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SUBSLAB DEPRESSURIZATION SYSTEM (SSDS) DESIGN WORK PLAN

Former Building 982 – Neptune Road
Poughkeepsie, New York
NYSDEC Site No. 314076

IBM
Poughkeepsie, New York

Prepared for IBM Corporation
File No. 3623.00
September 2013

2455 South Road
Poughkeepsie, NY 12601

September 26, 2013

R. Scott Deyette
Chief, Inspection Unit
New York State Department of Environmental Conservation
Division of Environmental Remediation, Remedial Bureau C
625 Broadway
Albany, New York 12233

Re: Subslab Depressurization System (SSDS) Design Work Plan
Former IBM Leased Building 982 – Neptune Road
Poughkeepsie, New York
NYSDEC Site No. 314076

Dear Mr. Deyette:

The enclosed document presents the International Business Machines Corporation (IBM) work plan for design of a Subslab Depressurization System (SSDS) to address potential volatile organic compound (VOC) entry into the indoor air of former IBM Building 982 located on Neptune Road, Poughkeepsie, New York. IBM prepared this work plan in response to a request by the New York State Department of Environmental Conservation and the New York State Department of Health (the Agencies) as communicated in an e-mail to IBM dated August 12, 2013. IBM's work plan was initially transmitted to the Agencies on September 3, 2013 and was discussed at a meeting with the Agencies in Albany on September 6, 2013.

The Agencies approved IBM's work plan in a letter dated September 18, 2013, contingent upon IBM's acceptance of the Agencies' comments. IBM accepts the Agencies' comments contained within their September 18, 2013 letter. As requested, the attached revised work plan incorporates the Agencies' comments, and includes a copy of the Agencies' September 18, 2013 letter.

If you wish to further discuss this document or have questions, please contact Mr. Steve Brannen of IBM at (845) 433-1509.

Sincerely,
International Business Machines Corporation

Michael Phelan, Manager
Environmental, Planning and Site Support Services

cc: T. Perretta, NYSDOH
D. Kaminski, Neptune Capital Investors, LLC.

New York State Department of Environmental Conservation
Division of Environmental Remediation, 11th Floor
625 Broadway, Albany, New York 12233-7014
Phone: (518) 402-9662
Fax: (518) 402-9679
Website: www.dec.ny.gov

Joe Martens
Commissioner

September 18, 2013

Mr. Michael T. Phelan
Manager, Environmental, Planning and Site Support Services
IBM, Corp.
2455 South Road
Poughkeepsie, NY 12601

Re: SSDS Design/Installation Work Plan
Neptune Commerce Center (Former IBM B952/982)
Poughkeepsie, Dutchess County, Site No. 314076

Dear Mr. Phelan:

The New York State Department of Environmental Conservation (Department), in consultation with the New York State Department of Health (DOH), has reviewed the SSDS Design/Installation Work Plan, dated September 3, 2013, for the former IBM 952/982 (now known as the Neptune Commerce Center), Site # 314076. The work plan is hereby approved with the following modifications:

1. Since the site is listed as a Class 4, meaning that only site management operations remain, the report should not be referring to a Remedial Design/Remedial Action Work Plan. Please re-title the document to refer to the design and installation of the Sub-slab Depressurization System (SSDS).

2. In Section 5.0, Conceptual Design of Remediation System, please remove the reference to a VOC source mass beneath the building, as past sampling has demonstrated that this is not the case. Rather, residual VOCs remain in the soil vapor which the system will address.

3. In Section 8.0, Schedule and Communications, the last sentence should be revised to remove the reference to a final engineering report. Rather, this report should refer specifically to the completion of the SSDS installation.

In accordance with the Order on Consent and 6NYCRR 375-1.6(d), please indicate within 15 days whether you accept the Department's modified work plan. Please ensure that all copies of the final work plan include this approval letter. The final copy of the work plan should be submitted as one electronic copy to both the DOH and the Department.

Please contact me with any questions at 518-402-9662 or via e-mail at sxdeyett@gw.dec.state.ny.us.

Sincerely,

R. Scott Deyette
Chief, Inspection Unit
Remedial Bureau C
Division of Environmental Remediation

ec: T. Perretta, NYSDOH Project Manager
C. Bethoney, NYSDOH
E. Moore, DEC Regional Hazardous Waste Engineer

cc: D. Kaminski, Neptune Capital Investors L.L.C.

SUBSLAB DEPRESSURIZATION SYSTEM
DESIGN WORK PLAN
FORMER IBM BUILDING 982 – NEPTUNE ROAD
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APPENDICES

1.0 INTRODUCTION

This document presents the International Business Machines Corporation (IBM) work plan to design and install a subslab depressurization system (SSDS) as part of redevelopment of the former IBM Building 982 located on Neptune Road, Poughkeepsie, New York (the Site). A Locus Plan is included as Figure 1. IBM has elected to install the SSDS as a pro-active, presumptive measure to mitigate the potential for volatile organic compounds (VOCs) to enter the indoor air of the building from the subslab soil. Although IBM is not the owner of the Site, IBM is performing the remediation.

IBM commissioned Sanborn, Head Engineering, P.C. (SHPC) to prepare this work plan. It has been prepared in accordance with the New York State Department of Environmental Conservation (NYSDEC) document entitled "Technical Guidance for Site Investigation and Remediation" (DER-10) dated May 2010, and the New York State Department of Health (NYSDOH) document entitled "Guidance for Evaluating Soil Vapor Intrusion in the State of New York" dated October 2006.

1.1 Purpose and Objectives

This document is intended to address a request from NYSDEC and NYSDOH (the Agencies) for a work plan to "further investigate and/or mitigate" potential VOC entry into Building 982, as conveyed in an e-mail to IBM dated August 12, 2013. To meet this objective, this work plan describes a program of additional investigations, including subslab soil vapor sampling, indoor air sampling, and subslab vapor extraction testing to support the design and installation of a SSDS for Building 982.

Given the Site owner's fast-track schedule for redevelopment of the property, this work plan also describes the conceptual design of the SSDS. Former Building 982 is currently a vacant, empty shell without an operating heating, ventilation, and air conditioning (HVAC) system. The Site owner intends to refurbish the building for commercial/recreational use. As previously agreed with the Agencies, in order to meet the owner's time constraints, IBM intends to proceed with final design of the SSDS concurrent with the additional investigation sampling and testing activities described herein. Adjustments to the final design will be made if appropriate based on the results of the investigation sampling and testing.

1.2 Organization and Scope of Work Plan

This work plan is organized into eight sections as described below:

- Section 1 presents a general introduction, including purpose and objectives.
- Section 2 provides a brief summary of Site background information relevant to the work plan.
- Section 3 describes the planned field sampling activities, including plans for sampling and analysis of indoor air, ambient (exterior) air, and subslab soil vapor.
- Section 4 describes design testing activities to support final design of the SSDS.

- Section 5 presents an overview of the conceptual design of the SSDS.
- Section 6 summarizes data management, validation, and reporting plans.
- Section 7 provides information regarding the project team.
- Section 8 discusses project schedule and communications.

2.0 BACKGROUND

This section provides a brief summary of Site background information. More detailed background information is presented in previous Site reports and work plans, most recently in the Site Management Plan[1] (SMP) and the Soil Vapor Investigation Work Plan[2] (SVIWP).

Former IBM Building 982 is one of two buildings that IBM leased on property on Neptune Road in Poughkeepsie from the mid-1950s to 1994. The other building, former Building 952, was demolished in 2013 as part of property redevelopment by the current owner, Neptune Capital Investors, LLC (NCI). IBM has agreed to perform past and on-going remedial activities on the property.

Various VOCs have been detected in soil and groundwater on the property as a result of past releases of chemicals to the subsurface. Previous voluntary remediation measures conducted by IBM, under the review and approval of NYSDEC, have included removal of an underground storage tank located between Buildings 952 and 982, excavation and disposal of VOC-containing soil, and installation and on-going operation of a groundwater extraction and treatment system.

Because some contamination remained on the property in soil and groundwater after completion of the remedial actions described above, the property is subject to the requirements of the SMP, which governs additional remediation and continued operation and management of the Site. The property is currently listed as a Class 4 site on the New York State Inactive Hazardous Waste Disposal Site Registry as Site #314076.

Former Building 982 is currently a vacant, empty shell. The Site owner intends to refurbish the building for commercial/recreational use. IBM understands that the property owner's plans for the building include an indoor trampoline recreational facility in the western half of the building, and commercial use in the eastern half of the building. The results of sampling conducted under the 2012 SVIWP indicated the presence of certain VOCs in subslab soil vapor that may have the potential to enter the indoor air of the building. As such, IBM has prepared this work plan to 1) further investigate through additional sampling the potential for VOC vapor entry into the building, 2) conduct testing to support final design of a SSDS, and 3) present the conceptual design of the SSDS as a pro-active

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1 *Site Management Plan, Neptune Commerce Center, Former IBM Leased B952/982 Site, Dutchess, New York*, Groundwater Sciences Corporation and HDR, December 2011.

2 *Soil Vapor Investigation Work Plan, Neptune Commerce Center, Former IBM Leased Buildings 952/982 Site, Town of Poughkeepsie, Dutchess County*, HDR, February 2012.

remedial measure to be installed and operated in conjunction with the renovation and re-occupation of the building for commercial/recreational purposes.

3.0 FIELD SAMPLING ACTIVITIES

This section provides an overview of the planned scope and rationale for the field sampling and analysis to be conducted under this work plan. Field sampling activities will include: 1) indoor and ambient (exterior) air sampling and analysis, and 2) subslab soil vapor sampling and analysis. The purpose of these sampling activities is to evaluate baseline conditions and to obtain additional data to support design of a SSDS. Further details are provided below, and additional design testing is described in Section 4.

3.1 Target VOC Analytes

The planned target VOCs for laboratory analysis have been identified based on a review of historical groundwater data3 and the soil vapor data from the 2012 sampling event4. The result of this review yields a Site-specific list of 23 VOCs, shown in Table 1 below, to be analyzed in samples of indoor air, ambient air, and soil vapor.

Table 1
Target Analyte List
Indoor Air, Ambient Air, and Subslab Soil Vapor

1,1,1-Trichloroethane
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)
1,1-Dichloroethane (1,1-DCA)
1,1-Dichloroethylene (1,1-DCE)
1,2,4-Trimethylbenzene
2-Butanone (Methyl Ethyl Ketone [MEK])
4-Methyl-2-Pentanone (2-Pentanone; Methyl Isobutyl Ketone [MIBK])
Acetone
Carbon disulfide
Carbon tetrachloride
Chloroform
cis-1,2-Dichloroethylene (cis-1,2-DCE)
Dichlorodifluoromethane (DCDFM; Freon 12)
Ethylbenzene
Isopropanol
Propylene
Tetrachloroethylene (PCE)
Toluene
Trichloroethylene (TCE)
Trichlorofluoromethane (TCFM; Freon 11)
Vinyl Chloride
o-Xylene
m/p-Xylene

[3] Groundwater VOC data were collected between 2008 and 2013 from Site monitoring wells by Groundwater Sciences Corporation of Beacon, NY.

[4] Soil vapor data were collected by HDR of Pearl River, NY on December 14, 2012 and were reported in a May 13, 2013 letter from IBM to NYSDEC entitled "Building 952/982- Soil Vapor investigation Work Plan Analytical Laboratory Reports".

The rationale for this target analyte list is that it includes all VOCs detected in at least one of the soil vapor samples collected in 2012. In addition, although they were not detected in the 2012 soil vapor sampling event, cis-1,2-DCE, PCE, and vinyl chloride are included on the list because these analytes are NYSDOH "decision matrix"[5] compounds, and they have historically been detected in site groundwater. Carbon tetrachloride (CT) is also included on the list because it is a NYSDOH decision matrix compound, although it has neither been detected in site groundwater, nor in the 2012 soil vapor sampling event.

3.2 Indoor Air Samples

Indoor air sampling will be conducted in Building 982 as part of this work plan prior to the refurbishment of the building by the Site owner. The purpose of indoor air sampling is to obtain "baseline" indoor air quality data prior to renovation of the building. Currently, the building is a vacant, empty shell, with no HVAC system installed or operating. Broken windows have been covered with plywood. Sampling under these stagnant, closed-in air conditions will likely provide "conservative" results (i.e., more likely to reveal potential VOC vapor entry) as compared to when the building is refurbished and occupied, because the future HVAC system will introduce fresh air exchange with the outdoors, and also likely generate a positive pressure that would counteract potential VOC entry. In general, indoor air sampling locations will be located near subslab sampling locations, and will be collected contemporaneously with the subslab samples to allow for comparison between subslab and indoor air results.

Although the indoor air sampling is planned outside the heating season, the time of year is irrelevant in this case because the current building conditions are more likely to reveal the potential for VOC entry than when the HVAC system is installed and operating. Unlike a typical residential structure, where the operation of a furnace can create air pressure differentials that increase the potential for VOC vapor entry, and where closed windows limit fresh air exchange, a commercial building equipped with an engineered HVAC system typically operates year-round to meet building code-required fresh air exchange rate. Thus, the potential for VOC vapor entry will likely be diminished when the HVAC system is operating, no matter the time of year, as long as the HVAC system operates with a consistent fresh air exchange and pressure.

Indoor air samples will be collected at the locations shown on Figure 2, subject to reasonable field adjustments as appropriate. Portable, hand-held screening instruments, such as a photoionization detector (PID), flame ionization detector (FID), or a portable gas chromatograph/mass spectrometer may be used to inform sampling locations, and to screen interior building space and features for potential VOC sources.

One ambient (outdoor) air sample will be collected for reference/control purposes. The location of the ambient sample will be selected based on site conditions at the time of sampling. For quality assurance/quality control (QA/QC) purposes, one duplicate indoor

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[5] As discussed in the New York State Department of Health's, Guidance for Evaluating Soil Vapor Intrusion in the State of New York - Final, October 2006. Specific VOCs assigned to the decision matrices are listed in a June 25, 2007 letter from NYSDOH to NYSDEC.

air sample will be collected. The samples will be collected as 8-hour, time-integrated samples using certified-clean Summa® canisters and flow controllers in accordance with the procedure provided in Appendix A.1. The samples will be analyzed in accordance with USEPA Method TO-15 in selective ion monitoring (SIM) mode for the target analyte list of VOCs (Section 3.1 above) by a laboratory certified by the NYSDOH Environmental Laboratory Approval Program (ELAP). The expected laboratory reporting limits for each analyte are included in Appendix B.

3.3 Subslab Soil Vapor Samples

Subslab soil vapor sampling will be conducted in Building 982 contemporaneous with the indoor air sampling discussed in the previous section. Subslab samples will be collected at the locations shown on Figure 2. Subslab sampling locations were selected to provide broad and representative coverage considering the constraints of building construction and subsurface utilities (e.g., water, sewer, and electrical), as well as anticipated future use of the building. Final sampling locations will be subject to reasonable field adjustments as appropriate.

The subslab samples will be collected as 1-hour, time-integrated samples using certified-clean Summa® canisters and flow controllers in accordance with the procedure provided in Appendix A.2. For QA/QC purposes, one duplicate subslab sample and one field blank (filled with laboratory provided nitrogen) will be collected. The samples will be analyzed in accordance with USEPA Method TO-15 in SIM mode for the target analyte list of VOCs (Section 3.1 above) by a laboratory certified by the NYSDOH Environmental Laboratory Approval Program (ELAP). The expected laboratory reporting limits for each analyte are included in Appendix B.

A sampling summary is provided on Table 2 below.

Table 2
Summary of Planned Sampling

<table>
<tr><th>Sample Type</th><th>Number Samples</th><th>Laboratory Method</th><th>Sample Volume (liters)</th><th>Flow Controller</th></tr>
<tr><td>Indoor Air</td><td>12 total (11 primary; 1 duplicate)</td><td rowspan="5">USEPA TO-15 SIM</td><td>2.7</td><td>8-hour</td></tr>
<tr><td>Subslab Soil Vapor</td><td>12 total (11 primary; 1 duplicate)</td><td>1</td><td>1-hour</td></tr>
<tr><td>Ambient (exterior) Air</td><td>1</td><td>2.7</td><td>8-hour</td></tr>
<tr><td>Communication Testing</td><td>6</td><td>1</td><td>None (grab)</td></tr>
<tr><td>Field Blank</td><td>1</td><td>1</td><td>1-hour</td></tr>
</table>

Notes: Field blank to be filled on-site from laboratory provided "lab-grade" nitrogen transfer canister.
Refer to text and Appendix A of Work Plan for additional information.

4.0 REMEDIATION SYSTEM DESIGN TESTING

This section describes the program of design field testing to support final design of a SSDS for former Building 982.

4.1 Purpose

The purpose of design testing is to obtain data to identify the appropriate number and location of extraction ports and/or trenches, size the conveyance pipe network, evaluate the number and size of vacuum blowers, and size vapor treatment equipment.

Design testing infrastructure (i.e., extraction test ports, monitoring ports) will be designed and installed in such a way that will allow it to be integrated into the full-scale system, if appropriate.

4.2 Layout of Extraction and Monitoring Ports

Design testing will involve extraction of subslab vapor using extraction ports, designated "EP", while monitoring the induced vacuum pressure beneath the slab using monitoring ports, designated "SSV", as shown on Figure 2. Design testing for induced vacuum is also known as subslab communications testing. The proposed locations of extraction and monitoring ports have been selected to meet the following objectives:

- Provide a sufficient number of extraction and monitoring ports to evaluate the ability to induce a negative pressure beneath the building slab;
- Locate the extraction ports appropriately to evaluate vapor communication, taking into account potential subsurface obstructions (i.e. structural members with the potential to block vapor flow);
- Locate the monitoring points at varying distances from extraction ports to evaluate the extent of vacuum influence from each extraction port;
- Locate select monitoring ports to serve a dual role of subsurface pressure monitoring and subsurface vapor collection points (Section 3.3); and
- Consider future use of the space, including potential installation of additional infrastructure beneath the slab, and future tenant use.

The final locations of the extraction and monitoring ports may change based on the presence of subsurface utilities/obstructions and proposed slab alterations by the property owner.

4.3 Procedures

A detailed procedure to install subslab monitoring ports is provided in Appendix A.2. A detailed procedure to install extraction ports and conduct subslab vapor extraction testing is provided in Appendix A.3.

5.0 CONCEPTUAL DESIGN OF REMEDIATION SYSTEM

This section describes the conceptual design of a SSDS for the former Building 982. The objective of the system is to remove VOCs in soil vapor beneath the building, which is intended to decrease the potential for VOC vapor entry into the building. Final design will depend on the results of the field sampling and design testing described in Sections 3 and 4.

5.1 Vapor Extraction Trench Network

To accommodate the Site owner's requirements that vapor extraction riser pipes not interfere with the planned future use of the building, the conceptual design includes a network of horizontal extraction trenches to be installed below the slab. The trench network, shown on Figure 3, is configured with an approximate spacing of 30 feet (ft) on center. This spacing will be confirmed or adjusted based on design testing results. Additionally, the trenches have been configured to create two separate networks (east and west) to accommodate the redevelopment schedule and build flexibility into the system.

The final trench network layout will consider subsurface utilities/obstructions, vacuum communication results from design testing, subsurface vapor and indoor air analytical data, and future tenant use.

5.2 Process Flow Diagram

The planned process flow diagram for the system is shown on Figure 4. The system will consist of two vapor extraction and treatment trains to provide flexibility and redundancy. While vapor treatment is included in the conceptual design, it is expected that the potential VOC emission rate will be less than the 0.5 lbs/hr threshold that would require air pollution controls under NYSDEC Division of Environmental Remediation Guidelines[6]. Therefore, depending on design testing results, treatment may not be included, or removed in the future, if emissions will not cause air pollution as indicated by an air quality impact analysis conducted in accordance with NYSDEC Division of Air Resources guidance.

Subslab vapor will be withdrawn from the extraction trench networks (east and west) using vacuum blowers. Before entering the blowers, the vapor will pass through a vapor-liquid-separator (VLS) to remove free moisture, then two granular activated carbon (GAC) units plumbed in series. Placing the GAC units on the suction side of the blower has several advantages, including 1) maintaining under vacuum all pipe and equipment with VOC-containing vapor, and 2) eliminating the need for a blower aftercooler, which would otherwise be needed on the blower discharge to reduce the temperature prior to GAC treatment. The vapor passing through the vacuum blower will be discharged outside via a new exhaust stack.

The VLSs, vacuum blowers, GAC vessels, and interconnecting piping will be sized using subsurface vapor analytical data, and flow and vacuum requirements obtained during design testing.

[6] NYSDEC, Division of Environmental Remediation, Internal memorandum from Dale Desnoyers, "Substantive Compliance with Air Requirements", February 28, 2003.

5.3 Equipment Location and Safeguards

The remediation equipment will be installed in a new, dedicated mechanical space to be constructed in conjunction with a new loading dock at the north end of Building 982 as shown on Figure 3. The system will include the following engineering design safeguards to prevent VOC vapors from entering the building during system operations, maintenance shutdowns, or potential malfunction:

- The above-slab portions of the extraction pipe network will be entirely under vacuum inside Building 982, eliminating the possibility of leakage to indoor air.

- The vacuum blower and vapor treatment equipment, if installed, will be located in a dedicated mechanical room separate from the main structure of Building 982.

- If installed, the GAC treatment units will be located upstream of the vacuum blowers such that VOC-containing vapors and the GAC units are maintained under a vacuum condition during operation.

- For maintenance shutdowns, including GAC replacement, the GAC beds and associated pipe/hose will be purged with clean air by opening a purge air inlet valve located upstream of the GAC units. This will allow clean air to be drawn through the GAC units to flush out VOC-containing vapor from the system prior to shut down and disconnecting them.

- The equipment room will be equipped with a new exhaust system, such that the equipment area will be ventilated during maintenance shut downs, including when the GAC units are disconnected from the system for replacement.

- The system will be equipped with several sensors and alarms (e.g., low vacuum, high temperature) that will automatically shut down the system, and that will have the ability to notify on-call personnel.

6.0 DATA MANAGEMENT, VALIDATION, AND REPORTING

This section pertains to the management, validation, and reporting of data from the field sampling program. Data associated with indoor air, ambient (exterior) air, and subslab soil vapor sampling will be subject to independent data validation.

6.1 Data Management

Data generated as part of the field sampling activities will be stored and managed in the Sanborn Head Data Management System (SHDMS), an online environmental data management system developed and hosted by Sanborn Head.

SHPC will follow a work flow developed to support the collection, storage, and reporting of environmental data. The process includes:

- Capturing sample and field data using paper field sampling forms or Electronic Sample Tracking Forms (ESTF);
- Transmitting field sampling information to the lab via electronic or paper chains of custodies (eCOC);
- Receiving analytical reports from the laboratory in a specific electronic data deliverable (EDD)-format and uploading the unvalidated data to SHDMS;
- Providing a summary table of the analytical results to an independent data validator for validation/usability assessment;
- Uploading the validated data to SHDMS following data validation;
- Reporting and summarizing data in tabular and spatial formats using SHDMS and ArcGIS (or other graphics software); and
- Exporting the validated data in NYSDEC's EDD format for upload to NYSDEC's EQuIS environmental data management system.

6.2 Data Validation for Samples

The laboratory data from the indoor air, ambient (exterior) air, and subslab soil vapor samples will be validated by an independent data validator. The data validation will be conducted following USEPA and NYSDEC guidelines and project-specific requirements summarized in Appendix B. A brief summary of data validation and usability assessment procedures and methods is provided below. Refer to Appendix B for additional information.

The data validation assessment is performed using a two-tier process. The first tier involves an in-depth review of sample data, including raw data, to verify that the laboratory has performed the analyses in compliance with the analytical methods required, laboratory procedures, this work plan, and USEPA and NYSDEC Guidelines for data validation of VOC data. A data usability report (DUR) for the in-depth assessment will be prepared by the validator to summarize the quality control (QC) issues that required action (qualification of data) and the effects of these actions on the usability of the results in terms of the data quality objectives (DQOs). The first tier review will be completed on the first sample delivery group only.

If the in-depth, first tier review indicates sample analysis meets the DQOs, then a second tier of data validation will be performed on data from the remaining sample delivery groups using a checklist review whereby all the project DQOs are assessed; however, evaluation of the raw data is not performed. The laboratory will provide NYSDEC Category B data packages that include sample results and summary quality control including method blank results, laboratory control sample/laboratory control sample duplicate (LCS/LCSD) recoveries, instrument QC sample results, and raw data for all analyses, including instrument tunes and calibrations for all data in the event that an in-depth assessment is needed in the future.

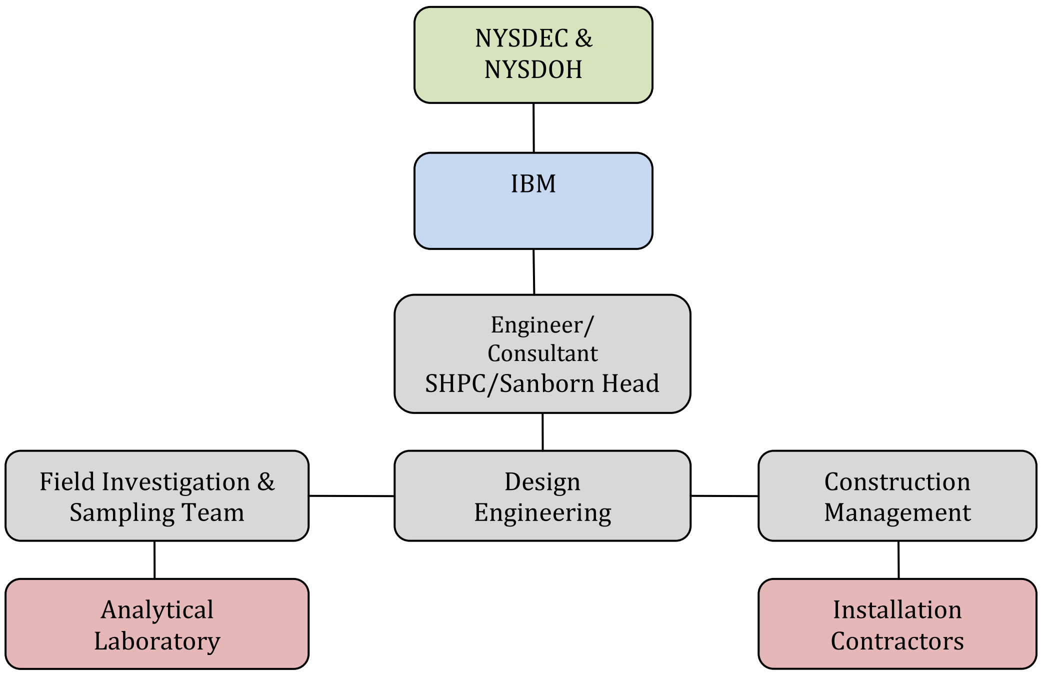
6.3 Data Reporting

IBM will communicate the validated data to the Agencies in a report of findings with appropriate context, interpretation, and recommendations. In addition, validated data will be uploaded to NYSDEC's EQuIS environmental data management system.

7.0 IBM PROJECT TEAM

IBM plans to conduct the work described in this document through a project team consisting of IBM personnel and external consultants, laboratories, and contractors. Exhibit 7.1 below shows the general organization of the project team.

Exhibit 7.1 – IBM Project Team Organization



IBM will coordinate project schedule and communications with the site owner. IBM reserves the right to modify the project team and its members while continuing to adhere to the objectives and procedures of the work plan. IBM will inform the Agencies of significant changes to the project team.

8.0 SCHEDULE AND COMMUNICATIONS

IBM intends to proceed with the activities described in this work plan beginning September 2013, with the goal of completing installation and testing of the SSDS to meet the Site owner's redevelopment schedule. Should the Agencies have comments on this work plan, IBM will make appropriate adjustments to the scope and details of the planned activities.

Following the installation and startup of the SSDS in Building 982, IBM will conduct performance monitoring, which will include subslab vacuum monitoring and/or indoor air sampling. A report documenting the completion of the SSDS installation will be prepared and submitted to the Agencies.

IBM will also provide routine updates to the Agencies and the Site owner during implementation of this work plan.

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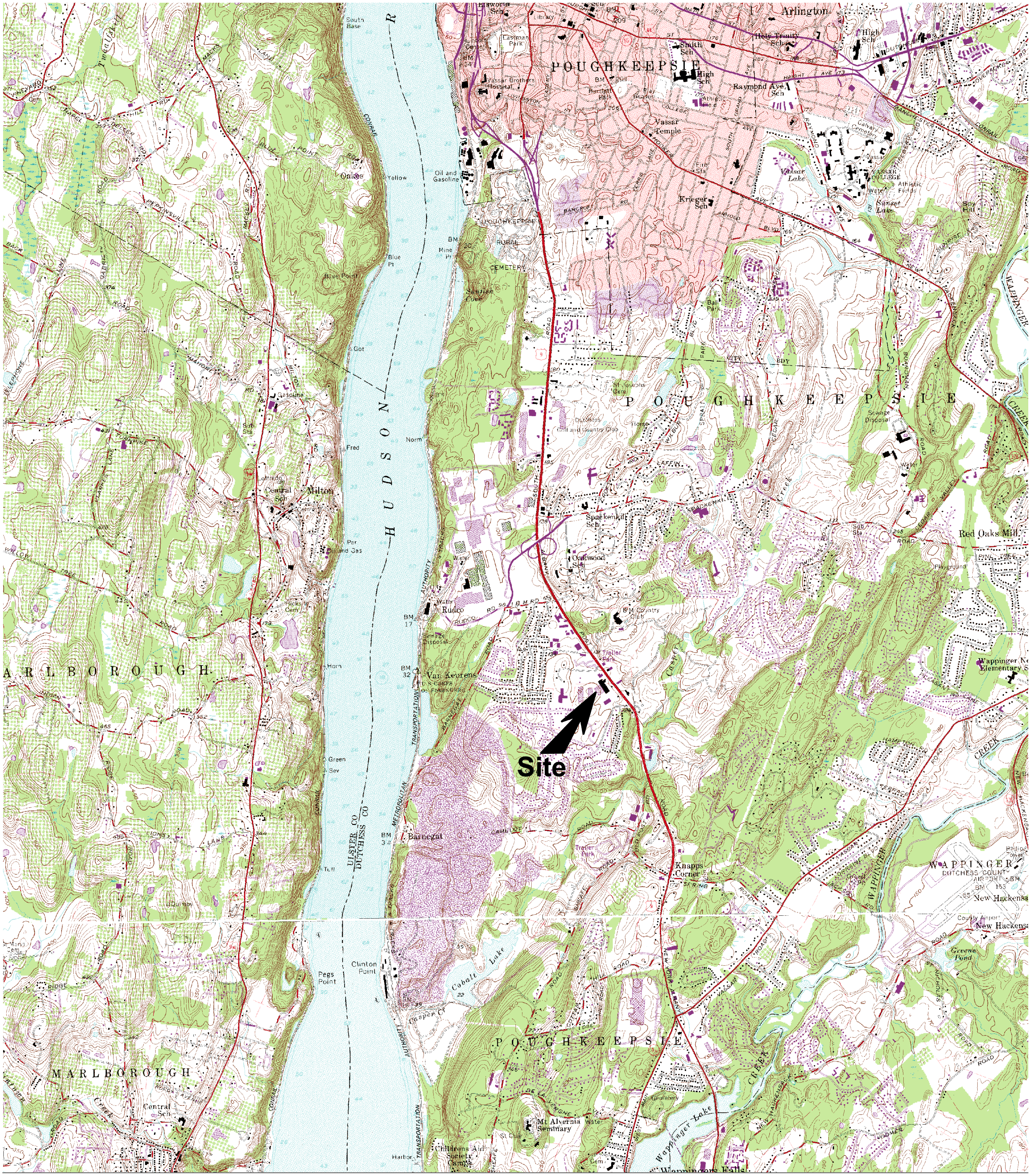
FIGURES

File:S:\WESDATA\3600\3623.00\Graphic Files\CAD\Neptune Road\SSDS Design Work Plan SEP13\SSDS Design Work Plan figs.dwg Plot Date: 9-23-13



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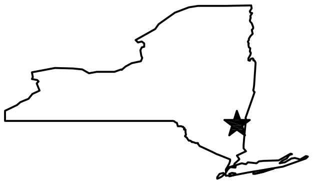

Note
Base map taken from 15 minute USGS Quadrangle Map: Poughkeepsie, N.Y., dated 1957 (Photorevised 1982)

Drawn By: R. Hirtle
Designed By: T. White
Reviewed By: D. Shea
Project No: 3623.00
Date: September 2013

SCALE: 1:24,000

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Figure 1

Locus Plan

Subslab Depressurization System (SSDS) Design Report

Former Building 982 Neptune Road

Poughkeepsie, New York

Figure No. 2

Sampling, Testing, and Monitoring Locations

Subslab Depressurization System (SSDS) Design Report

Former Building 982
Neptune Road
Poughkeepsie, New York

Drawn By: R.Hirtle
Designed By: S.Soos
Reviewed By: D.Shea
Project No: 3623.00
Date: September 2013

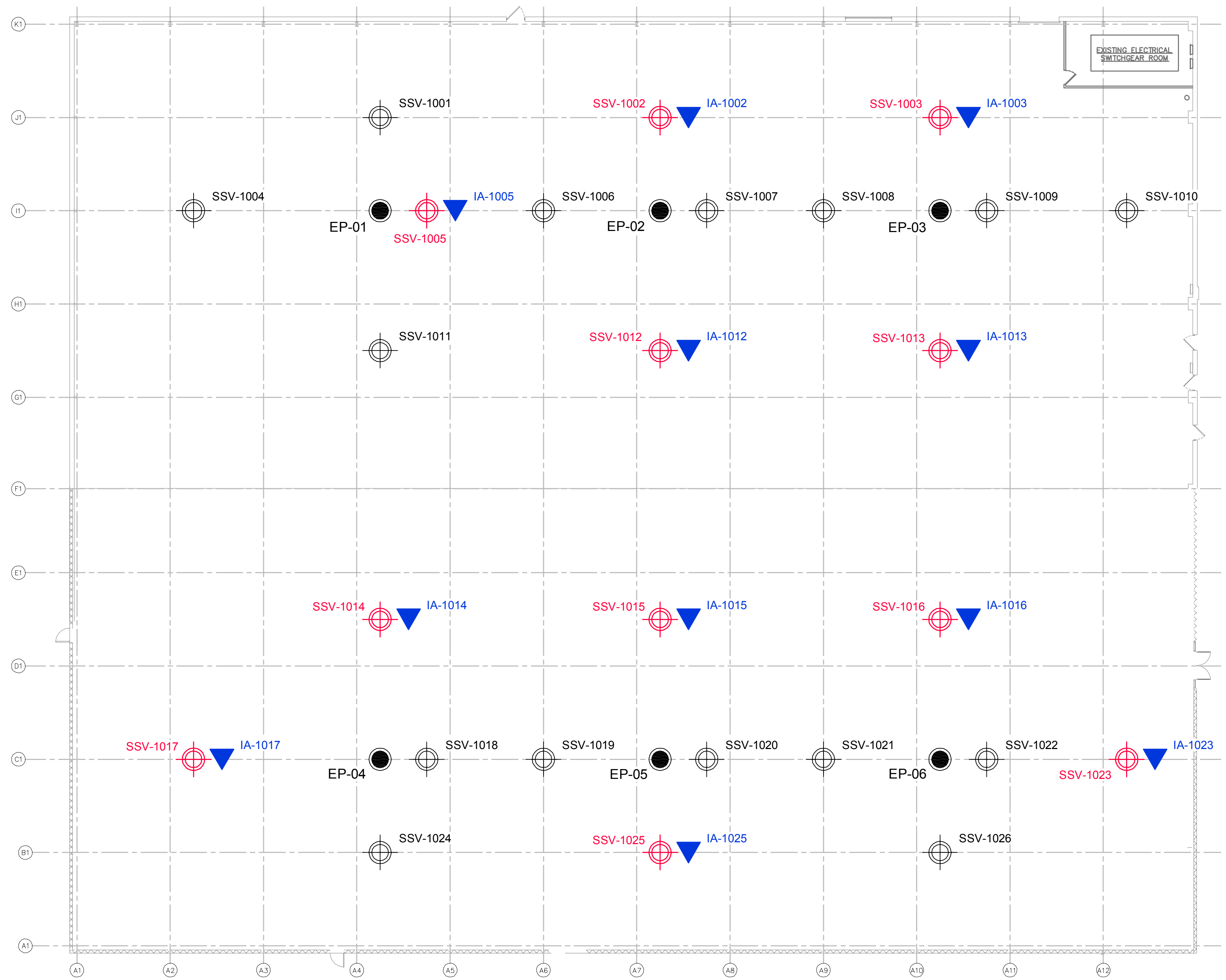


Figure Narrative

This figure shows the planned locations of subslab extraction ports and monitoring ports, including locations for subslab vapor sampling and indoor air sampling.

Note

Actual locations are subject to reasonable field adjustments based on subsurface utility locations and other factors

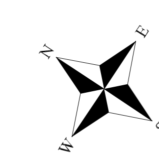
Legend

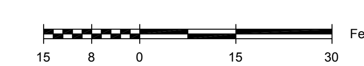
EP-01 — Approximate location and designation of subslab extraction port for communication testing

SSV-1001 — Approximate location and designation of subslab vacuum monitoring port

SSV-1002 — Approximate location and designation of subslab vapor sampling port/vacuum monitoring port

IA-1002 — Indoor air sampling location (paired with subslab vapor sampling port)





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File:S:\WESDATA\3600\3623.00\Graphic Files\CAD\Neptune Road\SSDS Design Work Plan\SSDS Design Work Plan SEP13\SSDS Design Work Plan figs.dwg Plot Date: 9-23-13

Figure No. 3

Conceptual Layout of Remediation System

Subslab Depressurization System (SSDS) Design Report

Former Building 982
Neptune Road
Poughkeepsie, New York

Drawn By: R.Hirtle
Designed By: S.Soos
Reviewed By: D.Shea
Project No: 3623.00
Date: September 2013

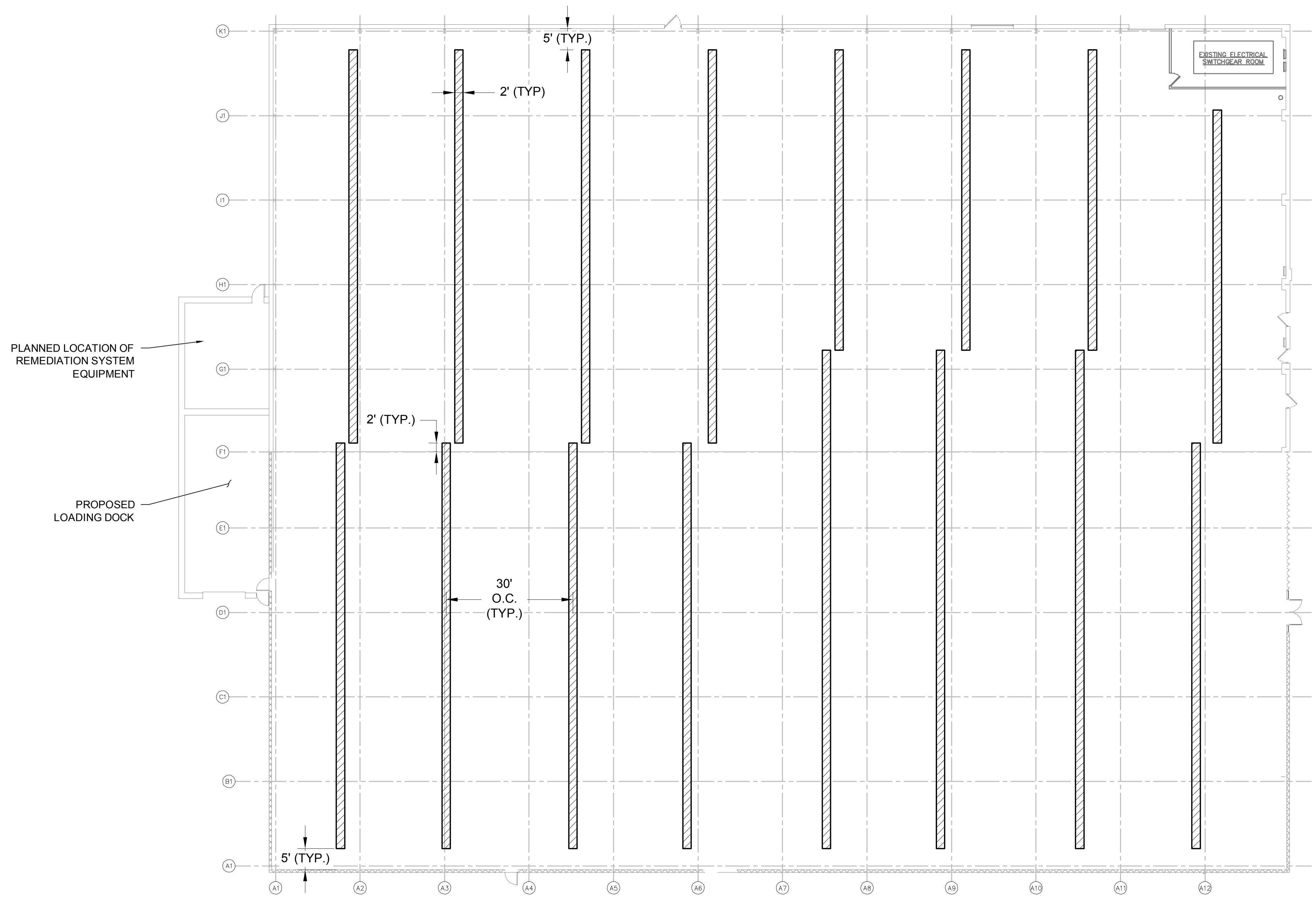

Figure Narrative

This figure shows the conceptual layout of the subslab depressurization system, including the extraction trenches and the location of remediation equipment.

The final layout is subject to adjustment based on the results of subslab communications testing, subsurface utility locations, and other factors.

Legend

Approximate location of planned subslab extraction trench

Feet
15 8 0 15 30

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File:S:\WESDATA\3600\3623.00\Graphic Files\CAD\Neptune Road\SSDS Design Work Plan SEP13\SSDS Design Work Plan figs.dwg Plot Date: 9-23-13

Figure No. 4

Remediation System Process Flow Diagram

Subslab Depressurization System (SSDS) Design Report

Former Building 982
Neptune Road
Poughkeepsie, New York

Drawn By: R.Hirtle
Designed By: S.Soos
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Project No: 3623.00
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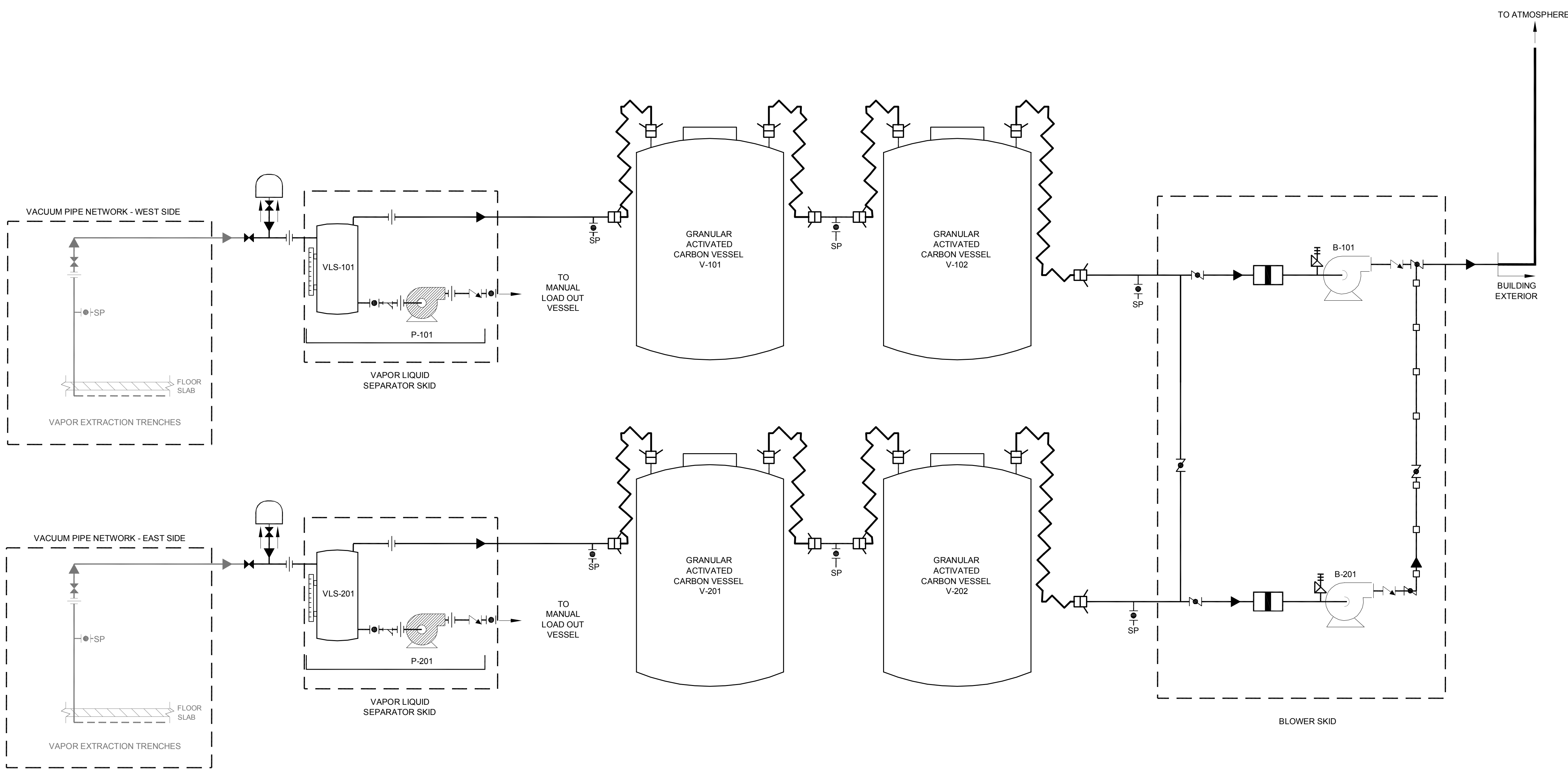

Figure Narrative

This figure shows the conceptual process flow of a subslab depressurization system.

Legend

- Ball valve
- Check valve or damper
- Gate valve
- Vacuum relief valve
- Y-strainer
- Butterfly valve
- Union
- SP Sample port
- Flexible conveyance hose
- Cam lock quick connect
- Rigid conveyance pipe
- Rigid conveyance pipe with insulation and insulation jacket
- Secondary containment
- Regenerative blower (B-101)
- Centrifugal pump (P-101)
- In-line particulate filter
- Air inlet filter
- VLS Vapor liquid seperator

NOT TO SCALE

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APPENDIX A

PROCEDURES AND PROTOCOLS

APPENDIX A.1

PROCEDURE FOR INDOOR AND AMBIENT AIR SAMPLING AND ANALYSIS USING SUMMA®-TYPE CANISTER

APPENDIX A.1
PROCEDURE FOR INDOOR AIR AND AMBIENT AIR SAMPLING AND ANALYSIS USING SUMMA®-TYPE CANISTERS

PURPOSE

This document provides general guidance for the setup and collection of indoor and ambient air samples from industrial and multi-use buildings for laboratory analysis of volatile organic compounds (VOCs). Indoor and ambient air samples will be collected using SUMMA®-type air canisters equipped with metering regulators. The purpose of the collection method is to obtain a "time-weighted average" or "time-integrated" indoor or ambient air sample.

EQUIPMENT AND MATERIALS

- Photoionization Detector (PID) equipped with an appropriate lamp and/or Flame Ionization Detector (FID);
- Wristwatch;
- Open-end wrenches including two 9/16-inch, one ½-inch, and one adjustable; and
- Indoor Air or Outdoor/Ambient Air Sampling Summary Form (attached) or equivalent electronic version.

LABORATORY-PROVIDED EQUIPMENT AND MATERIALS

- Stainless steel, pre-evacuated SUMMA® canister, individually certified clean (100% certification);
- Individually certified clean (100% certification) pressure gauge with integrated 8-hour metering regulator and inline 2-micron filter;
- Lab-grade nitrogen for field blank; and
- Laboratory chain-of-custody (COC) form or equivalent electronic version.

PROCEDURE FOR INDOOR AND AMBIENT AIR SAMPLE COLLECTION

The steps provided below should be considered a general guidance on the collection of indoor and ambient air samples; the sequence can be modified as needed based on Site-specific conditions at the time of sample collection.

Selection and Preparation of Sample Collection Area

1. Observe the area for the apparent presence of items or materials that may potentially produce or emit VOCs and interfere with analytical laboratory analysis of the collected sample. Record relevant information on the Indoor Air or Outdoor/Ambient Air Sampling Summary Form.

2. Using the PID (parts per billion by volume [ppbv] detection limit PID is preferred) and/or FID, screen indoor air in the location intended for sampling and in the vicinity of potential VOC sources to preliminarily assess for the potential gross presence of VOCs (note that the detection limits for the laboratory analyses to be performed on

the samples collected are considerably lower than the detection limits of the PID and FID). Record PID or FID readings on the Indoor Air Sampling Summary form. If the purpose of the indoor air sampling is to assess vapor intrusion (VI), items or materials within the building exhibiting PID or FID readings shall be considered probable sources of VOC interferences and isolated or removed prior to sampling if possible. If practicable, sampling will be rescheduled for 24 hours later.

Preparation of SUMMA® Canister Samples and Collection of Sample

The procedure for the collection of SUMMA® canister samples is provided below.

1. Place SUMMA® canister on a stable surface within the breathing zone (e.g., about five feet above the floor/ground) in a secure location. In general, areas near windows or other potential sources of 'drafts' and air supply vents shall be avoided unless those areas are being specifically targeted for indoor air quality assessment. For ambient air samples, where practicable, collect sample from 'upwind direction' from property. To the extent allowed by Site features, collect ambient air samples away from 'wind breaks' such as bushes or fences.

2. Confirm that that SUMMA® canister serial number and flow metering regulator serial numbers are identical and record on the Indoor Air or Outdoor/Ambient Air Sampling Summary Form and COC. If the serial numbers do not match, the SUMMA® canister and metering regulator will not be used for sample collection and will be replaced with a matching SUMMA® canister and flow metering regulator set.

3. Assign sample identification on canister ID tag, and record on the Indoor Air or Outdoor/Ambient Air Sampling Summary Form and COC.

4. Remove brass plug from canister fitting.

5. Install pressure gauge/metering regulator with in-line particulate filter assembly on canister valve fitting and tighten. Install the brass plug from the canister fitting onto the open end of the pressure gauge/metering regulator assembly and tighten. Check all other fittings on pressure gauge/flow metering regulator for tightness.

6. Quickly open and close canister valve. If the vacuum gauge reading begins to drop (i.e., returns to zero), then the assembly is leaking and the fittings need to be tightened or reconfigured. Repeat this step if tightening or reconfiguration is required.

7. Once the pressure gauge/metering regulator assembly is deemed leak-tight, record the gauge pressure on the Indoor Air or Outdoor/Ambient Air Sampling Summary Form and COC. The pressure gauge must read no less than 28 ± 2 inches Hg vacuum. Replace SUMMA® canister if pressure gauge initially reads a vacuum less than 28 inches Hg.

8. Remove brass plug from gauge fitting and store for later use.

9. Open SUMMA® canister valve to initiate sample collection.

10. Record date and local time (24-hour basis) of valve opening on the Indoor Air or Outdoor/Ambient Air Sampling Summary Form and COC.

11. Revisit SUMMA® canister at least once during the sample collection period (e.g., 4 hours after initiation of sample collection) and record any observed sampling discrepancies (e.g., no observed change in pressure gauge reading). For example, four hours after initiation of an 8-hour integrated sample the gauge should indicate a vacuum of approximately 17 inches Hg.

Termination and Shipment of Samples

1. Revisit SUMMA® canister approximately at end of sample collection period (e.g., 8 hours after initiation of sample collection) and record gauge pressure on the Indoor Air or Outdoor/Ambient Air Sampling Summary Form and COC. The final vacuum of the SUMMA® canister should be between 3 to 10 inches Hg.

2. Record date and local time (24-hour basis) of valve closing on Indoor Air or Outdoor/Ambient Air Sampling Summary form and COC.

3. Close SUMMA® canister valve.

4. Remove pressure gauge/metering regulator assembly from SUMMA® canister.

5. Reinstall brass plug on canister fitting and tighten.

6. Remove SUMMA® canister from sample collection area.

7. Pack SUMMA® canister in shipping container, verify installation of brass plug on tank fitting.

8. Complete COC and place requisite copies in shipping container.

9. Close shipping container and affix custody seal, if applicable, to container closure.

SUMMA® CANISTER SAMPLE ANALYTICAL METHOD

The SUMMA® canister samples shall be analyzed for the target list of VOCs indicated in Table 1 of the Work Plan by a NYSDOH Environmental Laboratory Approval Program (ELAP)-certified laboratory using USEPA Method TO-15 by gas chromatography/mass mass spectrometry (GC/MS) in selective ion monitoring (SIM) mode.

QUALITY ASSURANCE/QUALITY CONTROL

The collection of Quality Assurance/Quality Control (QA/QC) samples for the project will include the collection and submittal of duplicate samples for analyses of the target compounds. Duplicate samples will be collected using SUMMA® canisters placed in the same location (i.e., collocated or "side-by-side") and sampling concurrently over the same

8-hour time interval. Duplicate samples will be collected at a frequency of at least one per sample delivery group (SDG) or a minimum of one in every twenty samples (five percent).

In addition, field equipment blanks ("field blanks") will accompany sample containers (empty) to the field and the collected samples back to the lab. These equipment blanks will consist of a laboratory certified SUMMA® canister filled in the field with lab-grade nitrogen, and will not be opened during the course of transport. Field blanks will be filled with nitrogen in a location outside the building in which the indoor air samples are collected and located away from potential outdoor sources of VOCs. Field blank collection frequency shall be one per SDG or a minimum of one in every twenty samples. Additional QA/QC details are provided in Appendix B.

REFERENCE GUIDANCE DOCUMENTS

- New York State Department of Health, *Guidance for Evaluating Soil Vapor Intrusion in the State of New York - Final*, October 2006.

- New York State Department of Environmental Conservation, *NYSDEC Analytical Services Protocol*, relative to the Analysis of Air Samples for Volatile Organic Compounds (EPA TO-15), July 2005 as amended by the *NYSDEC Modifications to EPA Region 9 TO-15 QA/QC Criteria*, February 2008.

- Massachusetts Department of Environmental Protection, *Indoor Air Sampling and Evaluation Guide, WSC Policy #02-430*, April 2002, Appendix 4, Recommended SOP for Collection of Subatmospheric Air Samples.

- Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway From Groundwater and Soils (Subsurface Vapor Intrusion Guidance)* November 2002.

- U.S. Environmental Protection Agency, 1990, *U.S. EPA Environmental Response Team, Standard Operating Procedures, Summa Canister Sampling, SOP 1704, Rev. 11/16/90*.

- Air Toxics Ltd. Environmental Analytical Laboratory, *Guide to Air Sampling and Analysis*, Fifth Revision, March 2007.

- U.S. Environmental Protection Agency, 1999, *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Compendium Method TO-15*, Second Edition.

ATTACHMENTS

Indoor Air Sampling Summary Form
Outdoor/Ambient Air Sampling Summary Form

Indoor Air Sampling Summary

	Project No.:	Date:
	Project Name:	
	Location:	
Meters Used:	Project Manager:	
	Collector(s):	

SUMMA CANISTER RECORD						
Sample ID						
Canister Serial No.						
Flow Controller No.						
Start Date/Time						
Start Pressure (inches Hg)						
Stop Date/Time						
Stop Pressure (inches Hg)						
OTHER SAMPLING INFORMATION						
Story / Level						
Room						
Indoor Air Temp (°F)						
Approximate Intake Height Above Floor Level (feet)						
Noticeable Odor?						
PID Reading (ppbv)						
Duplicate Sample Designation						
Approximate Ceiling Height (feet)						
Comment Number						

COMMENTS

1.

2.

3.

4.

5.

Outdoor/Ambient Air Sample Record

	Project No.:	Date:
	Project Name:	
	Location:	
Project Manager:	Notes:	
Collector(s):		

OUTDOOR / AMBIENT AIR SAMPLE RECORD

Location No.						
Sample ID						
Sample Date						
Canister Serial No.						
Start Time						
Start Pressure (inches Hg)						
Stop Time						
Stop Pressure (inches Hg)						
Ambient Air Temp (°F)						
Weather Conditions						
Comment No.						

COMMENTS

1.

2.

3.

4.

5.

6.

7.

8.

APPENDIX A.2

PROCEDURE FOR SUBSLAB VAPOR SAMPLE PORT INSTALLATION, INTEGRITY TESTING, AND SAMPLING

APPENDIX A.2
PROCEDURE FOR SUBSLAB VAPOR SAMPLE PORT INSTALLATION, INTEGRITY TESTING, AND SAMPLING

PURPOSE

This document provides general guidance on the installation and sampling of subslab vapor sampling ports through concrete floors, including the protocol for integrity testing. The sequence of steps provided below may be modified based on the location specific conditions at the time of installation, but only if they will be at least as protective of the building environment as the procedure below.

EQUIPMENT AND MATERIALS

- Electric hammer-drill with 1¼-inch and ³/₈-inch drill bits
- Hard plastic containers ("dog dishes") with holes/ports for hammer-drill and vacuum hose
- High-efficiency particulate air (HEPA)-rated wet/dry vacuum
- HEPA replacement filters
- Granular bentonite
- Quick-drying hydraulic cement
- Stainless steel tubing cutter
- Two 50-foot long electrical extension cords
- Open-end wrenches including two ⁹/₁₆-inch and one adjustable
- Photoionization Detector (PID) equipped with an appropriate lamp and/or Flame Ionization Detector (FID)
- Tedlar bags (0.7 to 1.0 liter)
- Peristaltic pump with ¼-inch inner diameter (I.D.) silicone tubing
- Magnehelic gauges (0 to 10-inch water column range)
- Tracer gas (ultra-high-purity helium or sulfur hexafluoride)
- Tracer gas meter
- Oxygen, carbon dioxide, and methane meter
- Disposable polyethylene 60 cubic centimeter (cc) syringes
- Indoor Air Sampling Summary Form (attached) or equivalent

<u>Subslab sampling/monitoring point parts</u>

- ¼-inch stainless steel female ISO parallel thread to ¼-inch tube fitting connector
- ¼-inch outside diameter (O.D.) stainless steel tubing
- Rubber gasket or fender washer
- ¼-inch stainless steel parallel thread plug with o-ring (with appropriately sized hex wrench)
- ¼-inch male ISO parallel thread connector with integrated o-ring
- ¼-inch stainless steel 3-way switching valve
- ¹/₈-inch I.D. by ¼-inch O.D. Teflon tubing
- ³/₁₆-inch I.D. by ¼-inch O.D. Teflon tubing

LABORATORY-PROVIDED EQUIPMENT AND MATERIALS

- 1-liter stainless steel, pre-evacuated SUMMA® canister, individually certified clean (100% certification);
- Individually certified clean (100% certification) pressure gauge with integrated 1-hour metering regulator and inline 2-micron filter; and
- Laboratory chain-of-custody (COC) form or equivalent electronic version.

CLEARANCE OF UTILITIES, FLOOR SLAB THICKNESS SURVEY, AND REMOVAL OF FLOOR COVERINGS

1. Observe the condition of the building floor slab for apparent penetrations such as concrete floor cracks, floor drains, or sump holes. Using the PID and/or FID in ppbv mode, screen indoor air in the area of floor penetrations (note that the detection limits for the laboratory analyses to be performed on the samples collected are considerably lower than the detection limits of the PID and FID). Note the floor conditions on the sampling form along with the indoor air PID and FID readings.

2. Select a potential location or locations for a subsurface vapor port. Review the proposed location with building utility and space owners for potential conflicts with space activities or utilities below and above the floor. Review available construction plans with personnel to evaluate the thickness of the slab in the area of the proposed location and describe how the sampling port or ports will be installed. After receiving permission from the occupant/owner, mark the proposed location(s) and describe the location(s) on the sampling form. Mark the proposed location on the floor using duct tape or other removable indicator.

3. Identify floor covering (e.g., tile) at proposed location and collaborate with facility personnel for its removal to expose the underlying concrete slab. Confirm whether the floor material contains asbestos and if asbestos is present, arrange for removal by a licensed asbestos handler.

PROCEDURE FOR SUBSLAB SAMPLING/MONITORING PORT INSTALLATION

1. Once utility clearance is complete and floor covering has been removed, make sure that an adequate open area exists around the proposed vapor sample port location to allow easy access with the concrete coring and dust capture equipment.

2. Place hammer-drill equipped with a 1¼-inch drill bit over the proposed sample port location. During drilling, a hard plastic container through which the drill bit passes should be placed over the proposed location to limit dust migration. A port on the container will be connected to a HEPA-rated vacuum, which can then collect dust and drill cuttings.

3. Drill a 1¼-inch diameter hole into the floor slab to a depth of approximately three inches (this depth may be decreased if the total slab thickness is less than 4 inches). During drilling, the HEPA-rated vacuum should be operated by the support person to collect dust and concrete cuttings as they are generated.

4. When the proper depth has been reached, the 1¼-inch drill bit should be removed and replaced with a 3/8-inch drill bit. Drill a 3/8-inch diameter hole through the remainder of the floor slab. The HEPA vacuum should be used during this process to collect dust and small concrete chips.

5. Install a stainless-steel female ISO parallel thread to ¼-inch tube fitting connector onto a short section of ¼-inch O.D. stainless steel tubing. The ¼-inch stainless steel tubing should be pre-cut so that it extends up to two inches below the bottom of the slab, once the subslab sampling port is installed. A porous backfill material (i.e., silica sand or glass beads) should be placed to cover approximately one inch of the sampling tube. A ¼-inch stainless steel plug with o-ring will be installed into the female ISO parallel thread connector end of the fitting. Place a rubber gasket/fender washer onto the ¼-inch stainless steel tubing and insert the tubing into the drilled hole, so that the gasket/washer rests on the top of the 3/8-inch diameter hole and the top of the steel plug is flush with the floor surface. A depiction of a finished subslab sampling/monitoring port is provided on Figure A.4.1, Detail 1 (attached).

6. Place a small amount of granular bentonite, hydrated with an appropriate amount of water, on top of the gasket/washer, centering the subslab sampling/monitoring port within the drilled hole. Place hydraulic cement in the annular space between the drilled hole and the subslab sampling/monitoring port to secure it in the cored hole. Make sure that the subslab sampling/monitoring port is flush with the surrounding floor after cement is placed in the hole and that the cement does not cover the steel plug or impede its operation.

7. Allow the hydraulic cement to cure prior to initiating subslab vapor port integrity testing and/or sampling.

PROCEDURE FOR SAMPLING OF SUBSLAB SAMPLING/MONITORING PORTS

8. Remove the stainless steel plug from the subslab sampling/monitoring port. Verify that there are no obstructions present in the port. Install a clean ¼-inch male ISO parallel thread to ¼-inch tube connector with integrated o-ring into the subslab sampling/monitoring port, with a short piece of, ¼-inch Teflon or stainless steel tubing (either 1/8-inch or 3/16-inch I.D.) and a ¼-inch stainless steel 3-way inline switching valve installed on the tube connector using compression fittings. The valve should be installed quickly and in the closed position to minimize air flow either into or out of the subslab vapor port.

9. Connect a pressure gauge (e.g., Magnehelic) to one port on the 3-way valve and ¼-inch Teflon tubing to the remaining open port of the 3-way valve for purging and sampling. Open the switching valve to the pressure gauge position to collect and record a differential pressure reading at the subslab vapor sampling port relative to the room pressure. Reposition the 3-way switching valve to purge the sample train tubing of one equivalent volume using a polyethylene 60 cubic centimeter (cc) syringe. Close the valve, and remove and cap the syringe. **DO NOT DISCHARGE THE AIR/SOIL GAS SYRINGE INTO INDOOR AIR.**

10. Connect the ¼-inch Teflon® tubing on the 3-way switching valve to a SUMMA®-type canister. For duplicate sample locations connect a second canister before purging by installing a ¼-inch stainless steel "tee" fitting to the sampling port of the 3-way valve using ¼-Teflon tubing. Make sure that pipe and tubing fittings are tight prior to collection of subslab vapor samples. A depiction of a subslab sampling/monitoring port in the sampling configuration is provided on Figure A.2.1, Detail 2 (attached).

11. To collect a subslab vapor sample for laboratory analysis using a SUMMA®-type canister, place the canister adjacent to the subslab vapor sampling port and follow the methods and procedures outlined in Appendix A.1. During sampling, the subslab sampling/monitoring port will be connected to either the pressure gauge/metering regulator (for time-integrated samples) or to the SUMMA®-type canister valve fitting (for grab samples).

12. For screening of the subslab vapors (to be performed after the collection of a SUMMA®-type canister sample, if applicable), connect the ¼-inch Teflon tubing to a hand pump or peristaltic pump using an appropriate length of silicone tubing. Connect the open end of the silicone tubing to a short piece of ¼-inch Teflon tubing ($^1/_8$-inch I.D.).

13. Purge the tubing of one sample line volume if not previously performed for SUMMA®-type canister sampling. Install the ¼-inch Teflon tubing (1/8-inch I.D.) on the polyethylene valve of a clean Tedlar® bag. Using the hand pump, draw a sample from the sample port by opening the valve on the Tedlar® bag. Alternatively, using a peristaltic pump at a sampling rate equal to or less than 200 cubic centimeters per minute (cc/min), fill the Tedlar® bag and screen the contents of the Tedlar® bag using a PID and/or FID. A Tedlar® bag sample may also be collected for laboratory analysis using Method TO-15 (or equivalent method). Record relevant sampling information on the Indoor Air Sampling Summary Form and COC, as applicable.

14. Once sampling/monitoring has been completed, reposition the switching valve to the pressure gauge position to collect and record a post-sampling differential pressure reading at the subslab vapor sampling port relative to the room pressure. Remove the ¼-inch male ISO parallel thread connector from the subslab sampling/monitoring point. Replace the stainless steel plug and tighten as necessary.

ANALYTICAL METHODS

Subslab vapor samples submitted for analysis shall be analyzed for the target list of VOCs indicated in Table 1 of the Work Plan by a NYSDOH Environmental Laboratory Approval Program (ELAP)-certified laboratory using USEPA Method TO-15 by gas chromatography/ mass spectrometry (GC/MS) in selective ion monitoring (SIM) mode.

QUALITY ASSURANCE/QUALITY CONTROL

Quality Assurance/Quality Control (QA/QC) measures for the subslab sampling/monitoring ports will include collection of duplicate samples at a frequency of at least one per sample delivery group (SDG), or a minimum of one in every twenty samples (five percent). In addition, integrity testing will be performed on the installed points using a tracer gas test. A tracer gas (e.g., helium) will be used to assess the adequacy of the seal of the subslab sampling/monitoring port from ambient/indoor air leakage. The tracer gas will be dispersed around the floor surface in the vicinity of the subslab sampling/ monitoring port during the collection of a field screening sample into a dedicated, clean Tedlar® bag. The tracer gas will be confined to the vicinity of the port with a container (e.g., overturned bucket) set over the top of the port.

Applied vacuum measurements at the subslab sampling/monitoring port will be recorded with Magnehelic or equivalent gauges capable of measuring vacuums ranging from 0.1 to 10 inches of water column ("wc) during purging/sampling. Tracer gas testing will be performed at a sampling rate equal to or less than 200 cc/min. A second purging/sampling rate (also less than 200 cc/min) may be used to assess the relationship between the purging/sampling rate and measured vacuum. The extracted vapor will be directed to a Tedlar® bag and flow will be assessed using either an in-line flow meter, or by measuring the time to fill the known volume of the bag. No more than three liters of vapor will be withdrawn from the port during this testing to limit potential for introduction of ambient or indoor air.

The Tedlar® bag samples will be screened using a portable tracer gas meter with a detection limit of 25 parts per million on a volumetric basis (ppmv) or equivalent. The samples will also be screened for oxygen (O_2), carbon dioxide (CO_2), and methane (CH_4) using meters capable of reporting down to 1 percent (%) or less by volume. Should the tracer test indicate more than 10% tracer gas at an extraction rate equivalent to the sampling rate (i.e., equal to or less than 200 cc/min), the fittings and surface seal should be checked and repaired, as necessary. The results of the performance testing will be documented using the Soil Vapor Sampling Summary (attached). Additional QA/QC details are provided in Appendix B.

REFERENCE GUIDANCE DOCUMENTS

- New York State Department of Health, *Guidance for Evaluating Soil Vapor Intrusion in the State of New York - Final*, October 2006.

ATTACHMENTS

Subslab/Soil Vapor Field Sampling Summary Form
Figure A.2.1 – Subslab Sampling/Monitoring Port

Soil Vapor Field Sampling Summary

	Project No.:	Date:
	Project Name:	
	Location:	
O_2 / CH_4 / CO_2 Meter Used:		Project Manager:
PID Meter Used:		Collector(s):
Other:		FID Meter Used:

SOIL VAPOR SAMPLE RECORD

Location No.						
Sample ID						
Implant Install Date						
Sample Date						
Sample Collection Depth/ Slab Thickness (ft bgs)						
Approx. Purge Volume (cm^3)						
Canister Serial No.						
Start Time						
Start Pressure (inches Hg)						
Stop Time						
Stop Pressure (inches Hg)						
Ambient Air Temp (°F)						
Weather Conditions						
O_2 Reading (%)						
CH_4 Reading (%)						
CO_2 Reading (%)						
PID reading (ppmv)						
FID reading (ppmv)						
Comment No.						

COMMENTS

1.
2.
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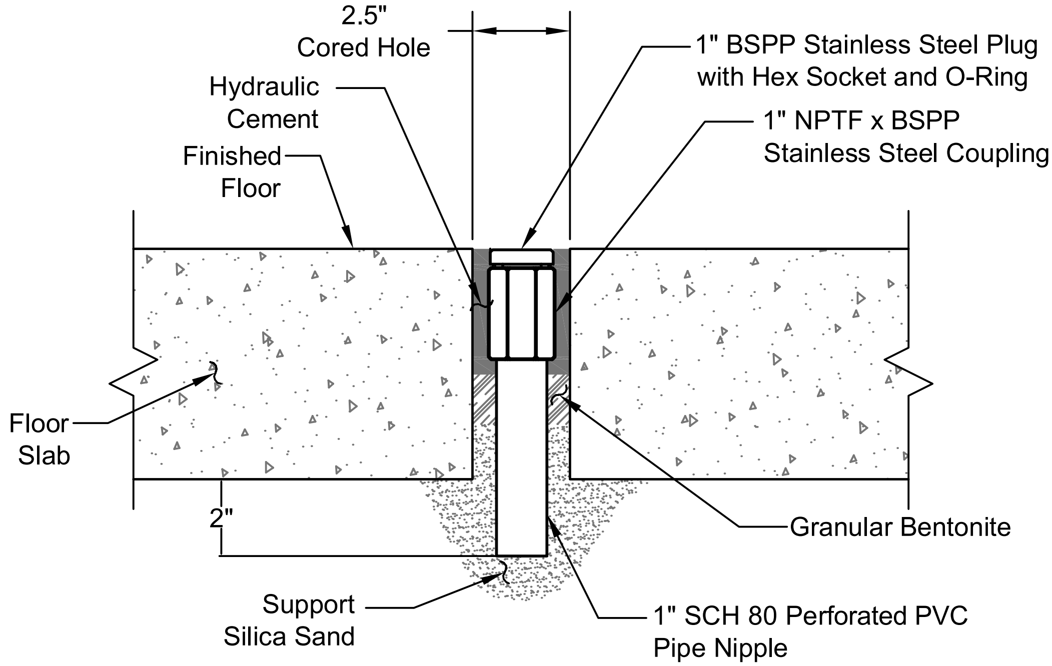
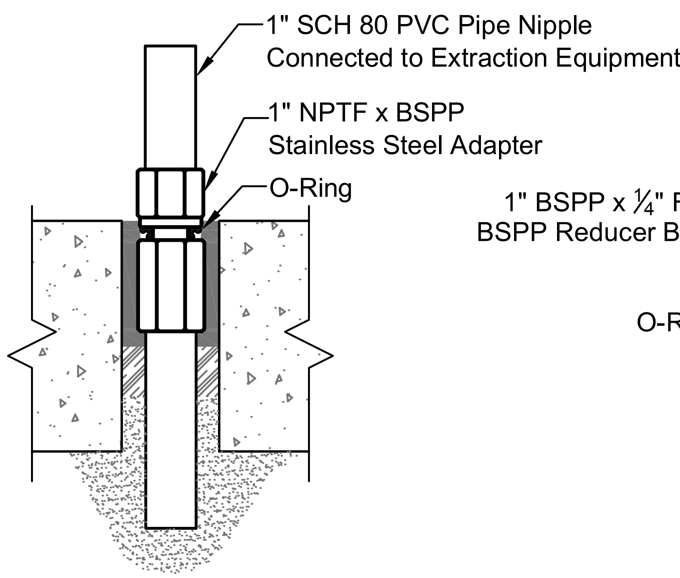
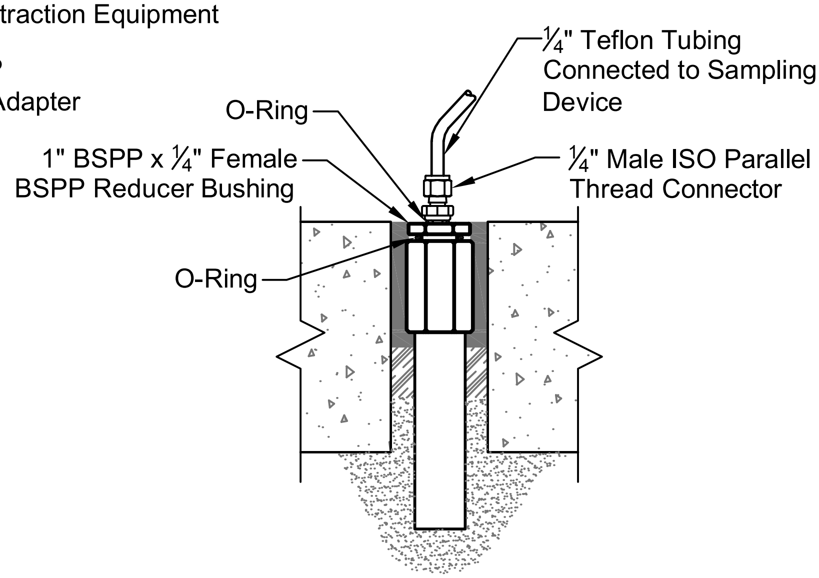
7.
8.



1 Subslab Extraction Test Port

Not To Scale





2 Subslab Depressurization Testing Configuration

Not To Scale

3 Subslab Vapor Sampling Configuration

Not To Scale

Drawn By: R. Hirtle
Designed By: T. White
Reviewed By: D. Shea
Project No: 3623.00
Date: September 2013

SCALE: Not to Scale

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Figure A.2.1

Subslab Sampling/ Monitoring Port

Subslab Depressurization System (SSDS) Design Report

Former Building 982 Neptune Road

Poughkeepsie, New York

APPENDIX A.3

PROCEDURE FOR SUBSLAB EXTRACTION TEST PORT INSTALLATION AND TESTING

APPENDIX A.3
PROCEDURE FOR SUBSLAB EXTRACTION
TEST PORT INSTALLATION AND TESTING

PURPOSE

This document provides general guidance on the installation and testing of subslab/substructure vapor extraction points. The sequence of steps provided below can be modified based on the location-specific conditions at the time of installation, but only if they will be as protective of the building environment as the procedure outlined below.

EQUIPMENT AND MATERIALS

- Portable, electric concrete coring drill with 2½-inch core barrel
- Hard plastic containers ("dog dishes") with holes/ports for coring equipment and vacuum
- Two, high-efficiency particulate air (HEPA)-rated wet/dry vacuums
- HEPA replacement filters
- Support sand
- Granular bentonite
- Quick-drying hydraulic cement
- Polyvinyl chloride (PVC) pipe cutter
- Two 50-foot long electrical extension cords
- Open-end wrenches including two $^{9}/_{16}$-inch and two adjustable
- Photoionization Detector (PID) equipped with an appropriate lamp and/or Flame Ionization Detector (FID)
- Tedlar bags (0.7 to 1.0 liter)
- Peristaltic pump with ¼-inch inner diameter (I.D.) silicone tubing
- $^{1}/_{8}$-inch I.D. by ¼-inch O.D. Teflon tubing
- $^{3}/_{16}$-inch I.D. by ¼-inch O.D. Teflon tubing
- Indoor Air Sampling Summary Form (attached) or equivalent

<u>Subslab extraction testing equipment</u>

- Hot-wire anemometer
- Digital manometer (0 to 1.000-inch water column)
- Discharge hose, size and length dependent on location and application
- Vacuum gauge (0 to 60-inch water column range)
- Rigid PVC pipe and flexible hose connections

<u>Subslab extraction port parts</u>

- 1-inch stainless steel female BSPP to 1-inch NPTF coupling
- Two, 1-inch Schedule 80 PVC pipe nipples
- 1-inch BSPP stainless steel plug with hex socket and o-ring (with appropriately sized hex wrench)
- 1-inch stainless steel female BSPP to 1-inch male NPT adapter with o-ring
- ¼-inch male ISO parallel thread connector with integrated o-ring

LABORATORY-PROVIDED EQUIPMENT AND MATERIALS

- 1-liter stainless steel, pre-evacuated SUMMA® canister, individually certified clean (100% certification) with pressure gauge;
- Laboratory chain-of-custody (COC) form or equivalent electronic version.

CLEARANCE OF UTILITIES AND REMOVAL OF FLOOR COVERINGS

1. Mark the proposed location on the floor for the extraction port using duct tape or other removable indicator.

2. Review the proposed location with building utility and space owners for potential conflicts with space activities or utilities below and above the floor.

3. Identify floor covering (e.g., tile) at proposed location and collaborate with facility personnel for its removal (if required) to expose the underlying concrete slab. Confirm whether the floor material contains asbestos and if asbestos is present, arrange for removal by a licensed asbestos handler.

PROCEDURE FOR EXTRACTION POINT INSTALLATION

1. Once utility clearance is complete and floor covering has been removed, make sure than an adequate open area exists around the proposed extraction port location to allow easy access with the concrete coring machine and dust capture equipment.

2. Place concrete coring drill over the proposed extraction point location and secure the corer to the floor using the vacuum-pump assembly. Test water delivery equipment prior to starting corer, and make sure that an adequate water supply is available to complete the core.

3. Core a 2½-inch diameter hole through the floor slab. During coring, the water dust suppression/bit cooling system shall be operated at all times. A wet/dry vacuum with a HEPA-rated filtration system should be operated by the support person to collect excess water and concrete cuttings as they are generated.

4. When the bottom of the floor slab has been reached, the core barrel should be removed, and a hammer and chisel should be used to remove the core from the floor slab. A light water mist from a portable water sprayer should be used during this step to suppress dust. The HEPA-rated vacuum should be used during this process to collect dust and small concrete chips from the core.

5. Thread the 1-inch Schedule 80 PVC pipe and the 1-inch BSPP stainless steel plug with o-ring into the 1-inch NPTF by 1-inch stainless-steel female BSPP coupling. Center the extraction port assembly in the core hole. The 1-inch PVC pipe should be pre-cut so that it does not extend below the bottom of the slab, once the subslab extraction port is installed. A depiction of a subslab extraction port is provided on Figure A.3.1, Detail 1 (attached).

6. Add support sand to anchor the extraction port assembly in place. Add a small amount (approximately 1-inch depth) of granular bentonite, hydrated with an appropriate amount of water above the support sand. Place hydraulic cement in the annular space around the outside of the extraction port assembly to secure it in the cored hole. Make sure that the subslab extraction port is flush with the surrounding floor after cement is placed in the hole and that the cement does not cover the steel plug or impede its operation.

7. Allow the hydraulic cement to cure prior to initiating extraction testing or subslab vapor sampling.

PROCEDURE FOR SUBSLAB EXTRACTION TESTING

A general procedure for subslab extraction testing is provided below. Actual subslab extraction testing procedures will be dependent on the location and conditions at the time of testing.

1. Remove the 1-inch stainless steel plug from the subslab extraction port. Thread a 1-inch Schedule 80 PVC nipple into a 1-inch NPTF by 1-inch BSPP stainless steel adapter with o-ring and install in the subslab extraction port. Check the connections for tightness. A depiction of the subslab extraction testing configuration is provided on Figure A.3.1, Detail 2 (attached).

2. Connect the vacuum (or equivalent) to the extraction port using both rigid PVC pipe and flexible fittings (e.g., Fernco fittings). A vacuum gauge (to measure applied vacuum at the extraction port), a port for velocity measurements using the hot-wire anemometer, and a port for vapor sample collection should be installed in the rigid PVC pipe. Hose will also be connected to the outlet side of the vacuum to vent to the outside of the building. Adjustments to the applied vacuum and extraction rate will be made with a valve installed in the rigid PVC pipe on the suction side of the blower.

3. During the tests, vapor flow rate will be measured using a hand-held, hot wire anemometer and vapor screening will be performed using a PID or FID. Vapor samples may also be collected into SUMMA®-type canisters or Tedlar® bags using a peristaltic pump for laboratory analysis using Method TO-15 selective ion monitoring (SIM) mode.

4. Surrounding subslab sampling/monitoring and extraction ports will be arranged in their respective sampling configurations (see Appendix A.2 and section below). Vacuum monitoring will be performed using a digital manometer connected to the ¼-inch Teflon tubing.

The general procedure for the extraction testing will consist of monitoring nearby subslab sampling/monitoring and extraction ports at intervals of approximately fifteen minutes while pulling a vacuum on the extraction test port. Monitoring measurements will include: (i) measurement of flow rates; (ii) screening of extracted vapors using a PID; and (iii) measurement of vacuum in the surrounding subslab sampling/monitoring and extraction ports. At the completion of the extraction testing, external fittings should be removed from the subslab sampling/monitoring and extraction ports and each port should be capped using the appropriate plug and o-ring.

PROCEDURE FOR SAMPLING OF SUBSLAB EXTRACTION PORTS

1. Remove the 1-inch stainless steel plug from the subslab extraction port. Verify that there are no obstructions present in the port. Thread a clean 1-inch BSPP by ¼-inch female BSPP reducer bushing into the subslab extraction port. Thread a clean ¼-inch male ISO parallel thread to ¼-inch tube connector with integrated o-ring and ¼" Teflon tubing (either $^{1}/_{8}$-inch or $^{3}/_{16}$-inch I.D.) into the reducer bushing. The Teflon tubing should be cut to a length that allows for connection to the applicable sampling device. Make sure that pipe and tubing fittings are tight prior to collection of subslab vapor samples. A depiction of a subslab extraction port in the sampling configuration is provided on Figure A.3.1, Detail 3 (attached).

2. For screening of the subslab vapors, connect the ¼-inch Teflon tubing to a peristaltic pump using an appropriate length of silicone tubing. Connect the open end of the silicone tubing to a short piece of ¼-inch Teflon tubing ($^{1}/_{8}$-inch I.D.). Purge the tubing by drawing enough sample volume to flush the installed sampling line.

3. Install the ¼-inch tubing on the polyethylene valve of a clean Tedlar® bag. Open the valve on the Tedlar® bag and turn on the peristaltic pump at a sampling rate of < 200 cc/min. Fill the Tedlar® bag to approximately two-thirds of its volume. Screen the contents of the Tedlar® bag using a PID and/or FID. A Tedlar® bag sample may also be collected for laboratory analysis using Method TO-15 (or equivalent method).

4. To collect a subslab vapor sample for laboratory analysis using a SUMMA®-type canister, follow the methods and procedures outlined in Appendix A.2 for collection and analysis of the sample. During sampling, the subslab extraction port ¼-inch Teflon tubing will be connected to either the pressure gauge/metering regulator (for time-integrated samples) or to the Summa®-type canister valve fitting (for grab samples).

5. Record relevant sampling information on the Indoor Air Sampling Summary Form and COC, as applicable.

6. Once sampling/monitoring has been completed, remove the ¼-inch male ISO parallel thread connector and reducer bushing (with o-ring) from the subslab extraction point. Replace the 1-inch stainless steel plug and tighten as necessary.

ANALYTICAL METHODS

Subslab vapor samples submitted for analysis shall be analyzed for the target list of VOCs indicated in Table 1 of the Work Plan by a NYSDOH Environmental Laboratory Approval Program (ELAP)-certified laboratory using USEPA Method TO-15 by gas chromatography/ mass spectrometry (GC/MS) in SIM mode.

QUALITY ASSURANCE/QUALITY CONTROL

Quality Assurance/Quality Control (QA/QC) measures for sampling the subslab extraction ports will include integrity testing of the installed points using a tracer gas test. The protocol for the tracer gas integrity test is outlined in the QA/QC section of Appendix A.2 and additional QA/QC details are provided in Appendix B.

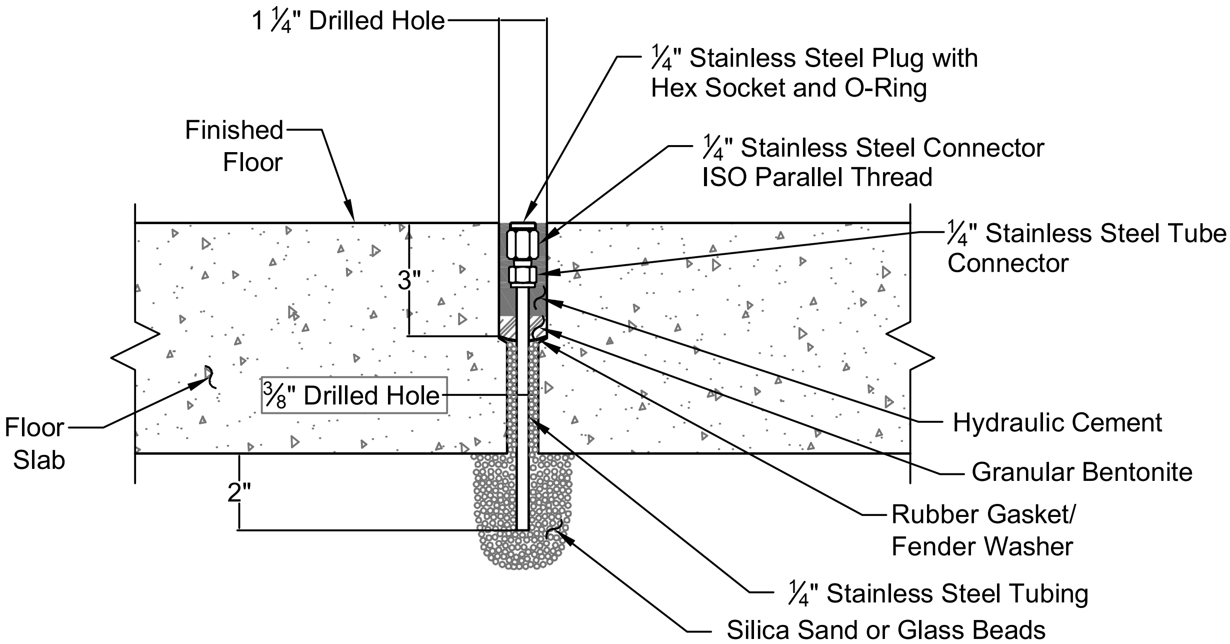
REFERENCE GUIDANCE DOCUMENTS

- New York State Department of Health, *Guidance for Evaluating Soil Vapor Intrusion in the State of New York - Final*, October 2006.

ATTACHMENTS

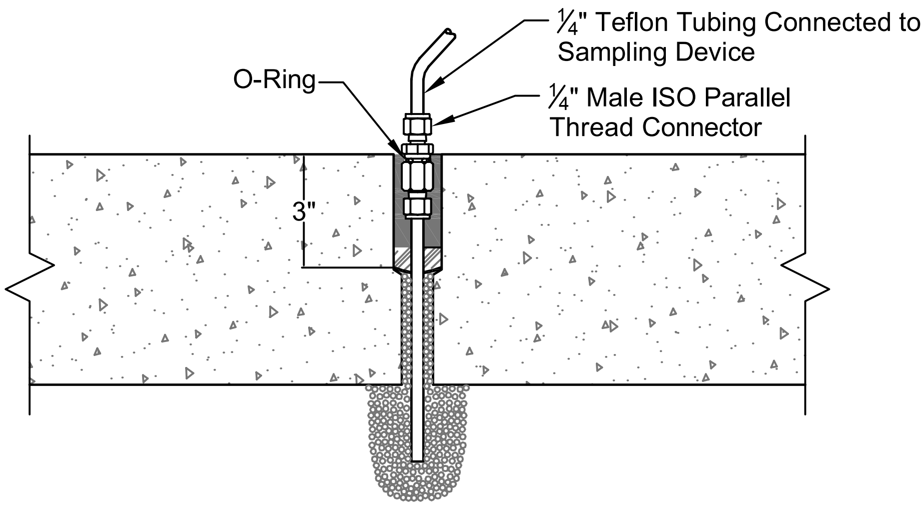
Figure A.3.1 – Subslab Extraction Port

S:\CONDATA\3600s\3623.00\Source Files\B982 Neptune Road Work Plan\Revised Work Plan\Appendix A\A.3-Extraction Testing Procedure.docx



1 Subslab Sampling/Monitoring Port

Not To Scale



2 Subslab Vapor Sampling Configuration

Not To Scale

Drawn By: R. Hirtle
Designed By: T. White
Reviewed By: D. Shea
Project No: 3623.00
Date: September 2013

SCALE: Not to Scale

SANBORN | HEAD ENGINEERING

Figure A.3.1

Subslab Sampling/ Monitoring Port

Subslab Depressurization System (SSDS) Design Report

Former Building 982 Neptune Road

Poughkeepsie, New York

APPENDIX B

QUALITY ASSURANCE/QUALITY CONTROL PLAN

APPENDIX B
QUALITY ASSURANCE/QUALITY CONTROL PROJECT PLAN
INDOOR AIR AND SUBSLAB SOIL VAPOR SAMPLING
SUBSLAB DEPRESSURIZATION SYSTEM (SSDS) DESIGN
WORK PLAN
FORMER BUILDING 982 – NEPTUNE ROAD
POUGHKEEPSIE, NEW YORK

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TABLES

B.1 INTRODUCTION

This appendix summarizes the quality assurance/quality control (QA/QC) project plan associated with the collection, analysis, and management of indoor air and subslab soil vapor samples, as part of the Subslab Depressurization System (SSDS) Design work plan at former Building 982 on Neptune Road in Poughkeepsie, New York (the Site). The purpose of the QA/QC program is to establish procedures for meeting data quality objectives (DQOs), data validation, and assessment of data usability.

B.2 DATA QUALITY OBJECTIVES

The DQOs were established to assess the presence and concentration or absence of target volatile organic compounds (VOCs) in indoor air and subslab vapor samples within the Site building. The DQOs were prepared in recognition that these data will be used to evaluate the need for, and support design of, a remedial system. The samples will be collected in SUMMA® type canisters and submitted to a NYSDOH Environmental Laboratory Approval Program (ELAP)-certified laboratory for analysis. Samples will be collected using the procedures described in Appendix A.1. The analysis will be completed using USEPA Method TO-15 by gas chromatography/mass mass spectrometry (GC/MS) in selective ion monitoring (SIM) mode for the target analyte list provided in Table B.1.

The analytical data will undergo data validation and usability assessment prior to use of the data. Criteria for performance measures, including precision, accuracy/bias, representativeness, data comparability, sensitivity (quantitation limits), and completeness are discussed below.

B.3 MEASUREMENT PERFORMANCE CRITERIA

This section documents the performance criteria defined for the analytical measurement systems so that the project DQOs, as defined above, are met. Measurement Performance Criteria (MPC) for precision, accuracy/bias, representativeness, completeness, sensitivity, and comparability have been determined for the proposed laboratory analysis of VOCs in indoor air samples. The proposed frequency of QA/QC elements associated with the MPC are outlined in Table B.2.

B.3.1 Precision

Precision is the degree of agreement among repeated measurements of the same characteristic (analyte, parameter, etc.) under the same or similar conditions. Precision data indicate how consistent and reproducible the field sampling and/or analytical procedures have been. “Overall project precision” will be measured by collecting data from duplicate field samples. In addition, analytical laboratory precision will be measured by analyzing laboratory control sample/laboratory control sample duplicate (LCS/LCSD) samples and laboratory duplicates (LD). Comparing overall project precision and laboratory precision will help to identify sources of imprecision, such as possible error in sample integrity, if such imprecision exists.

Field duplicate (FD), LD, and LCS/LCSD precision will be evaluated by calculating the relative percent difference (RPD) of the duplicate results using the following equation:

$$RPD = \frac{\left| x_1 - x_2 \right|}{\frac{x_1 + x_2}{2}} \times 100\%$$

Where,

RPD	represents the relative percent difference;
x_1	indicates the original sample concentration; and
x_2	indicates a replicate sample concentration.

The target for RPD for FD, LD and LCS/LCSD analyses is 20% for results greater than five-times the reporting limit (RPD criteria are not applicable for concentrations less than five-times the RL), which is consistent with NYSDEC requirements.

B.3.2 Accuracy/Bias

Accuracy is the extent of agreement between an observed value (sample result) and the accepted, or true, value of the parameter being measured. Accuracy is frequently used synonymously with bias. Specifically, the term "bias" describes the systematic or persistent error associated with a measurement process. Sources of error in the field and the laboratory that may contribute to poor accuracy include laboratory measurement error, sampling inconsistency, field contamination, laboratory contamination, and preservation and handling issues. Accuracy/bias will be evaluated using several different types of QC samples, including LCS, internal standard (IS) and surrogate spikes (if used), and field and laboratory blank samples. In addition, method- and NYSDEC-required instrument tuning (samples will be analyzed within 12 hours of tune based on NYSDEC criteria as compared to Method TO-15 criteria, which allows analysis of samples within 24 hours of tune), initial calibration, and continuing calibration criteria will be used to evaluate the accuracy of the analytical measurements. For the QC samples that have a "true" value (e.g., LCS), the following equation will be used to calculate the accuracy or potential bias in the result as a "percent recovery:"

$$Accuracy/Bias = \%Recovery = \frac{Measured\ Value}{True\ Value} \times 100\%$$

The acceptance criteria for the IS is 60-140% recovery and for surrogates and LCS is 70-130% for all target compounds, which is consistent with NYSDEC requirements.

B.3.3 Representativeness

Representativeness is a qualitative term that describes the extent to which a sampling design adequately reflects the Site conditions. It takes into consideration the magnitude of the area represented by one sample and assesses the feasibility/reasonableness of that design rationale. Representativeness also reflects the ability of the sampling team to collect samples and laboratory personnel to analyze those samples in such a manner that the data generated accurately and precisely reflect the Site conditions. As a quantitative measure of representativeness, field duplicate samples will be collected and analyzed. See Section B.3.1 and Appendix A.1 of the Work Plan for further description of the approach to duplicate collection, analysis, and criteria. Overall representativeness will be assessed once all of the data are validated and reviewed to determine whether or not the sampling design was adequate for defining the Site conditions.

B.3.4 Comparability

Comparability is a qualitative parameter that expresses the confidence with which data sets can be compared. Comparable data allows for the ability to combine analytical results acquired from various sources taken during the period of the assessment. Comparability relies upon precision and accuracy within the individual data sets to be acceptable, to promote confidence in the data sets. The consistent use of the sampling and analytical methods defined in this plan will yield comparable results. In addition, comparability can be affected by QA/QC criteria such as sample preservation, holding times, blank contamination, quantitation limits, and matrix issues. The QC criteria for these parameters have been defined in this plan to provide comparability of the data generated during the sampling program.

B.3.5 Sensitivity

Sensitivity is the ability of the method or instrument to detect the target VOCs at the concentration of interest. Several QC samples and procedures will be used to provide sensitivity consistent with Site DQOs. These include collection and analysis of field blank (FB), laboratory method blank samples, and instrument initial and continuing calibration criteria. The laboratory's lowest concentration initial calibration standard will be at a level at or below the project-required reporting limits, on a sample-equivalent basis. Adherence to method procedures, and field and laboratory instrument/equipment maintenance, testing, and inspection will also assist in providing the appropriate level of sensitivity.

All target VOCs will be analyzed by Method TO-15 using GC/MS in the Selected Ion Monitoring (SIM) mode of detection by Alpha Analytical, Inc. of Mansfield, Massachusetts (NELAP-certified). The laboratory reporting limits (RLs) for Method TO-15 analyses for the project-specific list of 23 target analytes are shown in Table B.1.

There are two potential methods that can be used by the laboratory to prepare the sample for analysis from the Summa® canister: 1) over-pressurization of canister or 2) use of a vacuum pump.

1. **Over-pressurization of the canister:** After the canister vacuum has been measured at the laboratory, the canister will be over-pressurized to 5 pounds per square inch (psi) as a part of the sample preparation procedure, which will lead to an expected sample dilution factor of about 2. A table depicting an example of the relationship between receipt canister vacuum, final pressure of canister, and dilution factor is

included below[1]. The dilution factor used will be sample-specific and adjusted to the actual receipt vacuum of the sample.

Receipt Canister Vacuum (in Hg)	4	4.5	5.0	5.5	6
Final Pressure of Canister (psi)	5	5	5	5	5
Dilution Factor	1.55	1.58	1.61	1.64	1.68

2. **Use of vacuum pump:** The laboratory will use a vacuum pump to extract the sample from the Summa® canister. In this case, it is not anticipated that the reporting limits will need to be increased by a dilution factor.

If a compound is detected at a concentration above the instrument calibration range during TO-15 analysis, a dilution at the GC/MS instrument level may be performed so that target compounds are quantified within the accurate calibration range of the instrument. If a dilution is performed, the reporting limits will be adjusted to account for this dilution.

If the laboratory is able to identify a target compound at a level below the reporting limit (equivalent to the sample-specific level associated with the lowest concentration initial calibration), they will report the result as an estimated value (flagged "J") due to uncertainty in quantitation at a level below the instrument calibration range. These results are qualitatively accurate and may be used for project decisions with the understanding of the uncertainty in the numerical value.

B.3.6 Completeness

Completeness is a measure of the amount of valid/usable data resulting from data collection and analysis activities. Completeness can be calculated as a percentage of the number of valid/usable results obtained compared to the total number of results (usable and rejected) obtained during the course of the investigation. Theoretically, a completeness target is reached through adherence to the methods and QC requirements. Deficiencies in the data may be due to sampling techniques, poor accuracy or precision, or laboratory error. While these deficiencies may affect certain aspects of the data, usable data may still be extracted from applicable samples. The completeness objective for this project is 90 percent.

B.4 EXECUTION OF SAMPLING AND ANALYSIS

QA/QC procedures related to the collection and analysis of samples are described in the sections below.

[1] The information provided in this table is from ATL's, *Guide to Air Sampling and Analysis*, Fifth Edition, March 2007. The dilution factor presented assumes that the canister was pressurized to 5 psig prior to analysis.

B.4.1 Sampling Procedures

Indoor air and subslab soil vapor samples will be collected and analyzed using the procedures and protocols provided in Appendix A. Samples will be collected in either 1-L or 2.7-L canisters, depending on the laboratory that is selected for conducting the analyses.

- Collection of a single sample 1-L canister will result in a sample volume of approximately 0.8 liters, which integrated over a 1-hour sampling period provides a sampling rate of approximately 13 milliliters per minute.
- Collection of a single sample 2.7-liter canister will result in a sample volume of approximately 2.2 liters, which integrated over an 8-hour sampling period provides a sampling rate of approximately 4.5 milliliters per minute.

Duplicate samples will be collected concurrently from a single indoor air monitoring point or subslab soil vapor sampling port.

B.4.2 Quality Assurance/Quality Control

The proposed schedule of QA/QC measures such as Field Duplicates (FD), Field Blanks (FB), and laboratory blanks are outlined in Table B.2. As outlined in the table and in the text to follow, QA/QC measures implemented during field sampling activities will include, but not be limited to:

- Confirmation of sample container and metering valve integrity before and after sample collection (canister vacuum prior to use must be 28 ± 2 inches Hg, field final vacuum must be within 3-10 inches Hg, lab receipt vacuum and field final vacuum must agree within ± 5 inches Hg, and RPD of the pre- and post-flow controller calibration checks should be ≤ 20%);
- Sample collection pursuant to the methods outlined in Appendix A;
- Collection of FD samples; and
- Collection of FB samples.
- NYSDEC Modifications to EPA Region 9 TO-15 QA/QC Criteria indicate that the field final vacuum should be 5 ± 1 inches Hg; however, in practice, meeting this stringent requirement has been found to be difficult and not value-added to obtaining air data of known and acceptable quality. Therefore, for this project, criteria have been established requiring the field final vacuum to be between 3 and 10 inches Hg.

The SUMMA® canisters used for sample collection will be "individually certified clean" by the analytical laboratory to ensure that the target compounds are non-detect at or above the RLs given in Table B.1, and confirmation of the presence of the certification seal or label for each container will be noted on sampling documentation. The flow metering regulator will also be "individually certified clean" and the laboratory will verify the flow rate prior to shipment and again upon receipt back at the laboratory. The canister ID number and vacuums will be noted and recorded before and after the collection of samples on the Chain of Custody (COC).

Field blanks (FBs) will be collected at minimum frequency of 1 per 20 field samples. FBs are laboratory-certified clean SUMMA® canisters, delivered empty to the field, filled in the field with lab-grade nitrogen and shipped back to the lab along with the field samples for analysis. . The FBs should not contain any target analyte at a concentration greater than its corresponding reporting limit, or other non-target compounds that may interfere with the analysis of a target analyte.

FD samples will be collected at a minimum frequency of 1 per 20 field samples) simultaneously (i.e., over the same time interval) and spatially adjacent to each other at the frequency outlined in Table B.2. The location selected for the collection of the FD sample should be a location where "upscale" but not "off scale" VOC concentrations are expected, if possible.

B.4.3 Sampling Documentation

The collection of indoor air samples will be documented with the use of Indoor Air Sampling Summary forms, or equivalent. An example of this form is included in Appendix A. Information recorded on this form will include:

- Identification of sample;
- Date and time of sample collection;
- Identity of sample collector(s);
- Description of sample collection location;
- Weather conditions at the time of sample collection (for outdoor samples);
- Sampling equipment and sample containers (e.g., type, serial number) used;
- Starting and ending vacuums of SUMMA® canisters; and
- Height of sample collection above ground or floor surface.

The collection, transfer of custody, and shipping/transport of the samples to the analytical laboratory will be documented using COC forms. Information recorded on the COC form will include:

- Sample identification (including Field Sample ID and Canister Number);
- Date and time of sample collection;
- Identity of sample collector(s);
- Starting and ending vacuums of SUMMA® canisters;

- Requested analyses; and
- Additional notes or comments pertinent to analysis of the samples.

B.4.4 Laboratory Analysis

IBM will use a NYSDOH ELAP-certified analytical laboratory to analyze for the target list of VOCs indicated in Table B.1 by USEPA Method TO-15. Samples will be analyzed by the laboratory within 30-days of collection and as required by NYSDEC Modifications to EPA Region 9 TO-15 QA/QC Criteria, sample analysis will be performed within 12 hours of the GC/MS tune. At a minimum, QA/QC measures including method blank, laboratory duplicate, laboratory control sample / laboratory control sample duplicate, and internal standards / surrogates, as applicable, will be performed at the frequencies listed in Table B.2

B.5 DATA VALIDATION

The indoor air and subslab soil vapor TO-15 data generated by the laboratory will be validated and assessed for usability compared to the project objectives by an independent data validator. The purpose of this data validation/usability assessment is to provide information on the uncertainty and bias in the data as considerations for decision-making. Data validation and usability assessment will be performed using professional judgment, QC criteria defined in this appendix, and guidance from the following USEPA and NYSDEC regulatory protocols:

- Method TO-15, *Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS)*, Publication EPA/625/R-96/010b, January 1999;
- USEPA Region 9 *Volatile Organic Compounds (VOCs) in Air (Ambient Air/Soil Vapor/Stack Gas) Samples Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), EPA Method TO-15* (January 1999), 01/21/2000 revision;
- NYSDEC Analytical Services Protocol, June 2005, with NYSDEC Modifications to the EPA Region 9 TO-15 QA/QC Criteria, February 2008;
- USEPA Region II SOP HW-31, *Validating Air Samples, Volatile Organic Analysis of Ambient Air in Canisters by Method TO-15*, Rev. 4, October 2006; and
- *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*; Publication USEPA540/R-07/003, July 2007.

The data validation/usability assessment is performed using a two-tier process. The first tier involves an in-depth review of sample matrix and batch QC results, a review of the raw data including initial and continuing instrument calibrations and sample-specific reporting limit and quantitation verifications, and sample collection QC (vacuums, FD, blanks) to evaluate whether the data meet the objectives described above and are compliant with the

USEPA method of analysis. This in-depth review will use QC criteria defined in this appendix and applicable regulatory guidelines from USEPA (Region II and National Guidelines) and NYSDEC.

A data usability report (DUR) will be prepared for the first tier assessment, which will describe the QC issues that required action (qualification of data) and the effects of these actions on the usability of the results. The DUR will also include an in-depth checklist to document the review, and a table of validated results. The first tier review will be completed on the first sample delivery group only.

If the in-depth, first tier review indicates sample analysis meets the project DQOs, then a second tier, abbreviated data validation review will be used for the remaining sample delivery groups. This second tier assessment is an abbreviated review whereby all the project QC criteria are assessed; however, evaluation of the raw data is not performed. This second-stage review is compliant in content to the NYSDEC Data Usability Summary Report, but, for time efficiency for this project, this review will be presented in an abbreviated report format. This report will consist of a brief letter tabulating any validation actions taken and effects (e.g., bias) on the results in terms of usability, the abbreviated checklist, and a table of validated results.

The laboratory will still provide a NYSDEC Category B deliverable (i.e., sample results, summary QC, method blank results, LCS recoveries, instrument QC sample results, raw data for all analyses, instrument tunes, and calibrations) for the abbreviated second tier review, so in the event that an in-depth assessment is needed in the future, a full laboratory deliverable package is readily available.

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TABLE B.1
VOC Analyte List and TO-15 SIM Reporting Limits
Subslab Depressurization System (SSDS) Design Work Plan
Former Building 982 - Neptune Road
Poughkeepsie, New York

Analyte List	USEPA Method TO-15 SIM	USEPA Method TO-15 SIM (3x dilution for 1-liter canister)
	RL (µg/m^3)	RL (µg/m3)
1,1,1-Trichloroethane	0.11	0.327
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	0.38	1.149
1,1-Dichloroethane (1,1-DCA)	0.081	0.243
1,1-Dichloroethylene (1,1-DCE)	0.079	0.237
1,2,4-Trimethylbenzene	0.098	0.294
2-Butanone (Methyl Ethyl Ketone [MEK])	1.48	4.44
4-Methyl-2-Pentanone (2-Pentanone; Methyl Isobutyl Ketone [MIBK])	2.05	6.15
Acetone	4.7	14.1
Carbon disulfide	0.62	1.86
Carbon tetrachloride	0.13	0.378
Chloroform	0.098	0.294
cis-1,2-Dichloroethylene (cis-1,2-DCE)	0.079	0.237
Dichlorodifluoromethane (DCDFM; Freon 12)	0.25	0.741
Ethylbenzene	0.09	0.261
Isopropanol	1.23	3.69
Propylene	0.86	2.04
Tetrachloroethylene (PCE)	0.136	0.408
Toluene	0.188	0.564
Trichloroethylene (TCE)	0.107	0.321
Trichlorofluoromethane (TCFM; Freon 11)	0.281	0.843
Vinyl chloride (VC)	0.051	0.153
m/p-Xylene	0.17	0.522
o-Xylene	0.087	0.261

NOTES:

1. This table summarizes the proposed analytes along with respective reporting limits (RLs) for United States Environmental Protection Agency (USEPA) Method TO-15 by gas chromatography/mass mass spectrometry (GC/MS) in selective ion monitoring (SIM) mode.

2. RLs for USEPA Method TO-15 SIM analysis were provided to Sanborn Head by Alpha Analytical, Inc. of Westborough, Massachusetts.

3. Actual RLs may be higher due to the presence of high concentrations of target and non-target analytes, matrix effects, and other factors.

TABLE B.2
Proposed Schedule of Quality Assurance/ Quality Control Elements
Subslab Depressurization System (SSDS) Design Work Plan
Building 982 – Neptune Road
Poughkeepsie, New York

Quality Control Element	Description	Frequency	Purpose	Synonyms
Field:				
Field Duplicate Samples (FD)	Two or more co-located samples collected simultaneously	At least one duplicate sample per sample delivery group or a minimum of one per 20 samples collected	To assess analytical precision and representativeness	Replicate samples Co-located samples Parallel samples
Field Blanks (FB)	Certified clean SUMMA canister, which is filled with laboratory-grade nitrogen in the field and accompanies samples back to laboratory	At least one per sample delivery group or a minimum of one per 20 samples collected	To assess for the presence of target compounds that could be due to equipment preparation and transportation of equipment to and from the field	Canister Blank Equipment Blank
Laboratory:				
Method Blank	Analyte-free sampling device analyzed like samples	One per analytical batch after Continuing Calibration Verification (CCV)	To assess for the presence of contamination of analytical system	Blank
Laboratory Duplicate (LD)	Duplicate analysis of a sample	One per analytical batch	To assess analytical precision	Matrix Duplicate (MD)
Lab Control Sample (LCS) and Lab Control Sample Duplicate (LCSD)	Standard matrix (air) with target analytes at verified concentrations	One per analytical batch	To assess accuracy and precision of analyses relative to matrix	Blank Spike (BS) and Blank Spike Duplicate (BSD)
Internal Standards (IS) and Surrogates (if used)	Compounds chemically similar to targets but not normally found in nature	Added by laboratory to every field sample and quality control sample	To assess accuracy of measurement process	IS Spikes