oxidizer operating in the manufacturing portion of the Facility, including typical hours of operation, sources of make-up air, and the duration of the vapor collection system shutdown prior to indoor air and soil gas sample collection. At the time indoor air and sub-slab soil gas samples are collected, JCO will measure and record atmospheric pressure outside the Facility, and inside both the manufacturing and non-manufacturing portions of the Facility.

3.1.3 Interior Layout of Non-Manufacturing Area

Changes in the layout and use of the manufacturing and office areas, if any, will be noted and JCO's site plans will be updated to reflect those changes.

3.2 SUB-SLAB SOIL VAPOR PIN INSTALLATION AND INTEGRITY TESTING

Semi-permanent sub-slab soil vapor sampling points will be installed at six locations that are shown approximately on Figure 3-1 as SS-6 through SS-11. The six sampling locations span the width and length of manufacturing portion of the Facility, including areas of relatively higher

VOC concentrations in soil gas in 2008. JCO is not aware of any subsurface partitions, e.g., deep foundation walls, subdividing the sub-slab zone below the Facility.

Sub-slab soil vapor sampling points will be installed using the VaporPin™ system distributed by Cox-Colvin and Associates, Inc. The VaporPin™ assembly consists of a stainless steel device with barb fittings on each end, installed into a hole drilled through the concrete floor slab. The lower barbed end of the device is fitted with a silicone sheath and the device is driven into place using tools provided by the manufacturer. The silicone sheath seals the device tightly against the walls of the drilled hole. For common floor slab thicknesses (4 to 6 inches), the stainless steel bottom of the VaporPin™ protrudes less than two inches below the bottom of the floor slab into the underlying material, consistent with NYSDOH guidance (NYSDOH, 2006). The upper barbed end of the VaporPin is connected to tubing for seal integrity (leak) testing, purging, and collecting sub-slab soil vapor samples. JCO will install VaporPins™ in a semi-permanent configuration with a threaded stainless steel cap installed flush with the surrounding floor surface when the device is not in use. The installation procedure is described in the VaporPin™ Standard Operating Procedure; Installation and Extraction of the VaporPin™ (Cox-Colvin, 2015) – see Appendix A.

An air-tight seal between the VaporPin™ and the concrete floor slab prevents introduction of indoor air into sub-slab soil vapor samples. A seal integrity ("leak") test will be performed for each installed VaporPin™ prior to the collection of sub-slab soil vapor samples, including existing and new sampling locations. The leak testing procedure is described in the Project-Specific Operating Procedure for Sub-Slab Soil Vapor and Indoor Air Sampling – see Appendix A.

3.3 BUILDING USE DURING SAMPLE COLLECTION

The vapor collection system at the Facility is currently operated approximately 40 to 80 hours over a period of 5 to 6 days in a typical week, which equates to about 25 to 50% operational up-time (ADC, 2017). Use of the vapor collection system and roof ventilation fans in the Facility likely cause a temporary increase in the indoor air exchange rate during operating hours. Applying the conservatively low 10th percentile value for commercial/industrial indoor air exchange rates published by USEPA (2011, 2015) of 0.6 hour^{-1} to represent conditions when the vapor collection system and roof fans are not in use (and air exchange is slower), predicts a complete air exchange every 1.7 hours. Therefore, the time required for indoor air conditions to equilibrate after shutdown of the vapor collection system is expected to be hours rather than days or weeks[4]. Accordingly, USEPA (2015) recommends allowing 24 to 72 hours for indoor air quality to equilibrate following removal of indoor VOC sources or opening a floor slab for installation of soil gas sampling points or monitoring wells in structures[5]. Based on that guideline, a 72-hour equilibration period will be required prior to sub-slab soil gas and indoor air sampling in the Facility, during which the vapor collection system and roof fans will not be operated.

3.4 SUB-SLAB SOIL VAPOR SAMPLE COLLECTION

Sub-slab soil vapor samples will be collected from locations SS-1 through SS-11 (see Figure 3-1) into 1-liter or 6-liter evacuated stainless steel canisters equipped with eight-hour flow controllers. An 8-hour target sample collection period will be used, and corresponds with a typical daytime work shift. Prior to purging and sampling, sub-slab soil vapor sampling devices will be sealed closed for a minimum of eight (8) hours to allow the sub-slab environment to re-equilibrate after installation and leak testing are successfully completed. Sub-slab soil vapor samples will be collected concurrently with indoor and ambient air samples as described in the Project-Specific Operating Procedure for Sub-Slab Soil Vapor and Indoor Air Sampling included in Appendix A.

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[4] The vapor collection system and RTO are currently used approximately 25% to 50% of the time in a typical week; during the remaining 50% to 75% of hours each week, the system is not operating and partial re-equilibration of indoor air quality may occur.

[5] NYSDOH guidance does not provide recommended indoor air quality equilibration times following HVAC changes affecting indoor air exchange rates. NYSDOH and USEPA guidance recommend a minimum 30-day equilibration period following start-up of a sub-slab depressurization system; however, such systems operate in the subsurface where relatively slow diffusion processes control the migration of VOCs in soil gas.

Samples will be shipped via overnight commercial courier in under chain-of-custody protocol to Eurofins Air Toxics, Inc. of Folsom, California (EATI), which is certified by NYSDOH for environmental analyses and air emissions.

3.5 INDOOR AND AMBIENT AIR SAMPLE COLLECTION

Indoor air samples will be collected from 11 locations, shown approximately on Figure 3-1 as IA-1 through IA-11, and co-located with the corresponding sub-slab soil vapor sampling locations. In the office area of the Facility, indoor air sampling locations were selected to represent smaller partitioned spaces such as the office rooms at locations IA-2 and IA-3, and larger open spaces such as the Employee lounge (IA-1) and lobby area (IA-4). Indoor air samples IA-5 through IA-11 will be collected from the manufacturing area of the Facility, which consists of a large open space that is not partitioned.

Indoor air samples will be collected into 6-liter evacuated stainless steel canisters equipped with 8-hour flow controllers. An 8-hour target sample collection period corresponds with a typical daytime work shift. Indoor air samples will be collected concurrently with sub-slab soil vapor and ambient air samples as described in the Project-Specific Operating Procedure for Sub-Slab Soil Vapor and Indoor Air Sampling – see Appendix A.

One ambient air sample (OA-1) will be collected outside the Facility, concurrent with sub-slab soil vapor and indoor air sample collection. The ambient air sample will be positioned approximately upwind of the Facility at the time of sampling, and away from wind breaks such as trees or shrubs. The procedure for collecting ambient air samples is described in Project-Specific Operating Procedure for Sub-Slab Soil Vapor and Indoor Air Sampling – see Appendix A.

Samples will be shipped via overnight commercial courier in under chain-of-custody protocol to EATI.

3.6 ANALYTICAL PARAMETERS

Sub-slab soil vapor, indoor air, and ambient air samples will be submitted under chain-of-custody protocol to EATI for analysis of 10 target VOC analytes using USEPA method TO-15 and TO-15 SIM. Table 3-1 provides a list of target analytes and the associated laboratory reporting limits. The target analytes include PCE, TCE and common degradation products cis-1,2-DCE; trans-1,2-DCE; 1,1-DCE; and vinyl chloride. PCE and TCE were detected in one or more soil vapor samples collected from beneath the Facility in 2008, 2016 or 2017. Dichloroethene isomers and vinyl chloride are included as target analytes because they are common degradation products of PCE and TCE, as recommended in the NYSDOH soil vapor intrusion guidance (NYSDOH, 2006). The remaining target analytes are carbon tetrachloride; 1,1,1-trichloroethane (1,1,1-TCA); 1,1-dichloroethane (1,1-DCA); and 1,2-dichloroethane (1,2-DCA). Each was detected at concentrations below current federal risk-based screening levels in one or more soil vapor samples collected in 2008, 2016, or 2017.

USEPA Method TO-15 SIM was selected for analysis of indoor air samples to achieve the lower reporting limits requested by NYSDEC, which are below the NYSDOH Ambient Air Guidelines for TCE (2 $\mu g/m^3$) and PCE (30 $\mu g/m^3$). With the exception of the Ambient Air Guidelines for PCE and TCE shown in Table 3-1, New York State has not published compound-specific screening levels for the target analytes in sub-slab soil vapor or indoor air. For all analytes, reporting limits[6] for USEPA Method TO-15 and TO-15 SIM are below USEPA risk-based screening levels for sub-slab soil vapor and indoor air, respectively (USEPA, 2016) (see Table 3-1).

3.7 INVESTIGATION-DERIVED WASTE MANAGEMENT

The activities described in this SOW are not expected to generate investigation-derived waste (IDW) containing constituents of concern. Waste materials generated will include concrete floor slab drill cuttings (dust) from the office portion of the Facility, and small

[6] Reporting limits for field samples may be higher in some cases if dilutions are required, sample volumes are low, or if interference occurs from non-target analytes.

quantities of potable water used for dust control during installation of sub-slab soil vapor sampling pins. Dry dust will be collected using a vacuum equipped with a HEPA filter, and wet dust will be wiped up with disposable towels for disposal with the standard solid waste stream from the Facility. In the unexpected event that potentially contaminated IDW is generated from these activities, the IDW will be containerized and characterized for off-site disposal by ADC in accordance with state and federal laws.

4.0 QUALITY ASSURANCE / QUALITY CONTROL

Quality Assurance / Quality Control (QA/QC) procedures will be employed in the field and laboratory to meet the primary project data quality objective: to produce data of sufficient quality to support decisions on appropriate actions regarding soil vapor and indoor air quality at the Site. Examples of subordinate objectives include collecting samples representative of Site conditions at the time of sampling, achieving laboratory PQLs at or below concentration levels used for regulatory screening, and producing analytical results within method- and laboratory SOP-defined limits for precision and bias.

Formal designation of a Quality Assurance Officer is not warranted for this Scope of Work due to the straightforward nature of the activities described in this Work Plan, and JCO's field experience implementing similar procedures.

4.1 FIELD QA/QC PROCEDURES

Sub-slab soil vapor probe seal integrity (or "leak") tests will be performed at each VaporPin™ prior to collecting samples, as described in Section 2.2 and Appendix A. Successful leak test results will demonstrate the integrity of each sub-slab soil vapor probe/pin seal. A proper seal will prevent introduction of indoor air into sub-slab soil vapor samples.

The sampling apparatus at each sub-slab soil vapor sampling location will be tested prior to sample collection by means of a "shut-in" test. The shut-in tests will be performed by applying a vacuum to the dedicated sample tubing apparatus used at each sub-slab soil vapor sampling location. After the vacuum is applied, all valves are shut to seal the vacuum in the tubing apparatus, and the vacuum gauge is monitored for vacuum leaks. Shut-in test procedures are described in the Project-Specific Operating Procedure for Sub-Slab Soil Vapor and Indoor Air Sampling – see Appendix A. A successful shut-in test result will demonstrate a sampling apparatus is free of leaks that could introduce indoor air into sub-slab soil vapor samples.

Field QA/QC sampling will consist of collecting a minimum of one blind duplicate indoor air sample and one blind duplicate sub-slab soil vapor sample during the sampling event. Procedures for duplicate sample collection are described in the Project-Specific Operating Procedure for Sub-Slab Soil Vapor and Indoor Air Sampling – see Appendix A. If field duplicate sample results for a constituent differ by more than 25 relative percent difference (RPD), data usability will be considered and discussed in the report.

Sample canister vacuums will be measured with a calibrated vacuum gauge before and after sample collection. Comparison of canister vacuum readings between the field and laboratory will be used to determine whether or not canister vacuum leaks occurred during sample canister transportation to and from the Site. The acceptance criterion for measurement differences is the sum of the tolerances determined for the laboratory and field vacuum gauges, plus an allowance for atmospheric pressure and sample canister temperature differences between the laboratory and field settings.

4.2 LABORATORY QA/QC PROCEDURES

All samples used to make decisions on appropriate actions will be analyzed by EATI, an NYSDEC ELAP-certified laboratory. EATI will follow standard QA/QC procedures as required by USEPA Method TO-15 and TO-15A and laboratory Standard Operating Procedures (SOPs). Acceptance criteria for QA/QC parameters are defined by the USEPA Methods and EATI SOPs, and by project data quality objectives where these are more restrictive. Deviations from those procedures and QA results outside of acceptable ranges will be noted in the laboratory reports and verified through the data validation process described below.

Laboratory criteria for the LCS and LCSD analyses within the overall range of 60 - 130 percent recovery (%R) will be used. Sample results for any analyte recovered between 50 – 60 %R in the associated LCS or LCSD will be qualified as estimated (J, UJ), and USEPA Region 2 guidance will be followed for qualifying or rejecting non-detected sample results for analytes recovered at <50 %R.

4.3 DATA VALIDATION AND USABILITY

Analytical data will be validated according to USEPA Region 2 guidelines (USEPA, 2014a) using a Stage 3 manual data validation for 100% of the data generated by the analytical laboratory. Specifically, the data will be reviewed for completeness, accuracy and bias, precision, representativeness, and sensitivity to ensure that the data is "usable" for making decisions on appropriate actions related to soil vapor intrusion and air quality. In instances where national or regional EPA data quality guidance is more restrictive than method or laboratory SOP criteria, project data quality objectives defined herein will be used to determine the appropriate criteria for use in accepting or qualifying sample results.

Data validation will be performed by an independent third-party data validator, Dr. Deborah Gaynor of Phoenix Chemistry Services. Dr. Gaynor has experience performing data validation and has prepared Data Usability Summary Reports for multiple environmental investigation and remediation projects in the State of New York. A Statement of Qualifications for Phoenix Chemistry Services, which includes Dr. Gaynor's resume, is provided in Appendix B.

Data validation will be conducted according to the USEPA Region 2 guidance entitled "USEPA Hazardous Waste Support Section: Analysis of Volatile Organic Compounds in Air in Canisters By Method TO-15" (USEPA, 2014a) and, as applicable, the "USEPA National Functional Guidelines for Superfund Organic Methods Data Review", (USEPA, 2014b). Non-compliance with the method specifications may be noted where relevant.

The data validation will include checking: field documentation; clean canister certifications; proper holding times; proper chain-of-custody documentation including vacuum measurements at the laboratory and in the field, achievement of target detection limits; acceptable laboratory calibrations and quality control parameters; and representativeness of replicate results. The validation will include the following elements:

- Holding times;
- Canister cleaning records;
- Standard chain-of-custody documentation and vacuum measurements;
- Detection limits;
- Blanks;
- Instrumental calibrations;
- Measurement traceability;
- Internal standard recoveries;
- Laboratory control sample recoveries;
- Analyte identifications;
- Field and laboratory precision; and,
- Calculation checks.

During the validation process, laboratory data are verified against available supporting documentation. Raw data will be examined to check calculations, compound identification, and/or transcription errors. Validated results will either be qualified or unqualified; if results are unqualified, this means that the reported values may be used without reservation. Final validated results are annotated with the qualification codes defined in the USEPA National Functional Guidelines (USEPA, 2014b).

The data validation will evaluate the data quality indicators including:

- Precision;
- Accuracy;
- Sensitivity;
- Representativeness; and
- Completeness.

Where appropriate and/or where advised by the analytical laboratory, data may be accepted as is, accepted but qualified, or rejected if it is determined not to be of sufficient quality for its intended use.

The results of the data validation will be used to prepare a Data Usability Summary Report (DUSR) as described in NYSDEC DER-10 guidance (NYSDEC, 2010). The DUSR will summarize the findings of the data validation. Deviations or specific data qualifications identified during validation will be discussed in terms of their effect on the decision-making process. Data usability will be evaluated based on the data verification and data validation processes.

5.0 HEALTH AND SAFETY PROTOCOLS

JCO will follow health and safety protocols described in a Site-Specific Health and Safety Plan (HASP) developed for this project. The HASP was developed for environmental investigation work JCO performed at the Site between 2007 and 2014, and applies to the activities described in this Work Plan.

6.0 SCHEDULE AND REPORTING

The field activities described in Sections 3.1 through 3.4 of this Work Plan are planned for the 2017/2018 winter heating season, pending NYSDEC approval. Collection of soil vapor and indoor air samples requires the Facility vapor collection system be shut down for a minimum of 72-hours preceding sample collection. Receipt of laboratory analytical reports is expected within 15 business days of sample receipt by the laboratory, and completion of third-party data validation is expected to occur within six (6) to seven (7) weeks after sampling. JCO will prepare a figure showing the sample locations for submittal to NYSDEC with the preliminary data set from the laboratory, prior to analytical data validation.

JCO will prepare a brief report for submittal to NYSDEC. The report will include tabulated sampling results, a map showing sample locations, and a discussion of the results relevant to potential soil vapor intrusion in the non-manufacturing portion of the Facility. Attachments to the report will include a Data Validation Report and DUSR prepared by the third-party data validator and a completed NYSDOH Indoor Air Quality Questionnaire and Building Inventory Form.

JCO will submit Electronic Data Deliverables (EDDs) to NYSDEC in the required EQUIS EDD format. EDDs will be generated by the analytical laboratory, and updated by the third-party data validator based on the results from data validation. JCO will perform final formatting of the EDDs to meet NYSDEC Environmental Information Management System (EIMS) specifications prior to submitting the files to NYSDEC via e-mail.

7.0 LIST OF PERSONNEL AND CONTACT INFORMATION

Remedial Party:

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8.0 REFERENCES

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TABLES

Table 2-1: Indoor Air and Sub-Slab Soil Vapor Analytical Results; 2016-2017

Former Paxar Facility

Orangeburg, New York

NYSDEC Site No. 344072

				Sample Date:	3/23/2016	1/25/2017	3/23/2016	1/25/2017	3/23/2016	1/25/2017	3/23/2016	1/25/2017	3/23/2016	3/23/2016	1/25/2017	1/25/2017
Sample Type	**Sample Duration**	**Analyte**	**NYSDOH Decision Matrix**	**USEPA Screening Level[1] ($\mu g/m^3$)**	**SS-1**	**SS-1**	**SS-2**	**SS-2**	**SS-3**	**SS-3**	**SS-4**	**SS-4**	**SS-5**	**SS-5 Duplicate**	**SS-5**	**SS-5 Duplicate**
Sub-Slab Soil Vapor	8 hours	Tetrachloroethene	Matrix 2	1,600	140	150	4.5	4.8	8.1	7.3	8.5	7.3	160	150	130	130
		Trichloroethene	Matrix 1	100	14	28	ND (<0.90)	ND (<0.96)	1.1	0.9 J	ND (<0.88)	ND (<0.98)	15	15	10	11
		cis-1,2-Dichloroethene	Matrix 2	--	ND (<0.65)	3.4	ND (<0.67)	ND (<0.71)	ND (<0.62)	ND (<0.68)	ND (<0.65)	ND (<0.72)	ND (<0.64)	ND (<0.61)	ND (<0.68)	ND (<0.67)
		trans-1,2-Dichloroethene	--	--	ND (<0.65)	ND (<0.69)	ND (<0.67)	ND (<0.71)	ND (<0.62)	ND (<0.68)	ND (<0.65)	ND (<0.72)	ND (<0.64)	ND (<0.61)	ND (<0.68)	ND (<0.67)
		1,1-Dichloroethene	Matrix 2	29,000	ND (<0.65)	ND (<0.69)	ND (<0.67)	ND (<0.71)	ND (<0.62)	ND (<0.68)	ND (<0.65)	ND (<0.72)	1.1	1.1	ND (<0.68)	0.75
		Vinyl chloride	Matrix 1	93	ND (<0.42)	ND (<0.45)	ND (<0.43)	ND (<0.46)	ND (<0.40)	ND (<0.44)	ND (<0.42)	ND (<0.47)	ND (<0.41)	ND (<0.39)	ND (<0.44)	ND (<0.43)
		1,1,1-Trichloroethane	Matrix 2	730,000	1.0	1.0	ND (<0.92)	ND (<0.98)	ND (<0.86)	ND (<0.93)	ND (<0.89)	ND (<1.0)	14	14	13	14
		Carbon Tetrachloride	Matrix 1	68	6.8	ND (<1.1)	29	ND (<1.1)	6.3	1.0 J	31	ND (<1.2)	7.1	7.4	5.2	5.6
		1,1-Dichloroethane	--	260	ND (<0.66)	ND (<0.71)	ND (<0.68)	ND (<0.72)	ND (<0.64)	ND (<0.69)	ND (<0.66)	ND (<0.74)	140	140	74	75
		1,2-Dichloroethane	--	16	ND (<0.66)	ND (<0.71)	ND (<0.68)	ND (<0.72)	ND (<0.64)	ND (<0.69)	ND (<0.66)	ND (<0.74)	ND (<0.65)	ND (<0.62)	ND (<0.69)	ND (<0.68)

					Sample Date:	3/23/2016	1/24/2017	3/23/2016	1/24/2017	3/23/2016	1/24/2017	3/23/2016	3/23/2016	1/24/2017	1/24/2017	3/23/2016	1/24/2017	3/23/2016	1/24/2017
Sample Type	**Sample Duration**	**Analyte**	**NYSDOH Decision Matrix**	**NYSDOH Indoor Air Guideline ($\mu g/m^3$)**	**USEPA Screening Level[1] ($\mu g/m^3$)**	**IA-1**	**IA-1**	**IA-1**	**IA-2**	**IA-3**	**IA-3**	**IA-4**	**IA-4 Duplicate**	**IA-4**	**IA-4 Duplicate**	**IA-5**	**IA-5**	**OA-1**	**OA-1**
Indoor and Ambient Air	8 hours	Tetrachloroethene	Matrix 2	30	47	0.74	ND (<0.62)	0.74	ND (<0.46)	ND (<1.1)	ND (<1.1)	0.70	0.70	ND (<0.30)	ND (<0.40)	ND (<2.2)	ND (<120)	ND (<0.22)	ND (<0.22)
		Trichloroethene	Matrix 1	2	3	ND (<0.45)	ND (<0.49)	ND (<0.45)	ND (<0.37)	ND (<0.85)	ND (<0.90)	ND (<0.43)	ND (<0.34)	ND (<0.24)	ND (<0.32)	ND (<1.7)	ND (<96)	ND (<0.17)	ND (<0.18)
		cis-1,2-Dichloroethene	Matrix 2	--	--	ND (<0.33)	ND (<0.36)	ND (<0.33)	ND (<0.27)	ND (<0.63)	ND (<0.67)	ND (<0.32)	ND (<0.25)	ND (<0.17)	ND (<0.24)	ND (<1.3)	ND (<71)	ND (<0.13)	ND (<0.13)
		trans-1,2-Dichloroethene	--	--	--	ND (<1.7)	ND (<1.8)	ND (<1.7)	ND (<1.4)	ND (<3.1)	ND (<3.3)	ND (<1.6)	ND (<1.2)	ND (<0.87)	ND (<1.2)	ND (<6.4)	ND (<71)	ND (<0.63)	ND (<0.65)
		1,1-Dichloroethene	Matrix 2	--	880	ND (<0.17)	ND (<0.18)	ND (<0.17)	ND (<0.14)	ND (<0.31)	ND (<0.33)	ND (<0.16)	ND (<0.12)	ND (<0.087)	ND (<0.12)	ND (<0.64)	ND (<71)	ND (<0.063)	ND (<0.065)
		Vinyl chloride	Matrix 1	--	2.8	ND (<0.11)	ND (<0.12)	ND (<0.11)	ND (<0.087)	ND (<0.20)	ND (<0.21)	ND (<0.10)	ND (<0.081)	ND (<0.056)	ND (<0.076)	ND (<0.41)	ND (<46)	ND (<0.041)	ND (<0.042)
		1,1,1-Trichloroethane	Matrix 2	--	22,000	ND (<0.46)	ND (<0.50)	ND (<0.46)	ND (<0.37)	ND (<0.86)	ND (<0.92)	ND (<0.44)	ND (<0.34)	ND (<0.24)	ND (<0.32)	ND (<1.8)	ND (<98)	ND (<0.17)	ND (<0.18)
		Carbon Tetrachloride	Matrix 1	--	2	0.65	ND (<0.58)	0.65	ND (<0.43)	ND (<0.99)	ND (<1.0)	0.74	0.69	0.45	0.45	ND (<2.0)	ND (<110)	0.47	0.53
		1,1-Dichloroethane	--	--	7.7	ND (<0.34)	ND (<0.37)	ND (<0.34)	ND (<0.28)	ND (<0.64)	ND (<0.68)	ND (<0.32)	ND (<0.26)	ND (<0.18)	ND (<0.24)	ND (<1.3)	ND (<72)	ND (<0.13)	ND (<0.13)
		1,2-Dichloroethane	--	--	0.47	ND (<0.34)	ND (<0.37)	ND (<0.34)	ND (<0.28)	ND (<0.64)	ND (<0.68)	ND (<0.32)	ND (<0.26)	ND (<0.18)	ND (<0.24)	ND (<1.3)	ND (<72)	ND (<0.13)	ND (<0.13)

Notes:

1. USEPA Screening Levels from Vapor Intrusion Screening Level Calculator version 3.5.1, May 2016 RSLs. Commercial Scenario, TCR = $1x10^{6}$; THQ = 1.0 (USEPA, 2016)
2. Indoor Air and Outdoor Air Samples analyzed by Eurofins Air Toxics using USEPA Method TO-15 SIM
3. Sub-Slab Soil Vapor Samples analyzed by Eurofins Air Toxics using modified USEPA Method TO-15
4. Concentrations expressed in units of micrograms per cubic meter ($\mu g/m^3$)

Abbreviations:

"ND" = analyte not detected; analytical reporting limit provided in parentheses

"--" = no guidance value or screening level for this compound

Table 3-1: Analytical Methods / Quality Assurance Summary Table

Former Paxar Facility

Orangeburg, New York

Sample Type	Sample Locations	Sample Duration	Analyte	Analytical Method	NYSDOH Decision Matrix	Analytical Reporting Limit[1] (µg/m³)	NYSDOH Indoor Air Guideline (µg/m³)	USEPA Screening Level[2] (µg/m3)	Sample Container Volume	Hold Time	Field QA/QC Sample Quantities (per event)		
											Duplicate	Blank	MS/MSD
Sub-Slab Soil Vapor	SS-1 SS-2 SS-3 SS-4 SV-5	8 hours	Tetrachloroethene	TO-15	Matrix 2	1.20	not applicable	1,600	6 liters or 1 liter	30 days	1	0	0
			Trichloroethene	TO-15	Matrix 1	0.94		100					
			cis-1,2-Dichloroethene	TO-15	Matrix 2	0.69		--					
			trans-1,2-Dichloroethene	TO-15	--	0.70		--					
			1,1-Dichloroethene	TO-15	Matrix 2	0.70		29,000					
			Vinyl chloride	TO-15	Matrix 1	0.46		93					
			1,1,1-Trichloroethane	TO-15	Matrix 2	0.95		730,000					
			Carbon Tetrachloride	TO-15	Matrix 1	1.10		68					
			1,1-Dichloroethane	TO-15	--	0.71		260					
			1,2-Dichloroethane	TO-15	--	0.71		16					
Indoor and Ambient Air	IA-1 IA-2 IA-3 IA-4 IA-5 OA-1	8 hours	Tetrachloroethene	TO-15-SIM	Matrix 2	0.25	30	47	6 liters	30 days	1	0	0
			Trichloroethene	TO-15-SIM	Matrix 1	0.19	2	3					
			cis-1,2-Dichloroethene	TO-15-SIM	Matrix 2	0.14	--	--					
			trans-1,2-Dichloroethene	TO-15-SIM	--	0.70	--	--					
			1,1-Dichloroethene	TO-15-SIM	Matrix 2	0.07	--	880					
			Vinyl chloride	TO-15-SIM	Matrix 1	0.05	--	2.8					
			1,1,1-Trichloroethane	TO-15-SIM	Matrix 2	0.19	--	22,000					
			Carbon Tetrachloride	TO-15-SIM	Matrix 1	0.22	--	2					
			1,1-Dichloroethane	TO-15-SIM	--	0.14	--	7.7					
			1,2-Dichloroethane	TO-15-SIM	--	0.14	--	0.47					

Notes:

1. Reporting limit values provided by Eurofins Air Toxics, Inc. (EATI) based on a post-sampling canister vacuum of 7 inches of mercury (inHg). Reporting Limits for field samples may vary due to multiple factors such as sample volume, sample dilutions, and/or interference from non-target analytes.
2. USEPA Screening Levels from Vapor Intrusion Screening Level Calculator version 3.4, November 2015 RSLs. Commercial Scenario, TCR = $1x10^{-6}$; THQ = 1.0 (USEPA, 2016)

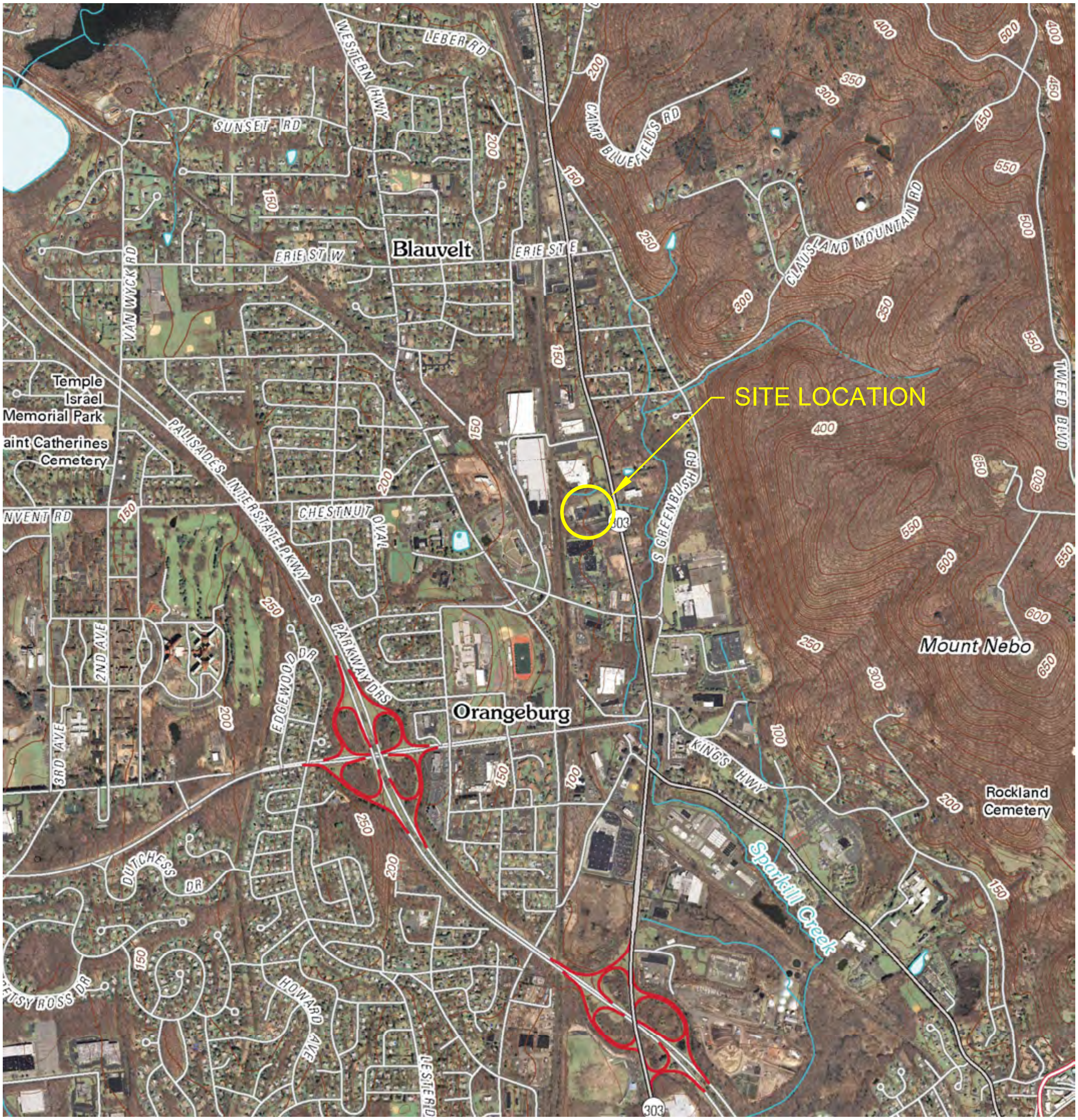
Abbreviations:

MS/MSD = matrix spike/matrix spike duplicate

"--" = no guidance value or screening level for this compound

FIGURES

K:\1-0145-15\CAD\Location Map.dwg



N

1	0.5	0	1

MILES

1000 0 1000 2000 3000 4000 5000 6000 7000

FEET

CONTOUR INTERVAL 10 FEET

QUADRANGLE LOCATION

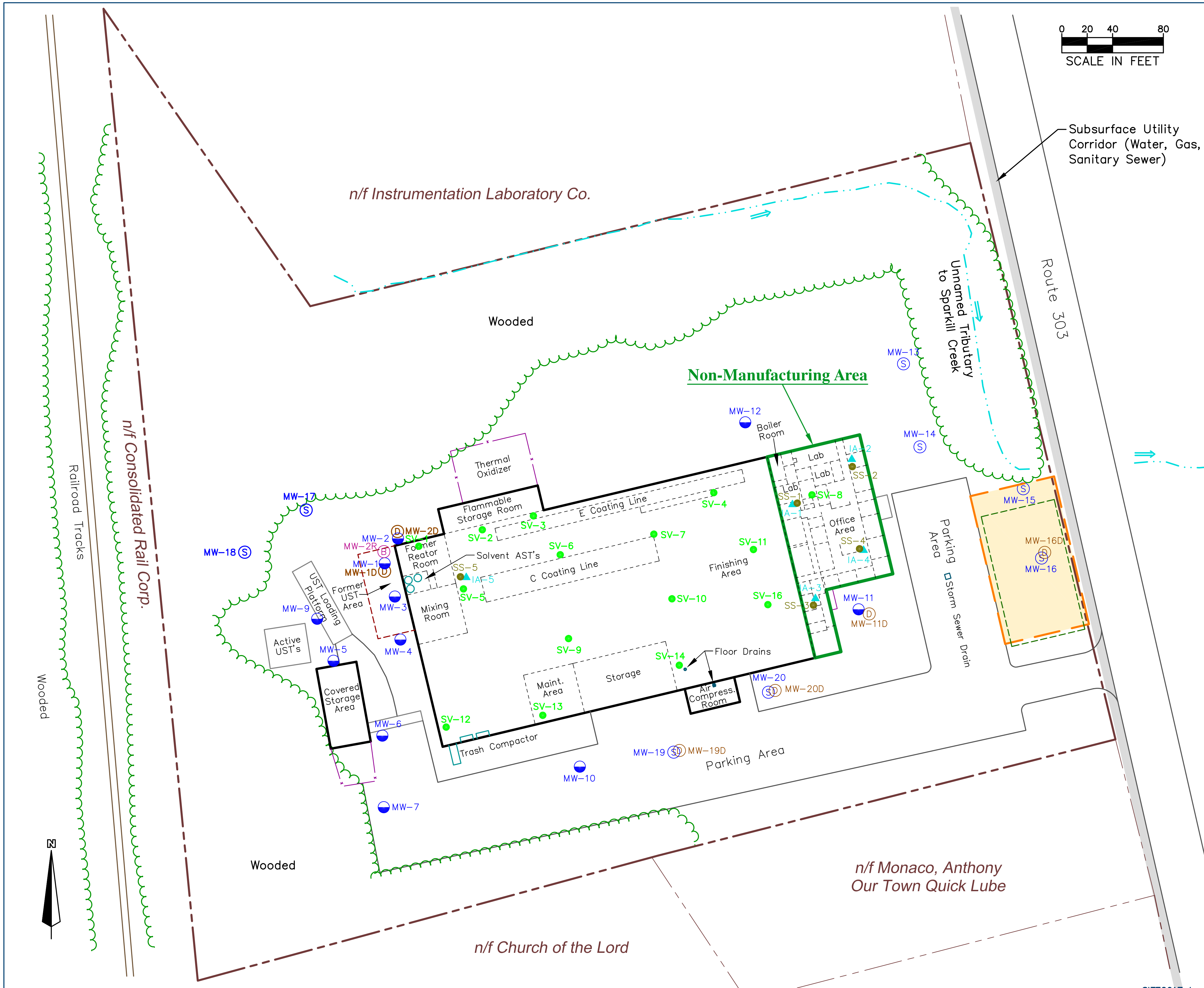
BASE MAP: USGS 7.5 Minute Topographic Quadrangle NYACK, NY–NJ

FIGURE 1-1: SITE LOCATION FORMER PAXAR FACILITY ORANGEBURG, NEW YORK

The Johnson Company

100 State Street, Suite 600
Montpelier, VT 05602

Drawn by: TJK	Date: 01/26/16
Reviewed by: CMT	Date: 01/26/16
Scale: As Shown	Project: 1-0145-15



LEGEND

- Property Line
- Building Footprint
- Approximate Building Interior Partition
- Fenceline
- Stream Location
- Former Septic System Leach Field (Approximate)
- Approximate Septic System GPR Survey Area
- SV-7 — 2008 Soil Gas Sampling Location
- SS-3 — 2016–2017 Sub-slab Soil Vapor Sampling Location
- IA-5 — 2016–2017 Indoor Air Sampling Location
- MW-12 — 2007 ERM Soil Sampling Location and Shallow Unconsolidated Deposits Groundwater Monitoring Well
- MW-15 — 2007–2014 Shallow Unconsolidated Deposits Groundwater Monitoring Well Location
- MW-1D — 2007–2014 Deep Unconsolidated Deposits Groundwater Monitoring Well Location
- MW-2R — 2007–2014 Bedrock Groundwater Monitoring Well Location

Note: Groundwater monitoring well locations surveyed by Tectonic Engineering & Surveying Consultants, P.C. on 12/07/10, 02/21/12, and 11/05/13. All other locations are approximate.

Sources:

Town of Orangeburg 1992 tax maps

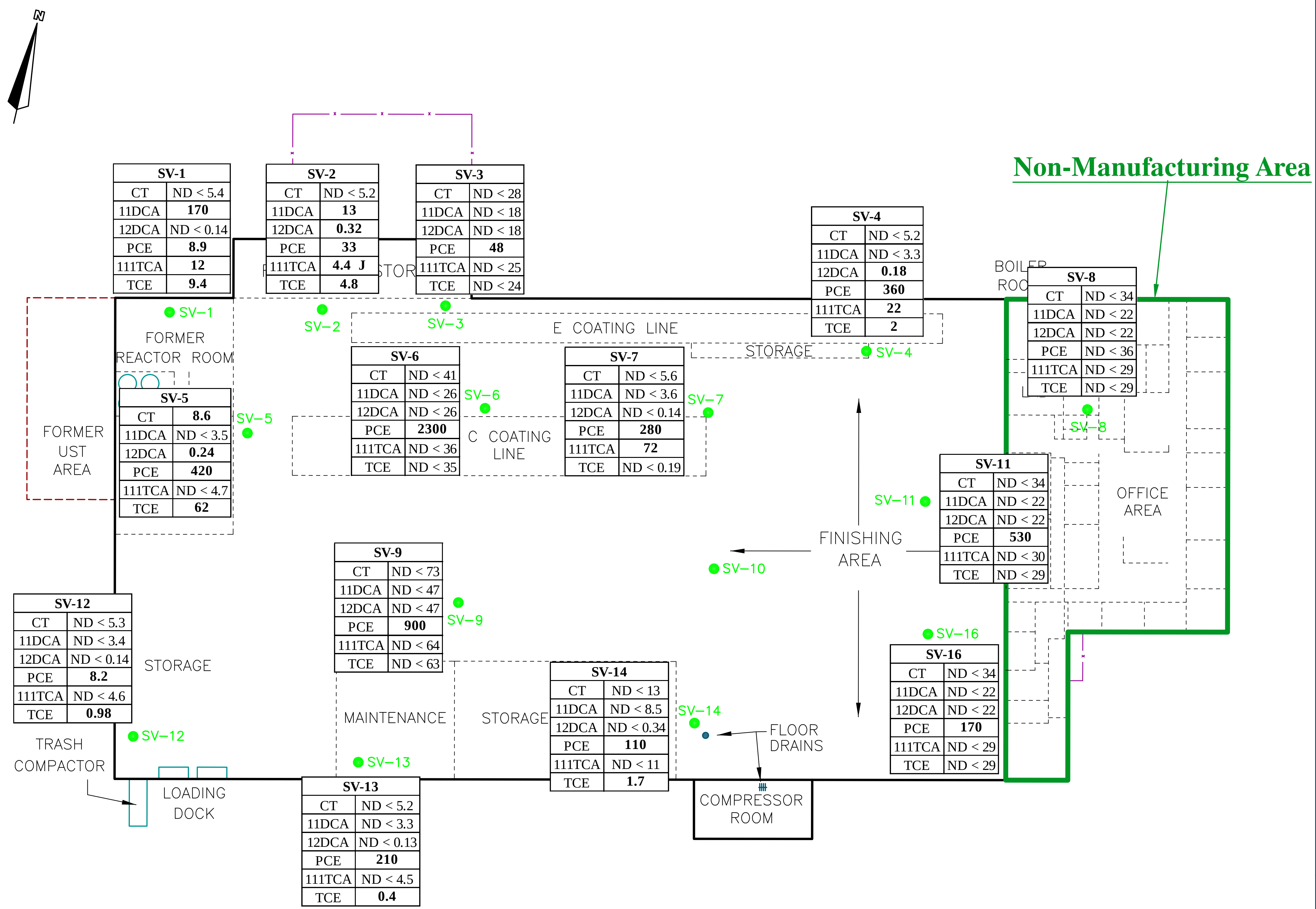
2007 aerial photography from New York State GIS Clearinghouse

Survey Plat by Tectonic Engineering & Surveying Consultants, P.C. dated 12/20/10, revised 02/28/12.

Figure 2-1
Site Plan
Former PAXAR Facility
Orangeburg, New York

The Johnson Company
100 State Street, Suite 600
Montpelier, VT 05602

Drawn by: TJK	Date: 09/26/17
Reviewed by: CMT	Date: 09/26/17
Scale: As Shown	Project: 1-0145-15



SV-1	
CT	ND < 5.4
11DCA	**170**
12DCA	ND < 0.14
PCE	**8.9**
111TCA	**12**
TCE	**9.4**

SV-2	
CT	ND < 5.2
11DCA	**13**
12DCA	**0.32**
PCE	**33**
111TCA	**4.4 J**
TCE	**4.8**

SV-3	
CT	ND < 28
11DCA	ND < 18
12DCA	ND < 18
PCE	**48**
111TCA	ND < 25
TCE	ND < 24

SV-4	
CT	ND < 5.2
11DCA	ND < 3.3
12DCA	**0.18**
PCE	**360**
111TCA	**22**
TCE	**2**

SV-5	
CT	**8.6**
11DCA	ND < 3.5
12DCA	**0.24**
PCE	**420**
111TCA	ND < 4.7
TCE	**62**

SV-6	
CT	ND < 41
11DCA	ND < 26
12DCA	ND < 26
PCE	**2300**
111TCA	ND < 36
TCE	ND < 35

SV-7	
CT	ND < 5.6
11DCA	ND < 3.6
12DCA	ND < 0.14
PCE	**280**
111TCA	**72**
TCE	ND < 0.19

SV-8	
CT	ND < 34
11DCA	ND < 22
12DCA	ND < 22
PCE	ND < 36
111TCA	ND < 29
TCE	ND < 29

SV-9	
CT	ND < 73
11DCA	ND < 47
12DCA	ND < 47
PCE	**900**
111TCA	ND < 64
TCE	ND < 63

SV-11	
CT	ND < 34
11DCA	ND < 22
12DCA	ND < 22
PCE	**530**
111TCA	ND < 30
TCE	ND < 29

SV-12	
CT	ND < 5.3
11DCA	ND < 3.4
12DCA	ND < 0.14
PCE	**8.2**
111TCA	ND < 4.6
TCE	**0.98**

SV-13	
CT	ND < 5.2
11DCA	ND < 3.3
12DCA	ND < 0.13
PCE	**210**
111TCA	ND < 4.5
TCE	**0.4**

SV-14	
CT	ND < 13
11DCA	ND < 8.5
12DCA	ND < 0.34
PCE	**110**
111TCA	ND < 11
TCE	**1.7**

SV-16	
CT	ND < 34
11DCA	ND < 22
12DCA	ND < 22
PCE	**170**
111TCA	ND < 29
TCE	ND < 29

Notes:
Figure includes compounds from 2017 analyte list that were detected in November 2008 soil vapor samples.
ND < ## = Compound not detected above the laboratory reporting limit, limit provided.
J = Compound detected below the laboratory reporting limit, estimated concentration provided.
All results given in micrograms per cubic meter ($\mu g/m^3$)

SITE2010.dwg

LEGEND

- Building Footprint
- Approximate Building Interior Partition
- Fenceline
- SV-7 Sub-Slab Soil Vapor Sampling Point Location

Sub-Slab Soil Vapor Sampling Point Identification

VOC Abbreviation (see Key)

VOC Result November 4, 2008 (ug/m³)

SV-1	
CT	ND < 5.4
11DCA	**170**
12DCA	ND < 0.14
PCE	**8.9**
111TCA	**12**
TCE	**9.4**

Key	
Abbreviation	**Compound Name**
CT	Carbon tetrachloride
11DCA	1,1-Dichloroethane
12DCA	1,2-Dichloroethane
PCE	Tetrachloroethene
111TCA	1,1,1-Trichloroethane
TCE	Trichloroethene

0 20 40 80

SCALE IN FEET

Figure 2-2: VOC Concentrations in Soil Vapor - November, 2008
Former PAXAR Facility
Orangeburg, New York

The Johnson Company
100 State Street, Suite 600
Montpelier, VT 05602

Drawn by: TJK	Date: 09/26/17
Reviewed by: CMT	Date: 09/26/17
Scale: 1" = 40'	Project: 1-0145-15

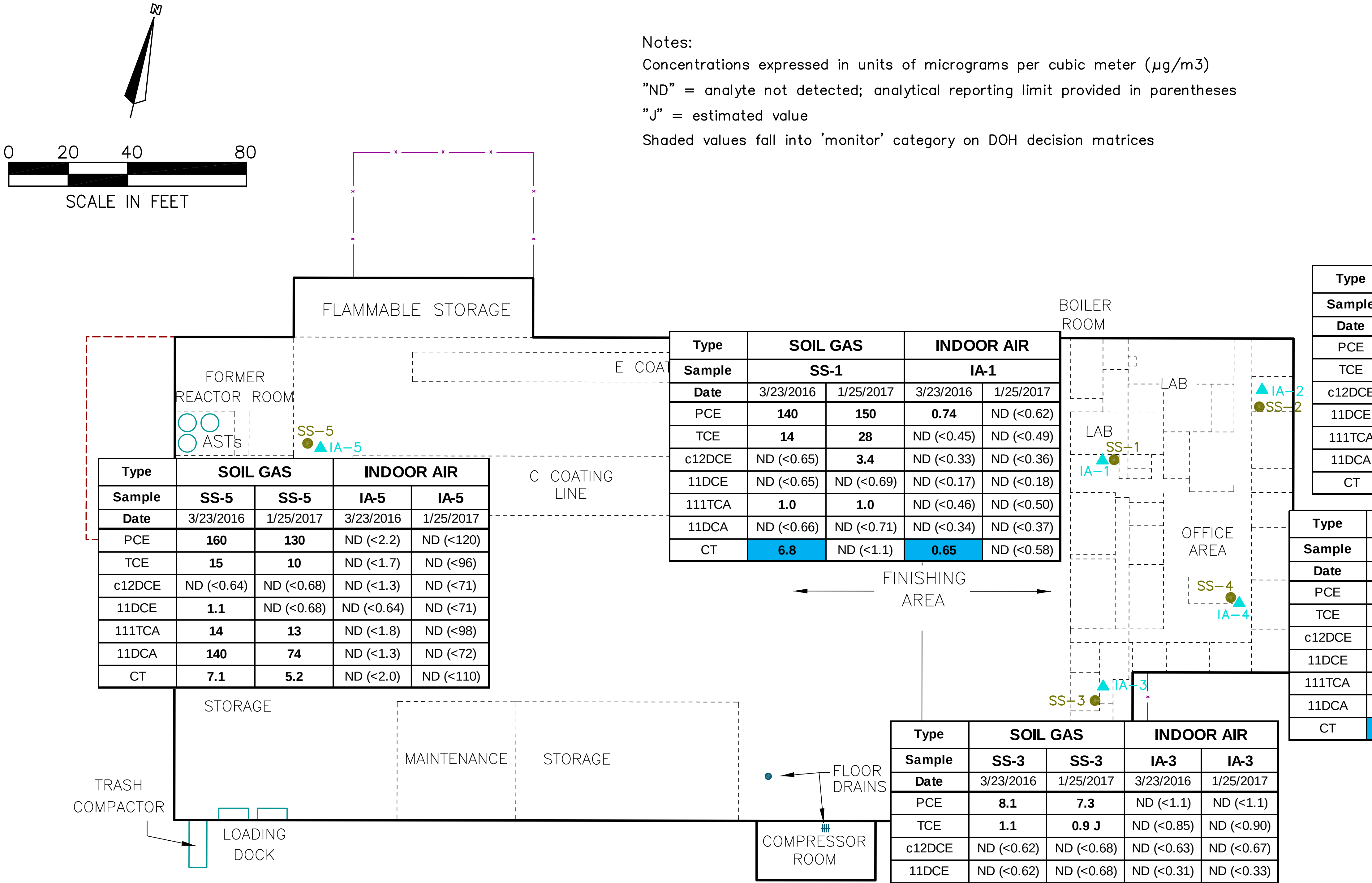
Notes:

Concentrations expressed in units of micrograms per cubic meter (μg/m3)

"ND" = analyte not detected; analytical reporting limit provided in parentheses

"J" = estimated value

Shaded values fall into 'monitor' category on DOH decision matrices



LEGEND

- Building Footprint
- Approximate Building Interior Partition
- Fenceline
- Indoor Air Sampling Location
- Sub-Slab Soil Vapor Sampling Location

Type	SOIL GAS		INDOOR AIR	
Sample	SS-5	SS-5	IA-5	IA-5
Date	3/23/2016	1/25/2017	3/23/2016	1/25/2017
PCE	**160**	**130**	ND (<2.2)	ND (<120)
TCE	**15**	**10**	ND (<1.7)	ND (<96)
c12DCE	ND (<0.64)	ND (<0.68)	ND (<1.3)	ND (<71)
11DCE	**1.1**	ND (<0.68)	ND (<0.64)	ND (<71)
111TCA	**14**	**13**	ND (<1.8)	ND (<98)
11DCA	**140**	**74**	ND (<1.3)	ND (<72)
CT	**7.1**	**5.2**	ND (<2.0)	ND (<110)

Type	SOIL GAS		INDOOR AIR	
Sample	SS-1		IA-1	
Date	3/23/2016	1/25/2017	3/23/2016	1/25/2017
PCE	**140**	**150**	**0.74**	ND (<0.62)
TCE	**14**	**28**	ND (<0.45)	ND (<0.49)
c12DCE	ND (<0.65)	**3.4**	ND (<0.33)	ND (<0.36)
11DCE	ND (<0.65)	ND (<0.69)	ND (<0.17)	ND (<0.18)
111TCA	**1.0**	**1.0**	ND (<0.46)	ND (<0.50)
11DCA	ND (<0.66)	ND (<0.71)	ND (<0.34)	ND (<0.37)
CT	**6.8**	ND (<1.1)	**0.65**	ND (<0.58)

Type	SOIL GAS		INDOOR AIR	
Sample	SS-2	SS-2	IA-2	IA-2
Date	3/23/2016	1/25/2017	3/23/2016	1/25/2017
PCE	**4.5**	**4.8**	**0.66**	ND (<0.46)
TCE	ND (<0.90)	ND (<0.96)	ND (<0.35)	ND (<0.37)
c12DCE	ND (<0.67)	ND (<0.71)	ND (<0.26)	ND (<0.27)
11DCE	ND (<0.67)	ND (<0.71)	ND (<0.13)	ND (<0.14)
111TCA	ND (<0.92)	ND (<0.98)	ND (<0.35)	ND (<0.37)
11DCA	ND (<0.68)	ND (<0.72)	ND (<0.26)	ND (<0.28)
CT	**29**	ND (<1.1)	**0.60**	ND (<0.43)

Type	SOIL GAS		INDOOR AIR	
Sample	SS-4	SS-4	IA-4	IA-4
Date	3/23/2016	1/25/2017	3/23/2016	1/25/2017
PCE	**8.5**	**7.3**	**0.70**	ND (<0.30)
TCE	ND (<0.88)	ND (<0.98)	ND (<0.43)	ND (<0.24)
c12DCE	ND (<0.65)	ND (<0.72)	ND (<0.32)	ND (<0.17)
11DCE	ND (<0.65)	ND (<0.72)	ND (<0.16)	ND (<0.087)
111TCA	ND (<0.89)	ND (<1.0)	ND (<0.44)	ND (<0.24)
11DCA	ND (<0.66)	ND (<0.74)	ND (<0.32)	ND (<0.18)
CT	**31**	ND (<1.2)	**0.74**	**0.45**

Type	SOIL GAS		INDOOR AIR	
Sample	SS-3	SS-3	IA-3	IA-3
Date	3/23/2016	1/25/2017	3/23/2016	1/25/2017
PCE	**8.1**	**7.3**	ND (<1.1)	ND (<1.1)
TCE	**1.1**	**0.9 J**	ND (<0.85)	ND (<0.90)
c12DCE	ND (<0.62)	ND (<0.68)	ND (<0.63)	ND (<0.67)
11DCE	ND (<0.62)	ND (<0.68)	ND (<0.31)	ND (<0.33)
111TCA	ND (<0.86)	ND (<0.93)	ND (<0.86)	ND (<0.92)
11DCA	ND (<0.64)	ND (<0.69)	ND (<0.64)	ND (<0.68)
CT	**6.3**	**1.0 J**	ND (<0.99)	ND (<1.0)

Abbreviations:	
PCE	Tetrachloroethene
TCE	Trichloroethene
c12DCE	cis-1,2-Dichloroethene
11DCE	1,1-Dichloroethene
111TCA	1,1,1-Trichloroethane
11DCA	1,1-Dichloroethane
CT	Carbon Tetrachloride

SITE2010.dwg

Figure 2-3: 2016 - 2017
Soil Vapor Investigation Results
Former PAXAR Facility
Orangeburg, New York

The Johnson Company
100 State Street, Suite 600
Montpelier, VT 05602

Drawn by: TJK Date: 09/26/07
Reviewed by: CMT Date: 09/26/07
Scale: As Shown Project: 1-0145-15

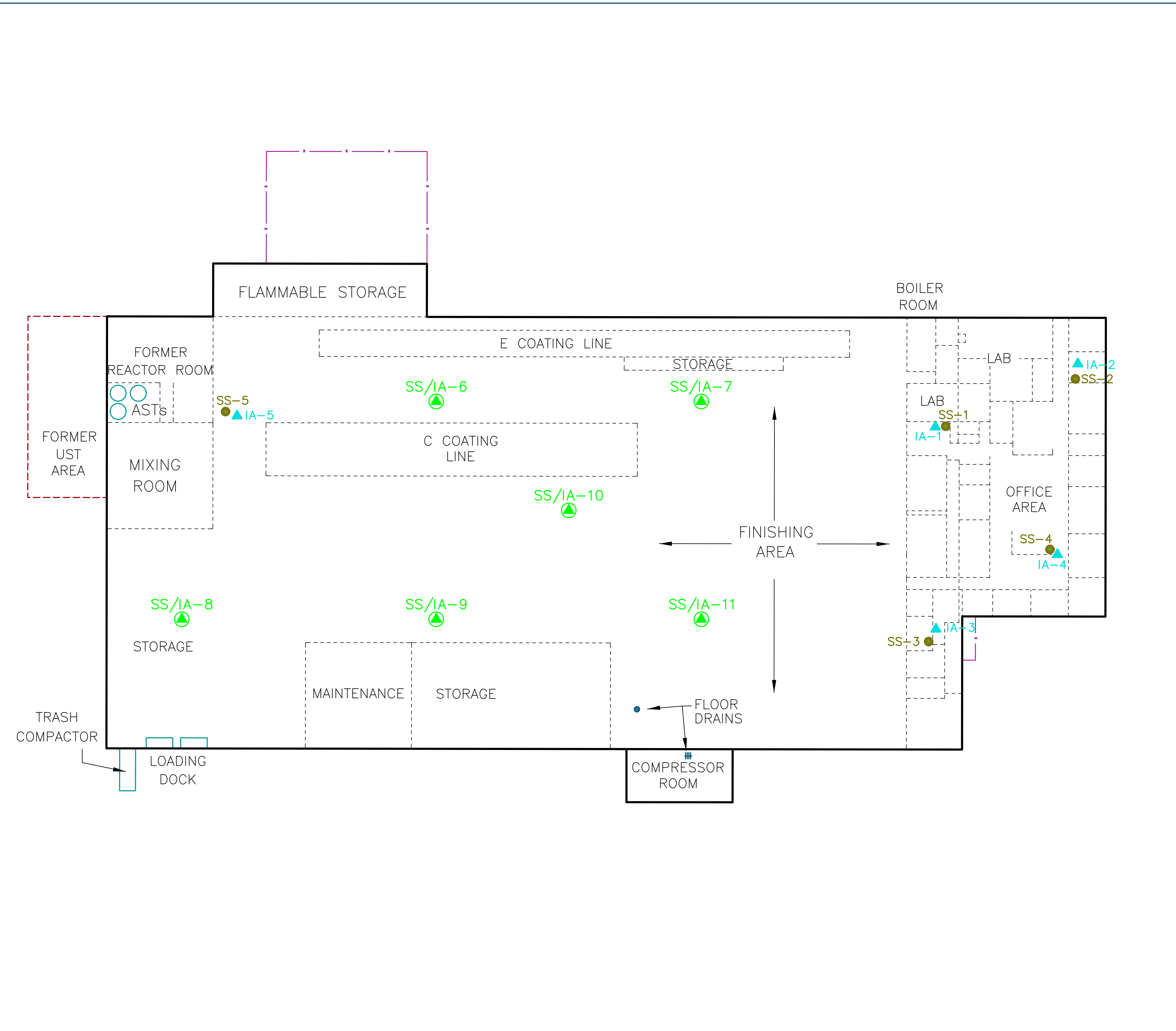


Figure 3-1: Planned Sub-Slab Soil Vapor and Indoor Air Sampling Locations
Former PAXAR Facility
Orangeburg, New York

The Johnson Company
100 State Street, Suite 600
Montpelier, VT 05602

Drawn by: TJK Date: 09/26/07
Reviewed by: CMT Date: 09/26/07
Scale: As Shown Project: 1-0145-15

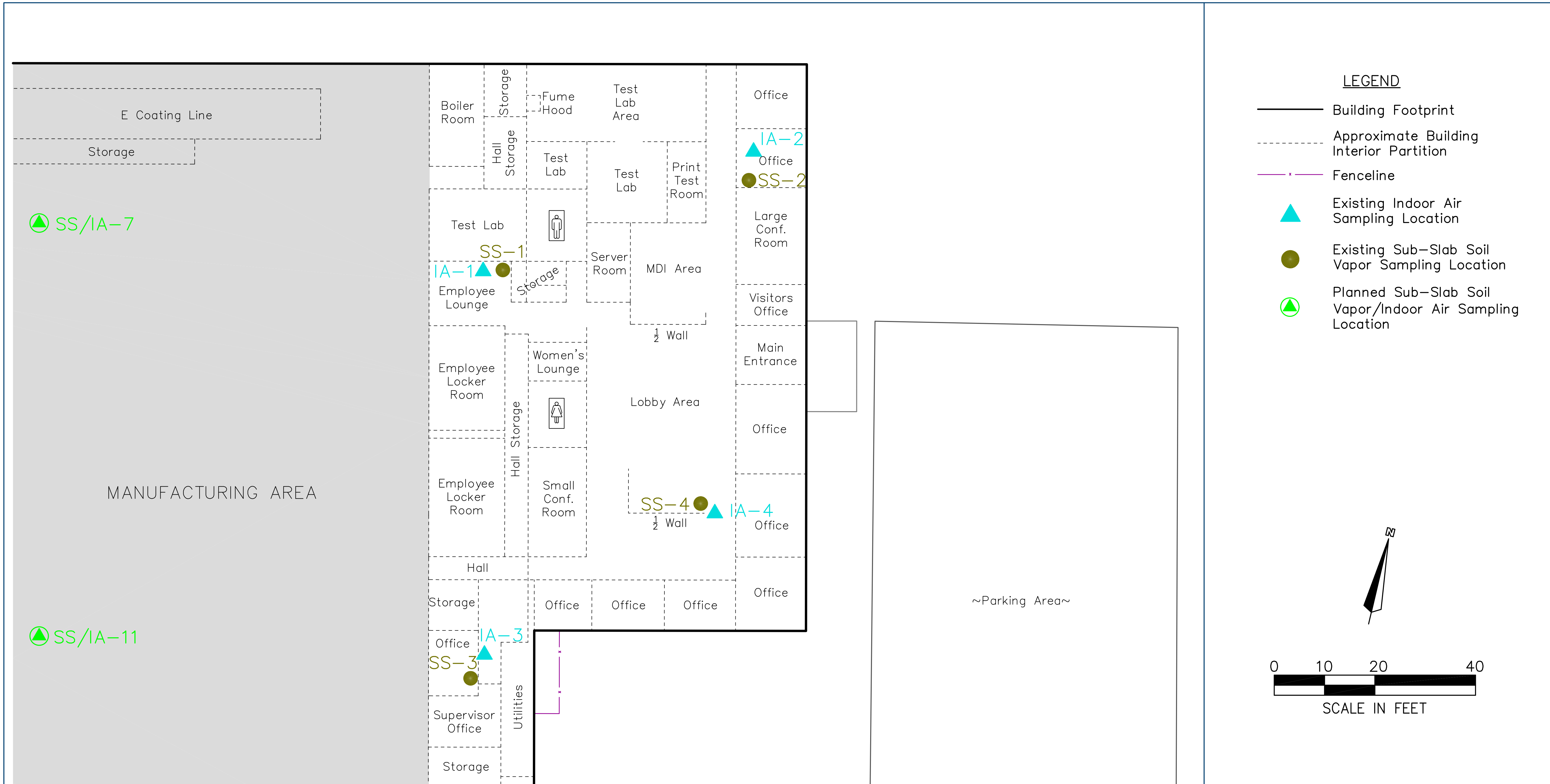


Figure 3-2: Planned Sampling Locations
Office Area Detail
Former PAXAR Facility
Orangeburg, New York

The Johnson Company

100 State Street, Suite 600
Montpelier, VT 05602

Drawn by: TJK	Date: 09/26/17
Reviewed by: CMT	Date: 09/26/17
Scale: 1" = 20'	Project: 1-0145-15

APPENDIX A:

Operating Procedures

Project-Specific Operating Procedure for Sub-Slab Soil Vapor and Indoor Air Sampling

The Johnson Company, Inc.

Project-Specific Operating Procedure
for
Sub-Slab Soil Vapor and Indoor Air Sampling

INTRODUCTION

This procedure describes the activities to be undertaken prior to or during the collection of sub-slab soil vapor and indoor air samples at the Former Paxar Facility located at 529 Route 303 in Orangeburg, New York (the “Site”). This procedure addresses the performance of gas tracer tests to verify the integrity of hardware installed for the collection of sub-slab soil vapor samples, and the collection of sub-atmospheric sub-slab soil vapor and indoor air samples using evacuated (e.g., SUMMA®) canisters.

EQUIPMENT AND SUPPLIES

A. Sub-Slab Soil Vapor Pin/Soil Vapor Probe[1] Leak Testing

- High Purity (HP) or Ultra High Purity (UHP) grade helium cylinder
- Helium cylinder regulator with nominal ¼-inch male compression fitting
- Helium detector (e.g., Radiodetection model MGD 2002)
- Leak testing apparatus
- In-line vacuum gauge

B. Sub-Slab Soil Vapor Sample Collection

- 0.25-inch (¼-inch) outer-diameter (OD) Teflon® tubing
- Swagelok™ nut and ferrules for 0.25-inch OD tubing
- Flexible tubing to connect sampling assembly to soil vapor pin (for VaporPin® applications)
- Swagelok quick-connect fitting to connect sampling assembly to soil vapor probe (for permanent soil vapor probe applications)
- Passivated stainless-steel canister(s) as described in ASTM Method D5466-01
- Laboratory calibrated flow control valve(s) for passivated canister(s)
- Certified calibrated digital pressure gauge that can measure negative pressure
- One manifold for each field duplicate sample collected (laboratory supplied or assembled in the field)
- T-connector (e.g. Swagelok™ B-400-3) with Teflon® tubing
- In-line valve (e.g. Swagelok™ B-4P4)
- Calibrated vacuum pump

[1] This Operating Procedure applies to two types of sub-slab soil vapor sampling devices: 1) permanent soil vapor probes installed at fifteen locations in 2008, each constructed with a sub-slab stainless steel wire mesh screen connected to a Swagelok™ quick-connect fitting at the surface via 1/8-inch OD stainless steel tubing; and, 2) VaporPin™ installations. A VaporPin™ is a temporary or semi-permanent stainless steel device installed inside a hole drilled through the concrete floor slab.

C. Indoor Air Sample Collection

- Passivated stainless-steel canister(s) as described in ASTM Method D5466-01
- Laboratory calibrated flow control valve(s) for passivated canister(s)
- Certified calibrated digital pressure gauge that can measure negative pressure
- One manifold for each field duplicate sample collected (laboratory supplied or assembled in the field)

PROCEDURES

A. Sub-Slab Soil Vapor Pin/Soil Vapor Probe Leak Testing

This section describes a helium gas tracer test used to assess the integrity of sub-slab soil vapor pin and soil vapor probe installations and a “shut-in” test. The helium tracer test is designed to detect leaks around or through soil vapor probe construction materials under pressure gradient conditions that are equal to or greater than pressure gradients induced during soil vapor sample collection. The shut-in test is specified for identifying potential leakage in the sampling train.

Helium Tracer Test

1. Connect the leak testing apparatus to the sub-slab soil vapor pin/probe being tested, as shown in Figure 1. The tracer testing apparatus should consist of an enclosure with an open bottom (such as an inverted bucket), and two ports - one port for injecting helium tracer gas into the enclosure, and a second port that allows a single piece of 0.25-inch OD tubing to pass through the enclosure. The end of the 0.25-inch OD tubing inside the enclosure is connected to the soil vapor probe using the appropriate air-tight fitting and the opposite end of the tubing is connected to a portable helium detector (such as a Radiodetection model MGD-2002 Multi-Gas Leak Locator) outside of the enclosure. The connection with the portable helium detector should be sealed to prevent ambient air from entering the helium detector during operation. The tracer injection port is connected to a cylinder containing high purity (HP) or ultra high purity (UHP) helium. The bottom edge of the enclosure should be equipped with foam padding or soft weather stripping to limit leakage of tracer gas out of the enclosure during the test. Fittings, ports, or holes in the enclosure should be sealed or plugged to limit leaking of helium from the enclosure during the test.

3. Begin operation of the portable helium detector, and record the vacuum pump rate specified in the operation manual for the helium detector (e.g., 0.5 liters per minute). This pumping rate should be greater than or equal to the anticipated rate of soil vapor extraction from the probe during sample collection. Wait for the reported helium concentration to stabilize; the stabilized helium concentration represents the baseline value for the leak test.

4. Inject helium tracer gas into the enclosure by opening the valve on the helium regulator slightly. During the initial introduction of helium gas, allow ambient air to escape from the bottom of the enclosure until the relatively low-temperature helium gas can be felt escaping, then rest the enclosure flat on the ground surface and apply downward pressure to limit helium escape from the enclosure. Maintain helium gas pressure inside the enclosure by setting the helium regulator at a slightly open position for the duration of the leak test (allowing a continuous flow of helium into the enclosure), or by adding 5 to 10 second bursts of tracer gas to the enclosure at 1-minute intervals throughout the duration of the leak test.

5. Allow the test to continue for a period of 5 minutes. During the test, helium detector readings should be recorded at 1-minute intervals. Peak helium concentrations measured in soil vapor should also be recorded. The soil vapor probe seal is deemed acceptable if helium concentrations detected in soil vapor do not exceed 1% by volume (10,000 ppmv) above the baseline helium concentration at any point during the test.

6. At the conclusion of the test, disconnect the leak testing apparatus from the soil vapor pin/probe. Install a cap on the vapor pin. Soil vapor probes are equipped with quick-connect fittings that close automatically when disconnected. Close the protective roadbox cover over the soil vapor probe or install the protective metal cap over the vapor pin.

Shut-in Test

Leak testing of the sampling train will be assessed at each location prior to collection of each sample by completing a “shut-in” test. A shut-in test consists of assembling the above-ground sampling apparatus (valves, lines, and fittings downstream of the top of the probe/pin), and evacuating the lines to a measured vacuum of approximately100 inches of water (approximately 7.3 inches of mercury), then shutting the vacuum in with the closed valves on opposite ends of the sample train. The vacuum gauge is observed for at least 1 min, and if there is any observable loss of vacuum, the fittings should be adjusted as needed until the vacuum in the aboveground portion of the sample train does not noticeably dissipate.”

B. <u>Sub-Slab Soil Vapor Sample Collection</u>

Sub-slab soil vapor samples will be collected into evacuated canisters (sample canisters) at final pressures below atmospheric pressure. Sample canisters described in this procedure consist of leak-free stainless-steel pressure vessels with passivated interior surfaces and a valve, such as SUMMA® or SilcoCan® canisters (ASTM, 2007). The practice of using evacuated canisters to collect gas samples with final pressures below atmospheric pressure is referred to as “sub-atmospheric sampling” in the USEPA Region 1 Canister Sampling Standard Operating Procedure, Revision #4 (USEPA, 2007) and ASTM Method D5466-01 (ASTM, 2007) and is the preferred method outlined in the Final Guidance for Evaluating Soil

Vapor Intrusion in the State of New York (NYSDOH, 2006). Sub-atmospheric sampling involves the use of a flow controller that limits the rate of gas entry into the canister.

1. **Equilibration:** Allow sub-slab soil vapor probes to equilibrate to subsurface conditions for a period of time after installation and leak tests are completed. Allow Summa canisters and flow controllers an appropriate equilibration period so that the canister and flow controller surfaces are at ambient temperature.

2. **Sample Containers and Flow Controllers:** Initially, six-liter Summa canisters will be used for sample collection. Depending on the results and project objectives, smaller volume canisters may be specified for subsequent sampling rounds.

   Flow controllers will be calibrated such that samples are collected over a period of 8 hours. For a 6-liter canister, this equates to a flow rate of approximately 10 milliliters per minute (ml/min).

   When ordering the canisters from the laboratory, specify the requirement for individual "clean" certification for each canister. A "clean" canister is defined as having no target analyte detected at a concentration equal to or greater than one half of its practical quantitation limit. The analytical laboratory should submit the canister certifications with the shipped canisters for review by the sampler prior to use.

3. **Pressure Check:** Use the certified calibrated digital pressure gauge to check the canister pressure prior to and just after sample collection as a check on the flow-controller pressure gauge and to assess for potential pressure changes that may occur during canister shipment. Pressure checks should be conducted in outdoor air or away from the sampling area.

   A low initial canister vacuum reading may be indicated by a faulty vacuum gauge on the flow controller or caused by canister leakage during transportation from the laboratory to the Site. The canister vacuum before sampling should be within 3 inches of mercury (in Hg) of the laboratory-recorded initial pressure. For example, if the laboratory initial pressure in a 6-L Summa® canister is reported as -27 in Hg; for use, the field measured pressure should be between -24 and -30 in Hg, or between 24 and 30 in Hg vacuum). If the initial canister vacuum reading is more than 3 in Hg less than the vacuum applied to the canister at the laboratory (as measured by a calibrated pressure gauge), do not use the canister for sample collection.

4. **Purging:** Connect the sample canister to the sub-slab soil vapor probe/pin as shown in Figures 2A and 2B. Assemble the sample tubing, flow controller, valves (in closed position) and fittings prior to connecting the sample tubing to the soil vapor sampling points.

Connect a vacuum pump to the in-line valve (see Figures 2A and 2B) using air-tight fittings. Open the in-line valve and turn on the vacuum pump to begin purging. Total purge volume should be equal to 3 to 5 times the internal volume of the soil vapor probe/pin assembly and the 0.25-inch OD sample tubing and fittings. The purge rate should not exceed 0.2 liters per minute. Total duration of purging may be calculated by dividing the desired total purge volume by the flow rate of the calibrated vacuum pump.

If field replicate sub-slab soil vapor samples are being collected from a soil vapor probe after purging, an in-line T-connection will be used as shown on Figure 2B. After purging, open the valve on both canisters simultaneously; the replicate samples will be collected simultaneously.

When purging is complete, shut off the in-line valve while the pump is running to prevent backflow, then turn off the vacuum pump. Disconnect the vacuum pump.

5. **Start Sample Collection:** Begin sub-slab soil vapor sample collection by opening the valve on the sample canister. Record the sample start time, the initial vacuum reading from the gauge on the flow controller (after opening the canister valve), and canister identification number on the sampling form provided in Attachment JCO-SOP-062-002. If field duplicate soil vapor samples are being collected from a sub-slab soil vapor probe, attach the duplicate sampling manifold prior to purging. After purging, open the valve on both canisters simultaneously; the duplicate samples will be collected simultaneously.

6. **Stop Sample Collection:** Check the canister gauge at the approximate half-way point during sampling to confirm that the flow rate is correct. For a 6-L Summa® canister evacuated to a pressure of -30 in Hg, a target stop pressure is between -3 in Hg and -9 in Hg. At the conclusion of the planned sub-slab soil vapor sample collection period, record the final vacuum reading from the gauge on the flow controller and close the canister valve. Use the calibrated digital vacuum gauge to measure the final vacuum in the canister. Ensure that the canister valve is not over-tightened because this is a frequent cause of leaks.

   Although flow controllers are calibrated to fill sample canisters to desired final vacuum levels within the specified time period, such calibrations are not exact, and subsurface conditions may restrict the flow of soil vapor into a probe. Thus, it is sometimes beneficial to extend the sample collection period to obtain a sample volume sufficient to achieve the required detection limits. Discuss with the project manager before extending the sample period beyond the 8-hour target. After closing the valve on the canister, disconnect the sample tubing from the soil vapor probe/pin, replace the soil vapor sampling pin cap and close the protective roadbox cover over the soil vapor probe/pin, and disassemble the sampling apparatus.

7. **Chain of Custody and Shipping:** Package and ship the sample canisters to the analytical laboratory for next-day delivery (or courier pickup) under chain-of-custody protocol. Record sample collection start and end times, initial vacuum, and final vacuum for each sample canister on the chain-of-custody form.

C. Indoor Air Sample Collection

Indoor air and ambient air samples will be collected into evacuated canisters (sample canisters) at final pressures below atmospheric pressure. Sample canisters described in this procedure consist of leak-free stainless-steel pressure vessels with passivated interior surfaces and a valve, such as SUMMA® or SiloCan® canisters (ASTM, 2007). The practice of using evacuated canisters to collect gas samples with final pressures below atmospheric pressure is referred to as “sub-atmospheric sampling” in the USEPA Region 1 Canister Sampling Standard Operating Procedure, Revision #4 (USEPA, 2007) and ASTM Method D5466-01 (ASTM, 2007) and is the preferred method outlined in the Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York (NYSDOH, 2006). Sub-atmospheric sampling involves the use of a flow controller that limits the rate of gas entry into the canister.

1. **Select Ambient (Outdoor) Air Sampling Location:** One ambient air sampling location should be collected from a location upwind of the building and away from wind obstructions (e.g., trees or bushes), and not biased toward obvious sources of VOCs, for example; automobiles, lawnmowers, oil storage tanks, USTs, etc.

2. **Equilibration:** Allow Summa canisters and flow controllers an appropriate equilibration period so that the canister and flow controller surfaces are at ambient temperature.

3. **Sample Containers and Flow Controllers:** Initially, six-liter Summa canisters will be used for sample collection. Depending on the results and project objectives, smaller volume canisters may be specified for subsequent sampling rounds.

   Flow controllers will be calibrated such that samples are collected over a period of 8 hours. For a 6-liter canister, this equates to a flow rate of approximately 12 milliliters per minute (ml/min).

   When ordering the canisters from the laboratory, specify the requirement for individual “clean” certification for each canister.

4. **Pressure Check:** Use the certified calibrated digital pressure gauge to check the canister pressure prior to and just after sample collection as a check on the flow-controller pressure gauge and to assess for potential pressure changes that may occur during canister shipment. Pressure checks should be conducted in outdoor air or away from the sampling area.

A low initial canister vacuum reading may be indicated by a faulty vacuum gauge on the flow controller or caused by canister leakage during transportation from the laboratory to the Site. The canister vacuum before sampling should be within 3 inches of mercury (in Hg) of the laboratory-recorded initial pressure. For example, if the laboratory initial pressure in a 6-L Summa® canister is reported as -27 in Hg; for use, the field measured pressure should be between -24 and -30 in Hg, or between 24 and 30 in Hg vacuum). If the initial canister vacuum reading is more than 3 in Hg less than the vacuum applied to the canister at the laboratory (as measured by a calibrated pressure gauge), do not use the canister for sample collection.

5. **Elevate Sample Canister:** Position the sample canister and flow controller such that the sample intake port is positioned within the breathing zone for the environment being sampled. For indoor air samples, position the sample intake port approximately three feet above the floor surface (NYSDOH, 2006). For outdoor air samples, position the sample intake port approximately three to five feet above ground surface (NYSDOH, 2006). The canister may be elevated using a tripod, cardboard box, or furniture already present in the sampling environment (e.g., a glass-topped table, etc.). Care must be taken to avoid elevating the sample containers using objects containing or potentially off-gassing VOCs, such as a new or newly upholstered chair or recently-finished wooden table top.

6. **Start Sample Collection:** Begin indoor and ambient air sample collection by opening the valve on the sample canister. Record the sample start time, the initial vacuum reading from the gauge on the flow controller (after opening the canister valve), and canister identification number on the sampling form provided in Attachment JCO-SOP-062-002. If field duplicate air samples are being collected, attach a duplicate sampling manifold to the primary and duplicate flow controllers, and open the valve on both canisters simultaneously; the duplicate samples will be collected simultaneously.

7. **Stop Sample Collection:** Check the canister gauge at the approximate half-way point during sampling to confirm that the flow rate is correct. For a 6-L Summa® canister evacuated to a pressure of -30 in Hg, a target stop pressure is between -3 in Hg and -9 in Hg. At the conclusion of the planned air sample collection period, record the final vacuum reading from the gauge on the flow controller and close the canister valve. Use the calibrated digital vacuum gauge to measure the final vacuum in the canister. Ensure that the canister valve is not over-tightened because this is a frequent cause of leaks.

   Although flow controllers are calibrated to fill sample canisters to desired final vacuum levels within the specified time period, such calibrations are not exact. Thus, it is sometimes beneficial to extend the sample collection period to obtain a sample volume sufficient to achieve the required detection limits. Discuss with the project manager before extending the sample period beyond the 8-hour target.

8. **Chain of Custody and Shipping:** Package and ship the sample canisters to the analytical laboratory for next-day delivery (or courier pickup) under chain-of-custody protocol. Record sample collection start and end times, initial vacuum, and final vacuum for each sample canister on the chain-of-custody form.

REFERENCES

ASTM International (ASTM, 2007). Standard Test Method for Determination of Volatile Organic Chemicals in Atmospheres (Canister Sampling Methodology) Designation D- 5466-01 (Reapproved 2007).

New York Department of Health (NYSDOH, 2006). Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York. October 2006.

United States Environmental Protection Agency Region 1 (USEPA, 2007). Canister Sampling Standard Operating Procedure, Revision #4. Office of Environmental Measurement and Evaluation. Ecosystems Assessment Team. 11 Technology Drive, North Chelmsford, Massachusetts. August 31, 2007.

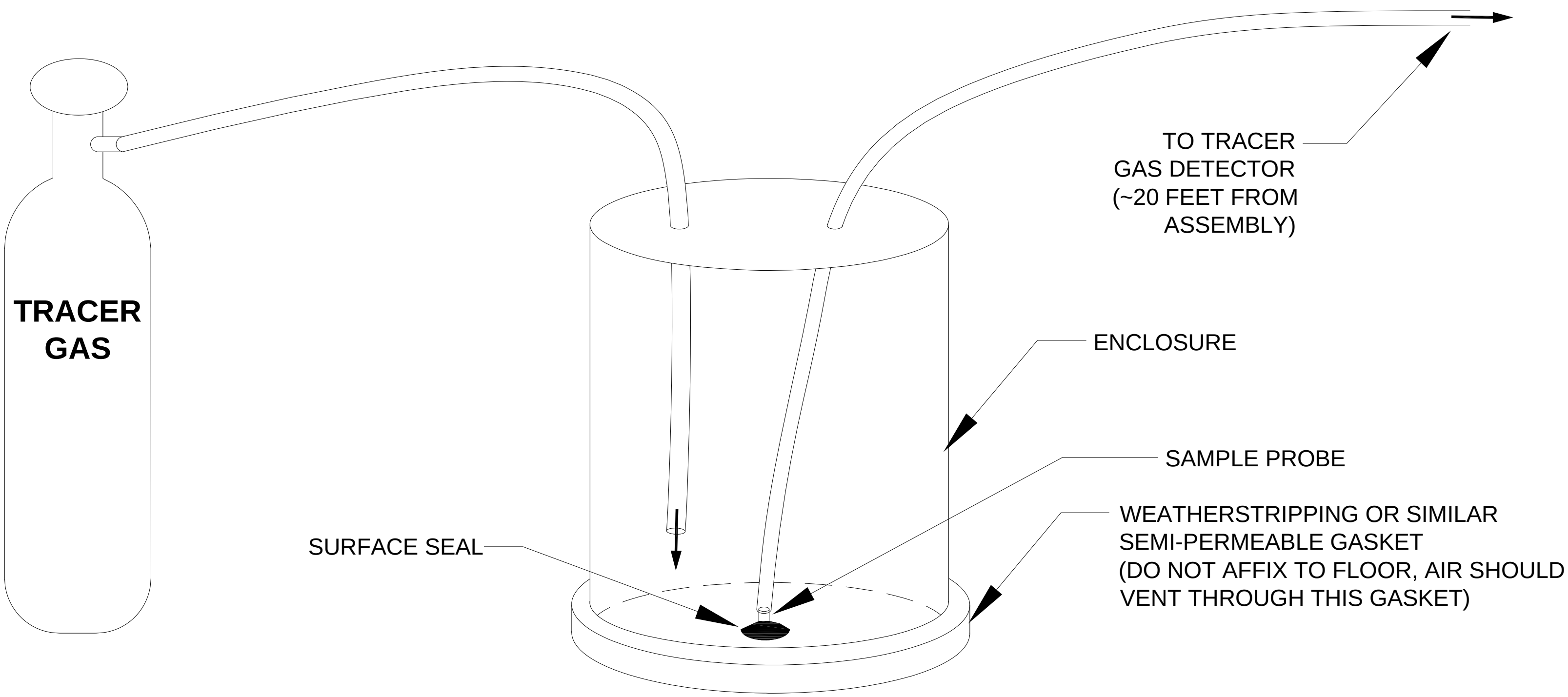


Figure 1. Tracer gas assembly.

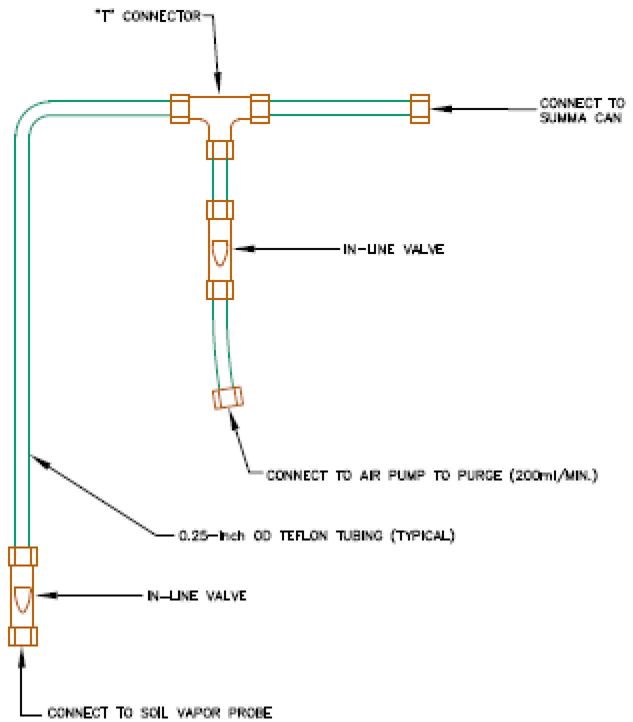


Figure 2A. Soil vapor sampling assembly.

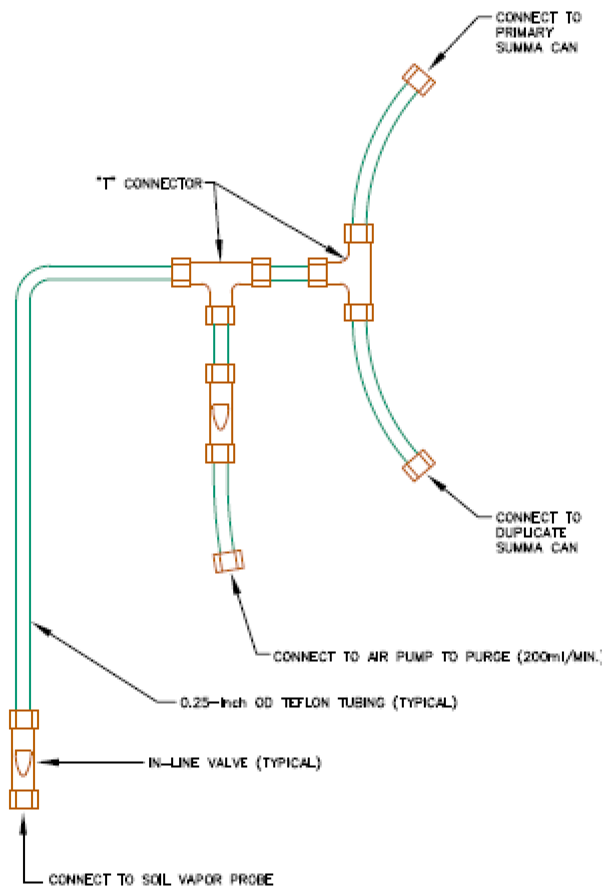


Figure 2B. Duplicate soil vapor sampling assembly.

Attachment 001

Ambient Air and Soil Vapor Field Sampling Form

THE JOHNSON COMPANY, INC.
100 State Street, Suite 600
Montpelier, Vermont 05602
(802) 229-4600

Ambient Air and Soil Vapor Sampling Form

Site Name: ____ Personnel: _________________________________ JCO #: ________________

Canister Size: _______________________________ Barometer/Thermometer Source/ID:____

Pressure Check: Summa Canister ID #: ________________________ Pressure Gauge Make/Model: ____

Gauge Calibration Date: _______________ *Pre-Sampling* Pressure Check: Location: ______________________ Pressure Gauge Reading: ______________

Post-Sampling Pressure Check: Location: ______________________ Pressure Gauge Reading: _____________________

Sample ID							
Summa Canister ID (not barcode)							
Flow Controller #							
Sampling Height (ft)							
Date	Start:	Start:	Start:	Start:	Start:	Start:	Start:
	End:	End:	End:	End:	End:	End:	End:
Time	Start:	Start:	Start:	Start:	Start:	Start:	Start:
	End:	End:	End:	End:	End:	End:	End:
Flow Controller Vacuum (in Hg)	Start:	Start:	Start:	Start:	Start:	Start:	Start:
	End:	End:	End:	End:	End:	End:	End:
Digital Pressure Gauge (in Hg)	Start:	Start:	Start:	Start:	Start:	Start:	Start:
	End:	End:	End:	End:	End:	End:	End:
Ambient Temperature (°C)	Start:	Start:	Start:	Start:	Start:	Start:	Start:
	End:	End:	End:	End:	End:	End:	End:
Barometric Pressure (in Hg)	Start:	Start:	Start:	Start:	Start:	Start:	Start:
	End:	End:	End:	End:	End:	End:	End:
Controller Flow Rate (mL/min)							
COC Number							

Replicate Information: Original Sample Name: _________________ Replicate Name: ______________________

Replicate Collection Method (Circle one): T-Connection or Side-by Side or Consecutive or Other (specify): ____

Sample ID							
Summa Canister ID (not barcode)							
Flow Controller #							
Sampling Height (ft)							
Date	Start:	Start:	Start:	Start:	Start:	Start:	Start:
	End:	End:	End:	End:	End:	End:	End:
Time	Start:	Start:	Start:	Start:	Start:	Start:	Start:
	End:	End:	End:	End:	End:	End:	End:
Flow Controller Vacuum (in Hg)	Start:	Start:	Start:	Start:	Start:	Start:	Start:
	End:	End:	End:	End:	End:	End:	End:
Digital Pressure Gauge (in Hg)	Start:	Start:	Start:	Start:	Start:	Start:	Start:
	End:	End:	End:	End:	End:	End:	End:
Ambient Temperature (°C)	Start:	Start:	Start:	Start:	Start:	Start:	Start:
	End:	End:	End:	End:	End:	End:	End:
Barometric Pressure (in Hg)	Start:	Start:	Start:	Start:	Start:	Start:	Start:
	End:	End:	End:	End:	End:	End:	End:
Controller Flow Rate (mL/min)							
COC Number							

Background Sample Information: Sample Name: ______________________ Location: ____

Other weather conditions: ____ Wind Speed/Direction (Start): ________________________________

Wind Speed/Direction (specify interval): ______________________________________/____

Shipping Information: Shipping Method: _____________________________________ Date Shipped: ______________________________

Notes: ____

____

Standard Operating Procedure: Installation and Extraction of the VaporPin™

Cox-Colvin & Associates, Inc.

Standard Operating Procedure Installation and Extraction of the Vapor Pin™

Updated April 3, 2015

Scope:

This standard operating procedure describes the installation and extraction of the Vapor Pin™ for use in sub-slab soil-gas sampling.

Purpose:

The purpose of this procedure is to assure good quality control in field operations and uniformity between field personnel in the use of the Vapor Pin™ for the collection of sub-slab soil-gas samples or pressure readings.

Equipment Needed:

- Assembled Vapor Pin™ [Vapor Pin™ and silicone sleeve(Figure 1)]; Because of sharp edges, gloves are recommended for sleeve installation;
- Hammer drill;
- 5/8-inch (16mm) diameter hammer bit (hole **must** be 5/8-inch (16mm) diameter to ensure seal. It is recommended that you use the drill guide). (Hilti™ TE-YX 5/8" x 22" (400 mm) #00206514 or equivalent);
- 1½-inch (38mm) diameter hammer bit (Hilti™ TE-YX 1½" x 23" #00293032 or equivalent) for flush mount applications;
- ¾-inch (19mm) diameter bottle brush;
- Wet/Dry vacuum with HEPA filter (optional);
- Vapor Pin™ installation/extraction tool;
- Dead blow hammer;
- Vapor Pin™ flush mount cover, if desired;
- Vapor Pin™ drilling guide, if desired;
- Vapor Pin™ protective cap; and
- VOC-free hole patching material (hydraulic cement) and putty knife or trowel for repairing the hole following the extraction of the Vapor Pin™.

Figure 1. Assembled Vapor Pin™

Installation Procedure:

1) Check for buried obstacles (pipes, electrical lines, etc.) prior to proceeding.

2) Set up wet/dry vacuum to collect drill cuttings.

3) If a flush mount installation is required, drill a 1½-inch (38mm) diameter hole at least 1¾-inches (45mm) into the slab. Use of a Vapor Pin™ drilling guide is recommended.

4) Drill a 5/8-inch (16mm) diameter hole through the slab and approximately 1-inch (25mm) into the underlying soil to form a void. Hole **must** be 5/8-inch (16mm) in diameter to ensure seal. It is recommended that you use the drill guide.

5) Remove the drill bit, brush the hole with the bottle brush, and remove the loose cuttings with the vacuum.

6) Place the lower end of Vapor Pin™ assembly into the drilled hole. Place the small hole located in the handle of the installation/extraction tool over the Vapor Pin™ to protect the barb fitting, and tap the Vapor Pin™ into place using a dead blow hammer (Figure 2). Make sure the installation/extraction tool is aligned parallel to the Vapor Pin™ to avoid damaging the barb fitting.

Figure 2. Installing the Vapor Pin™.

During installation, the silicone sleeve will form a slight bulge between the slab and the Vapor Pin™ shoulder. Place the protective cap on Vapor Pin™ to prevent vapor loss prior to sampling (Figure 3).

Figure 3. Installed Vapor Pin™

7) For flush mount installations, cover the Vapor Pin™ with a flush mount cover, using either the plastic cover or the optional stainless-steel Secure Cover (Figure 4).

Figure 4. Secure Cover Installed

8) Allow 20 minutes or more (consult applicable guidance for your situation) for the sub-slab soil-gas conditions to re-equilibrate prior to sampling.

9) Remove protective cap and connect sample tubing to the barb fitting of the Vapor Pin™. This connection can be made using a short piece of Tygon™ tubing to join the Vapor Pin™ with the Nylaflow

tubing (Figure 5). Put the Nylaflow tubing as close to the Vapor Pin as possible to minimize contact between soil gas and Tygon™ tubing.

Figure 5. Vapor Pin™ sample connection.

10) Conduct leak tests in accordance with applicable guidance. If the method of leak testing is not specified, an alternative can be the use of a water dam and vacuum pump, as described in SOP Leak Testing the Vapor Pin™ via Mechanical Means (Figure 6). For flush-mount installations, distilled water can be poured directly into the 1 1/2 inch (38mm) hole.

Figure 6. Water dam used for leak detection

11) Collect sub-slab soil gas sample or pressure reading. When finished, replace the protective cap and flush mount cover until the next event. If the sampling is complete, extract the Vapor Pin™.

<u>Extraction Procedure:</u>

1) Remove the protective cap, and thread the installation/extraction tool onto the barrel of the Vapor Pin™ (Figure 7). Continue turning the tool clockwise to pull the Vapor Pin™ from the hole into the installation/extraction tool.

2) Fill the void with hydraulic cement and smooth with a trowel or putty knife.

Figure 7. Removing the Vapor Pin™.

3) Prior to reuse, remove the silicone sleeve and protective cap and discard. Decontaminate the Vapor Pin™ in a hot water and Alconox® wash, then heat in an oven to a temperature of 265° F (130° C) for 15 to 30 minutes.

The Vapor Pin™ to designed be used repeatedly, however, replacement parts and supplies will be required periodically. These parts are available on-line at VaporPin.CoxColvin.com.

Indoor Air Quality Questionnaire and Building Inventory

NYSDOH Center for Environmental Health

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.

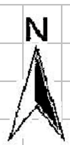
Basement:

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.

APPENDIX B:

Statement of Qualifications

Phoenix Chemistry Services

STATEMENT OF QUALIFICATIONS

Phoenix Chemistry Services

December 2015

Phoenix Chemistry Services
126 Covered Bridge Rd.,
N. Ferrisburg, VT 05473
802.233.2473 e-mail: info@phoenixchemistryservices.com

TABLE OF CONTENTS

1.0 COMPANY DESCRIPTION

Phoenix Chemistry Services, founded in 2000 by Dr. Deborah H. Gaynor, is a sole proprietorship with certification as a Disadvantaged Business Enterprise (Supportive, WBE: Vermont). This certification includes reciprocity with the Federal program.

The company provides a full suite of superior quality chemistry consulting services. Phoenix Chemistry Services specializes in a range of consulting services in the field of analytical chemistry, with a concentration in the environmental sector. Regardless of the magnitude of the problem or challenge, Phoenix Chemistry Services is committed to finding an appropriate solution, while keeping in mind the client's specific needs and ensuring the excellence and defensibility of the final product.

The center of operations for Phoenix Chemistry Services is located just outside of Burlington, Vermont, with associates in Montpelier, VT, and Dallas, TX. Phoenix Chemistry Services is comprised of a small group of experienced chemists and engineers who have worked together and retained strong working relationships since 1986.

2.0 SUMMARY OF QUALIFICATIONS AND CAPABILITIES

Phoenix Chemistry Services offers a full suite of consulting services in the fields of analytical chemistry, environmental chemistry, project management, data validation, quality control and quality assurance. We specialize in training in the performance of laboratory methods of analytical chemistry for all applications. Phoenix Chemistry Services specializes in training and education in quality control and quality assurance theory, methods, and protocols. Our personnel are proficient in laboratory services and management, and specialize in quality assurance in environmental applications. Phoenix Chemistry Services personnel have experience collecting samples in the field, analyzing samples in the laboratory, managing an environmental or commercial laboratory, and performing laboratory quality assurance functions, as well as in project management.

Dr. Deborah Gaynor, principal, has more than 25 years of analytical chemistry, quality assurance, environmental management and consulting experience. For eleven years she worked closely with the USEPA through the Contract Laboratory Program (CLP). Dr. Gaynor has provided extensive training for Target software for chromatographic instrumentation, in laboratories serving the needs of environmental, petrochemical, pharmaceutical, and clinical industries. For five years, Dr. Gaynor was the Quality Assurance Officer of a microbiology laboratory, leading them to their first NELAC certification, and maintaining their status as an approved laboratory performing *Cryptosporidium* and *Giardia* testing for municipal water suppliers under the USEPA Quality Assurance Program for the Long Term 2 Surface Water Treatment Rule. She developed and teaches a Quality Assurance for Environmental Projects class for the Northwest Environmental Training Center (NWETC).

Included in the technical support network for Phoenix Chemistry Services are Kim Watson, Joe Blersch, and Deborah Loring. Ms. Watson has over 34 years of environmental chemistry experience, project management, and quality assurance management, including extensive experience in data validation and systems and technical audits. She has worked in an environmental laboratory for over eighteen years, during which time she managed numerous projects and was employed as the Quality Assurance Manager. Dr. Blersch has more than 32 years of analytical chemistry and quality assurance management experience. He has taught chemistry at the college level, and has worked in environmental, engineering, and commercial beverage laboratories. Ms. Deborah Loring has over 32 years of environmental laboratory chemistry experience, in technical, financial, and supervisory management, and extensive quality assurance experience, including supervision, training, planning, data validation, and systems and technical audits.

Phoenix Chemistry Services is dedicated to providing the highest quality technical support, and to finding timely and effective solutions to any challenge that our clients encounter. We meet the needs of businesses as diverse as environmental chemistry, environmental engineering, biotechnology, and materials science. Our small size and extensive experience allows us to tailor our response to each client's specific needs.

3.0 DESCRIPTIONS OF SERVICES

Phoenix Chemistry Services has the technical knowledge and flexibility to provide customized services to clients. Below is a list of commonly performed services. Phoenix Chemistry Services also specializes in performing client-specific tasks upon request.

Consulting Services

- Data Validation
- Laboratory Audits
- Project Management
- Site-Specific Sampling and Analysis Plans
- Quality Assurance Project Plan development, including Unified Federal Policy (UFP) format
- Site-Specific Field/Laboratory Coordination Memorandum of Understanding
- Litigation Support Services

Laboratory Support Services

- GC and GC/MS Method Development
- GC, GC/MS, and HPLC Data Reduction and Reporting
- Standard Operating Procedures Development
- Chromatography Troubleshooting
- Internal Auditing
- Ensuring Defensibility
- Analytical Program Development

Training Programs

For engineers, courses are offered in topics that support the decisions and uses of laboratory services and results. Short courses ranging from one hour to a full day are available for individuals and groups wishing to better understand the choices available for laboratory services, how to select a laboratory that can meet their needs, and how to better understand the results they receive.

- Understanding Your Laboratory Results: Analytical Methods and Data Quality
- Setting Up a Laboratory Analysis Program to Achieve Your Data Quality Objectives
- Interpreting Your Chemistry Data

Courses in general analytical and quality assurance topics for the laboratory community are also offered. One, two, and three-day courses are available for individuals and groups in the subjects listed below.

- Organics Analysis
- Inorganics Analysis on the ICP/MS
- Mass Spectral Interpretation
- Quality Assurance/Quality Control in the Environmental Laboratory

Through the Northwest Environmental Training Center, Dr. Gaynor also offers:

- Quality Assurance and Quality Control Methodology

which is an intensive, two-day course in systematic project planning, quality assurance methodology, statistics, and data analysis as applied to environmental investigations and monitoring, and was developed for engineers, regulators, and other environmental professionals. This course includes an introduction to writing a UFP QAPP.

As a Thru-Put Systems, Inc. Solution Partner, Dr. Gaynor developed both introductory and advanced courses in the functions and uses of Target software for chromatography data systems. Laboratories with these legacy systems can still take advantage of both the introductory course, in which new analysts become productive and independent workers within just a few days, and the advanced course, which helps experienced users increase their efficiency and independence by demonstrating how to utilize the full functionality of Target software to generate custom analyses and reports. These courses are available for any analytical setting (clinical, petrochemical, pharmaceutical, and environmental).

Phoenix Chemistry Services also provides custom course development for topics tailored to each organization’s particular needs. Each training program is customized to meet the needs of the organization and the individuals in the class.

4.0 REPRESENTATIVE PROJECTS

Data Validation

Federal Lands (non-defense), national **–**Ongoing data validation and quality assurance support for investigative and remediation engineering projects that may employ incremental sampling methodology for all extractable organics and metals in soils and sediments, including high-resolution polychlorinated dioxins and furans, explosives, and perchlorate; air toxics analyses; and a wide range of analytical methods in potable and non-potable water samples. Services are provided according to US EPA National and Regional validation requirements and state reporting specifications.

Brownfields Sites, national **–**Ongoing data validation and quality assurance support for investigative and remediation engineering projects that include volatile and semivolatile organics in water and air, and metals, pesticides, and PCBs in soil and water. Services are provided according to US EPA Regional validation requirements and state reporting specifications.

Department of Defense Sites, national **–**Full data validation for wide range of SW-846 methodologies in support of base closure investigation and remediation in soil, water, and air samples.

Confidential River Sediments Hazardous Waste Site, New Jersey **–**Provided full data validation for all PCB congeners and homologs by high resolution GC/high resolution MS (EPA 1668A) in river bottom sediments.

Pine Street Barge Canal Superfund Site, Burlington, VT **–** Semiannual (on-going) data validation of soil, sediment, water, and air samples analyzed using various SW-846 methodologies and SIM-PAH, AVS/SEM, Lloyd Kahn TOC, and TO-15.

Clean Harbors Superfund Site, Natick, MA **–**Provided data validation in support of an investigative project that includes volatile organic compounds and pesticides.

State Hazardous Waste Site, Williamstown, VT **–**Quarterly data validation in support of a remediation and monitoring project at a former dry-cleaners site that includes volatile organics in water and air (low-level TO-15).

UniFirst Superfund Site, Woburn, MA **–**Data validation in support of investigation for vapor intrusion of volatile organics in indoor air, by low-level TO-15 and Massachusetts APH analyses; annual data validation in support of routine monitoring for volatile organics in water.

Industrial Sites, New York State **–** Providing data validation and data usability summary reports (DUSRs) for environmental samples analyzed using various SW-846 methodologies at several privately owned commercial sites.

Laboratory Audits

National Park Service – Performing laboratory audits of selected national commercial environmental laboratories in support of various investigation and remediation projects at National Parks sites.

Vermont Department of Environmental Conservation, Waterbury, VT **–** Performed laboratory audits of large analytical laboratory in support of an on-going volatile organics and air monitoring project.

Confidential Fortune 500 Corporation, Essex Junction, VT – Provided quality assessment management for RCRA environmental monitoring.

Analytical Project Management

Site Investigation in France – Remotely managed all analytical aspects of a site investigation from equipment needs to quality assurance management.

Site Investigation in Switzerland – Remotely selected European laboratory and managed quality assurance support for a site investigation in Switzerland. Providing on-going quality assurance services for project.

USEPA Contract Laboratory Program (CLP), Inorganic Contract – Managed all laboratory aspects of this contract from scheduling samples and tracking sample analysis to generation of the final data and diskette deliverable. Served as a liaison between the EPA and associated subcontractors and the laboratory.

Several Total Environmental Restoration Contract (TERC) Sites, Massachusetts **–** Managed the analytical phase of several Superfund sites under the TERC contract for a confidential national environmental engineering firm. Directed all day-to-day activities including laboratory scheduling, bottle orders, analytical tracking, technical support, and client communication.

Seneca Army Depot, Romulus, NY **–** Managed all laboratory activities associated with this site under the guidance of the US Army Corps of Engineers (USACE) and New York Department of Environmental Conservation (NYSDEC) in conjunction with a confidential national engineering firm. Directed all day-to-day activities including laboratory scheduling, bottle orders, analytical tracking, technical support, and client communication.

Litigation Support Services

Vermont Department of Health, Burlington, VT **–** Provided expert witness testimony in the areas of ethanol absorption, elimination, and gas chromatography for court cases and depositions involving blood alcohol determinations of breath samples.

Ensuring Defensibility

Confidential National Analytical Laboratory, Richardson, TX – Performed review and damage assessment of data associated with fraudulent laboratory practices. Provided expert witness testimony during litigation.

Confidential National Analytical Laboratory, Pittsburgh, PA – Assessed existing laboratory practices and standards. Provided recommendations for quality system improvements.

Training

Northwest Environmental Training Center (NWETC), Seattle, WA – Developed and teaching a Quality Assurance, Quality Control methodology course ("Improving Environmental Data Usability"), and modified to "Quality Assurance and Quality Control Methodology") for environmental professionals.

Thru-Put Systems, Inc. (now Thermo-Dynamics, Inc.), Orlando, FL – Developed and presented introductory and advanced classes in Target chromatography data systems software for various organizations in the environmental, petrochemical, clinical, and pharmaceutical fields.

Analytical Services Inc., Williston, VT – Presented basic chromatography course, titled Introduction to GC.

Intertek Testing Services (formerly Aquatec, Inc.), Colchester, VT – Developed and presented a general organic analysis course to employees and international employees from Russia. This included training on specific environmental analyses using Target software and Hewlett Packard GC/MS systems.

Vermont Technical College, Randolph, VT – Developed and taught general microscopy course for high school teachers, titled Microscopy for Teachers.

Confidential Biodiesel Production Facility, VT – Provided consulting services for installation of GC/MS system and laboratory fit-up, and implementation of ASTM methodology.

Technology Transfer

Microwire Transmission Services, Williston, VT – Developed marketing documents and contributed to final technology transfer materials for cable assembly technology sale.

5.0 PERSONNEL QUALIFICATIONS

Phoenix Chemistry Services personnel are highly trained and meticulous professionals. These professionals are available to provide exceptional technical consulting, training, and customer support for all types of analytical projects.

The resumes for key personnel have been included in Appendix A.

6.0 REFERENCES

Phoenix Chemistry Services is pleased to provide the following list of general business references. Specific project and training references are also available upon request.

Johnson Company
100 State Street
Montpelier, VT 05602
(802)-229-4600
www.johnsonco.com
Contact: Mr. Michael Moore, Vice-President
Description: General chemistry and quality assurance consulting and data validation services; project planning; laboratory audits

Thru-Put Systems, Inc. (now Thermo-Dynamics, Inc.)
(321)-795-6223
Contact: Ms. Lynn Matthews, Founder and former President
Description: Specific software training including curriculum and training manual development

Department of Environmental Conservation
Waste Management and Prevention Division
1 National Life Dr – Davis 1
Montpelier, VT 05620-3704
(802)-522-5614
Contact: Mr. Gerold Noyes, P.E.
Description: Data validation, quality assurance services, and laboratory audits

7.0 APPROVALS AND CERTIFICATIONS

Phoenix Chemistry Services is certified as a Disadvantaged Business Enterprise (Supportive, WBE) by the State of Vermont, which enjoys reciprocity with the Federal program.

APPENDIX A

Resumes of Key Personnel

DEBORAH H. GAYNOR
126 Covered Bridge Rd.
N. Ferrisburg, VT 05473
(802) 425-2178 (landline); (802) 233-2473 (cell)

EDUCATION

Ph.D. Chemistry, Dartmouth College, Hanover, NH - 1991
Thesis - Pesticides in Cloudwater at Low and High Elevation Sites in New England

B.A. Biology, Middlebury College, Middlebury, VT - 1977

PROFESSIONAL EXPERIENCE

Phoenix Chemistry Services, N. Ferrisburg, VT 2000 - present
Owner

Providing consulting services to laboratories, engineering firms, and businesses in the fields of analytical chemistry, analysis and regulatory compliance, and related training services.

- Providing training, data review, analytical consulting, laboratory audits, and quality assurance services for major environmental laboratories and engineering firms.
- Created and teaching 2-day course, “Quality Assurance/Quality Control Methodology” for Northwest Environmental Training Center (NWETC; Seattle, WA).
- Providing data validation services for Superfund, DoD, RCRA, Brownfield, and other sites.
- Provided software training as a Solution Partner for Thru-Put Systems.

Consultant 1996 - 2000

- Provided software training for petrochemical, environmental, and chemical laboratory customers as a Solution Partner for Thru-Put Systems, Inc.
- Created and taught one- to three-day seminars in various topics for HP ChemServer users with Thru-Put Target software for reporting chromatographic analytical data.
- Created and taught a one-day seminar in Introduction to High Resolution Gas Chromatography. .
- Designed and implemented a new Method 8260B analysis compliant with the 1996 regulations, including customized standards mixes, instrumental method, data processing and reporting method, and new SOP.

Avatar Environmental, LLC, West Chester, PA 2011 - 2015
Chemist

Provided chemistry and quality assurance support services on a project-specific basis for Department of Defense investigation and monitoring projects.

Analytical Services (formerly IEA), Williston, VT 1997 - 2008
Quality Assurance Officer

Responsible for overall laboratory quality assurance (QA), including development and implementation of QA policies and procedures, and control of laboratory QA documents. Led the laboratory to NELAP accreditation, and renewal of USEPA LT2 accreditation.

Scanning Electron Microscopist

Providing Scanning Electron Microscopy and Energy Dispersive Spectroscopy analytical and interpretive services. Contributing to project design for research and development of methodologies for calibration of laser particle counters, UPW filter testing, and medical device testing..

Inchcape Testing Services (formerly Aquatec), Colchester, VT 1991 - 1996
GC/MS Section Head

Managed development of instrumental and data processing methods for a new GC/MS facility. Implemented USEPA Superfund, SDWA, and RCRA methodologies, and developed numerous custom methods in accordance with client needs. Supervised group of ten analysts and data reviewers. Increased sample throughput four-fold while increasing quality of results and complexity of methodology.

- Managed GC/MS laboratories and provided QA for analysis and reporting of samples received under USEPA CLP contracts.
- Hired and trained three analysts and three data reviewers.
- Wrote the sectional SOP and about 20 individual method SOPs.

Technical Specialist

Performed sample analysis and spectral interpretation for CLP, SW-846, and New York State (DEC ASP) methods, QA/QC of GC/MS data, and reporting for semivolatiles and volatiles analyses for a variety of methods and clients. Provided technical support to project managers, analysts, and data reviewers for method compliance, training, and data reporting.

Dartmouth College, Hanover, NH 1986 - 1991
Research Assistant
Teaching Assistant

University of Vermont, Burlington, VT 1981 - 1985
Research Assistant

University of Pennsylvania, Philadelphia, PA 1979 - 1981
Laboratory Technician

CURRENT and RECENT PROJECTS

Federal Sites, national (Department of Defense; National Park Service) –Full data validation with coordination and laboratory oversight and audits for wide range of SW-846 and Air Toxics methodologies in support of investigation and remediation in soil, sediment, water, biota, and air samples.

State Hazardous Waste Sites, ME, VT, NY, MA, CT, NJ, WV, OH, WI, CA –Full data validation per US EPA National and Regional guidelines and state reporting specifications for volatiles in air and water by low level methods, and water, soil, and air by routine methods; for all PCB congeners and homologs by high resolution GC/MS (EPA 1668A); for dioxins and furans by high resolution GC/MS (Method 8290); for PCB Aroclors and congeners, TOC, and AVS/SEM in porewater and sediments; for wide range of SW-846 and Air Toxics methodologies at resource recovery sites and former industrial sites; and laboratory audits.

Superfund Sites, Burlington, VT; Woburn, MA – Semiannual data validation of water, soil, sediment and air samples analyzed using SW-846 methodologies, SIM-PAH, and AVS/SEM; data validation in support of investigation for vapor intrusion of volatile organics in indoor air, by low-level TO-15 and Massachusetts APH analyses; annual data validation in support of monitoring project for volatile organics in water.

Brownfields Sites, national –Ongoing data validation and quality assurance support and QAPP development for investigative and remediation engineering projects that include wide range of methods in all matrices.

Former Industrial Sites, France, Switzerland, US –Project quality assurance design, laboratory approval and oversight, and QA support and data validation for volatiles and fuel oil methods in soil and water samples. Includes data validaton and production of data usability summary reports (DUSRs) for New York State sites.

PROFESSIONAL AFFILIATIONS and ACTIVITIES

Member, American Chemical Society and Green Mountain Local Section
Member, The NELAC Institute
Co-Chair, Air Methods and Monitoring Session, National Environmental Monitoring Conference (NEMC)

JOSEPH A. BLERSCH, Ph. D.
2355 HWY 360 North, Apt. 1017
Grand Prairie, Texas, 75050
(817) 633-6328

EDUCATION

Ph.D., Physical Chemistry, University of Vermont, Burlington, VT 1989

B.S., Natural Science, Daemen College, Buffalo, NY, 1980

PROFESSIONAL EXPERIENCE

Pepsi-Cola Company – Arlington, Texas 2000 – Present
Principal Scientist

- Team leader in developing state-of-the-art water quality monitoring program including trace analysis of water, raw materials and finished beverage products by GC/MS and ICP/MS.
- Provides water treatment system troubleshooting and support for beverage bottling plants across North America.
- Led team to develop Water Treatment Certification training for Pepsi-Cola bottling plant personnel.
- Instructor in training courses for bottling plant operations.

The Johnson Company, Inc. - Montpelier, Vermont 1998 – 2000
Senior Analytical Chemist

- Quality Assurance/Quality Control (QA/QC) Officer for an EPA Superfund Site Remediation in Burlington, Vermont
- Performed on-site and in-house analytical chemistry services, particularly GC/FID/ECD and GC/MS analysis for volatile (VOCs) and semivolatile organic compounds (SVOCs). Set up on-site laboratory and performed all analysis for VOCs and total petroleum hydrocarbon (TPH) at a site in France. Developed methods for rapid on-site GC/MS analysis for a wide range of compounds using solid phase microextraction (SPME).
- Provided senior-level chemistry expertise for on-going projects involving site contaminant characterization and transport, industrial waste water and hazardous waste treatment, including process development and treatability studies, quality assurance, and analytical methodology.

Vermont Science and Education Center - St. Albans, Vermont 1997 - 1998
Senior Scientist

- Led team in setting up analytical chemistry testing laboratory for environmental, food, pharmaceutical and product testing.
- Responsible for curriculum development, chemistry lectures, laboratory training, and contract testing in analytical chemistry.
- Successfully trained and placed in technical positions the entire first year pilot class.

Intertek Testing Services - Colchester, Vermont 1991 – 1997
<u>Senior Scientist</u>

- Volatile and semivolatile organic analysis by gas chromatography (GC) and gas chromatography/mass spectroscopy (GC/MS). Extensive experience with gas chromatography coupled with a wide array of detectors including: ECD, NPD, FID, FPD, PID, HALL and ion trap.
- Extensive pesticide and PCB analytical experience following EPA protocols including analysis of PCBs by congener.
- Development of methods for VOC, SVOC, pesticide and PCB analysis by GC/Ion Trap.
- UNIX and Target Systems Administrator. Administration and management of 10 UNIX-based (HP-UX) systems used for GC/MS, GC and LC data acquisition, data processing and database storage, data reporting and electronic data deliverables.

Johnson State College - Johnson, Vermont 1996 – 1997
<u>Adjunct Professor of Chemistry</u>

- Professor of Introductory and General Chemistry.

University of Vermont - Burlington, Vermont 1990 – 1991
<u>Postdoctoral Research Associate</u>

- Raman spectroscopy and computational chemistry (QCFF, HUCKEL, MNDO and AMPAC)
- Extensive experience with: molecular fluorescence and phosphorescence emission spectroscopy, specializing in triplet state optically detected magnetic resonance (ODMR); cryogenic techniques (< 2 K) necessary for ODMR; use of argon ion laser (Coherent Innova I00 20 W) and ring dye laser (Coherent CR-699) for both Raman and laser excited fluorescence spectroscopy; familiar with nonlinear optics. Proficient with ^{1}H and ^{13}C FT-NMR (Brucker 270 MHZ) and FT-IR (Nicolet 6000).

Hamilton College - Clinton, New York 1989 – 1990
<u>Visiting Assistant Professor of Chemistry</u>

- Taught undergraduate Physical Chemistry including Thermodynamics, Quantum Chemistry, Statistical Thermodynamics and Kinetics.
- Taught Advanced Laboratory Techniques, an integrated laboratory course including topics in instrumentation, Organic and Inorganic Synthesis, and Physical Chemistry.

University of Vermont - Burlington, Vermont 1983 – 1988
<u>Teaching and Research Assistant</u>

- Taught General, Organic and Physical Chemistry.
- Investigations of phosphorescence, fluorescence and triplet state properties of DNA intercalating agents, bilirubin and miscellaneous double-ring molecules.

SHORT COURSES

- Inductively Coupled Plasma Mass Spectrometry. Agilent Technologies, Bellevue, WA. June, 2001.
- Mass Spectral Interpretation. Professional Analytical and Consulting Services, Colchester, VT, 1994.

- Fundamentals of the UNIX System, Hewlett-Packard Company, Mountain View, CA, 1995.
- HP-UX System Administration, Hewlett-Packard Company, Mountain View, CA, 1995.
- OSHA 40 Hour (29 CFR 1910.120) Health & Safety Class, Hazardous Waste Operations and Emergency Response October, 1998

PRESENTATIONS AND PUBLICATIONS

D.E. Bugay, C.H. Bushweller, C.T. Danehey, Jr., S. Hoogasian, J.A. Blersch and W.R. Leenstra. *A Complementary IR/NMR Approach for the Determination of IR Extinction Coefficients and Thermodynamic Parameters for Conformers in Rapid Equilibrium*. The Halocyclohexanes. J. Phys. Chem., 1989, 93, 3908.

J.A. Blersch and W.R. Leenstra, *MNDO Calculations on Half-Bilirubin*, presented at the 201st ACS National Meeting, Atlanta, Georgia, April 1991.

J.A. Blersch and W.R. Leenstra, *MNDO Calculations on Half-Bilirubin* presented at the Photochemistry and Spectroscopy in Organized Media Symposium, Worchester Polytechnic Institute, October 1990
(Paper P-7).

J.A. Blersch and W.R. Leenstra, *Secondary Solution Structure and Localization of Triplet State Excitation in Bilirubin*, 17th Northeast Regional Meeting of the ACS, Rochester, New York, November, 1987. (Paper 369).

J.A. Blersch and W.R. Leenstra, *ODMR Investigation of the Structural and Configurational Photoisomerization of Bilirubin* presented at the 192nd ACS National Meeting, Anaheim, California, September, 1986. (Paper 118). .

KIM BRYANT WATSON
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EDUCATION

B.S. cum Laude, Environmental Engineering Technology, Norwich University – 1981
"Environmental Applications of Gas Chromatographic Mass Spectrometry", Indiana University, July 1995
Registered Quality Assurance Professional in Good Laboratory Practices, RQAP-GLP, April 2004-2010

PROFESSIONAL EXPERIENCE

Stone Environmental, Inc. Montpelier, VT 2001 - Present
Quality Assurance Manager
Acting as the Quality Assurance Manager and Quality Assurance Unit (QAU) responsible for monitoring environmental studies performed under the USEPA programs (FIFRA, CWA, SDWA, RCRA, CERCLA).

- Monitor studies to assure management that facilities, equipment, personnel, methods, practices, records and controls are in conformance with the Good Laboratory Regulations (GLP).
- Conduct field and sampling inspections and maintain records appropriate to the study.
- Compile and evaluate site data from various on-site analytical programs.
- Ensure data is compliant for publication and possible litigation.
- Prepare and design project documents such as analytical Standard Operating Procedures (SOPs) and Quality Assurance Project Plans (QAPP).
- Design and monitor the performance of sampling and analysis projects.

Strategic Environmental Management, Montpelier, VT 2000 - Present
Owner and Principal
Quality Data Assessment Manager
Provide consulting and environmental data assessment. Review and validation of CLP-type data packages generated in support of sampling analysis program at industrial/commercial clients' plant sites. Validation conducted in accordance with EPA's National Functional Guidelines, regional guidelines, other agency procedures, method specific standard operating procedures, and professional judgment as appropriate.

- Compilation and evaluation of site data from various on-site analytical programs.
- Ensure data is compliant for publication and possible litigation.
- Preparation and design of project documents such as analytical Standard Operating Procedures (SOPs) and Quality Assurance Project Plans (QAPP).

Design and performance of sampling and analysis projects.

Severn Trent Laboratories (formerly Aquatec, Inc.) Colchester, VT 1997- 2001
Quality Assurance Manager

- Responsible for overall laboratory quality assurance (QA).
- Responsible for the development, implementation and documentation of QA procedures dealing with the day-to-day operation of the laboratory.

- Controlled and reviewed the laboratories' standard operating procedures.

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Trillium, Inc. Consultants in Environmental Analytical Chemistry, Montpelier, VT
Quality Assessment Manager 1995 - 1997

- Review and validation of CLP-type data packages generated in support of sampling analysis program at industrial/commercial clients' plant sites. Validation conducted in accordance with EPA's National Functional Guidelines, regional guidelines, other agency procedures, method specific standard operating procedures, and professional judgment as appropriate
- Compilation and evaluation of site data from various on-site analytical programs.
- Ensure data is compliant for publication and possible litigation.
- Preparation and design of project documents such as analytical Standard Operating Procedures (SOPs) and Quality Assurance Project Plans (QAPP).
- Design and performance of sampling and analysis projects.
- Responsible for marketing of company's environmental chemistry capabilities in the greater New England area.
- Upon request from USEPA Region I provided extensive review and comments on Parts I and II of the Region I, EPA-New England Data Validation Functional Guidelines for Evaluation Environmental Analyses.
- Facilitate education seminar on environmental chemistry for Engineers and Lawyers. Provide training in Laboratory Quality Manuals and Field Laboratory Coordination Memoranda.

Inchcape Testing Services, (formerly Aquatec, Inc.) 1983 - 1995
Quality Control Manager for HP GC/MS Laboratory 1992 - 1995

- Responsible for a group of seven people working on the review of data, publication, and mass spectral interpretation.
- Assisted in overseeing daily laboratory operation such as sample handling, method development, analysis, data processing, review and report generation.
- Analytical experience in the VOA HP5971A MSD GC/MS Systems.

Project Director 1988 - 1995

Managed the Special Analytical Service Contracts, USEPA Contract Laboratory Program Contract, and Government Contracts. Reviewed government policies. Responsible for successfully securing contracts through the bid process. Responsible for writing and publishing bid proposals. Once an award was made, coordinated the work as it progressed through the laboratory.

- Responsibilities included: scheduling project activities (e.g. bottle shipment), tracking sample analysis, and performing final review on the analytical data and writing the analytical case narratives.
- Performed data validation reports on independent laboratory results and laboratory audits.

Quality Control/Quality Assurance Assistant 1983 - 1988

Quality control/quality assurance on data for USEPA Superfund projects. Review and report analytical data, Finnigan GC/MS analysis, wet chemistry, metals analysis, GC analysis and Pesticide/PCB analysis. Co-author of Analytical Laboratory Standard Operating Procedures

Extraction Lab Technician 1983 – 1984

Vermont Agency of Environmental Conservation, Montpelier, VT 1981 - 1982
<u>Air and Solid Waste Technician</u>

- Preliminary design and review of solid waste disposal facilities for the state solid waste program.
- Assistant author of State Certifications of Solid Waste facilities.
- Performed water quality monitoring at the major solid waste facilities in the state.
- Performed asbestos air monitoring.

PROFESSIONAL AFFILIATIONS

American Chemical Society
SQA – Society of Quality Assurance
American Society for Quality- ASQ
Norwich University Engineering Society
President and Co-Founder of Chi Beta Chapter of Tau Alpha phi
Engineering Technology Award, Norwich University, 1981

PROFESSIONAL COURSES

Supervisory Skills in Positive Discipline, October 1997
Water Environment Federation, "Environmental Labs: Testing the Waters", Cincinnati, Ohio, August 1995 PACS Training Course in Mass Spectral Interpretation, May 1994
Inchcape *<u>Managerial</u>* Skills
Training Workshop I - April 1993
Training Workshop II - July 1994
Current 40-Hour (29 CFR 1910.120) OSHA Health and Safety Training for hazardous waste operations and emergency response

DEBORAH A. LORING
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802-881-5958

Qualifications

32 years of experience in environmental analytical chemistry

Extensive knowledge in:

- management of environmental laboratories, operations, technical and quality assurance
- technical understanding of environmental analytical chemistry techniques and methods
- implementation of quality systems, data quality and integrity, and regulatory compliance
- data validation, systems and data audits

Professional Experience

Environmental Consultant, Burlington, VT, 2010-present

Consult in environmental project management, laboratory management, technical operations, regulatory compliance, and quality assurance. Validate environmental chemistry data against risk based levels for sites regulated by state and national programs; perform laboratory data and systems audits for compliance with technical and regulatory requirements, develop and conduct technical and management training courses.

TestAmerica (formerly Severn Trent Laboratories - STL), Burlington, VT

Corporate Operations Specialist, STL Corporate, 2001-2010

Responsible for special projects as assigned by Chief Operating Officer, assisting 30 environmental chemistry laboratories across the US with technical, quality, and regulatory issues. Projects include troubleshooting quality, technical and financial issues at laboratories, evaluating management, assisting the laboratory with regulatory agencies, providing technical assistance and project design for client environmental programs, and developing and conducting technical and managerial training courses.

Corporate Quality Assurance (QA) Director, STL Corporate, 1998-2001

Responsibilities included developing and implementing a Quality Management System, and establishing corporate policies and Standard Operating Procedures. Developed data integrity and ethics program, responded to all data integrity issues across the company, and developed and conducted training for 30 laboratories. Served as the STL QA representative with federal and state regulatory agencies.

Professional Experience (continued)

Laboratory Director, Intertek/STL Burlington, 1997-1998

Responsible for technical, supervisory, and financial management of full service environmental chemistry laboratory. Responsibilities included development and training of technical staff (61 employees), providing technical support for analysts and clients, meeting financial objectives, and supervising all operations at the Burlington, VT laboratory. Successfully met all objectives; including financial turnaround of laboratory. Intertek was sold to STL in 1998.

Loring Environmental Associates, Boston, MA, President, 1992-1996

Founded consulting firm involved in environmental project management and regulatory compliance. Provided project plan and SOP writing services, data validation, and developed and conducted training courses. Sold company in 1996.

Enseco, Inc., Cambridge, MA, 1987-1991.

QA Director, Eastern Region, Enseco East, Somerset, NJ, 1990-1991.
QA Director, Enseco Erco, Cambridge, MA 1988-1989.
Manager, Organic Preparation Laboratory, Enseco Erco, 1987-1988.

Aquatec, Inc, South Burlington, VT, 1984-1986

Manager, GC/MS Laboratory, 1985-1986.
Chemist, 1984-1985.

Education

Bachelor of Science in Chemistry, Tufts University, 1983
GPA: 3.61/4.00; Jackson Scholarship, 1982-1983

Publications

Where Do Company Ethics Programs Fall Short?, Deborah Loring, Bonnie Smoren. Environmental Testing and Analysis, August 2000. Presented, by request, to the Department of Defense Army Corp of Engineers.

QA Perspective on Performance Based Method Systems (PBMS), Deborah Loring. Presented at the US EPA Office of Solid Waste Conference, August 1999.

Guiding Field Activities by Using Rapid, Cost-Effective Screening Methods at a Fixed Laboratory, Rick Gomez, Deborah Loring, 1994. Presented at US EPA Office of Solid Waste Conference, July 1994 and at Fifth International FZK/TNO Conference on Contaminated Soil, Maastricht, The Netherlands, October 1995.

An Alternative Approach to RCRA Facility Investigations, Susan Chapnick, Deborah Loring. Presented at the US EPA Office of Solid Waste Conference, July 1993.

Developing a Uniform Approach for Complying with EPA Methods, Deborah Loring, Jerry Parr, Nancy Rothman, Peggy Sleevi. Presented at the US EPA Office of Solid Waste Conference, July 1991.