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REPORT OF FINDINGS

BUILDING 003 VOC SOURCE ASSESSMENT

IBM Poughkeepsie Facility
Poughkeepsie, New York

IBM
Poughkeepsie, New York

Prepared for IBM Corporation
File No. 3463.00
May 2013

2455 South Road
Poughkeepsie, NY 12601

May 1, 2013

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Re: Report of Findings
Building 003 VOC Source Assessment – RCRA Facility Investigation
IBM Poughkeepsie Facility
Poughkeepsie, New York
EPA ID No. NYD080480734, NYSDEC Site No. 314001

Dear Mr. Czuhanich and Ms. Kulow:

The enclosed report presents the findings of our assessment of sources of certain volatile organic compounds (VOCs) in indoor air in Building 003 at the IBM Poughkeepsie facility located at 2455 South Road, Poughkeepsie, New York. IBM conducted this work between November 2012 and March 2013. This work was conducted consistent with the objectives and procedures described in IBM's Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan, which was submitted to the New York State Department of Environmental Conservation and the New York State Department of Health (the Agencies) on October 23, 2012.

IBM is moving forward with the detailed design of VOC source remediation, targeting construction beginning in June 2013 and startup at the end of the third quarter of 2013. IBM understands that construction and operation of the remediation system can proceed once the Agencies have accepted this report.

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

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Sanborn, Head Engineering, P.C.

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EXECUTIVE SUMMARY

This report presents the findings of investigations, testing, and actions taken to-date relative to the subsurface source of volatile organic compounds (VOCs) beneath the floor slab of Building 003 (B003) at the IBM Poughkeepsie facility (the Site). The work was conducted consistent with the objectives and procedures described in IBM's Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan, which was submitted to the New York State Department of Environmental Conservation and the New York State Department of Health (collectively, the Agencies) on October 23, 2012. While the RFI Work Plan is pending Agencies' approval, the B003 VOC source assessment was initiated based on verbal authorization from the Agencies in November 2012.

B003 was designated for source assessment because historical environmental investigations indicated the residual presence of VOCs, principally trichloroethene (TCE), in subsurface soil, groundwater, and subslab vapor beneath B003. Vapors from this residual VOC presence beneath the building have the potential to migrate and enter the indoor air of the building. TCE was detected in indoor air samples collected in August 2002 in the west-central area of the first floor of the building directly above the known VOC source area. These samples were collected as part of a RCRA Environmental Indicator (EI) evaluation. The sample results were posted to notify employees that worked there, and were also reported to NYSDEC with the EI determination of "Current Human Exposures Under Control" in September 2002[1].

The objectives of the source assessment work were to: 1) evaluate the extent of VOC presence in indoor air on the ground floor, 2) improve the understanding of the source of VOC mass beneath the floor slab and potential pathways contributing to VOC presence in indoor air, and 3) assess the feasibility of subslab soil vapor extraction (SVE) to remove VOC mass and control air pressure gradients across the slab.

Indoor air screening and sampling conducted as part of this work indicates VOC presence throughout the first floor of B003. Subslab vapor sampling and analysis indicates that while VOC-containing vapor is widespread under the building, the highest VOC concentrations were confirmed within the historical source area beneath the west-central area of the building. In addition, subslab-to-indoor air pressure differentials across the floor slab were found to range from neutral to slightly favorable for vapor entry into the building in most areas.

Building reconnaissance, review of HVAC system configuration and operations, and targeted screening revealed potential pathways for subsurface VOCs to enter the building and be subsequently entrained in the HVAC systems and distributed throughout the first floor. In particular, the building floor trench system and interior manholes serving the groundwater collection system are apparent pathways for VOC vapor entry. In addition, the mechanical rooms housing the air handler units (AHUs) for the first floor are imparting a negative pressure on the floor slab that is conducive to vapor entry and entrainment in

1 RCRA Corrective Action, Environmental Indicator RCRIS code (CA725), Current Human Exposures Under Control, IBM Corporation, Poughkeepsie Main Plant Site, September 27, 2002.

the HVAC system. In response to these findings, IBM has implemented several design and operational modifications to certain AHUs to reduce unfavorable differential pressure gradients and increase outside air exchanges. In addition, IBM has sealed features that are potential pathways for vapor entry, including certain floor cracks, joints, trench cover plates, and sumps.

Subslab SVE testing confirmed that this method offers a feasible means to address the source and capture VOCs that might otherwise enter the building. The rate of VOC mass removal observed during testing was substantially greater than the estimated rate of VOC mass entry into the building that can cause the observed VOC presence in indoor air. In addition, vapor extraction from the covered floor trench network and certain interior manholes would also be effective at capturing subslab VOCs that have the potential to enter the building through these features.

A design basis for a subslab SVE and treatment system, and floor trench and manhole vapor extraction and treatment system, is presented herein. The design basis is intended to achieve the goals of VOC mass removal and control of subslab-to-indoor air pressure differentials to reduce VOC mass entry into the building, while also providing for operating flexibility, redundancy, and future expansion, if appropriate.

IBM is moving forward with the detailed design of VOC source remediation using subslab SVE and trench/manhole vapor extraction, targeting construction beginning in June 2013 and startup at the end of the third quarter of 2013. IBM understands that construction and operation of the remediation system can proceed once the Agencies have accepted this report.

1.0 INTRODUCTION

This report presents the findings of investigations, testing, and actions taken to-date relative to the subsurface source of volatile organic compounds (VOCs) beneath the floor slab of Building 003 (B003) at the IBM Poughkeepsie facility (the Site). A Site locus plan is provided as Figure 1, and the location of B003 on the Site is shown on Figure 2.

This work was conducted consistent with the objectives and procedures described in IBM's Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan, which was submitted to the New York State Department of Environmental Conservation and the New York State Department of Health (collectively, the Agencies) on October 23, 2012. While the RFI Work Plan is pending Agencies' approval, the B003 VOC source assessment was initiated based on verbal authorization from the Agencies in November 2012. A progress update was presented to the Agencies in a meeting on January 22, 2013.

B003 was designated in the RFI Work Plan for VOC source investigation based on the following considerations:

- Trichloroethene (TCE) was observed in subslab soil gas samples collected from beneath the west-central area of the building in the 1990s[2] at concentrations indicative of residual VOC source presence.

- TCE and other VOCs were detected in soil and groundwater samples collected from below the building through 2002, with the highest concentrations detected beneath the west-central area of the building corresponding to the area with the highest concentrations in soil gas samples.

As an additional consideration, TCE was observed in past indoor air samples collected in 2002 in the west-central area of the building (in the vacated former mail services and reproduction area) directly above the location where the VOC presence was observed in soil, soil gas, and groundwater. These sample results were reported to NYSDEC in September 2002[3] and also posted within the area to notify employees that worked there.

Sanborn, Head Engineering P.C. (SHPC) conducted the B003 source assessment during November 2012 through March 2013. The assessment and this report are subject to the standard limitation for this type of work, as provided in Appendix A.

1.1 Report Organization

This report is organized into seven sections as described below:

Section 1 presents a general introduction, including the objectives and scope of the assessment.

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2 *IBM Poughkeepsie Groundwater RCRA Facility Investigation Main Plant Site,* prepared by Groundwater Sciences Corporation, dated December 12, 1997.

3 RCRA Corrective Action, Environmental Indicator RCRIS code (CA725), Current Human Exposures Under Control, IBM Corporation, Poughkeepsie Main Plant Site, September 27, 2002.

Section 2 provides background on B003 use, infrastructure, past investigation findings, regulatory status, and an overview of the first floor HVAC system.

Section 3 presents a summary of source assessment activities and findings, including results of field screening, air sampling, and subslab vapor sampling and monitoring.

Section 4 summarizes actions implemented to-date to address the source assessment findings.

Section 5 describes pilot testing of planned source remediation measures, including subslab soil vapor extraction (SVE) and vapor extraction from other building features.

Section 6 presents the design basis for source remediation measures resulting from the pilot testing work.

Section 7 presents the conclusions of the assessment and this report.

1.2 Objectives and Scope

The objectives of this work were to: 1) evaluate the extent of VOC presence in indoor air on the ground floor, 2) improve the understanding of the source of VOC mass beneath the floor slab and potential pathways contributing to VOC presence in indoor air, and 3) assess the feasibility of subslab soil vapor extraction (SVE) to remove VOC mass and control air pressure gradients across the slab.

To meet these objectives, the work included:

- Implementation of an indoor air screening survey using a field portable gas chromatograph/mass spectrometer (GC/MS) (i.e., HAPSITE) to assess VOC presence in indoor air and to support the selection of locations for collecting indoor air samples using Summa canisters for laboratory analysis.

- Reconnaissance of B003 for potential pathways for VOC entry into the building, including use of the HAPSITE to screen potential pathways (e.g., floor cracks, sumps, and trenches) for VOC presence.

- Collection and analysis of 8-hour time-weighted-average indoor air and ambient (outdoor) air samples using Summa canisters for laboratory analysis.

- Review of the configuration and operating conditions of the heating, ventilating, and air conditioning (HVAC) systems on the B003 first floor.

- Collection and analysis of subslab vapor samples to improve understanding of the VOC source and extent beneath the building.

- A program of vapor extraction testing from subslab ports, covered floor trenches, and an interior manhole to evaluate the method for VOC source remediation and to obtain data to support design of full-scale remediation systems.

The above work was conducted in November 2012 through March 2013.

2.0 BACKGROUND INFORMATION

This section provides a summary of background information relevant to the assessment work being conducted in B003.

2.1 B003 Overview

B003 is a three-story structure constructed in 1952 with a footprint of about 100,000 square feet and a total area of about 300,000 square feet.

Figure 3 shows the layout of the first floor. There are currently no occupants on the first floor. Current uses of the first floor include de-ionized (DI) water treatment rooms, the ferricyanide waste treatment room, and storage.

2.2 B003 Infrastructure

B003 is constructed of a reinforced poured concrete foundation with reinforced poured-in-place concrete floors and columns. The exterior walls are constructed of concrete block with brick veneer.

The building was constructed over a portion of the pre-existing Site storm drain network, and several manholes are present on the first floor. As shown on Figure 3, a foundation under drain system was constructed beneath the floor slab and interconnected with the storm drain system during original building construction. In the mid- to late-1990s, the under drain and storm drain pipes beneath B003 were converted to a collection system for VOC-containing groundwater. Storm water from parking lots and other areas that formerly flowed through the network under B003 was re-routed around the building.

VOC-containing groundwater collected by the B003 under drain system flows to manhole No. 30 (MH-30) located in the north-central area of the building, and is then conveyed to an exterior manhole on the west side of the building where it is pumped to the Site's industrial wastewater (IW) treatment plant.

Floor utility trenches run along the entire length of the east and west sides of the building as shown on Figure 3. In addition, a utility trench bisects the building and connects the east and west side trenches to a central pit. This trench network carries the former steam condensate return pipes associated with the building's original heating system back to the former central condensate pit. The trenches are about 1.5 ft wide by 1.5 ft deep, and foundation plans indicate that they are constructed of poured-in-place concrete floor and sidewalls, although they are not generally visible. The trenches are covered with steel diamond plate, and the steel plate is covered by carpet or floor tile throughout most of the building. The steel plate is exposed in the mechanical rooms that house the air handling units 3-1-5 and 3-1-8 (see Figure 3) and in a storage area in the northeast corner of the building. The trench is open (no steel plate) in the DI water room and waste treatment room in the southwest corner of the building.

Exterior subsurface piping and manholes associated with a former industrial waste sewer line were located just to the west of B003 (RCRA Solid Waste Management Unit [SWMU] 194 – Former IW Drainage System). Elevated concentrations of TCE were detected in solids from one of the industrial waste manholes located to the west of the former mailroom in the 1990s. A significant portion of the former industrial waste sewer line was removed in the late 1990s[4]. A former TCE underground storage tank (UST) to the west of B003 near the former mail room (see Figure 3) was used to support operations on the third floor of the building. TCE was transferred to B003 through subsurface pipes. The UST was reportedly in operation from the 1960s to early 1970s and subsequently removed. The UST, the underground piping that transferred TCE from the UST to B003, and the former industrial waste sewer line (SWMU 194) are potential sources of the subsurface contamination beneath the B003.

2.3 Remediation and Regulatory Status

IBM voluntarily initiated a Groundwater Protection Program at the Site in 1978 to characterize and remediate sources of contaminated media[5]. Several VOC groundwater plumes were identified during that investigation. The plume proximate to B003 is referred to as the Site Gravel Plume, which is identified as Area of Concern (AOC) B in the RCRA Part 373 Permit for the Site[6]. Two groundwater extraction wells located to the north of B003 are currently operating in the Site Gravel Plume. IBM has obtained approved Final Corrective Measures status from NYSDEC for groundwater investigation and remediation matters addressed under the Part 373 Permit.

As described above, VOC-containing groundwater collected by the B003 under drain system and treated at the Site's IW treatment plant is referred to as the B003 passive groundwater collection system. B003 was assigned SWMU 201, with a status of "RFI Complete (Groundwater)" in the 2009 Part 373 Permit. The RCRA Status for SWMU 194 (Former IW Drainage System) was listed as "RFA Report Approved, 08/30/90", with a RCRA Determination of "No Further Action", in the 2009 Part 373 Permit. A groundwater monitoring program (GMP) associated with these and other corrective actions at the Site are currently being implemented in accordance with the 2009 Part 373 Permit.

2.4 Subsurface Conditions

The following sections provide a summary of the subsurface conditions beneath B003, including a discussion of the hydrogeology and subsurface contaminant distribution.

2.4.1 Hydrogeologic Conditions

Groundwater is present in both the overburden and bedrock units beneath the Site. Overburden thickness ranges from approximately 0 to 95 feet across the Site,

4 *IBM Poughkeepsie Groundwater RCRA Facility Investigation, Main Plant Site*, prepared by Groundwater Sciences Corporation, December 12, 1997.

5 *IBM Poughkeepsie Statement of Basis: Proposed Final Corrective Measures*, prepared by Groundwater Sciences Corporation, March 14, 2007.

6 6NYCRR Part 373 Permit, DEC Hazardous Waste Permit 3-1346-00035/00123, EPA ID No NYD080480734, Attachment XI, Corrective Action, 2009.

corresponding with a highly irregular top-of-bedrock surface. Figure 2 shows the approximate areas at the Site where there is no saturated overburden because of the shallow bedrock in those areas.

The bedrock surface beneath B003 generally slopes down from south to north at depths of between approximately 10 feet below ground surface (bgs) at the southern end to 35 feet bgs at the northern end[7]. The overburden beneath B003 consists of up to approximately 6.5 feet of medium to coarse-grained fill underlain by sand and gravel (north) or sand and silt (south). Overburden groundwater beneath B003 generally flows from south to north and is locally influenced by the Site Gravel Plume extraction wells to the north. Overburden groundwater is present at depths of between approximately 3 feet (south) and 5.5 feet (north) below the building floor slab[8].

2.4.2 Contaminant Distribution

Figure 2 shows the inferred extent of total VOCs in overburden groundwater at the Site, with B003 located on the southeast corner of the Site Gravel Plume. As discussed in Section 1, VOCs have been detected in subslab vapor, soil, and groundwater beneath B003 during previous investigations. The highest concentrations of VOCs in each of these media were detected beneath the west-central area of the building in the general vicinity of the former mail room. A summary of TCE detections (the chemical detected at the highest concentration and greatest frequency) in various media in B003 is provided below:

- **Soil:** Soil samples were collected as part of the groundwater RFI process. TCE concentrations in these samples ranged from non-detect to 8,900,000 micrograms per kilogram (µg/kg) beneath B003.

- **Subslab Vapor:** A subslab vapor investigation was performed in 1991 in B003. TCE concentrations in subslab vapor ranged from non-detect to approximately 15,000,000 [9] micrograms per cubic meter (µg/m^3).

- **Groundwater:** TCE concentrations up to 1,300,000 micrograms per liter (µg/L) were observed in groundwater samples collected from wells located within B003 in the late 1990s.

2.5 HVAC System Overview

The heating, ventilating, and air conditioning (HVAC) system on the first floor of B003 includes 7 air handling units (AHUs) that serve 7 areas (zones) on the first floor. The AHUs

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7 Based on Bedrock Surface contours provided on Plate 12 of the *IBM Poughkeepsie Groundwater RCRA Facility Investigation, Main Plant Site Report*, prepared by Groundwater Sciences Corporation, December 12, 1997.

8 Based on floor slab elevation provided on Plate 19 of the *IBM Poughkeepsie Groundwater RCRA Facility Investigation, Main Plant Site Report*, prepared by Groundwater Sciences Corporation, December 12, 1997 and groundwater elevation data presented in Groundwater Sciences Corporation's 2011 Annual Groundwater Monitoring Report Main Plant Site, dated April 26, 2012.

9 Originally reported at concentration of 15,000 micrograms per liter (µg/L) in the 1997 IBM Poughkeepsie Groundwater RCRA Campus Investigation Main Plant Site Report by Groundwater Sciences Corporation. 1 µg/L=10^3 µg/m^3.

are located in mechanical rooms located on the first floor. The AHU rooms and zones they serve are shown on Figure 3. The AHUs that serve the second and third floor of B003 are located in mechanical space above the third floor and thus separate from the first floor AHUs.

The AHUs are configured to draw in a combination of outside air and recycled air (return air) from the building space. The mixed outside air and return air then passes through filters and heating and cooling coils before entering the fan, which discharges the conditioned air, known as supply air, to the zone being served. A summary of AHU operating conditions when assessment activities were initiated in November 2012 is provided in Exhibit 2.1 below.

AHU No. 3-1-*	Operating Schedule (weekdays only)	Outside Air (cfm)	Return Air (cfm)	Supply Air (cfm)	Zone Area (sq. ft.)	Zone Volume (cu. ft.)	Outside Air Exchange Rate (per/hr)
1	0600 - 1800	980	8,000	9,000	11,100	155,400	0.4
2	0700 - 1700	5,700	3,600	9,300	8,400	117,600	2.9
3	0630 - 1830	2,400	9,300	11,700	14,300	200,200	0.7
4	0630 - 1700	2,300	10,700	13,000	13,900	194,600	0.7
5	0630 - 1700	790	1,500	2,300	7,700	107,800	0.4
6	0715 - 1700	3,400	11,600	15,000	15,000	210,000	1
8	2 hrs/weekday	0	6,000	6,000	7,300	102,200	0

Exhibit 2.1 – Summary of AHU Operating Conditions in November 2012, B003 First Floor

Operating conditions and features of the AHUs relevant to the source assessment and indoor VOC levels are as follows:

- The AHUs run only when the first floor is normally occupied, except for AHU 3-1-8, which was running 2 hours per day because the zone it serves is vacant. In addition, AHU 3-1-8 was only providing recycled air. Its outdoor air intake damper was intentionally closed because the space is vacant.

- Return air flows back to the AHUs through the common ceiling plenum (i.e., the space above the suspended ceiling). Thus, the air in one zone can mix with air in neighboring zones in the ceiling plenum as it flows back to the AHU rooms.

- All seven AHU rooms were at lower air pressure than the zone they serve because the fans were drawing in return air from the open ceiling plenum above the room (i.e., no return ducts are directly connected to the fan intake).

3.0 VOC SOURCE ASSESSMENT AND FINDINGS

VOC source assessment activities were initiated in November 2012 and included the following steps:

- Field screening of indoor air and targeted screening of certain features of the building;

- Sampling and laboratory analysis of indoor air and ambient (outdoor) air;

- Sampling and laboratory analysis of subslab vapor; and

- Monitoring of subslab-to-indoor-air differential pressures.

The following sections provide details and discussion of the investigation methods and results in the general sequence they were conducted. The field methods and laboratory analyses were conducted in general accordance with the procedures and protocols provided in the RFI Work Plan, Appendix A. Refer to Appendix B of this report for further details and documentation of the field methods and data quality assurance/quality control (QA/QC).

3.1 Field Screening

Field screening for VOCs in indoor air was conducted at 61 locations throughout the first floor. The purpose of field screening was to: 1) obtain an initial understanding of the potential presence and levels of VOCs in indoor air, 2) support the selection of indoor air sampling locations for laboratory analysis, and 3) support the selection of subslab monitoring and sampling locations. Targeted field screening of certain features of the floor slab, such as trench covers, manholes, and other features was also conducted to evaluate these as potential pathways for VOCs to enter the indoor air.

Field screening for VOCs was conducted using the Inficon HAPSITE Smart Plus portable gas chromatograph/mass spectrometer (GC/MS). The samples were screened for the project-specific analytes listed in the RFI Work Plan, which includes chloroethane (CA), 1,1-dichloroethane (1,1-DCA), 1,1-dichloroethene (1,1-DCE), cis-1,2-dichloroethene (c-1,2-DCE), trans-1,2-dichloroethene (t-1,2-DCE), tetrachloroethene (PCE), TCE, and vinyl chloride (VC). The HAPSITE data was used for general screening purposes only, and were used qualitatively and not for final decision making.

Exhibit 3.1 shows the HAPSITE in use for indoor air and targeted screening.

View of the HAPSITE during indoor air screening

Example of targeted air screening with the HAPSITE: trench in AHU room 3-1-5

Exhibit 3.1 – Field screening with HAPSITE (portable GC/MS)

3.1.1 Indoor Air Screening Results

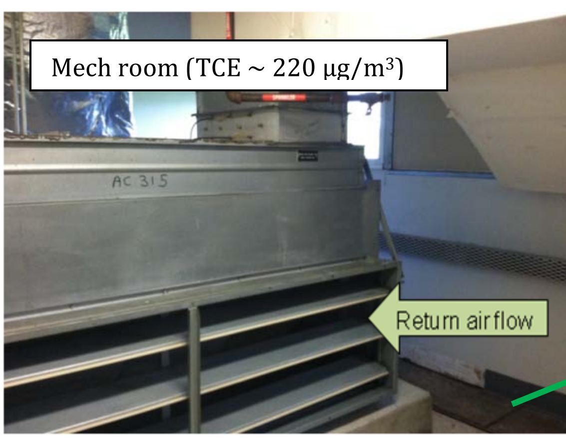
The HAPSITE indoor air screening results are presented in Table 1, and the TCE results are shown on Figure 4. TCE and c-1,2-DCE were observed in all screening samples at concentrations consistently greater than the other analytes. TCE concentrations from the HAPSITE indoor air screening ranged from 15 to 690 ug/m^3. The highest TCE concentrations, typically greater than 100 ug/m^3, were generally observed on the east side of the building within the currently vacant office space in the east-central area, and in the vacant manufacturing space in the northeastern corner. As indicated in Exhibit 2.1, the outside air exchange rate on the east side of the building is generally lower than the west side; in particular, AHU 3-1-8 located in the northeastern corner was not supplying outside air to this zone when the screening was conducted.

At two of the screening locations for indoor air (IA 1025 and IA 1059), grab air samples were collected into SUMMA canisters at about the same time as the HAPSITE screening. The TCE results obtained from the laboratory analysis of the grab samples are shown on Figure 4 alongside the HAPSITE result for TCE at the same location. Although these are not actual field duplicate samples, the HAPSITE and laboratory results exhibit order-of magnitude agreement.

3.1.2 Targeted Screening Results

Targeted screening of certain floor slab features was conducted using the HAPSITE with the goal of evaluating them as potential pathways for subslab VOCs to enter the indoor air. Targeted screening included the floor trench covers, manhole covers, monitoring well covers, and various utility penetrations through the slab.

Exhibit 3.2 shows the results of targeted screening of the floor trench cover in the mechanical room housing AHU 3-1-5. The results show the trench as a potential source for VOCs to be drawn into the return air intake of AHU 3-1-5 and subsequently distributed to the HVAC zone by the fan. Targeted screening in the mechanical room housing AHU 3-1-8 revealed a similar condition.



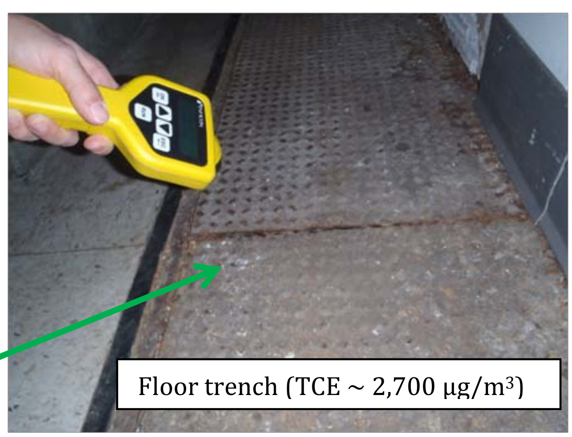
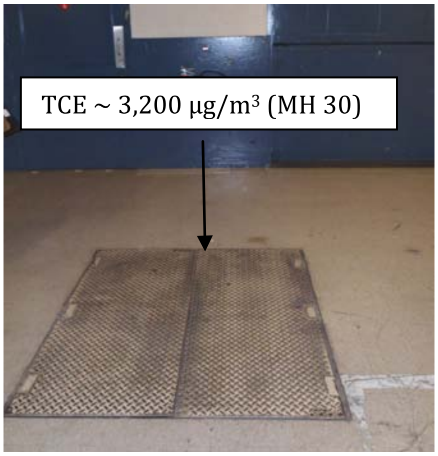


Exhibit 3.2 – Targeted screening results in mechanical room housing AHU 3-1-5

Exhibit 3.3 shows the results of targeted screening of the cover of MH-30, which serves the VOC-containing groundwater collection system under the building. The results show the manhole as a potential source of VOCs to enter the indoor air.



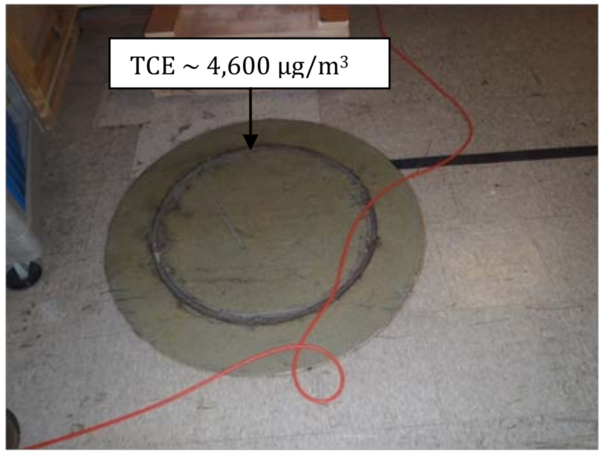


Exhibit 3.3 – Targeted screening results at interior manholes

Based on the results of the targeted screening, IBM has modified the AHU configurations for AHUs 3-1-5 and 3-1-8 and implemented a program to seal potential pathways for VOC entry into the indoor air. These actions are further described in Section 4.

3.2 Indoor Air Sampling and Laboratory Analysis Results

Ten samples of indoor air and one sample of ambient outdoor air were collected in November 2012 at the locations shown on Figure 5. The sample locations were selected based on the field screening data and the objective to obtain broad coverage of the first floor with at least one sample per HVAC zone. The samples were collected as 8-hour time-weighted-average samples at breathing zone height using SUMMA canisters and submitted to Alpha Analytical of Mansfield, Massachusetts for analysis of the project-specific VOCs by USEPA Method TO-15 in selective ion monitoring (SIM) mode. Additional information about the sampling locations is provided in Table 2. Refer to Appendix B for further discussion of the field methods and data QA/QC evaluation. The analytical laboratory report is provided in Appendix D, and the data validation report is provided in Appendix E. The results of the November 2012 indoor air samples were posted in a common area of the first floor on February 4, 2012 for a period of 14 days.

The indoor and ambient outdoor air sample results are presented in Table 3. Figure 5 shows the TCE concentrations reported in the samples. TCE was reported in all indoor air samples at concentrations ranging from 49 to 660 ug/m^3. Similar to the field screening results, the highest TCE concentrations were observed on the east side of the building. The three highest TCE results were observed in HVAC zones where the outside air exchange is relatively lower than the other zones (zones 3-1-1, 3-1-5, and 3-1-8 – see Exhibit 2.1); in particular, zone 3-1-8 had no outside air exchange at the time of sample collection.

The total TCE mass entering the first floor can be estimated using a mass balance approach. Assuming steady-state, well-mixed conditions, the rate of TCE mass entry into the first floor is equal to the rate of TCE mass exit. The latter can be estimated by multiplying the outside air flow rate by the average TCE concentration in indoor air. Assuming a combined outside air flow of 15,600 cfm (see Exhibit 2.1) and the average indoor TCE concentration over ten samples of 300 ug/m^3, then the rate of TCE entry into the first floor is about 0.4 lbs/day. This is the rate of TCE mass entry estimated to support the observed average TCE level in indoor air.

3.3 Subslab Vapor and Differential Pressure Assessment

An assessment of subslab VOC presence and subslab-to-indoor air differential pressure conditions was conducted to: 1) evaluate the source and extent of the VOCs below the floor slab, 2) obtain an understanding of differential pressures relevant to potential VOC entry into indoor air, and 3) establish a subslab testing and monitoring network to support potential VOC source remediation.

Figure 6 shows the location of subslab monitoring and vapor extraction ports installed in the first floor of B003. The network includes 86 subslab vapor monitoring points, 32 subslab vapor extraction ports, and 16 extraction/monitoring ports installed through the steel cover plates of the floor trench. The subslab port network provides broad coverage of the building, with higher spatial density in the west-central area where historical investigations indicated the location of the VOC source area.

The subslab monitoring and extraction ports were constructed in general accordance with the procedures and protocols provided in the RFI Work Plan, Appendix A. Refer to Appendix B of this report for further details and documentation of the field methods, including the results of integrity testing and data QA/QC.

3.3.1 Subslab Vapor Sampling Results

Subslab vapor samples were collected at 64 monitoring points and 11 extraction ports. The samples were analyzed for the project-specific analytes by Microseeps, Inc. of Pittsburgh, PA. The subslab vapor sample results are presented in Table 4, and the analytical laboratory report is provided in Appendix D. Similar to the indoor air screening and sampling results, TCE and c-1,2-DCE were the compounds observed at the highest concentrations in almost all of the samples.

Figure 7 shows the TCE concentrations observed in the subslab vapor samples. The inferred TCE isopleths shown on Figure 7 show concentrations greater than 100,000 ug/m^3 beneath about 11,000 square feet in the west-central area of the building. These results are consistent with the findings of historical investigations that indicated this area as the VOC source area. TCE concentrations in subslab vapor gradually decrease with increasing distance from the source area.

3.3.2 Subslab-to-Indoor Air Differential Pressure Monitoring

Observations of subslab pressure relative to the indoor air pressure were obtained at the monitoring ports using digital micro-manometers. Figures 7 and 8 show the results at each location using color-coding to indicate where subslab pressure was greater than, less than, or neutral relative to indoor air. The differential pressure data are posted on Figure 8. Review of these data indicate that 95% of the locations exhibit neutral to slightly positive pressure differentials relative to indoor air, conditions which support migration of VOCs from the subsurface to indoor air.

4.0 ACTIONS COMPLETED TO-DATE

Based on the findings to-date, IBM has implemented several actions, including reducing the potential for VOCs to enter the indoor air, increasing outdoor air exchange rate, and initiating design testing for source remediation. This section summarizes certain HVAC system modifications and a program of sealing floor slab features. Sections 5 and 6 describe pilot testing and the design basis for source remediation.

4.1 HVAC System Modifications

IBM has made the following modifications to certain AHUs on the first floor of B003:

- AHU 3-1-8 has been modified to operate on 100% outside air (no return air) and to run 12 hours per day. This unit previously ran 2 hours/day using only return air. In addition, the return air intake that was located above the floor trench has been eliminated.

- The outside air flow to AHU 3-1-5 has been increased and the return air intake located adjacent to the floor trench (see Exhibit 3.2) has been eliminated. Return air now enters the AHU via new ducts connected directly to the ceiling plenum.

- The outside air flows to AHUs 3-1-4 and 3-1-6 have been increased by upsizing the separate makeup air fans that deliver outside air to these units. In addition, the makeup air fans for these units and AHU 3-1-2 now operate 24 hours/day. The other AHUs are not equipped with outside air fans.

As a result of these modifications, more outside air is being supplied to the first floor, particularly in zone 3-1-8 in the northeast corner, and potential pathways for VOCs to enter the return air intakes of AHUs 3-1-5 and 3-1-8 have been eliminated. Exhibit 4.1 summarizes the current HVAC system operating conditions, showing changes from previous conditions highlighted.

AHU No. 3-1-*	Operating Schedule[1] (weekdays only)	Outside Air (cfm)	Return Air (cfm)	Supply Air (cfm)	Zone Area (sq. ft.)	Zone Volume (cu. ft.)	Outside Air Exchange Rate (per/hr)	Increase in Outside Air Exchange Rate
1	0600 - 1800	980	8,000	9,000	11,100	155,400	0.4	0%
2	0700 - 1700	5,700	3,600	9,300	8,400	117,600	2.9	0%
3	0630 - 1830	2,400	9,300	11,700	14,300	200,200	0.7	0%
4	0630 - 1700	4,100	8,900	13,000	13,900	194,600	1.3	86%
5	0630 - 1700	970	2,530	3,500	7,700	107,800	0.5	25%
6	0715 - 1700	4,200	10,800	15,000	15,000	210,000	1.2	20%
8	0600 - 1800	2,500	3,200	5,700	7,300	102,200	1.5	>100%

1. Outside makeup air fans on AHUs 2, 4, and 6 operate 24/7.
2. Red font indicates modified condition.

Exhibit 4.1 – Summary of AHU Operating Conditions in April 2013, B003 First Floor

4.2 Sealing of Floor Slab Features

IBM implemented a program to seal certain floor slab features that are potential pathways for VOC entry to indoor air. These features were identified during building reconnaissance and targeted screening with a PID or the HAPSITE portable GC/MS. Sealing was conducted using a combination of materials, including expanding foam, silicone and polyurethane sealants, non-shrinking grout, ready-mix concrete, and epoxy coatings. The types of features sealed included:

- Gaps around the steel plates covering the floor trench in AHU rooms 3-1-5 and 3-1-8, and in the storage area in the northeast corner;
- Pipe penetrations through the covers of the floor trench system;
- Manhole covers associated with the storm sewer and sanitary sewer systems;
- Floor slab utility penetrations;
- Condensate sumps in certain AHU mechanical rooms;
- Cracks at the intersection of columns and floor slab;
- Expansion joints; and
- Monitoring well and drain line cleanout covers.

While these measures are reasonable and practical actions to reduce the potential for VOC entry in the indoor air, source remediation is planned for VOC capture and further reduction of potential for VOC migration into indoor air. The following section describes pilot testing to support design of planned source remediation measures.

5.0 VAPOR EXTRACTION PILOT TESTING

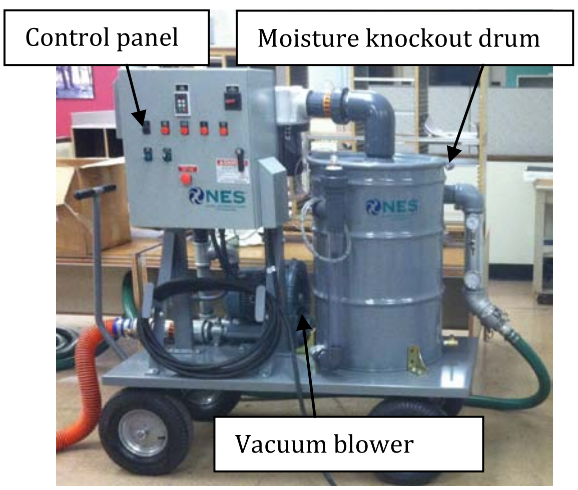
A program of vapor extraction testing was conducted in February and March 2013 to: 1) evaluate the method as a potential source reduction/remediation measure to remove VOC mass from beneath the building, and 2) obtain observational data that could be used to support design of full-scale remediation system(s). The following three types of remediation tests were conducted:

1. Subslab soil vapor extraction (SVE).
2. Vapor extraction from the covered portions of the utility floor trench system.
3. Vapor extraction from the headspace of an interior manhole serving the groundwater collection system that underlies Building 003.

This section provides a summary of the testing procedures, results, and implications for remediation system design.

5.1 Subslab Soil Vapor Extraction (SVE) Testing

Subslab SVE testing was conducted at 32 extraction ports that were installed throughout the first floor of B003. The extraction ports are identified with the prefix "EP" and their locations are shown on Figure 6. Each extraction port was constructed by coring a hole through the concrete floor slab and installing a perforated ¾-in.-diameter PVC pipe set in grout. To test each port for soil vapor extraction, a regenerative vacuum blower mounted on a portable cart, shown in Exhibit 5.1 below, was used to withdraw vapor from the ports for durations of approximately 60 minutes each. The vapor flow rate and applied vacuum was monitored and recorded at each extraction port using the assembly shown in Exhibit 5.1. For each test, the differential pressure response between the subslab and indoor air was monitored at other nearby subslab ports using digital manometers.



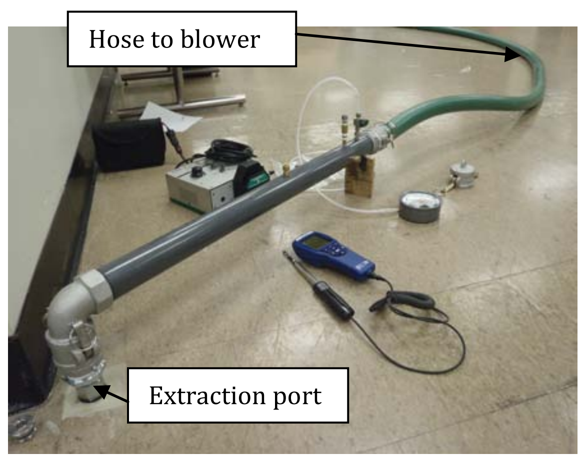


Exhibit 5.1 – Subslab Extraction Testing Setup.
Blower cart (left) and extraction port test assembly (right)

Figure 9 summarizes the vapor extraction conditions and inferred extent of subslab pressure response for all 32 extraction tests. The subslab pressure response for each individual test is shown on Figures C-1 through C-32 in Appendix C. On these figures, the inferred extent of subslab pressure response is depicted by the pressure differential isopleth of -0.005 in. wc (approximately 1 Pascal); this value, or lower pressure (greater vacuum), is indication that vapor extraction has influence, and expected to be sufficient to capture subslab soil vapor, within at least the area encompassed by the -0.005 in. wc isopleth. Please note that the results of the individual tests are superimposed on Figure 9; simultaneous extraction would likely result in a somewhat different response pattern.

The test results indicate a wide range of variability in the extent of subslab pressure response and extraction flow rate. For example, while the applied vacuum at the ports generally ranged from 55 to 60 in. wc, the resulting extraction rates ranged from less than 1 cubic foot per minute (cfm) to 41 cfm. At some ports, vacuum influence was observed at radial distances of up to 70 feet or more (e.g, EP-1001, 1008, 1009, 1016, 1020); other ports yielded low flow with limited subslab vacuum response (e.g., EP-1003, 1006, 1013, 1014, 1027, 1028).

Although the individual test results varied, the aggregate results indicate that significant and extensive depressurization of the B003 footprint can be achieved by concurrent extraction from the installed port network. In particular, simultaneous extraction from several ports installed in the west-central area of the building (within the former mail room/reproduction services area) will effectively depressurize this area where subslab TCE concentrations are greater than 100,000 $\mu g/m^3$, the area that represents the primary source of VOCs in the indoor air of the first floor of Building 003.

During each test, a sample of the vapor stream was collected into a Tedlar bag and screened using a PID. Near the conclusion of most tests, a grab sample of the vapor stream was collected into a Summa canister for analysis by USEPA Method TO-15 for the project-specific analyte list. The screening and laboratory data for each test are summarized in Exhibit 5.2 below. The complete analytical results for the extraction test vapor samples are provided in Table 5.

Port Location	Applied Vacuum [in. wc]	Extracted Flow Rate [cfm]	PID Screening [ppmv]	Total VOCs - Laboratory Analysis		VOC Removal Rate [lbs/hr]
				[ppmv]	[µg/m³]	
EP1001	-60	12	4.1	0.1	600	2.7E-05
EP1002	-58	19	26	2.7	13,000	9.2E-04
EP1003	-58	4.7	9	0.3	1,400	2.5E-05
EP1004	-56	0.59	9.9	3.3	17,000	3.8E-05
EP1005	-60	1.6	7.1	1.5	7,600	4.5E-05
EP1006	-58	0.06	12	2.5	13,000	2.9E-06
EP1007	-60	41	13	0.8	3,800	5.8E-04
EP1008	-58	7.9	11	0.5	2,500	7.4E-05
EP1009	-57	22	73	40	190,000	1.6E-02
EP1010	-76	24	520	590	3,000,000	2.7E-01
EP1011	-57	1.6	15	4.7	25,000	1.5E-04
EP1012	-59	7.8	5.6	0.7	3,800	1.1E-04
EP1013	-56	2.5	6	NS	NS	NS
EP1014	-56	1.3	6.3	NS	NS	NS
EP1015	-56	14	13	NS	NS	NS
EP1016	-56	39	23	1.7	8,400	1.2E-03
EP1017	-55	8.6	570	460	2,400,000	7.7E-02
EP1018	-58	0.66	380	400	2,000,000	4.9E-03
EP1019	-57	2.5	30	3.7	19,000	1.8E-04
EP1020	-59	12	16	NS	NS	NS
EP1021	-58	2.8	560	580	2,900,000	3.0E-02
EP1022	-57	3.4	55	NS	NS	NS
EP1023	-57	3.4	51	NS	NS	NS
EP1024	-57	1.1	14	1.3	6,800	2.8E-05
EP1025	-56	0.6	66	NS	NS	NS
EP1026	-60	11	40	12	58,000	2.4E-03
EP1027	-59	0.13	33	NS	NS	NS
EP1028	-55	0.05	110	27	140,000	2.6E-05
EP1029	-59	1.5	19	2.1	11,000	6.2E-05
EP1030	-55	0.78	36	NS	NS	NS
EP1031	-59	7.5	33	NS	NS	NS
EP1032	-58	2.2	40	2.9	14,000	1.2E-04

Exhibit 5.2 – Subslab SVE Testing Data Summary
Port planned for full-scale operation; NS = Not Sampled (see Section 6.1.1)

Overall, the subslab SVE test data indicate substantial depressurization and interception of VOC mass flux can be achieved by several ports (about 5) located within the approximately 11,000 ft² area delineated by the 100,000 µg/m³ TCE isopleth encompassing the west-central area of the building that is the primary source of indoor air VOC presence. However, extraction from more ports than is necessary to address the primary source area would be a prudent measure in that it provides redundancy and flexibility to adjust system operations if appropriate based on future observed conditions.

5.2 Vapor Extraction Testing from Utility Floor Trench System

Vapor extraction testing was also conducted on the covered portions of the utility trench system of the first floor of Building 003. As previously described, the floor trench carries the former steam condensate return pipes associated with the original heating system. The trench is covered with steel diamond plate and carpet or tile, except in the southwest corner of the building where the trench is open. The purpose of the testing was to evaluate the feasibility of using a series of ports installed through the trench covers to collect subslab soil vapor that has the potential to enter the building through the trench network.

Vapor extraction testing and monitoring was conducted using 15 ports drilled through the steel covers of the trench. The trench extraction ports, designated TEP-1 through TEP-15, are shown on Figure 6. An additional port, TEP-16, was installed after testing as a replacement for TEP-14. Extraction testing was conducted at 6 of the ports, with the balance of the ports used for monitoring differential pressure response along the trench. Because the trench is covered, monitoring differential pressure along the trench in response to vapor extraction was used as an indicator of whether the trench is interconnected. Since the trench contains asbestos-insulated pipe, a vacuum blower equipped with a high-efficiency particulate air (HEPA) filter was used for the trench vapor extraction tests.

Figure 10 shows the combined results of the 6 tests. The extraction data indicates that a higher flow rate (110 to 130 cfm) was obtained at a lower applied vacuum (about 0.7 in. wc) as compared to the subslab SVE tests. The pressure response within the trench to each individual test is shown on Figures C-33 through C-38 in Appendix C. The green highlighting of the trench indicates the extent of the observed pressure along the trench in response to vapor extraction. Although each test was conducted individually, Figure 10 shows that concurrent extraction from the 6 ports at applied vacuums and flows similar to those tested would be sufficient to attain a pressure response along the entire covered trench network.

Monitoring of differential pressure at sublab monitoring points proximate to the trench was also conducted. Although pressure response was not observed at the subslab monitoring points, this observation was not unexpected given that the vacuum applied on the trench was about 100 times less than that applied during subslab SVE testing.

During each test, a sample of the vapor stream was collected into a Tedlar bag and screened using a PID. Near the conclusion of each test, a grab sample of the vapor stream was collected into a Summa canister for analysis by USEPA Method TO-15 in SIM mode for the project-specific analyte list. The screening and laboratory data for each test are summarized in Exhibit 5.3 below. The complete analytical results for the extraction test vapor samples are provided in Table 6.

Port Location	Applied Vacuum [in. wc]	Extracted Flow Rate [cfm]	PID Screening [ppmv]	Total VOCs - Laboratory Analysis		VOC Removal Rate [lbs/hr]
				[ppmv]	[µg/m^3]	
TEP1002	-0.7	110	0.9	0.04	180	7.4E-05
TEP1004	-0.7	120	44	6.2	31,000	1.4E-02
TEP1008	-0.67	120	4.9	1.6	7,700	3.5E-03
TEP1010	-0.76	130	38	1.2	6,100	3.0E-03
TEP1011	-0.7	120	34	1.8	8,800	3.9E-03
TEP1014*	-0.84	130	37	4.5	23,000	1.1E-02

Exhibit 5.3 – Trench Vapor Extraction Testing Data Summary
Port planned for full-scale operation (see Section 6.2.1); *TEP1014 to be replaced by TEP1016

The vapor samples collected during the tests indicate that in aggregate, extraction from the trench system has lower potential for VOC mass removal as compared to the subslab extraction ports. However, the testing indicates that vapor extraction from the trench system is feasible and would be a prudent supplemental measure to capture subslab VOC source mass that has the potential to migrate into the building via the trench system.

5.3 Extraction Testing at the Groundwater Collection System Manhole

As previously described in Section 2, the foundation drain network was converted to a capture/collection system for VOC-containing groundwater. The foundation drain system includes 4 interior manholes in Building 003 that are a potential source for VOC vapors to enter the building. Vapor extraction testing was conducted at manhole No. 30 (MH-30), which is located in the north-central area of the building (see Figure 6 and Exhibit 5.4 below). The purpose of the testing was to evaluate the feasibility of reducing the air pressure below the manhole cover so that the indoor air pressure is higher than the pressure below the cover. To limit the extraction rate required to achieve the manhole air pressure reduction, MH-30 was equipped with an internal cover below the double-door surface hatch, and vapor extraction was conducted from the space between the internal cover and the surface hatch.

Exhibit 5.4 – Manhole No. 30. Double-door cover (left) and internal cover (right).

The testing showed that vapor extraction from the manhole can reduce the air pressure in the space between the internal and surface covers to less than the building air pressure. The vacuum measured below the surface cover was about 0.01 in. wc during vapor extraction from the manhole. Thus, the test results demonstrated that it would be feasible to modify the air pressure gradients at the manhole covers by vapor extraction and thereby prevent VOC vapors originating from the groundwater collection system from entering the building through the manhole covers.

During testing of vapor extraction from MH-30 on two separate dates, a grab sample of the vapor stream was collected into a Summa canister for analysis by USEPA Method TO-15 in SIM mode for the project-specific analyte list. The complete analytical results for the extraction test vapor samples are provided in Table 7.

6.0 REMEDIATION SYSTEM DESIGN BASIS

This section presents the design basis for VOC source remediation beneath B003. The remediation design is based on the results of vapor extraction pilot testing, which indicates that a combination of vapor extraction approaches will achieve the goals of removal of VOC source mass from below the slab and capture of VOC vapor migrating into the building space. To meet these goals, the following two remediation systems are planned:

1. Subslab SVE and treatment system; and

2. Floor trench and manhole vapor extraction and treatment system.

The design of each of these systems is described below, including the configuration of the vapor extraction ports, target operating conditions (applied vacuum and extraction flow rate), and treatment of VOC-containing vapor.

6.1 Subslab SVE System

This section describes the design basis for the subslab SVE system.

6.1.1 Extraction Port Configuration and Target Operating Conditions

Pilot testing indicated that subslab SVE using about 5 ports would effectively depressurize and remove VOC mass from the area delineated by the 100,000 $\mu g/m^3$ subslab TCE isopleth encompassing the west-central area of the building that is the primary source of indoor air VOC presence. However, initially vapor extraction from more ports than is necessary to address the primary source area is planned as a conservative measure to provide redundancy and operating flexibility.

A total of 26 of the 32 extraction ports used for pilot testing will be incorporated into the full-scale system, including 5 ports within or proximate to the primary source area. These ports, which are highlighted in green in Exhibit 5.2 and shown in the system layout on Figure 11, were selected because they exhibited relatively favorable test results with respect to extraction rate and area of influence. The planned port network will extend the influence of subslab soil vapor extraction well beyond the VOC source area.

The design target for the applied vacuum at the extraction ports will be 60 in. wc because this was the vacuum during pilot testing that provided a reasonable balance among extraction flow, vacuum influence, and the efficient operating range of blower capability. Application of a higher vacuum (e.g. 80 in. wc) was not observed to provide significantly better performance for most ports tested.

At the target applied vacuum, the total subslab SVE rate estimated by summing the extraction rates observed during pilot testing at the 26 ports would be about 240 cfm. Of course, the actual withdrawal rate during simultaneous extraction from the port network will likely be lower than estimated above due in part to superposition effects and competition among extraction ports. Overall, the planned extraction port network and target operating conditions will provide for operating flexibility and redundancy via overlapping areas of influence. Additional ports can be added if appropriate based on the results of system startup performance testing.

6.1.2 Process Flow Diagram

The planned process flow diagram for the system is shown in Exhibit 6.1. Subslab soil vapor will be withdrawn from the extraction ports using a vacuum blower. Before entering the blower, the vapor will pass through 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 treated vapor passing through the vacuum blower will be discharged outside via a new exhaust stack.

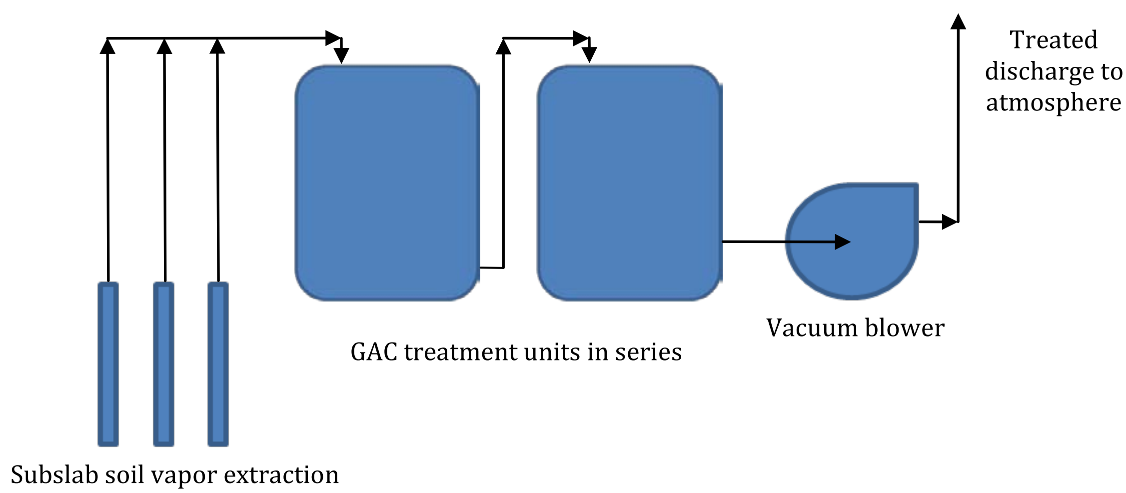


Exhibit 6.1 – Subslab Vapor Extraction Process Flow Diagram

The vacuum blower will be sized to achieve an applied vacuum at the extraction ports of 60 in. wc at a total vapor extraction rate of about 240 cfm. Exhibit 6.2 below shows the curve representing the applied vacuum, plus the estimated losses (in. wc) through the extraction pipe network and GAC units, at various flow rates (i.e., the system curve). The graph also shows the vacuum vs. flow rate curves (i.e. blower curves) for a FPZ Model K09-MS, 15 horsepower regenerative blower at operating frequencies of 50 and 60 Hz. The estimated operating condition falls below the 50 Hz curve. Thus, this blower would meet the design target and have some additional capacity for future additional ports if appropriate.

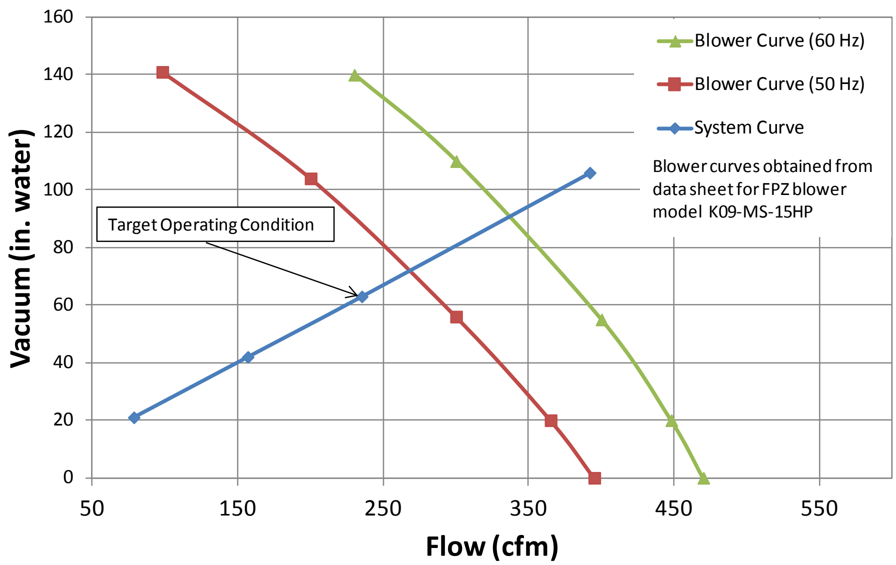


Exhibit 6.2 – SVE Blower Design Conditions

To allow for flexibility and efficiency in blower operation, the motor will be equipped with a variable frequency drive (VFD). The VFD will allow for lower power consumption when operating at conditions less than the capacity of the blower.

6.1.3 VOC Mass Removal and Treatment

The sum of the VOC mass removal rates observed during short-term testing of the 26 ports planned for full-scale operation was about 0.4 lb/hr (10 lbs/day). This mass recovery rate far exceeds the estimate of mass that is currently entering the building based on mass balance and HVAC system considerations discussed in Section 3.2. Over time, we expect the actual VOC mass recovery rate will decrease according to an exponential decay curve that approaches an asymptote that represents the mass transfer limitations in the subsurface.

While the projected VOC removal rate is expected to be less than the emission rate potential threshold of 0.5 lbs/hr that would require air pollution controls under NYSDEC Division of Environmental Remediation guidelines[10], installation of GAC for emissions control is planned. VOC mass in the vapor stream will be treated using coconut-shell GAC units installed in a lead-lag configuration. Each GAC unit will contain about 1,600 lbs of GAC. Assuming an adsorption capacity of about 0.1 lb VOC per lb GAC, and that the initial average VOC loading will be 50% of that observed during pilot testing (i.e. 5 lbs/day), a 1,600 lb GAC unit would need to be replaced after about 32 days. The GAC replacement

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

frequency will gradually decrease as the VOC mass recovery rate declines. GAC treatment may be 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.

Monitoring of the VOC breakthrough of the lead unit will be conducted, and when the lead unit has exhausted its capacity, the lag unit could be moved to the lead position, and a fresh GAC unit could be placed in the lag position. Spent GAC will be sent off-Site for reactivation or disposal.

6.1.4 System Location and Safeguards

The subslab SVE and treatment equipment is planned for installation in the vacant former mailroom on the first level of Building 003, which overlies the VOC source area. The system will include the following engineering design and operational safeguards that will prevent VOC vapors from entering the building during system operation, maintenance shutdowns, or potential system malfunction:

- The vacuum blower will be located downstream of the GAC units such that VOC-containing vapors and the GAC units are maintained under a vacuum condition during operation.

- The discharge from the vacuum blower will contain only treated vapor and will be piped to an exhaust stack that will be installed on the outside wall of the building.

- For maintenance shutdowns, including GAC replacement, the GAC beds and associated pipe/hose will be purged with clean, indoor air by opening a purge air inlet valve located upstream of the GAC units. This will allow clean indoor 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 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 be interconnected with the Site-wide alarm system that is monitored around the clock.

6.2 Floor Trench and Manhole Vapor Extraction System

Separate vapor extraction systems are planned to address the covered portions of the floor trench and the interior manholes, as further described in this section.

6.2.1 Extraction Port Configuration and Target Operating Conditions

Pilot testing indicated that vapor extraction from ports installed through the cover of the floor trench would effectively depressurize the trench and capture subslab soil vapor that has the potential to enter the building through the trench network. In addition, pilot testing indicated that vapor extraction from the interior manholes is a feasible method to capture VOC-containing vapor from the groundwater collection system that has the potential to migrate into the building.

The vapor extraction system will consist of 6 ports installed through the covered trench network, plus vapor extraction from three of the interior manholes. The planned vapor extraction locations are shown on the layout on Figure 12.

Based on pilot testing, the design target for the applied vacuum at the trench extraction ports will be about 1 in. wc, while for the manholes the applied vacuum design target will be 10 in. wc. The target flow rate will be 150 cfm for each port. Thus, the total flow from all nine locations will be 1,350 cfm. Similar to the subslab soil vapor extraction system, the trench and manhole vapor extraction port network and target operating conditions will provide flexibility and redundancy.

6.2.2 Process Flow Diagram

The planned process flow diagram for the system is shown in Exhibit 6.3. Two separate blowers and GAC treatment trains are planned to serve the ports and manholes on the east side and west side of the building. Similar to the subslab SVE system, the captured vapor will pass through two GAC units plumbed in series before entering the vacuum blowers. The treated vapor passing through the blowers will be discharged outside via a new exhaust stack.

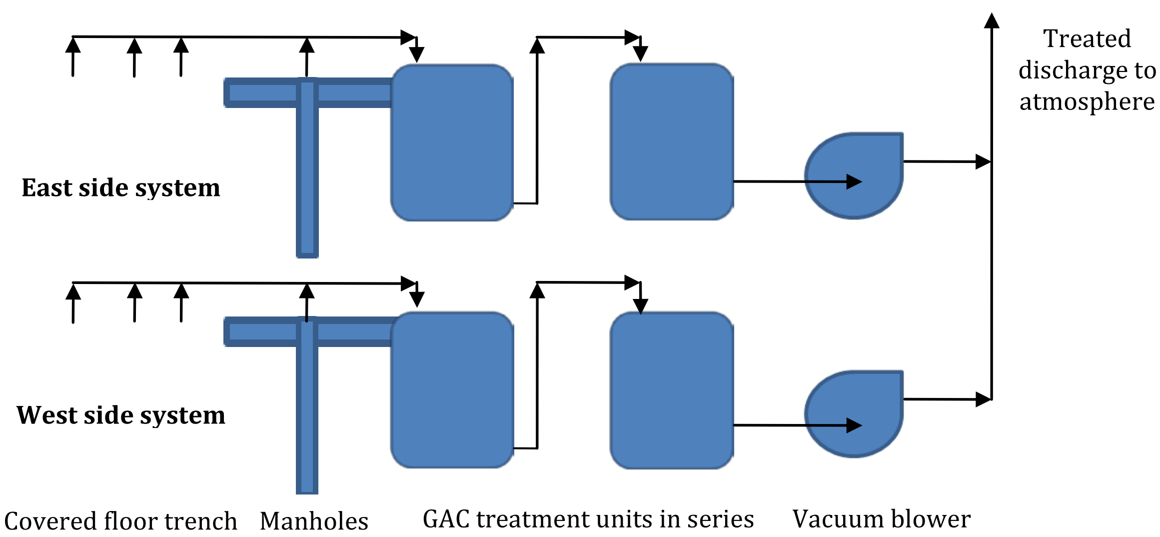


Exhibit 6.3 – Floor Trench and Manhole Vapor Extraction Process Flow Diagram

The blowers will be sized to achieve the design target vacuum at vapor extraction rates of 600 cfm (west side) and 750 cfm (east side). Exhibit 6.4 below shows the system curves and the blower performance curves for a FPZ Model K09-TS, 15 horsepower regenerative blower at operating frequencies of 50 and 60 Hz. The estimated design operating conditions for each system fall below the 60 Hz curve. Thus, this blower would meet the design target and have some additional capacity for future additional ports if appropriate.

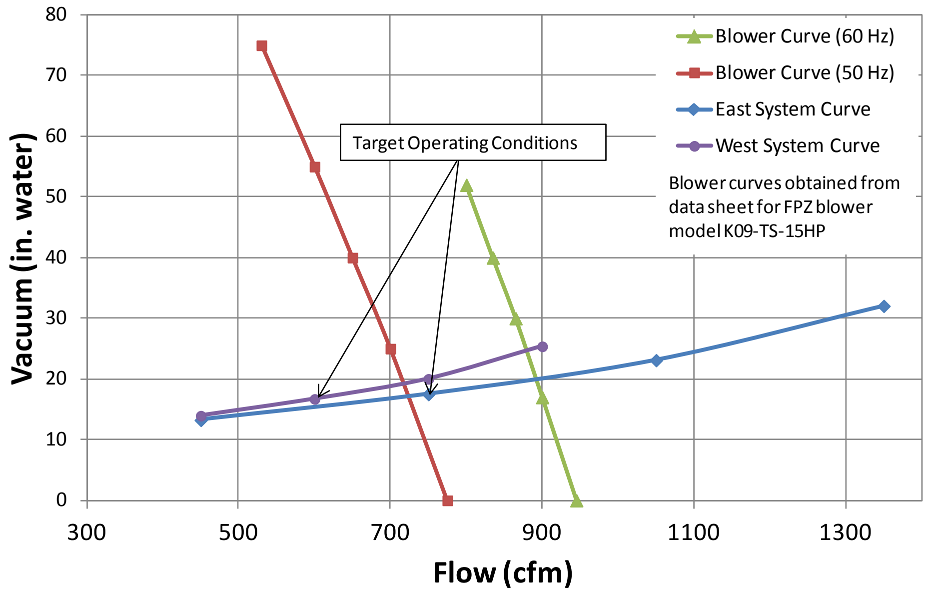


Exhibit 6.4 – Trench Blower Design Conditions

To allow for flexibility and efficiency in blower operation, the motors will be equipped with VFDs. The VFDs will allow for lower power consumption when operating at conditions less than the capacity of the blower.

6.2.3 VOC Mass Removal and Treatment

The sum of the VOC mass removal rates observed during short-term testing of the individual ports planned for full-scale operation was about 0.04 lbs/hr (1 lb/day). This removal rate is about ten times less than the removal rate estimated from testing of the subslab SVE ports, which supports the inference that subslab soil vapor is the primary source for the VOC presence in indoor air.

While the projected VOC removal rate is expected to be less than the emission rate potential threshold of 0.5 lbs/hr that would require air pollution controls under NYSDEC Division of Environmental Remediation guidelines, installation of GAC for emissions control is planned. VOC mass in the vapor streams will be treated using coconut-shell GAC units installed in a lead-lag configuration. Each GAC unit will contain about 700 lbs of GAC. Assuming an adsorption capacity of about 0.1 lb VOC per lb GAC, and that the average VOC loading will be 50% of that observed during pilot testing (i.e. 0.5 lbs/day), a 700 lb GAC unit would need to be replaced after about 140 days. GAC treatment may be 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.

Monitoring of the VOC breakthrough of the lead units will be conducted, and when the lead units have exhausted their capacity, the lag units could be moved to the lead position, and fresh GAC units could be placed in the lag position. Spent GAC will be sent off-Site for reactivation or disposal.

6.2.4 System Location and Safeguards

The vapor extraction and treatment equipment for the floor trench and interior manholes is planned for installation in the vacant former mailroom on the first level of Building 003, along with the subslab SVE equipment. To prevent VOC vapors from entering the building during system operation, maintenance shutdowns, or potential system malfunction, the two blower and treatment systems serving the floor trenches and manholes on the east and west sides of the building will include the same engineering design and operational safeguards as presented in Section 6.1.4 for the subslab SVE system. In addition, the floor trench and manhole vapor extraction system will be completely separate from the subslab SVE system, including separate exhaust stacks, thereby eliminating any possibility of cross-connection or backflow of vapor from one system to the other.

7.0 CONCLUSIONS

The results of this work have met the objectives of: 1) assessing the extent of VOC presence in indoor air on the ground floor, 2) improving the understanding of the VOC source mass distribution beneath the floor slab and potential pathways contributing to VOC presence in indoor air, and 3) evaluating the feasibility of subslab SVE to reduce VOC source mass and control air pressure gradients across the slab.

Indoor air screening and sampling indicates VOC presence throughout the B003 first floor. The indoor VOC presence can be explained by residual VOC source mass in soil and groundwater beneath the building. Subslab vapor sampling and analysis indicates that while VOC-containing vapor is widespread under the building, the highest VOC concentrations correspond to the historical source area beneath the west-central area of the building. This work defined an area of about 11,000 square feet where TCE presence in subslab vapor is greater than 100,000 ug/m^3. Monitoring of subslab-to-indoor air pressure differentials throughout the first floor indicate that in most areas, generally neutral to slightly subslab positive pressures exist, conditions which can allow migration of VOCs from the subsurface to indoor air.

Building reconnaissance, review of HVAC systems, and targeted screening revealed the existence of potential pathways for subsurface VOCs to enter the building and be subsequently entrained in the HVAC systems and distributed throughout the first floor. In particular, the building floor trench system and interior manholes serving the groundwater collection system are apparent pathways for VOC vapor entry. In some areas where pathways are present, including certain AHU mechanical rooms, differential pressure gradients across the floor slab have exacerbated vapor entry. IBM has implemented several design and operational modifications to certain AHUs to reduce unfavorable differential pressure gradients and increase outside air exchanges. In addition, IBM has sealed features that are potential pathways for vapor entry, including certain floor cracks, joints, trench cover plates, and sumps.

Subslab SVE testing confirmed the viability of this method for VOC source remediation and control of air pressure gradients across the floor slab. The VOC mass extraction rate observed during testing was substantially greater than the estimated rate of VOC mass entry into the building needed to support the observed VOC presence in indoor air. In addition, vapor extraction from the covered floor trench network and certain interior manholes would also be effective at capturing subslab VOCs that have the potential to enter the building through these features.

A design basis for a subslab SVE and treatment system and floor trench and manhole vapor extraction and treatment system has been developed. The design basis is intended to achieve the goals of VOC mass removal and control of subslab-to-indoor air pressure differentials to reduce VOC mass entry into the building, while also providing for operating flexibility, redundancy, and future expansion, if appropriate.

IBM is moving forward with the detailed design of VOC source remediation using subslab SVE and trench/manhole vapor extraction, targeting construction beginning in June 2013 and startup at the end of the third quarter of 2013. IBM understands that construction and operation of the remediation system can proceed once the Agencies have accepted this report.

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TABLES

TABLE 1
Summary of Portable GC/MS Indoor Air Screening Results
Report of Findings – Building 003 VOC Source Assessment
IBM Poughkeepsie Facility
Poughkeepsie, New York

Sample Location	Collection Date	Sample Type	Location Description	PID	1,1-DCA	1,1-DCE	c-1,2-DCE	t-1,2-DCE	PCE	TCE	VC
				ppbv	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$
IA1001	11/27/2012	HAPSITE - Room Air	DI Water Room	70	<0.40	<0.40	44	<0.40	<0.68	63	1.3 B
IA1002	11/27/2012	HAPSITE - Room Air	DI Water Room	70	<0.40	<0.40	35	<0.40	<0.68	46	1.5 B
IA1003	11/27/2012	HAPSITE - Room Air	DI Water Room	105	<0.40	<0.40	47	<0.40	<0.68	60	1.9 B
IA1004	11/27/2012	HAPSITE - Room Air	DI Water Control Room	87	<0.40	<0.40	47	<0.40	<0.68	56	0.52 B
IA1005	11/27/2012	HAPSITE - Room Air	DI Water Room	98	<0.40	<0.40	44	<0.40	<0.68	50	0.68 B
IA1006	11/27/2012	HAPSITE - Room Air	DI Water Room	18	<0.40	<0.40	14	<0.40	<0.68	15 B	0.62 B
IA1007	11/27/2012	HAPSITE - Room Air	Hallway	120	<0.40	<0.40	66	<0.40	<0.68	71	1.1 B
IA1008	11/27/2012	HAPSITE - Room Air	Vacant Room - Raised Floor	76	<0.40	<0.40	44	<0.40	<0.68	44	0.58 B
IA1009	11/27/2012	HAPSITE - Room Air	HVAC Room (3-1-1) Coil Side	96	<0.40	<0.40	56	<0.40	<0.68	57	0.95 B
IA1010	11/27/2012	HAPSITE - Room Air	HVAC Room (3-1-1) Fan Side	87	<0.40	<0.40	53	<0.40	<0.68	53	1.6 B
IA1011	11/27/2012	HAPSITE - Room Air	Server Room - Raised Floor	78	<0.40	<0.40	45	<0.40	<0.68	47	0.81 B
IA1012	11/27/2012	HAPSITE - Room Air	Server Room - Raised Floor	76	<0.40	<0.40	47	<0.40	<0.68	46	0.94 B
IA1013	11/27/2012	HAPSITE - Room Air	Hallway	140	<0.40	<0.40	76	<0.40	<0.68	72	1.5 B
IA1014	11/27/2012	HAPSITE - Room Air	Vacant Office	317	<0.40	0.46	200	0.41	<0.68	200	2.4 B
IA1016	11/27/2012	HAPSITE - Room Air	HVAC Room (3-1-5)	327	<0.40	0.51	220	<0.40	<0.68	220	2.7 B
IA1017	11/27/2012	HAPSITE - Room Air	Classroom	273	<0.40	0.42	180	<0.40	<0.68	180	2.0 B
IA1018	11/27/2012	HAPSITE - Room Air	Coffee Room	305	<0.40	0.53	190	0.51	<0.68	380	2.6 B
IA1019	11/27/2012	HAPSITE - Room Air	Hallway	273	<0.40	0.46	150	<0.40	<0.68	220	1.7 B
IA1020	11/27/2012	HAPSITE - Room Air	Office	263	<0.40	<0.40	150	<0.40	<0.68	180	1.4 B
IA1021	11/27/2012	HAPSITE - Room Air	Hallway	263	<0.40	0.46	150	0.40	<0.68	170	1.8 B
IA1022	11/27/2012	HAPSITE - Room Air	Hallway	327	<0.40	0.45	160	<0.40	<0.68	180	2.0 B
IA1023	11/27/2012	HAPSITE - Room Air	Conference Room	339	<0.40	0.73	290	0.57	<0.68	310	2.7 B
IA1023	11/28/2012	HAPSITE - Room Air	Conference Room	350	0.48	1.3	470	0.90	<0.68	690	4.2 B
IA1023	11/28/2012	HAPSITE - Room Air	Conference Room	276	<0.40	0.80	300	0.58	<0.68	510	1.9 B
IA1024	11/27/2012	HAPSITE - Room Air	File Room	317	<0.40	0.46	170	<0.40	<0.68	190	2.2 B
IA1025	11/27/2012	HAPSITE - Room Air	Conference Room	310	<0.40	0.42	160	<0.40	<0.68	170	2.6 B
IA1025	11/27/2012	SUMMA Grab - Room Air	Conference Room	310	0.19 J	0.56 J	180	0.33 J	1.0 J	480	1.3 B
IA1026	11/27/2012	HAPSITE - Room Air	HVAC Room (3-1-3) Coil Side	300	<0.40	0.45	160	0.44	<0.68	170	2.2 B
IA1027	11/27/2012	HAPSITE - Room Air	HVAC Room (3-1-3) Fan Side	300	<0.40	0.44	160	<0.40	<0.68	180	2.1 B
IA1028	11/27/2012	HAPSITE - Room Air	Former Manufacturing Area	180	<0.40	<0.40	110	<0.40	<0.68	110	1.0 B
IA1029	11/27/2012	HAPSITE - Room Air	Former Manufacturing Area	160	<0.40	<0.40	110	<0.40	<0.68	110	2.1 B
IA1030	11/27/2012	HAPSITE - Room Air	Former Manufacturing Area	305	<0.40	0.47	200	<0.40	<0.68	220	2.2 B
IA1031	11/27/2012	HAPSITE - Room Air	HVAC Room (3-1-8)	263	<0.40	0.53	250	0.41	<0.68	280	2.5 B
IA1032	11/27/2012	HAPSITE - Room Air	Warehouse Area	157	<0.40	<0.40	82	<0.40	<0.68	90	1.5 B
IA1033	11/27/2012	HAPSITE - Room Air	Former Manufacturing Area	290	<0.40	<0.40	190	<0.40	<0.68	210	1.3 B
IA1034	11/28/2012	HAPSITE - Room Air	Office	104	<0.40	<0.40	43	<0.40	<0.68	52	1.1 B
IA1035	11/28/2012	HAPSITE - Room Air	Hallway	56	<0.40	<0.40	35	<0.40	<0.68	46	0.94 B
IA1036	11/28/2012	HAPSITE - Room Air	Break Room	68	<0.40	<0.40	36	<0.40	<0.68	47	0.82 B
IA1037	11/28/2012	HAPSITE - Room Air	Hallway	86	<0.40	<0.40	19	<0.40	<0.68	24	0.33 B
IA1038	11/28/2012	HAPSITE - Room Air	Vacant Office	60	<0.40	<0.40	31	<0.40	<0.68	44	0.79 B
IA1039	11/28/2012	HAPSITE - Room Air	Hallway	45	<0.40	<0.40	49	<0.40	<0.68	63	1.7 B
IA1040	11/28/2012	HAPSITE - Room Air	Former Reproduction Room	34	<0.40	<0.40	26	<0.40	<0.68	37	0.70 B
IA1041	11/28/2012	HAPSITE - Room Air	Former Reproduction Room	36	<0.40	<0.40	25	<0.40	<0.68	38	0.72 B

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Poughkeepsie, New York

Sample Location	Collection Date	Sample Type	Location Description	PID	1,1-DCA	1,1-DCE	c-1,2-DCE	t-1,2-DCE	PCE	TCE	VC
				ppbv	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
IA1042	11/28/2012	HAPSITE - Room Air	HVAC Room (3-1-6) Coil Side	41	<0.40	<0.40	20	<0.40	<0.68	28	0.74 B
IA1043	11/28/2012	HAPSITE - Room Air	HVAC Room (3-1-6) Fan Side	6	<0.40	<0.40	19	<0.40	<0.68	27	0.37 B
IA1044	11/28/2012	HAPSITE - Room Air	Former Reproduction Room	43	<0.40	<0.40	28	<0.40	<0.68	42	0.32 B
IA1045	11/28/2012	HAPSITE - Room Air	Vacant Office	44	<0.40	<0.40	21	<0.40	<0.68	32	<0.26
IA1046	11/28/2012	HAPSITE - Room Air	Former Mail Room	48	<0.40	<0.40	42	<0.40	<0.68	70	0.65 B
IA1047	11/28/2012	HAPSITE - Room Air	Former Mail Room	55	<0.40	<0.40	44	<0.40	<0.68	76	0.49 B
IA1048	11/28/2012	HAPSITE - Room Air	Former Mail Room	59	<0.40	<0.40	47	<0.40	<0.68	80	0.30 B
IA1049	11/28/2012	HAPSITE - Room Air	Off Former Mail Room	59	<0.40	<0.40	47	<0.40	<0.68	80	<0.26
IA1050	11/28/2012	HAPSITE - Room Air	Former Mail Room	59	<0.40	<0.40	48	<0.40	<0.68	85	0.29 B
IA1051	11/28/2012	HAPSITE - Room Air	Vacant Office	55	<0.40	<0.40	36	<0.40	<0.68	62	<0.26
IA1052	11/28/2012	HAPSITE - Room Air	Vacant Office	64	<0.40	<0.40	39	<0.40	<0.68	64	0.82 B
IA1053	11/28/2012	HAPSITE - Room Air	Hallway Storage Area	60	<0.40	<0.40	39	<0.40	<0.68	62	<0.26
IA1054	11/28/2012	HAPSITE - Room Air	Micrographics Area	67	<0.40	<0.40	51	<0.40	<0.68	85	1.1 B
IA1055	11/28/2012	HAPSITE - Room Air	Women's Room	38	<0.40	<0.40	17	<0.40	<0.68	29	0.75 B
IA1056	11/28/2012	HAPSITE - Room Air	Core Area Near MH 30	53	<0.40	<0.40	24	<0.40	<0.68	39	0.43 B
IA1057	11/28/2012	HAPSITE - Room Air	Hallway	49	<0.40	<0.40	58	<0.40	<0.68	99	0.82 B
IA1058	11/28/2012	HAPSITE - Room Air	Classroom	72	<0.40	<0.40	63	<0.40	<0.68	120	0.59 B
IA1059	11/28/2012	HAPSITE - Room Air	Equipment Maintenance Room	53	<0.40	<0.40	44	<0.40	<0.68	85	0.54 B
IA1059	11/28/2012	SUMMA Grab - Room Air	Equipment Maintenance Room	53	<0.81	0.19 J	57	0.12 J	0.22 J	160	0.40 B
IA1060	11/28/2012	HAPSITE - Room Air	Cleaning Supply Room	NS	<0.40	<0.40	38	<0.40	<0.68	65	1.4 B
IA1063	11/27/2012	HAPSITE - Room Air	Office	317	<0.40	0.50	210	<0.40	<0.68	190	2.4 B
Field Blank	11/27/2012	HAPSITE - Outside Air	Outside Stair #3	NS	<0.40	<0.40	0.47	<0.40	<0.68	<0.54	<0.26
Field Blank	11/27/2012	HAPSITE - Outside Air	Outside Stair #3	NS	<0.40	<0.40	<0.40	<0.40	<0.68	<0.54	1.1
Field Blank	11/27/2012	HAPSITE - Outside Air	Outside Stair #3	NS	<0.40	<0.40	1.3	<0.40	<0.68	0.73	0.83
Field Blank	11/27/2012	HAPSITE - Outside Air	Outside Stair #3	NS	<0.40	<0.40	1.1	<0.40	<0.68	1.9	2.1
Field Blank	11/27/2012	HAPSITE - Outside Air	Outside Stair #3	NS	<0.40	<0.40	0.60	<0.40	<0.68	1.1	<0.26
Field Blank	11/28/2012	HAPSITE - Outside Air	Outside Stair #3	NS	<0.40	<0.40	0.69	<0.40	<0.68	<0.54	1.1
Field Blank	11/28/2012	HAPSITE - Outside Air	Outside Stair #3	NS	<0.40	<0.40	<0.40	<0.40	<0.68	<0.54	0.85
Field Blank	11/28/2012	HAPSITE - Outside Air	Outside Stair #3	NS	<0.40	<0.40	0.72	<0.40	<0.68	0.75	<0.26

Notes:

1. This table summarizes data recorded during field screening of grab indoor air samples using a HAPSITE SmartPlus portable gas chromatograph/mass spectrometer (GC/MS), manufactured by Inficon. The instrument was calibrated to manufacturer prepared standards ranging from 0.1 part per billion on a volumetric basis (ppbv) to 50 ppbv, for the following compounds: tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (c-1,2-DCE), trans-1,2-dichloroethene (t-1,2-DCE), 1,1-dichloroethene (1,1-DCE), 1,1-dichloroethane (1,1-DCA), and vinyl chloride (VC). The field samples were collected by Sanborn Head personnel directly into the HAPSITE sampling probe from the location and on the dates noted in the table. The samples were screened using the HAPSITE in selective ion monitoring (SIM) mode. Results were converted to micrograms per cubic meter ($\mu g/m^3$) by Sanborn Head assuming standard temperature (25 °C) and pressure (1 atmosphere) for the conversion. Results were rounded to two significant figures.

2. The HAPSITE was used as a field screening tool; therefore, the data should be considered estimated and not suitable for independent validation and decision-making. The findings should be considered in conjunction with results of samples analyzed by a fixed laboratory.

3. "PID" indicates photoionization detector data presented in ppbv.

4. Legend / Flags

< - The lower calibration range of 0.1 ppbv was considered the method reporting limit for the HAPSITE samples. Values that were detected below 0.1 ppbv are shown as being less than the method reporting limit in $\mu g/m^3$. Compounds that were not detected by the HAPSITE, as signified by no chromatogram peak or the peak did not meet minimum fit parameters, are also shown as being less than the method reporting limit.

J - Analyte in a SUMMA canister sample was detected below the laboratory reporting limit but above the method detection limit and should be considered estimated.

B - Analyte was detected within 10-times the concentration that was detected in an associated outside air blank. Values for the outside air blank may reflect background conditions from outside air or from residual compounds within the instrument itself.

NS - Not sampled for this parameter.

TABLE 2
Summary of Indoor Air Sample Information
Report of Findings – Building 003 VOC Source Assessment
IBM Poughkeepsie Facility
Poughkeepsie, New York

Sample Location	Building Floor	Sample Matrix	Canister Number	Sample Height (ft above floor)	Start Time (hours)	Start Pressure (mm Hg)	Stop Time (hours)	Stop Pressure (mm Hg)	PID (ppbv)	Temperature (°F)	Location Description	Chemicals Observed Near Sample Location	Notes
Collection Date: November 29, 2012													
AA1001	NA	Ambient Air	532	NA	0827	29.61	1634	6.67	NM	NM	Exterior location SE of building	–	Tubing inserted into clean air intake for AHU 3-1-5 (from exterior location)
IA1001	Ground	Indoor Air	103	4.3	0730	29.65	1530	6.32	56	78	DI Water Room	H2SO4 tank, NaOH tank, Flammable Storage	–
IA1012	Ground	Indoor Air	1721	4.3	0834	29.65	1600	10.1	35	75	Server Room - Raised Floor	–	–
IA1018	Ground	Indoor Air	204	4.3	0751	29.31	1551	7.98	195	71	Coffee Room (Office ID 1-F-2)	–	–
IA1018 (DUP1)	Ground	Indoor Air	111	4.3	0751	29.03	1551	7.31					
IA1030	Ground	Indoor Air	1736	4.3	0757	29.67	1603	6.27	253	73	Former Manufacturing Area	–	HVAC not running during sampling
IA1034	Ground	Indoor Air	366	4.3	0802	30.02	1608	8.25	15	71	Office ID K-3	2 Printers, Dry Erase Markers, Permanent Markers	–
IA1061	Ground	Indoor Air	116	4.3	0734	30.23	1534	8.22	43	76	Recycle Water Room	Ferricyanide Tanks, Rinse and Brine Tanks, Salt Pellet Bags	–
IA1062	Ground	Indoor Air	1746	4.3	0736	29.87	1536	9.42	121	75	Vending Area	–	–
IA1063	Ground	Indoor Air	376	4.3	0747	29.77	1547	7.35	245	74	Office ID 1-A-20	AJAX, Dry Erase Markers, White Board Cleaner, Antibacterial Wipes	–
IA1064	Ground	Indoor Air	189	4.3	0742	29.62	1542	8	48	71	Former Mail Room	White Board Cleaner, Powdered Hand Cleaner	–
IA1065	Ground	Indoor Air	463	4.3	0739	29.45	1539	5.71	116	75	Walkway/Elevator Entrance	–	Located near storm sewer manhole
Field Blank	NA	Nitrogen	449	Ground surface	0823	29.48	1635	3.6	NM	NM	Exterior location near Stair #18	–	–

Notes:

1. Samples were collected by Sanborn, Head & Associates, Inc. on November 29, 2012.

2. Samples were collected into 2.7-liter, stainless steel, pre-evacuated SUMMA® canisters using 8-hour metering regulators and inline 2-micron filters. Canisters and regulators were laboratory-certified clean (100% certification).

3. PID screening was conducted using a ppbRAE, calibrated to a 10 parts per billion by volume (ppbv) isobutylene-in-air standard.

4. "NM" indicates not monitored.
 "NA" indicates not applicable.

TABLE 3
Summary of Indoor Air 8-Hour Composite Sampling Results
Report of Findings – Building 003 VOC Source Assessment
IBM Poughkeepsie Facility
Poughkeepsie, New York

Sample Location	Field Sample Name	Collection Date	Concentrations in µg/m³																							
			CA			1,1-DCA			1,1-DCE			c-1,2-DCE			t-1,2-DCE			PCE			TCE			VC		
			Result	Qualifer	Bias	Result	Qualifer	Bias	Result	Qualifer	Bias	Result	Qualifer	Bias	Result	Qualifer	Bias	Result	Qualifer	Bias	Result	Qualifer	Bias	Result	Qualifier	Bias
AA1001	AA1001	11/29/12	0.053	U		0.081	U		0.079	U		0.23	EB	H	0.079	U		0.14	U		0.69	EB	H	0.051	U	
IA1001	IA1001	11/29/12	0.053	U		0.085			0.23			63			0.17			0.26			200			0.46		
IA1012	IA1012	11/29/12	0.053	UJ	I	0.13	J	I	0.75	J	I	160	J	I	0.86	J	I	0.33	J	I	660	J	I	0.55	J	I
IA1018	IA1018	11/29/12	0.053	U		0.16			0.46			140			0.32			0.52			410			1.1		
	DUP1	11/29/12	0.053	U		0.18			0.53			160			0.34			0.54			460			1.2		
IA1030	IA1030	11/29/12	0.053	U		0.12			0.62			210			0.43			0.60			580			1.8		
IA1034	IA1034	11/29/12	0.053	U		0.081	U		0.079	U		17			0.079	U		0.22			49			0.15		
IA1061	IA1061	11/29/12	0.053	U		0.081	U		0.13			37			0.091			0.20			110			0.28		
IA1062	IA1062	11/29/12	0.053	U		0.085			0.23			75			0.17			0.40			210			0.60		
IA1063	IA1063	11/29/12	0.053	U		0.28			0.69			220			0.46			0.40			630			1.8		
IA1064	IA1064	11/29/12	0.053	UJ	I	0.081	UJ	I	0.14	J	I	38	J	I	0.14	J	I	0.22	J	I	120	J	I	0.28	J	I
IA1065	IA1065	11/29/12	0.053	U		0.081	U		0.16			52			0.13			0.35			140			0.47		
Field Blank	FB1	11/29/12	0.053	U		0.081	U		0.079	U		0.15			0.079	U		0.14	U		0.47			0.051	U	

Notes:

1. Samples were collected by Sanborn, Head & Associates, Inc. on the dates indicated over an 8-hour sampling interval. The samples were analyzed by Alpha Analytical of Westborough, Massachusetts for the project-specific list of volatile organic compounds (VOCs) by United States Protection Agency (USEPA) Method TO-15 in selective ion monitoring (SIM) mode. "CA" is chloroethane; "1,1-DCA" is 1,1-dichloroethane; "1,1-DCE" is 1,1-dichloroethene; "c-1,2-DCE" is cis-1,2-dichloroethene; "t-1,2-DCE" is trans-1,2-dichloroethene; "PCE" is tetrachloroethene; "TCE" is trichloroethene; and "VC" is vinyl chloride.

2. Results are presented in micrograms per cubic meter (µg/m³).

3. An in-depth data usability review (DUR) was performed on the data by New Environmental Horizons, Inc. (NEH) of Arlington, Massachusetts. All results were considered acceptable, with the understanding of the potential uncertainty (bias) in the qualified results. In some cases, NEH assigned the following qualifiers and biases to the data. Refer to the DUR report for further details.
"U" indicates the analyte is non-detect at or above the indicated sample specific practical quantification limit (PQL).
"J" indicates the result is an estimated value.
"UJ" indicates the non-detect is estimated at the indicated PQL.
"EB" indicates analyte was also present in the associated field blank.
"H" indicates a high bias.
"I" indicates an indeterminate bias.

4. The "AA" designation indicates that the sample consists of ambient air collected from outside the building.

5. The field blank sample was collected by transferring high purity nitrogen provided by the laboratory from one certified clean SUMMA canister into another certified clean SUMMA canister over an approximately 8-hour period.

6. Results were rounded to two significant figures.

TABLE 4
Summary of Subslab Vapor Sampling Results
Report of Findings – Building 003 VOC Source Assessment
IBM Poughkeepsie Facility
Poughkeepsie, New York

Sample Location	Collection Date	DP in. H_2O	PID ppbv	CA µg/m³	1,1-DCA µg/m³	1,1-DCE µg/m³	c-1,2-DCE µg/m³	t-1,2-DCE µg/m³	PCE µg/m³	TCE µg/m³	VC µg/m³
EP1001	02/11/13	0	23,500	<2,600	<81	<40	<79	<40	<68	540	1,100 J
EP1002	02/11/13	0	6,227	<2,600	<81	<40	8,700	<40	16 J	16,000	540 J
EP1003	02/11/13	-0.013	1,005	<2,600	<81	<40	<79	<40	20 J	540	380 J
EP1004	02/11/13	0	3,089	<2,600	3,900	1,500	<79	<40	2,300	860	410 J
EP1005	02/11/13	-0.024	5,861	<2,600	<81	<40	1,300	<40	43 J	8,600	360 J
EP1006	02/11/13	0	5,760	<2,600	<81	<40	9,100	<40	22 J	24,000	<2,600
EP1007	02/11/13	0	2,096	<2,600	<81	<40	830	<40	16 J	2,100	360 J
EP1008	02/11/13	0	1,419	<2,600	<81	<40	200	<40	15 J	1,300	410 J
EP1009	02/11/13	0.029	38,600	<2,600	<81	440	19,000	2,100	8.8 J	52,000	540 J
EP1010	02/11/13	0.005	1,027,000	<2,600	350	3,100	310,000	3,500	100	1,800,000	<2,600
EP1011	02/11/13	0.003	5,024	<2,600	32 J	<40	1,600	<40	24 J	14,000	<2,600
SSV1001	02/12/13	0.008	19,300	<2,600	130	<40	5,600	<40	46 J	20,000	1,200 J
SSV1002	02/12/13	0	14,000	<2,600	<81	<40	9,900	<40	45 J	21,000	840 J
SSV1003	02/12/13	0.011	3,896	<2,600	<81	<40	<79	<40	<68	440	310 J
SSV1004	02/12/13	0.022	3,393	<2,600	<81	<40	<79	<40	<68	110	330 J
SSV1005	02/12/13	0.009	3,875	<2,600	<81	<40	310	<40	<68	240	260 J
SSV1006	02/12/13	0	15,200	<2,600	<81	<40	8,300	<40	22 J	15,000	310 J
SSV1006 (DUP1)	02/12/13	0	15,200	<2,600	<81	<40	5,200	<40	10 J	8,600	<2,600
SSV1007	02/12/13	0	3,362	<2,600	<81	<40	<79	<40	12 J	440	<2,600
SSV1008	02/12/13	0	3,457	<2,600	<81	<40	<79	<40	11 J	330	250 J
SSV1009	02/12/13	0	3,477	<2,600	<81	<40	130	<40	17 J	1,200	<2,600
SSV1010	02/11/13	0	16,100	<2,600	<81	<40	<79	<40	<68	250	<2,600
SSV1011	02/12/13	0	3,822	<2,600	<81	<40	<79	<40	30 J	360	<2,600
SSV1012	02/11/13	0	59,100	<2,600	<81	<40	3,400	<40	10 J	8,100	<2,600
SSV1013	02/12/13	0	9,301	<2,600	<81	<40	3,400	<40	20 J	13,000	<2,600
SSV1014	02/12/13	0.009	19,500	<2,600	<81	24 J	8,300	<40	20 J	19,000	<2,600
SSV1014 (DUP2)	02/12/13	0.009	19,500	<2,600	<81	<40	5,900	<40	12 J	17,000	<2,600
SSV1016	02/12/13	0.01	3,594	<2,600	<81	<40	<79	<40	75	1,200	310 J
SSV1017	02/12/13	0	718	<2,600	<81	<40	<79	<40	7.5 J	320	<2,600
SSV1018	02/12/13	0.016	7,700	<2,600	<81	<40	400	<40	28 J	12,000	<2,600
SSV1019	02/12/13	0	7,109	<2,600	53 J	<40	400	<40	43 J	2,500	<2,600
SSV1020	02/12/13	0.008	6,480	<2,600	<81	<40	<79	<40	17 J	590	260 J
SSV1021	02/12/13	0	2,406	<2,600	<81	<40	<79	<40	18 J	45 J	<2,600
SSV1022	02/12/13	0	3,155	<2,600	<81	<40	<79	<40	<68	160	720 J
SSV1023	02/12/13	0.004	2,743	<2,600	<81	<40	<79	<40	10 J	390	410 J
SSV1024	02/12/13	0.005	3,589	<2,600	<81	<40	<79	<40	10 J	1,000	280 J
SSV1025	02/11/13	0	61,700	<2,600	40 J	400	7,900	910	<68	34,000	460 J
SSV1026	02/12/13	0	21,600	<2,600	230	67	2,900	<40	9.5 J	16,000	360 J
SSV1026 (DUP4)	02/12/13	0	21,600	<2,600	240	52	2,800	<40	8.8 J	16,000	280 J
SSV1027	02/12/13	0	14,700	<2,600	<81	19 J	4,400	<40	10 J	15,000	410 J
SSV1028	02/12/13	0	22,200	<2,600	<81	39 J	11,000	<40	14 J	21,000	410 J
SSV1029	02/12/13	0.003	9,372	<2,600	<81	<40	670	<40	88	3,900	<2,600
SSV1030	02/12/13	0	11,700	<2,600	36 J	<40	210	<40	120	2,500	<2,600
SSV1031	02/12/13	0	15,400	<2,600	<81	<40	5,600	<40	23 J	17,000	310 J
SSV1032	02/11/13	0.004	998,000	<2,600	1,200	3,600	240,000	4,000	81	1,200,000	<2,600
SSV1033	02/11/13	0	234,000	<2,600	85	320	30,000	480	14 J	200,000	<2,600
SSV1034	02/12/13	0	96,900	<2,600	<81	670	56,000	1,800	9.5 J	64,000	<2,600
SSV1034 (DUP3)	02/12/13	0	96,900	<2,600	40 J	560	48,000	1,300	8.8 J	54,000	310 J
SSV1035	02/11/13	0.014	74,100	<2,600	<81	830	36,000	2,900	7.5 J	59,000	310 J
SSV1036	02/12/13	0.012	89,500	<2,600	85	1,600	23,000	2,600	8.8 J	120,000	310 J
SSV1037	02/12/13	0.006	837,000	<2,600	270	5,900	590,000	5,900	31 J	1,100,000	790 J
SSV1038	02/12/13	0	687,000	<2,600	1,200	3,000	250,000	2,900	42 J	1,100,000	560 J
SSV1039	02/12/13	-0.006	53,800	<2,600	180	220	32,000	130	37 J	59,000	310 J

TABLE 4
Summary of Subslab Vapor Sampling Results
Report of Findings – Building 003 VOC Source Assessment
IBM Poughkeepsie Facility
Poughkeepsie, New York

Sample Location	Collection Date	DP in. H_2O	PID ppbv	CA µg/m³	1,1-DCA µg/m³	1,1-DCE µg/m³	c-1,2-DCE µg/m³	t-1,2-DCE µg/m³	PCE µg/m³	TCE µg/m³	VC µg/m³
SSV1040	02/12/13	0	40,200	<2,600	570	630	16,000	190	30 J	59,000	330 J
SSV1041	02/12/13	0.008	25,600	<2,600	<81	5.6 J	21,000	<40	45 J	28,000	1,200 J
SSV1042	02/12/13	0.005	4,105	<2,600	<81	<40	990	<40	<68	1,500	460 J
SSV1043	02/12/13	0.01	814	<2,600	<81	<40	<79	<40	<68	400	490 J
SSV1044	02/12/13	0.017	14,500	<2,600	<81	<40	630	<40	<68	430	510 J
SSV1045	02/12/13	0.006	4,074	<2,600	<81	<40	180	<40	6.8 J	1,200	<2,600
SSV1046	02/12/13	0.005	4,733	<2,600	<81	9.1 J	1,200	<40	8.1 J	2,500	380 J
SSV1047	02/11/13	0.006	143,000	<2,600	65 J	710	52,000	1,100	22 J	150,000	280 J
SSV1048	02/12/13	0	4,125	<2,600	<81	<40	440	<40	29 J	1,600	360 J
SSV1049	02/12/13	0	3,991	<2,600	<81	<40	590	<40	27 J	1,900	260 J
SSV1050	02/12/13	0.003	3,685	<2,600	<81	<40	260	<40	21 J	1,400	<2,600
SSV1051	02/12/13	0	3,567	<2,600	<81	<40	<79	<40	15 J	1,000	310 J
SSV1052	02/11/13	0	1,277,000	<2,600	1,700	7,900	300,000	3,800	50 J	1,200,000	660 J
SSV1053	02/11/13	0.01	71,100	<2,600	49 J	150	23,000	<40	10 J	51,000	<2,600
SSV1054	02/12/13	0.003	16,000	<2,600	45 J	<40	6,300	<40	12 J	9,700	<2,600
SSV1055	02/12/13	0.008	23,200	<2,600	<81	<40	14,000	<40	19 J	24,000	360 J
SSV1056	02/12/13	0	20,800	<2,600	36 J	17 J	13,000	<40	22 J	19,000	280 J
SSV1057	02/12/13	0.004	3,865	<2,600	<81	<40	<79	<40	22 J	860	<2,600
SSV1058	02/12/13	0	4,440	<2,600	<81	<40	330	<40	28 J	2,500	<2,600
SSV1059	02/12/13	-0.02	20,400	<2,600	170	87	4,800	<40	26 J	18,300	560 J
SSV1060	02/12/13	0	3,787	<2,600	450	21 J	260	<40	7.5 J	1,500	460 J
SSV1061	02/12/13	0.003	19,300	<2,600	<81	110	1,900	360	6.8 J	20,000	410 J
SSV1062	02/11/13	0.006	11,500	<2,600	<81	37 J	1,300	400	8.1 J	9,700	<2,600
SSV1063	02/12/13	0	5,122	<2,600	<81	10 J	590	140	20 J	2,000	310 J
SSV1064	02/12/13	0.008	3,816	<2,600	<81	<40	150	<40	21 J	1,900	310 J
SSV1065	02/12/13	0.012	3,135	<2,600	<81	<40	<79	<40	8.8	200	280

Notes:

1. Samples were collected by Sanborn, Head & Associates, Inc. on the dates indicated using two 22-cubic centimeter (cc) glass vials provided by Microseeps, Inc. (Microseeps) of Pittsburgh, Pennsylvania. Sample analysis was completed by Microseeps using Method AM4.02. The data were reported by Microseeps in units of parts per million by volume (ppmv) and were converted to micrograms per cubic meter ($\mu g/m^3$) by Sanborn Head assuming standard temperature (25 °C) and pressure (1 atmosphere) for the conversion. Results were rounded to two significant figures. "CA" is chloroethane; "1,1-DCA" is 1,1-dichloroethane; "1,1-DCE" is 1,1-dichloroethene; "c-1,2-DCE" is cis-1,2-dichloroethene; "t-1,2-DCE" is trans-1,2-dichloroethene; "PCE" is tetrachloroethene; "TCE" is trichloroethene; and "VC" is vinyl chloride.

2. "DP" indicates differential pressure and is presented in units of inches of water (in. H_2O). Negative values indicate that the subslab pressure is less than the building pressure, and positive values indicate that the subslab pressure is greater than the building pressure.
"PID" indicates photoionization detector. PID results are presented in units of parts per billion by volume (ppbv).

3. "J" indicates the laboratory reported the result as an estimated value between the reporting limit and the method detection limit.

TABLE 5
Summary of Subslab Vapor Extraction Pilot Test Results
Report of Findings – Building 003 VOC Source Assessment
IBM Poughkeepsie Facility
Poughkeepsie, New York

Sample Location	Collection Date	CA	1,1-DCA	1,1-DCE	c-1,2-DCE	t-1,2-DCE	PCE	TCE	VC	Total VOCs
		μg/m³	μg/m³	μg/m³	μg/m³	μg/m³	μg/m³	μg/m³	μg/m³	μg/m³
EP1001	2/28/2013	<0.15	0.26	<0.22	67	0.28	1.9	530	0.14	600
EP1002	2/26/2013	<2.6	<4.0	<3.9	3,100	7.5	15	10,000	1.8 J	13,000 J
EP1003	2/26/2013	<0.36	0.91	1.1	220	4.8	35	1,100	0.47	1,400
EP1004	2/28/2013	<5.9	3,700	1,200	960	54	5,400	5,400	3.1 J	17,000 J
EP1005	2/28/2013	<1.4	6.0	<2.1	660	3.4	48	6,900	<1.3	7,600
EP1006	2/27/2013	<3.4	<5.3	<5.2	2,800	5.9	39	9,800	11	13,000
EP1007	2/26/2013	<0.46	4.0	4.7	860	11	23	2,900	5.8	3,800
EP1008	2/27/2013	<0.46	2.2	2.0	590	46	29	1,800	0.3 J	2,500 J
EP1009	2/25/2013	<26	<40	540	42,000	1,200	<68	150,000	53	190,000
EP1010	2/25/2013	<150	<220	1,500	320,000	1,700	860	2,700,000	180	3,000,000
EP1011	2/27/2013	<6.9	27	<10	2,500	<10	310	22,000	<6.6	25,000
EP1012	3/21/2013	<0.49	0.97	3.4	440	2.2	10	3,300	<0.47	3,800
EP1016	3/21/2013	<1.1	7.1	29	1,400	99	8.7	6,800	8.8	8,400
EP1017	3/18/2013	<140	<220	2,500	300,000	1,600	<370	2,100,000	210	2,400,000
EP1018	3/18/2013	<150	<230	2,400	400,000	2,800	<380	1,600,000	290	2,000,000
EP1019	3/19/2013	<4.7	8.7	61	1,600	18	<12	17,000	<4.6	19,000
EP1021	3/18/2013	<150	1,100	6,300	320,000	2,400	<390	2,600,000	390	2,900,000
EP1024	3/20/2013	<1.3	3.4	5.7	960	2.9	8.6	5,800	18	6,800
EP1026	3/20/2013	<11	19	39	12,000	22	<28	46,000	92	58,000
EP1028	3/19/2013	<21	810	250	650	<31	<53	140,000	<20	140,000
EP1029	3/20/2013	<3.9	17	<5.9	760	<5.9	30	10,000	<3.8	11,000
EP1032	3/19/2013	<1.5	7.0	4.4	4,200	6.6	49	9,800	5.1	14,000

Notes:

1. Samples were collected by Sanborn, Head & Associates, Inc. on the dates indicated. Samples were grab samples collected in SUMMA canisters during subslab vapor extraction pilot testing, and were collected once the pilot test field parameters stabilized. The samples were analyzed by Alpha Analytical of Westborough, Massachusetts for the project-specific list of volatile organic compounds (VOCs) by United States Protection Agency (USEPA) Method TO-15 in selective ion monitoring (SIM) mode. "CA" is chloroethane; "1,1-DCA" is 1,1-dichloroethane; "1,1-DCE" is 1,1-dichloroethene; "c-1,2-DCE" is cis-1,2-dichloroethene; "t-1,2-DCE" is trans-1,2-dichloroethene; "PCE" is tetrachloroethene; "TCE" is trichloroethene; and "VC" is vinyl chloride. Results were converted to micrograms per cubic meter ($\mu g/m^3$) by Sanborn Head assuming standard temperature (25 °C) and pressure (1 atmosphere) for the conversion. Results were rounded to two significant figures.

2. "<" indicates the analyte was not detected above the indicated laboratory reporting limit.
"J" indicates the analyte was detected below the laboratory reporting limit but above the method detection limit and should be considered estimated.

3. Total VOCs are the sum of the detected concentrations of VOCs, rounded to two significant figures.

TABLE 6
Summary of Trench Extraction Pilot Test Results
Report of Findings – Building 003 VOC Source Assessment
IBM Poughkeepsie Facility
Poughkeepsie, New York

Sample Location	Collection Date	CA	1,1-DCA	1,1-DCE	c-1,2-DCE	t-1,2-DCE	PCE	TCE	VC	Total VOCs
		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
TEP1002	3/4/2013	<0.16	<0.25	<0.24	41	<0.24	1.4	140	0.34	180
TEP1004	3/4/2013	<6.4	<9.9	21	6,200	15	<17	25,000	34	31,000
TEP1008	3/5/2013	<1.3	2.2	6.8	2,300	4.2	4.1	5,400	19	7,700
TEP1010	3/5/2013	<1.5	<2.2	4.6	1,300	2.5	<3.7	4,800	12	6,100
TEP1011	3/5/2013	<1.6	3.0	6.5	2,000	3.6	<4.0	6,800	18	8,800
TEP1014	3/5/2013	<5.2	<8.0	16	4,700	9.8	<13	18,000	36	23,000

Notes:

1. Samples were collected by Sanborn, Head & Associates, Inc. on the dates indicated. Samples were grab samples collected in SUMMA canisters during trench extraction pilot testing, and were collected once the pilot test field parameters stabilized. The samples were analyzed by Alpha Analytical of Westborough, Massachusetts for the project-specific list of volatile organic compounds (VOCs) by United States Protection Agency (USEPA) Method TO-15 in selective ion monitoring (SIM) mode. "CA" is chloroethane; "1,1-DCA" is 1,1-dichloroethane; "1,1-DCE" is 1,1-dichloroethene; "c-1,2-DCE" is cis-1,2-dichloroethene; "t-1,2-DCE" is trans-1,2-dichloroethene; "PCE" is tetrachloroethene; "TCE" is trichloroethene; and "VC" is vinyl chloride. Results were converted to micrograms per cubic meter (µg/m³) by Sanborn Head assuming standard temperature (25 °C) and pressure (1 atmosphere) for the conversion. Results were rounded to two significant figures.

2. "<" indicates the analyte was not detected above the indicated laboratory reporting limit.

3. Total VOCs are the sum of the detected concentrations of VOCs, rounded to two significant figures.

TABLE 7
Summary of Manhole Extraction Pilot Test Results
Report of Findings – Building 003 VOC Source Assessment
IBM Poughkeepsie Facility
Poughkeepsie, New York

Sample Location	Collection Date	CA	1,1-DCA	1,1-DCE	c-1,2-DCE	t-1,2-DCE	PCE	TCE	VC	Total VOCs
		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
MH30	2/25/2013	<0.70	1.3	4.8	1,500	4.2	12	3,900	15	5,400
MH30	3/21/2013	<0.63	1.4	4.3	1,300	3.4	13	2,900	13	4,200

Notes:

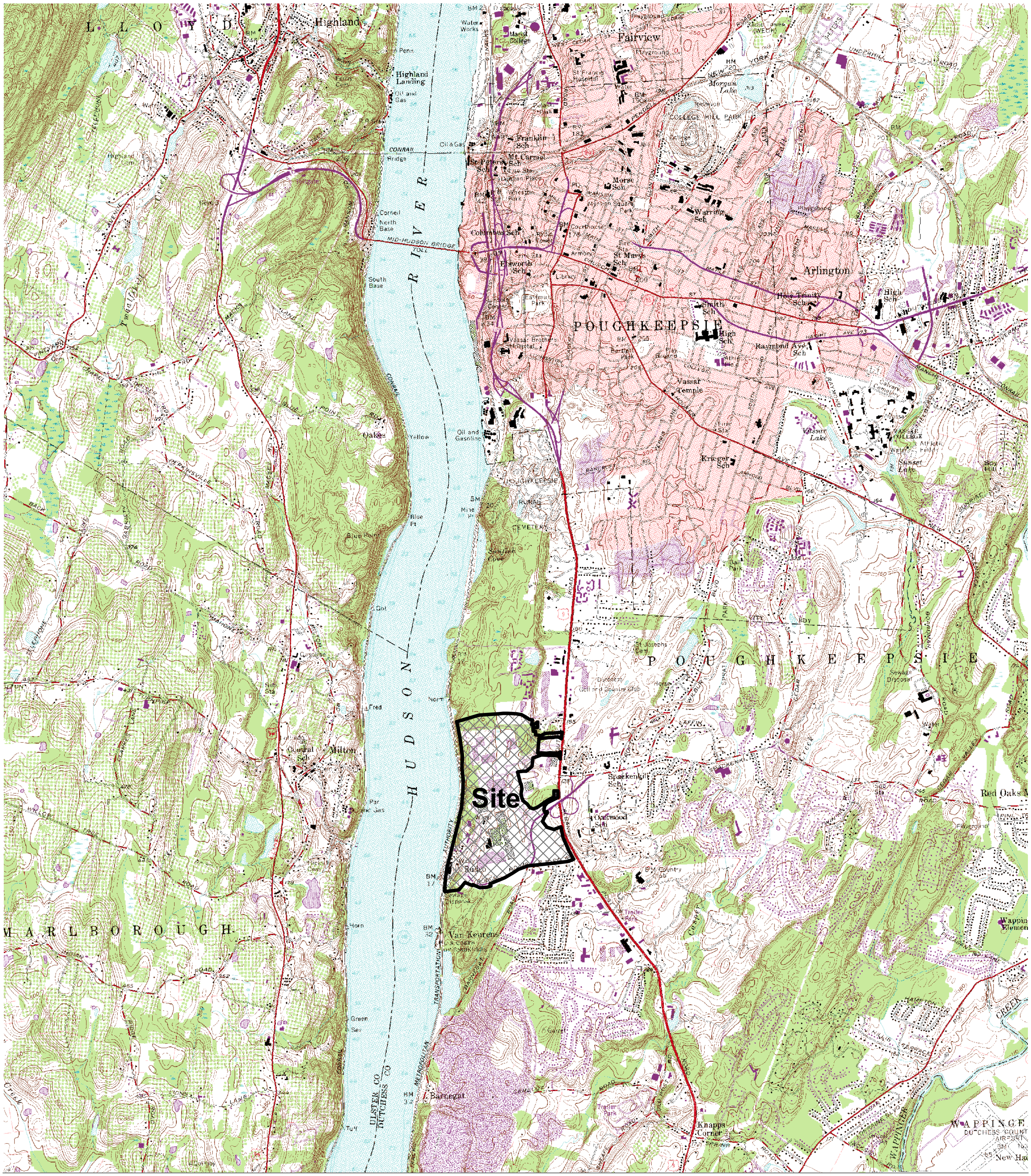
1. Samples were collected by Sanborn, Head & Associates, Inc. on the dates indicated. Samples were grab samples collected in SUMMA canisters during manhole extraction pilot testing, and were collected once the pilot test field parameters stabilized. The samples were analyzed by Alpha Analytical of Westborough, Massachusetts for the project-specific list of volatile organic compounds (VOCs) by United States Protection Agency (USEPA) Method TO-15 in selective ion monitoring (SIM) mode. "CA" is chloroethane; "1,1-DCA" is 1,1-dichloroethane; "1,1-DCE" is 1,1-dichloroethene; "c-1,2-DCE" is cis-1,2-dichloroethene; "t-1,2-DCE" is trans-1,2-dichloroethene; "PCE" is tetrachloroethene; "TCE" is trichloroethene; and "VC" is vinyl chloride. Results were converted to micrograms per cubic meter (µg/m^3) by Sanborn Head assuming standard temperature (25 °C) and pressure (1 atmosphere) for the conversion. Results were rounded to two significant figures.

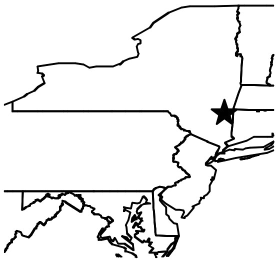
2. "<" indicates the analyte was not detected above the indicated laboratory reporting limit.

3. Total VOCs are the sum of the detected concentrations of VOCs, rounded to two significant figures.

FIGURES

File:\\conserv1\DataShare\DATA\CONDATA\3400s\3463.00\Graphics Files\CAD\B003 Rpt of Findings\B003_RptofFindings_Locus.dwg Plot Date: 4-15-13





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

Drawn By: E. Wright
Designed By: J. Sanborn/B. Green
Reviewed By: D. Shea
Project No: 3463.00
Date: May 2013

2,000' 0 4,000' Feet

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Figure 1

Locus Plan

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

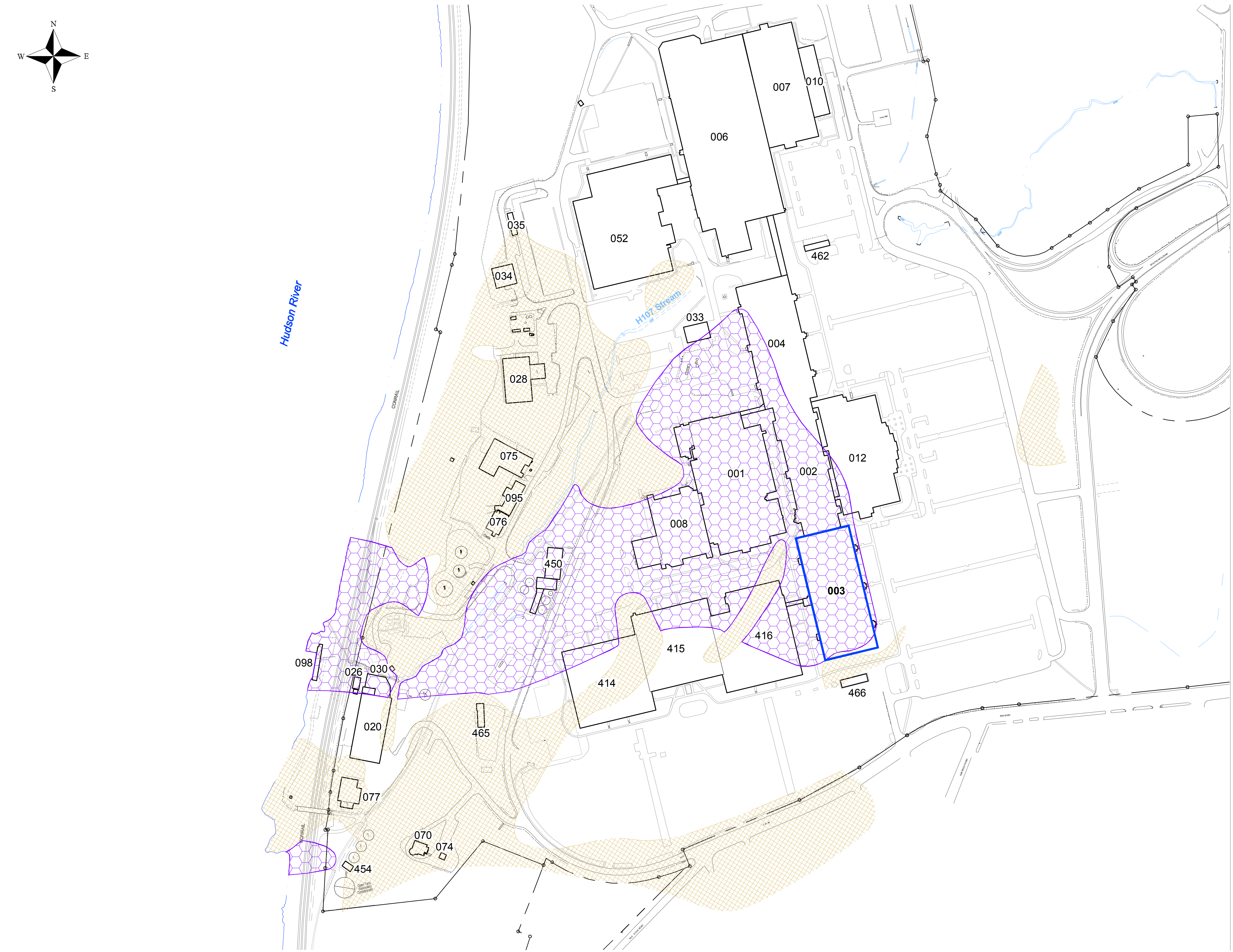

Figure 2

Building 003 Location and VOC Extent in Overburden Groundwater

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By: E. Wright
Designed By: J. Sanborn / B. Green
Reviewed By: D. Shea
Project No: 3463.00
Date: May 2013

Figure Narrative

This figure shows the Building 003 location, other site buildings, and the inferred extent of total VOCs in overburden groundwater. It is based on the most recent sampling data at existing site overburden monitoring and extraction wells, as well as data and figures presented in the site's 2011 Annual Groundwater Monitoring Report prepared by Groundwater Sciences Corporation (GSC) dated April 26, 2012.

Notes

1. Base plan was prepared using AutoCAD files provided by Grubb & Ellis Management Services, Inc. (GEMS) in December 2009.

2. Groundwater analytical data was provided to Sanborn Head by GSC on August 14, 2012 via electronic file transfer.

3. The area of no saturated overburden was provided in GSC's 2011 Annual Groundwater Monitoring Report, Main Plant Site, dated April 26, 2012.

Legend

- Approximate location of property line
- Inferred extent of VOCs in overburden groundwater
- Area of no saturated overburden
- **003** Indicates building number
- Indicates the location of Building 003
- Unlabeled features include tanks, storage sheds, and other structures and features not intended for routine occupancy

Feet
175' 87.5' 0 175' 350'

SANBORN HEAD ENGINEERING

Figure 3

Building 003 Layout and HVAC Zones

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility

Poughkeepsie, New York

Drawn By: E. Wright
Designed By: S. Warner
Reviewed By: D. Shea
Project No: 3463.00
Date: May 2013

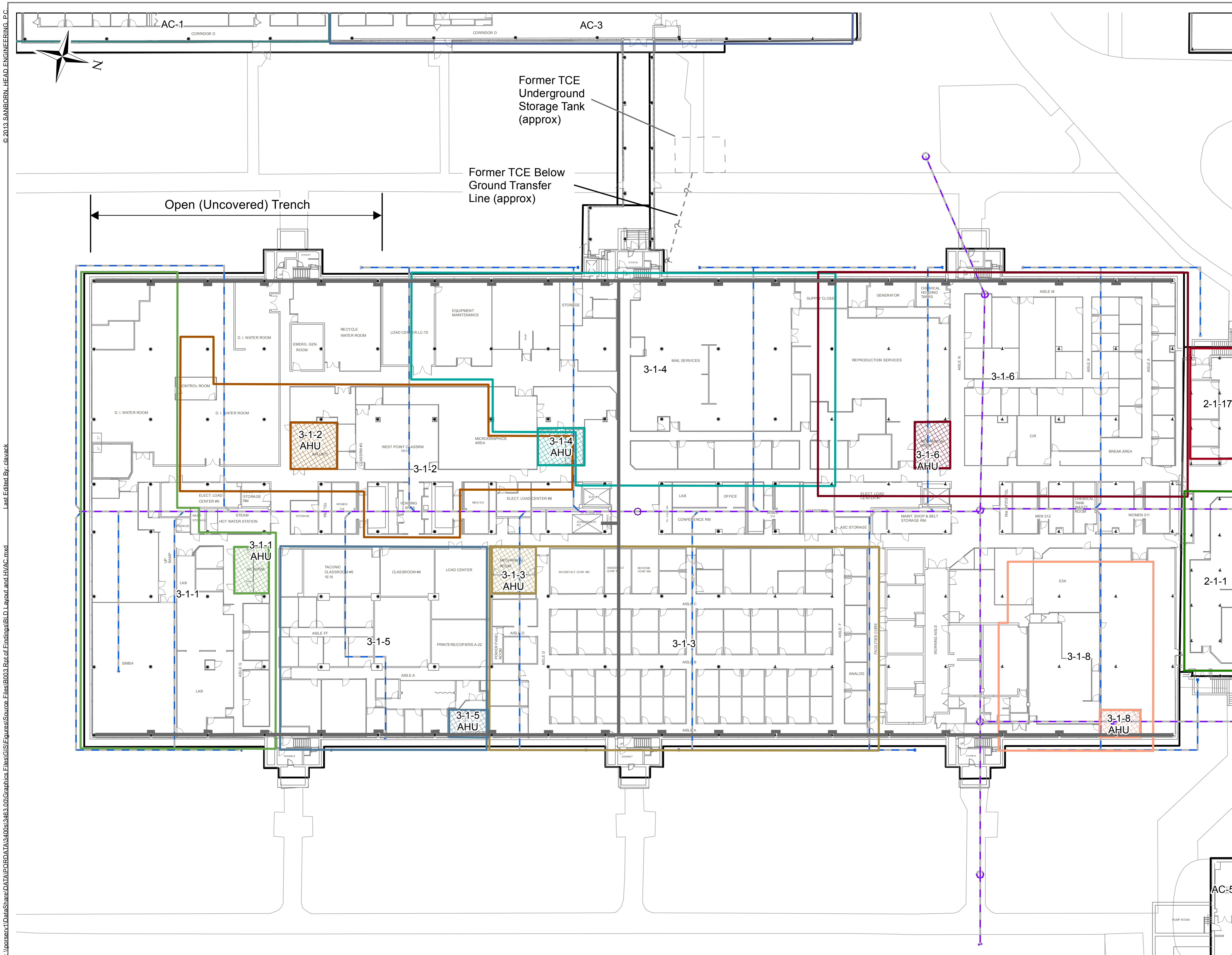

Figure Narrative

This figure shows the first floor layout of Building 003. Refer to the legend for additional information.

Notes:

1. The locations of the former TCE UST and associated piping were taken from Figure 2-21 of Groundwater Sciences Corporation's Groundwater RFI Report, dated December 12, 1997.

Legend

- Storm sewer
- Under drain
- Pipe conveyance trench
- Manhole
- Column
- 3-1-6 AHU — Mechanical room for indicated air handling unit (AHU)
- 3-1-8 — Approximate limits of HVAC Zone

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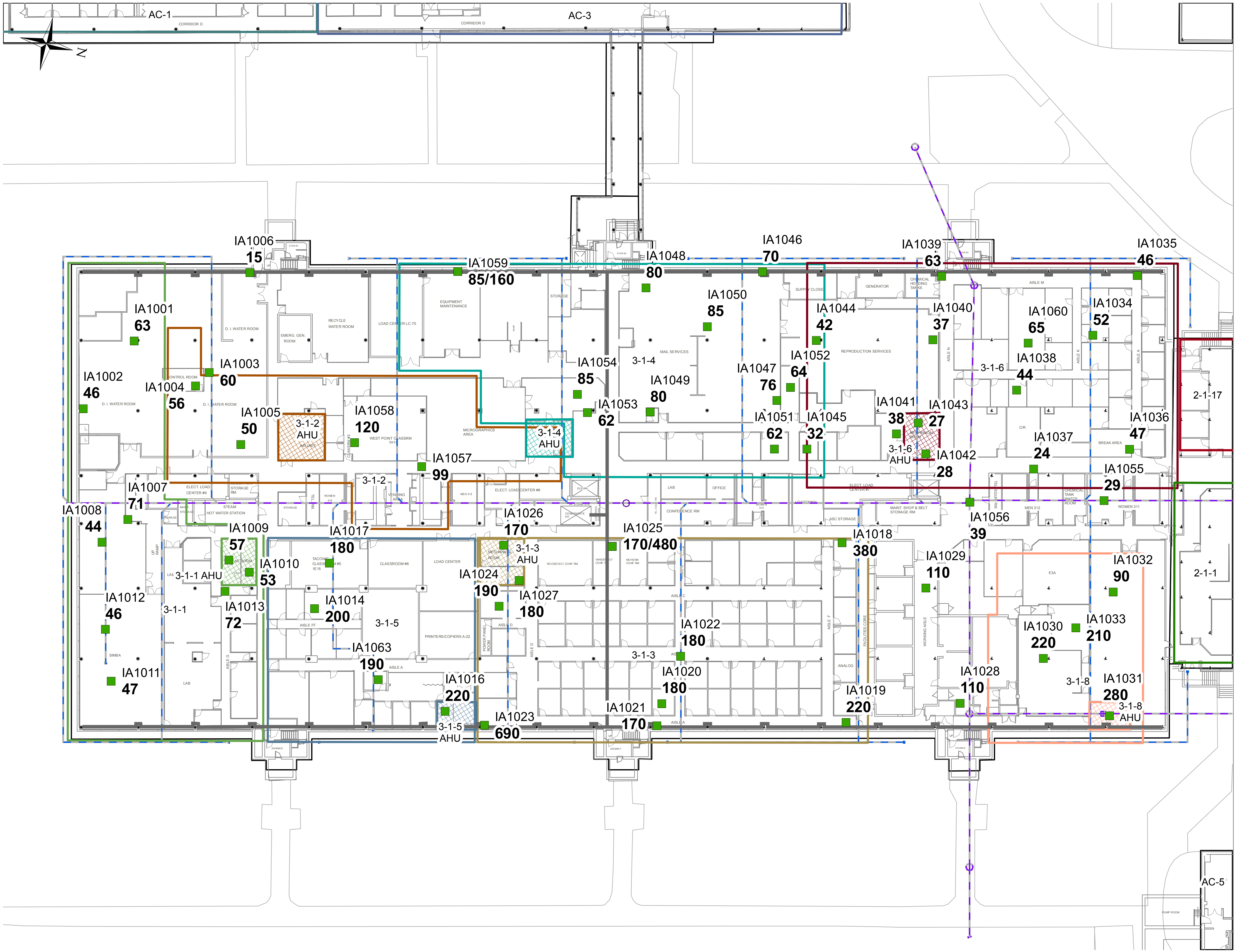

Figure 4

Summary of TCE Screening in Indoor Air (Portable GC/MS Results)

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility

Poughkeepsie, New York

Drawn By: E. Wright
Designed By: S. Warner
Reviewed By: D. Shea
Project No: 3463.00
Date: May 2013

Figure Narrative

This figure shows the results of indoor air screening for TCE in November 2012 using a portable gas chromatograph/ mass spectrometer (GC/MS). The portable GC/MS results should be considered screening level only. The results for TCE are shown in units of micrograms per cubic meter (μg/m^3).

The portable GC/MS samples were generally collected over a time interval of 1 minute; however, the locations with the highest concentrations were collected over a sample interval as low as 15 seconds for dilution purposes. The sampling interval for the SUMMA canister grab samples varied, but was less than one minute in each instance.

Legend

Refer to Figure 3 for additional legend items

IA1001 Indoor air sampling location

63 TCE result (μg/m^3)

85/160 Indicates that a SUMMA canister grab sample was collected at this location. The first and second values represent the portable GC/MS and SUMMA data, respectively

20 10 0 20 40
Feet

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Figure 5

Summary of TCE Concentrations in Indoor Air (8-Hour Samples)

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility

Poughkeepsie, New York

Drawn By: E. Wright
Designed By: S. Warner
Reviewed By: D. Shea
Project No: 3463.00
Date: May 2013

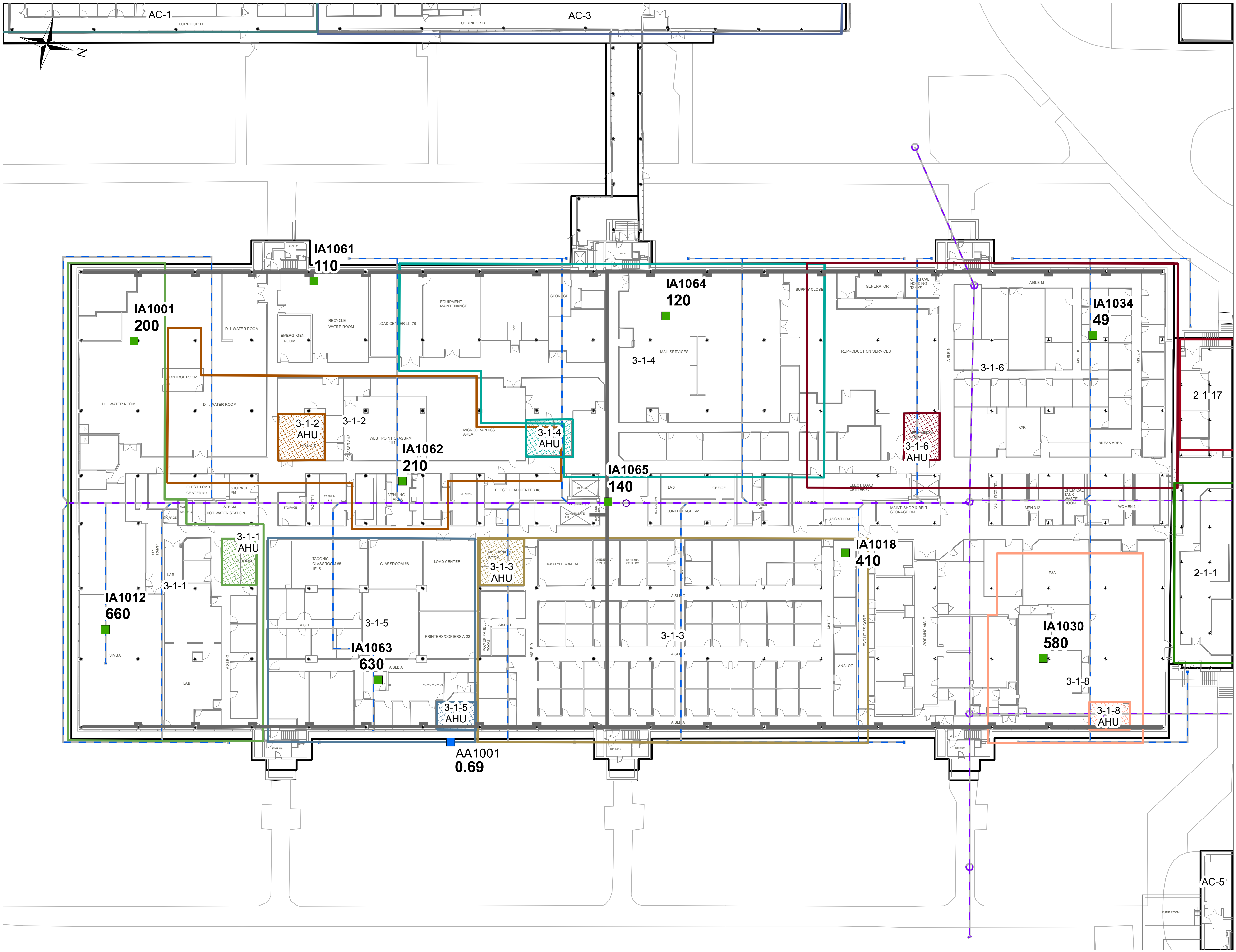

Figure Narrative

This figure shows the results of indoor air sampling conducted by Sanborn Head personnel on November 29, 2012. The samples were collected as 8-hour time weighted average samples using Summa canisters. The results for TCE are shown in units of micrograms per cubic meter ($\mu g/m^3$).

Legend

- IA1001 — Indoor air sample location
- 200 — TCE result ($\mu g/m^3$) for 11/29/2012
- QA/QC sample location
- AA1001 — Indicates an ambient air sample
- Storm sewer
- Under drain
- Pipe conveyance trench
- Manhole
- Column
- 3-1-6 AHU — Mechanical room for indicated air handling unit (AHU)
- 3-1-8 — Approximate limits of HVAC Zone

20 10 0 20 40
Feet

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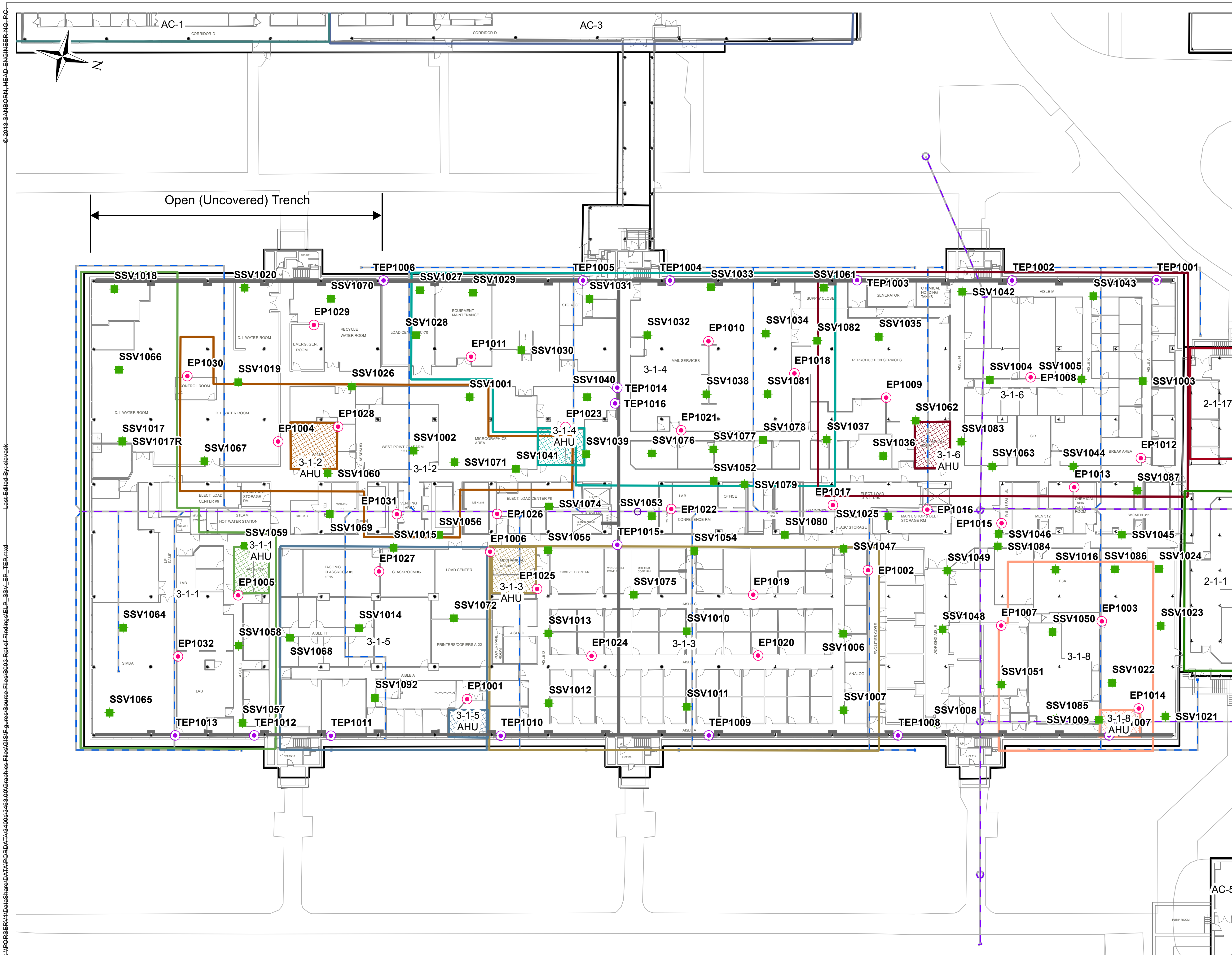

Figure 6

Exploration Location Plan

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility

Poughkeepsie, New York

Drawn By:	E. Wright
Designed By:	S. Warner
Reviewed By:	D. Shea
Project No:	3463.00
Date:	May 2013

Figure Narrative

This figure shows the location and designation of subslab vapor monitoring ports and extraction ports in Building 003. The ports were installed by Sanborn Head personnel in January through March 2013. Refer to the legend for additional information.

Legend

- SSV1001 Subslab vapor monitoring location
- EP1001 Subslab soil vapor extraction port
- TEP1001 Trench vapor extraction port
- Storm sewer
- Under drain
- Pipe conveyance trench
- Manhole
- Column
- 3-1-6 AHU Mechanical room for indicated air handling unit (AHU)
- 3-1-8 Approximate limits of HVAC Zone

20 10 0 20 40
Feet

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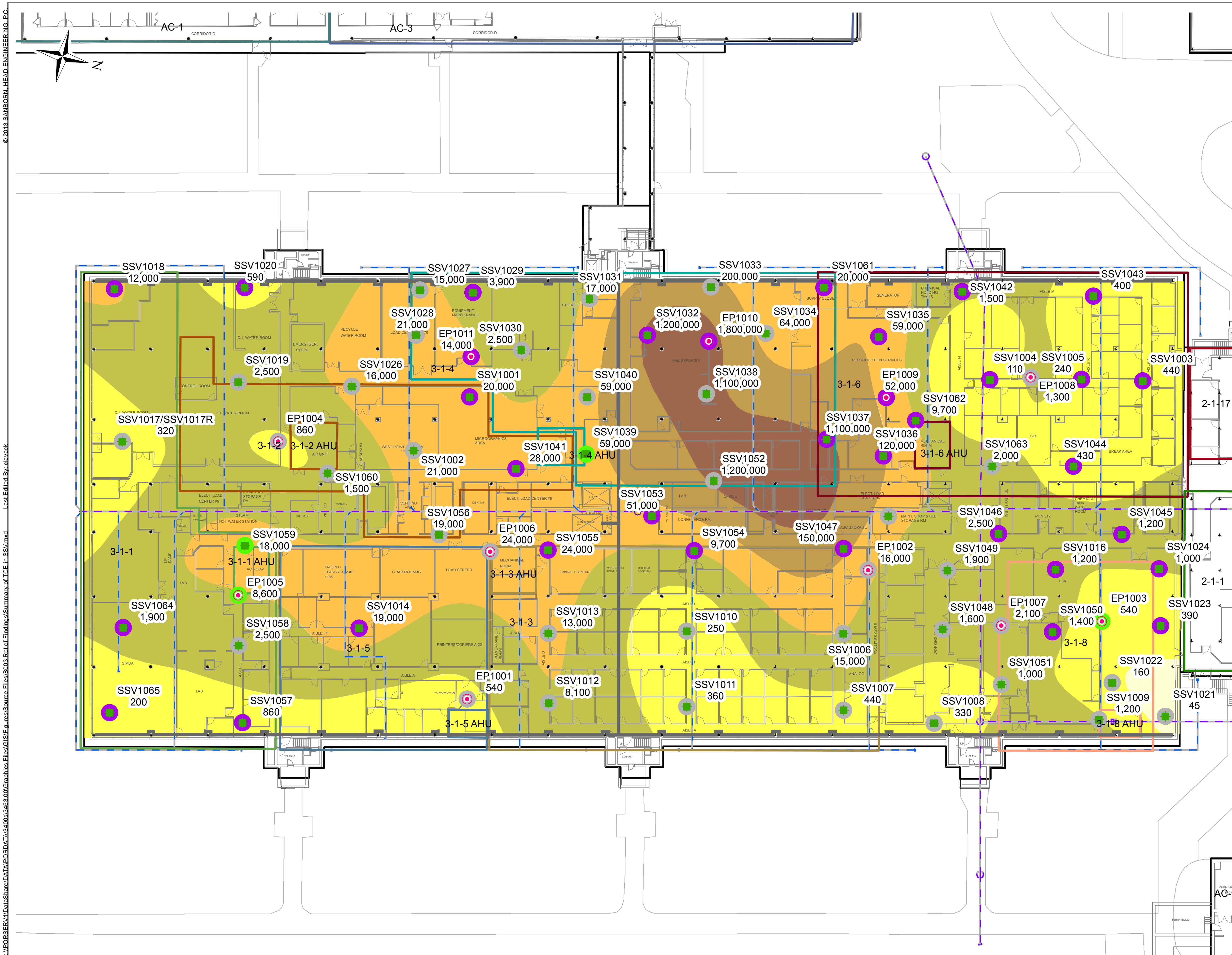

Figure 7

Summary of TCE Concentrations in Subslab Vapor

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility

Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	B. Green/D. Shea
Project No:	3463.00
Date:	May 2013

Figure Narrative

This figure shows the results of subslab vapor sampling and differential pressure monitoring conducted in February 2013. The results for TCE are shown in units of micrograms per cubic meter (µg/m3) with linearly inferred concentration gradients below the slab.

Legend

Refer to Figure 3 for additional legend items

Differential Pressures

- Subslab Pressure < Building Pressure
- Subslab Pressure = Building Pressure
- Subslab Pressure > Building Pressure

Subslab Locations

- SSV1001 20,000 — Subslab vapor monitoring location TCE value (µg/m^3)
- EP1001 540 — Vapor extraction port TCE value (µg/m^3)

February 2013 TCE concentration in subslab vapor (µg/m^3)

- <100
- 100-1,000
- 1,000-10,000
- 10,000-100,000
- 100,000-1,000,000
- >1,000,000

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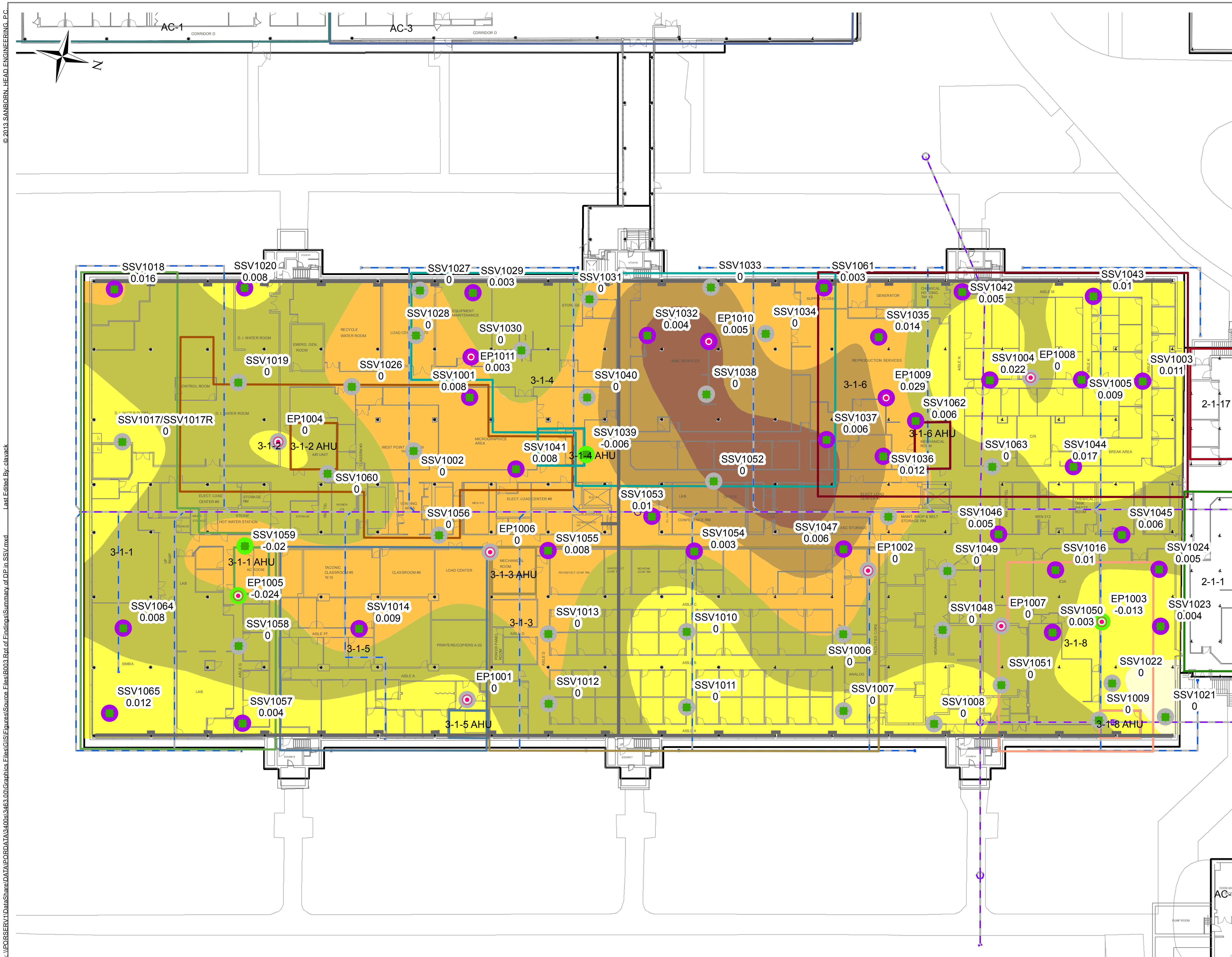

Figure 8
Summary of Subslab Differential Pressure Monitoring

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility

Poughkeepsie, New York

Drawn By: S. Warner
Designed By: S. Warner
Reviewed By: B. Green/D. Shea
Project No: 3463.00
Date: May 2013

Figure Narrative

This figure shows the results of differential pressure monitoring conducted concurrent with subslab vapor sampling in February 2013 at the subslab monitoring locations shown. Differential pressure monitoring was conducted using a digital manometer capable of measuring pressures from 0.000 to 1.0 inches of water.

Legend

Refer to Figure 3 for additional legend items

Differential Pressures

- Subslab Pressure < Building Pressure
- Subslab Pressure = Building Pressure
- Subslab Pressure > Building Pressure

Subslab Locations

- SSV1001 0.008 — Subslab vapor monitoring location Differential pressure (in. water)
- EP1001 0 — Vapor extraction port Differential pressure (in. water)

Differential pressure values are relative to building air pressure. A positive value indicates subslab pressure is greater than building pressure. A negative value indicates subslab pressure is less than building pressure.

February 2013 TCE concentration in subslab vapor (µg/m^3)

- <100
- 100-1,000
- 1,000-10,000
- 10,000-100,000
- 100,000-1,000,000
- >1,000,000

20 10 0 20 40
Feet

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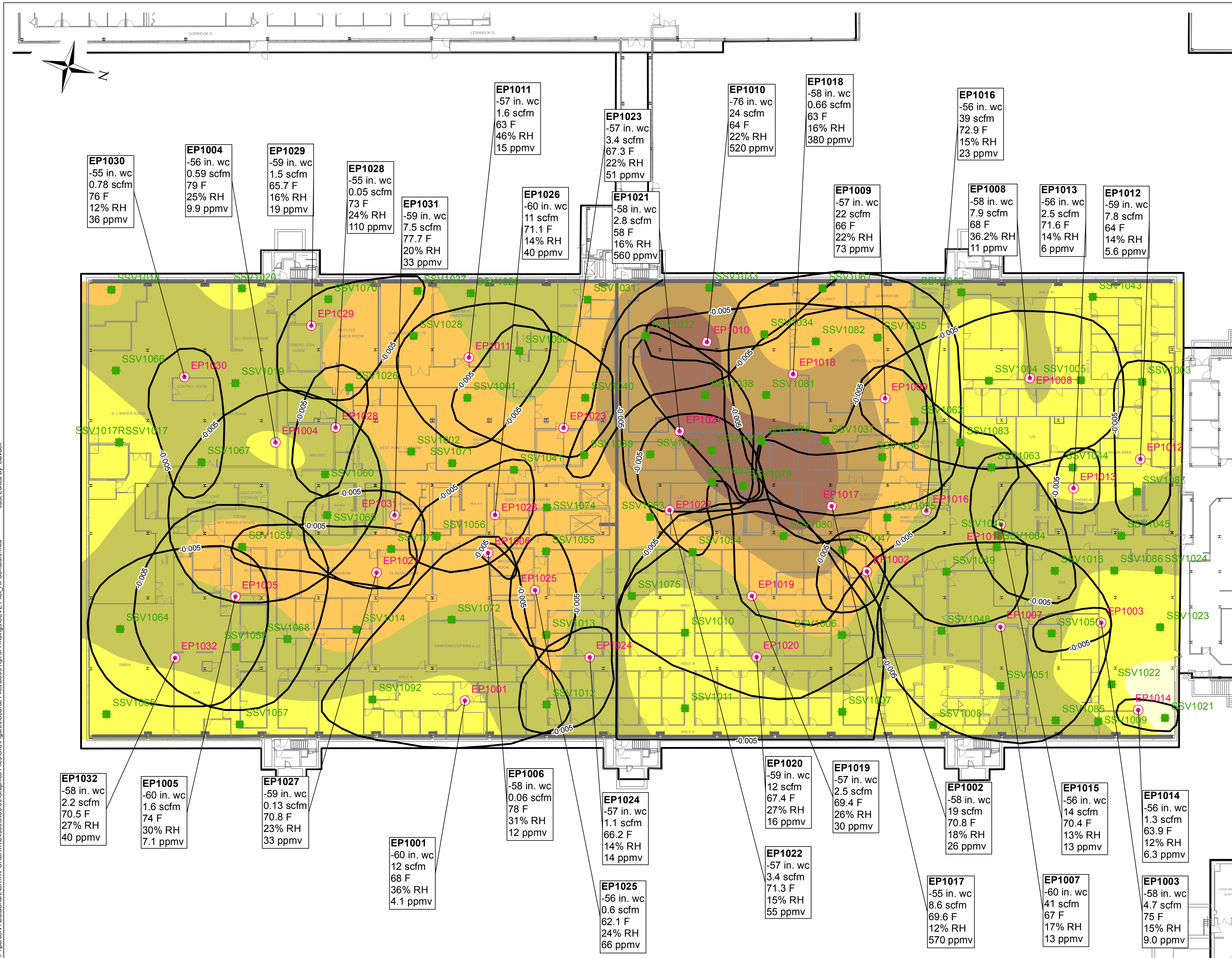

Figure 9

Subslab Pressure Response to Vapor Extraction Testing

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

Figure Narrative

This figure shows the vapor extraction test data and observed subslab pressure response. The extraction tests were conducted individually - the results are presented in aggregate. Subslab pressure was monitored using a digital manometer referenced to the indoor pressure. Negative values indicate subslab pressure less than room air pressure.

Legend

Refer to Figure 3 for additional legend items

SSV1001 Subslab vapor monitoring location

EP1001 Vapor extraction port

-0.005 Differential pressure contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

February 2013 TCE in Subslab Vapor (µg/m³)

- <100
- 100-1,000
- 1,000-10,000
- 10,000-100,000
- 100,000-1,000,000
- >1,000,000

20 10 0 20 40
Feet

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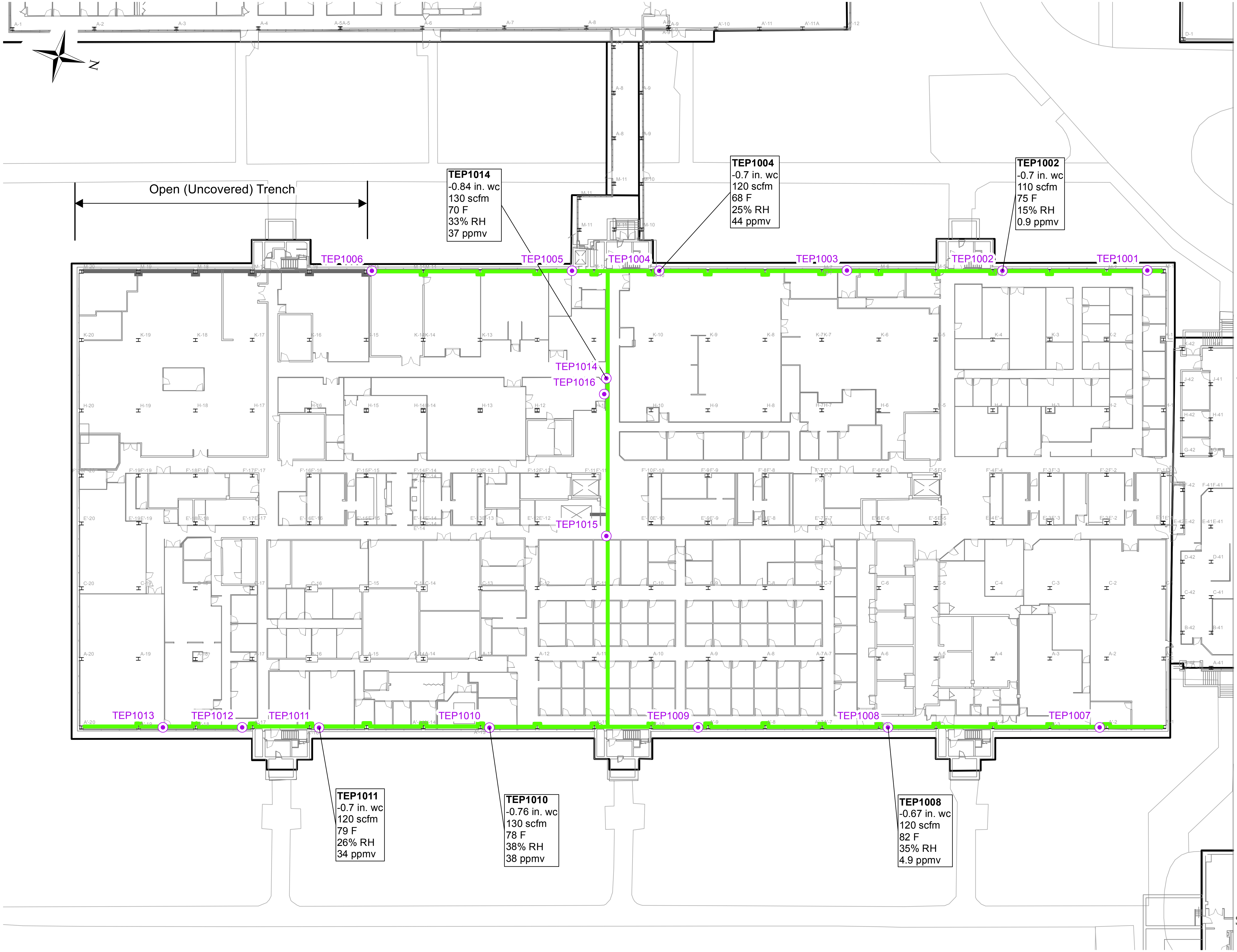

Figure 10

Pressure Response from Floor Trench Vapor Extraction

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	E. Wright
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

Figure Narrative

This figure shows the extraction test data and observed pressure response within the floor trench at the locations indicated. The pressure differential between the trench and indoor air was monitored using a digital manometer referenced to the indoor pressure.

Legend

Refer to Figure 3 for additional legend items

TEP1001 Trench extraction port

Inferred pressure difference in response to vapor extraction based on test observations

TEP1002	Trench Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

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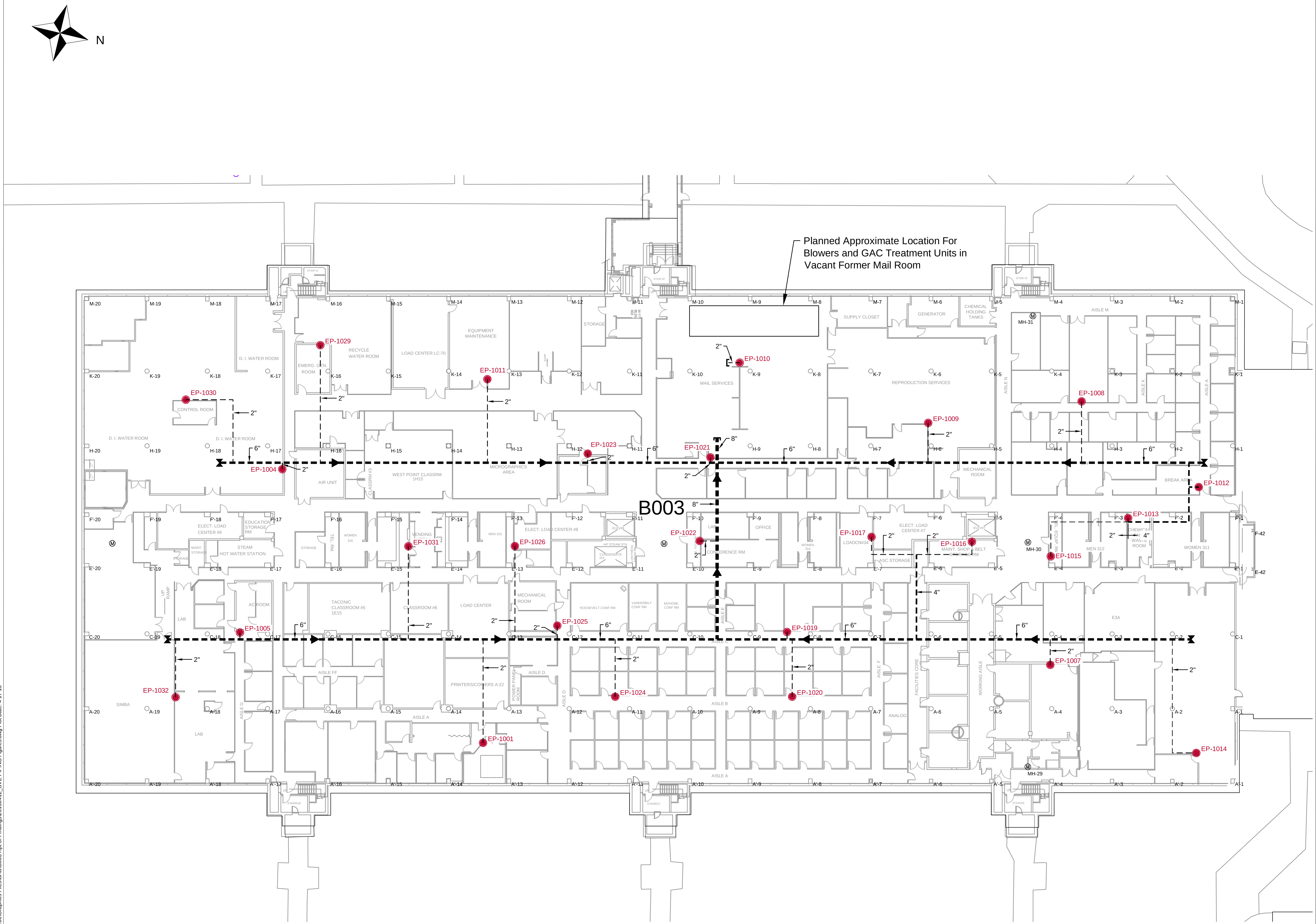

Figure 11

Subslab SVE System Layout

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By: D. Dombrowsky
Designed By: S. Soos / D. Shea
Reviewed By: D. Shea
Project No: 3463.00
Date: May 2013

Figure Narrative

This figure shows the planned layout of the subslab SVE ports, overhead vapor conveyance pipe, and blower and vapor treatment equipment to be installed as part of VOC source remediation in Building 003. The conveyance pipe route shown is approximate and may be changed based on field conditions. Final connections to equipment will be determined as part of final design.

Legend

EP-1004 — Subslab extraction port location

MH-30 Ⓜ — Manhole

4" — Spencer tubing conveyance pipe with nominal size and flow arrow

Feet
20' 10' 0 20' 40'

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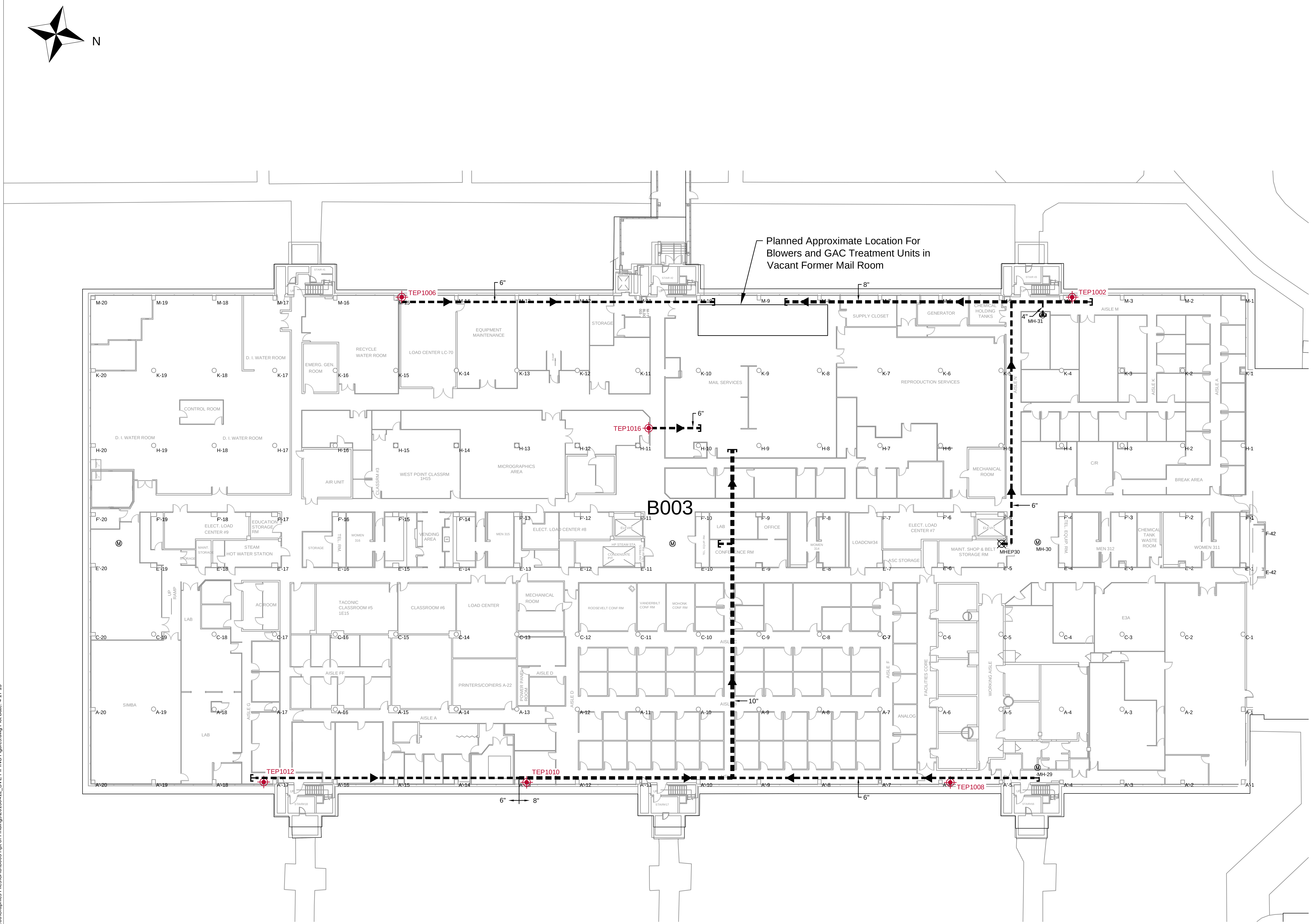

Figure 12

Vapor Extraction System Layout for Floor Trench and Manholes

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By: D. Dombrowsky
Designed By: S. Soos / D. Shea
Reviewed By: D. Shea
Project No: 3463.00
Date: May 2013

Figure Narrative

This figure shows the planned layout of the extraction ports, overhead vapor conveyance pipe, and blower and vapor treatment equipment associated with the vapor extraction system for the floor trench and manholes to be installed as part of VOC source remediation in Building 003. The conveyance pipe route shown is approximate and may change based on field conditions. Final connections to equipment will be determined as part of final design.

Legend

TEP1002 — Trench extraction port location to be connected to blower

MHEP30 — Manhole extraction port location to be connected to blower

MH-30 — Manhole

4" — Spencer tubing conveyance pipe with nominal size and flow direction

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APPENDIX A

LIMITATIONS

APPENDIX A
SHPC LIMITATIONS

1. The findings and conclusions described in this report are based in part on the data obtained from a finite number of samples from widely spaced locations. The figures are intended to depict inferred conditions during a given period of time, consistent with available information. The actual conditions will vary from that shown, both spatially and temporally. Other interpretations are possible. The nature and extent of variations between sampling locations may not become evident until further investigation is initiated. If variations or other latent conditions then appear evident, it may be necessary to re-evaluate the conclusions of this report.

2. The conclusions contained in this report are based in part upon various types of chemical data as well as historical and hydrogeologic information developed by previous investigators. While SHPC has reviewed that data available to us at the time the report was prepared and information as stated in this report, any of SHPC's interpretations and conclusions that have relied on that information will be contingent on its validity. SHPC has not performed an independent assessment of the reliability of the data; should additional chemical data, historical information, or hydrogeologic information become available in the future, such information should be reviewed by SHPC and the interpretations and conclusions presented herein may be modified accordingly.

3. Sampling and quantitative laboratory testing was performed by others as part of the investigation as noted within the report. Where such analyses have been conducted by an outside laboratory, unless otherwise stated in the report, SHPC has relied upon the data provided, and has not conducted an independent evaluation of the reliability of these data. It must be noted that additional compounds not searched for during the current study may be present in vapor and indoor air at the site. Moreover, it should be noted that variations in the types and concentrations of contaminants and variations in their distribution within the vapor and indoor air may occur due to the passage of time, seasonal water table fluctuations, recharge events, and other factors.

4. This report has been prepared for the exclusive use of the IBM Corporation for specific application to the IBM Poughkeepsie facility in accordance with generally accepted hydrogeologic and engineering practices. No warranty, expressed or implied, is made. The contents of this report should not be relied on by any other party without the express written consent of SHPC.

5. In preparing this report, SHPC has endeavored to conform to generally accepted practices of other consultants undertaking similar studies at the same time and in the same geographical area. SHPC has attempted to observe a degree of care and skill generally exercised by the technical community under similar circumstances and conditions.

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APPENDIX B

SUMMARY OF FIELD METHODS AND QA/QC

APPENDIX B
SUMMARY OF FIELD METHODS AND QA/QC

B.1 INTRODUCTION

This appendix describes the field methods, and data quality assurance/quality control (QA/QC) evaluations and results, associated with Building 003 VOC Source Assessment work at IBM's Poughkeepsie facility. Field procedures and data QA/QC measures were conducted in general accordance with the standard operating procedures (SOP) provided in IBM's VOC Source Assessment RFI Work Plan (RFI Work Plan).

Tabular summaries of the data described below are provided in Tables 1 through 7 of the main report. The Site-specific analyte list referenced below was presented in the RFI Work Plan and includes the following volatile organic compounds (VOCs): chloroethane (CA), 1,1-dichloroethane (1,1-DCA), 1,1-dichloroethene (1,1-DCE), cis-1,2-dichloroethene (c-1,2-DCE), trans-1,2-dichloroethene (t-1,2-DCE), tetrachloroethene (PCE), trichloroethene (TCE), and vinyl chloride (VC).

B.2 INDOOR AIR AND TARGETED AIR SCREENING

B.2.1 Field Methods

Initial indoor air and targeted air screening on the first floor of B003 was conducted using an Inficon HAPSITE SmartPlus field portable gas chromatograph/mass spectrometer (GC/MS) (i.e., HAPSITE). The HAPSITE was used as an initial air-screening device for seven of the Site-specific VOCs[1]. In addition, at two locations subject to HAPSITE screening, grab samples of indoor air were collected into SUMMA® canisters for laboratory analysis by USEPA Method TO-15. The initial screening was conducted on November 27 and 28, 2012.

The HAPSITE was calibrated to manufacturer-prepared standards ranging from 0.1 to 50 parts per billion by volume (ppbv) for the target analytes, and the samples were screened in selective ion monitoring (SIM) mode. The lower calibration range of 0.1 ppbv was considered the method reporting limit for the HAPSITE samples, as shown on Table 1. The instrument reports values based on the quality of fit of chromatograph peaks and ion pairs, both within and outside of the calibration range. The minimum acceptable quality of fit for the analyte list was 75%.

HAPSITE sample collection and analysis takes approximately 6 minutes. The line is purged for 1 minute to remove remnants of previous samples, and then the concentrator tube is filled for 1 minute. The mass collected in the concentrator is then pumped through the GC/MS for analysis. Total analysis time is approximately 4 minutes and is based on the elution time of the analytes. Prior to HAPSITE screening, the indoor air and targeted air locations were screened with a photoionization detector (PID). Where PID readings were relatively greater, the HAPSITE screening was conducted by "diluting" the sample by

[1] The HAPSITE was not calibrated for the Site-specific compound chloroethane; therefore, chloroethane was not reported.

reducing the concentrator fill time from the normal 1 minute down to either 30 or 15 seconds. A 30-second concentrator fill time is equivalent to a 50% dilution and a 15-second concentrator fill time is equivalent to a 75% dilution. Once the analysis is complete, the concentration results provided by the HAPSITE are multiplied by either 2 or 4, respectively, to get the indoor air/targeted air concentrations.

B.2.2 QA/QC Evaluation

The objective of HAPSITE field screening was to obtain general, order-of-magnitude understanding of VOC concentrations to inform and adjust the focus of the field activities in real time. The HAPSITE data is not intended to support final decisions. Nevertheless, the following QA/QC measures were taken to support evaluation of the field screening data.

Outside air blanks were collected directly into the HAPSITE from locations outside of B003 three to five times per day. Values for c-1,2-DCE, TCE, and VC were each observed in blanks collected on November 27 and 28, 2012. HAPSITE results shown in Table 1 were flagged with a "B" when they were within 10 times the concentration detected in an outside air blank collected on the same day as the sample. Sample results similar to (and therefore not discernible from) that recorded for blanks may be associated with the HAPSITE operating environment and/or residual VOC presence in the HAPSITE column, and should not be considered valid detections.

In addition, grab indoor air samples were collected into 2.7-liter pre-evacuated SUMMA canisters at two indoor air screening locations (IA1025 and IA1059) immediately after HAPSITE screening was conducted. The purpose of these grab SUMMA samples was to obtain an understanding of the general comparability of the HAPSITE screening results with the results of samples subject to laboratory analysis. The TCE results for these grab SUMMA samples are shown on Figure 4. While the HAPSITE screening and grab SUMMA samples are not true field duplicate samples because the sample time intervals and volumes are different for each method, the TCE results indicate order-of-magnitude agreement.

B.3 INDOOR AIR SAMPLING

B.3.1 Field Methods

SUMMA canisters were used to collect 8-hour time-weighted-average indoor air samples at ten locations on the first floor of B003 on November 29, 2013. The indoor air samples were collected in accordance with the Indoor and Ambient Air Sampling SOP included in Appendix A.1 of the RFI Work Plan. The samples were collected into 2.7-liter pre-evacuated SUMMA canisters at a height of approximately 4 feet above the floor. SUMMA canisters were submitted to Alpha Analytical of Mansfield, MA (Alpha) for laboratory analysis of the eight site-specific VOCs using USEPA Method TO-15 in selective ion monitoring (SIM) mode. A summary of sampling information for the air samples is provided in Table 3.

B.3.2 QA/QC Evaluation

Field and laboratory QA/QC measures were implemented for the November 29, 2012 8-hour indoor air sampled in accordance with Table B.1 of the RFI Work Plan QA/QC Plan. Field QA/QC samples included collection of one field duplicate sample, one ambient air sample, and one field blank using ultra-high purity nitrogen provided by the laboratory.

Analytical data was provided to New Environmental Horizons, Inc. (NEH) of Arlington, Massachusetts for an independent third-party in-depth data usability review (DUR). NEH's DUR report is presented as Appendix E.

NEH's evaluation included a review of sample data, including raw data, to verify that the laboratory performed the analyses in compliance with the analytical methods required, and to verify consistency with the QA/QC Plan requirements. The evaluation was conducted in accordance with the USEPA and NYSDEC guidelines for data validation of organic data. NEH prepared an In-Depth Data Usability Review Report that summarized the QC issues that required action (qualification of data) and compared QA/QC criteria to the data quality objectives (DQOs) described in the Work Plan.

In summary, NEH found the data to be usable in accordance with the project DQOs subject to a few minor qualifications. The following QA/QC considerations were noted by NEH:

- The final field and lab receipt vacuums for sample IA1012 were greater than 10 inches of mercury (in. Hg), which is above the highest acceptable vacuum specified in the Work Plan. All results for sample IA1012 were qualified as estimated (i.e., "J" flagged) with an indeterminate bias due to high receipt vacuum.

- The flow controller on the canister for sample IA1064 did not meet pre- and post-sample collection flow rate precision of RPD < 20% as required by the Work Plan. All results for this sample were estimated ("J" or "UJ" flagged) with indeterminate bias due to the flow controller being outside criteria.

- Trichloroethene and cis-1,2-dichloroethene were reported at low levels in one of the method blanks and the field blank (FB1). A comparison was made between the levels of these compounds in the blanks and samples and the data validator took the following actions:

    - Trichloroethene and cis-1,2-dichloroethene were estimated ("EB" flagged) in sample AA1001 since the sample results may be biased high based on the presence of these compounds in the associated equipment blank.

- Five samples were initially analyzed without dilution (dilution factor (DF) =1) and one or more results were reported above the instrument calibration range (flagged "E" by the laboratory). These samples were re-analyzed at secondary dilutions to report all data properly. Both sets of data for each sample were evaluated, and one of the two results for each sample was retained. Refer to the DUR in Appendix E for a description of which results were retained. Data not accepted for reporting were eliminated from the electronic data deliverable (EDD) so that only one valid result per compound is reported for each sample.

In summary and as stated above, the data were found to be usable in accordance with the project DQOs and subject to only minor qualifications.

B.4 SUBSLAB VAPOR SAMPLING

B.4.1 Field Methods

The initial group of 64 subslab vapor (SSV) monitoring points and 11 extraction ports were installed in the first floor of B003 from January 30 through February 6, 2013. The SSV monitoring ports were installed in accordance with Figure A.4.1 of the RFI Work Plan. The extraction ports were modified from the details provided in A.5.1 of the RFI Work Plan due to dense subslab soils; the revised details are attached as Figure B.4.1.

To demonstrate the soundness of subslab monitoring point construction, integrity testing was conducted at approximately 10% of the monitoring points and extraction ports in accordance with the Subslab Vapor Sample Port Installation, Integrity Testing, and Sampling SOP included in Appendix A.4 of the RFI Work Plan. Further information on integrity testing is provided in Section B.4.2.

Prior to collecting a sample, SSV monitoring points and extraction ports were purged of a volume approximately equal to one volume of the subsurface tubing or piping using a laboratory-supplied syringe. The purge volume was equal to between 3 and 4 cm^3 for the SSV monitoring points and between approximately 100 and 130 cm^3 for the extraction ports. Samples were then collected by extracting approximately 60 mL of subslab vapor with a syringe and transferring it to laboratory-supplied glass vials with septum caps. Two glass vials were collected at each location and samples were submitted to Microseeps, Inc. of Pittsburgh, PA for analysis of the Site-specific VOCs using analytical method (AM) 4.02. Subslab differential pressure measurements were collected from each SSV monitoring point and extraction port prior to sampling.

A second group of SSV monitoring and extraction ports were installed from March 6 through 15, 2013. These locations were not included in the comprehensive glass vial sampling round described above. During subslab and trench vapor extraction testing, grab 1-liter SUMMA canister samples were collected from the testing manifold and submitted to Alpha for analysis of the Site-specific VOCs using USEPA Method TO-15 in SIM mode. These data are provided in Tables 5, 6, and 7.

B.4.2 QA/QC Evaluation

Integrity testing was conducted at 7 subslab vapor (SSV) monitoring points and 1 extraction port following the procedures outlined in Appendix A.4 of the RFI Work Plan. The results of the integrity tests indicated that the seal of the SSV monitoring points and extraction ports was adequate. Integrity testing results are provided in Table B.4.1

During SSV sampling, one field duplicate sample was collected for every 20 primary SSV samples, for a total of 4 field duplicates. Exhibit B.4.1 summarizes the relative percent difference (RPD) between the primary and field duplicate samples.

Sample	SSV1006	SSV1006 (DUP1)	RPD	SSV1014	SSV1014 (DUP2)	RPD	SSV1026	SSV1026 (DUP4)	RPD	SSV1034	SSV1034 (DUP3)	RPD
Date	02/12/13			02/12/13			02/12/13			02/12/13		
Units	µg/m^3	µg/m^3	%	µg/m^3	µg/m^3	%	µg/m^3	µg/m^3	%	µg/m^3	µg/m^3	%
CA	<2,600	<2,600	–	<2,600	<2,600	–	<2,600	<2,600	–	<2,600	<2,600	–
1,1-DCA	<81	<81	–	<81	<81	–	230	240	4.3%	<81	40 J	–
1,1-DCE	<40	<40	–	24 J	<40	–	67	52	25%	670	560	18%
c-1,2-DCE	8,300	5,200	46%	8,300	5,900	34%	2,900	2,800	3.5%	56,000	48,000	15%
t-1,2-DCE	<40	<40	–	<40	<40	–	<40	<40	–	1,800	1,300	32%
PCE	22 J	10 J	75%	20 J	12 J	50%	9.5 J	8.8 J	7.7%	9.5 J	8.8 J	7.7%
TCE	15,000	8,600	54%	19,000	17,000	11%	16,000	16,000	0.0%	64,000	54,000	17%
VC	310 J	<2,600	–	<2,600	<2,600	–	360 J	280 J	25%	<2,600	310 J	–

Notes:

1. % RPD is the relative percent difference, calculated by the formula:

   | Result1 - Result2 | / ((Result1 + Result2) / 2) * 100

2. "–" indicates the RPD can not be calculated because one or both of the results are non-detect.

3. Refer to Table 4 for additional information including definitions of qualifiers and abbreviations.

Exhibit B.4.1 – Summary of RPDs for Primary and Field Duplicate SSV Samples

RPDs ranged from 0.0% to 75%, which demonstrates the small-scale variability of SSV concentrations.

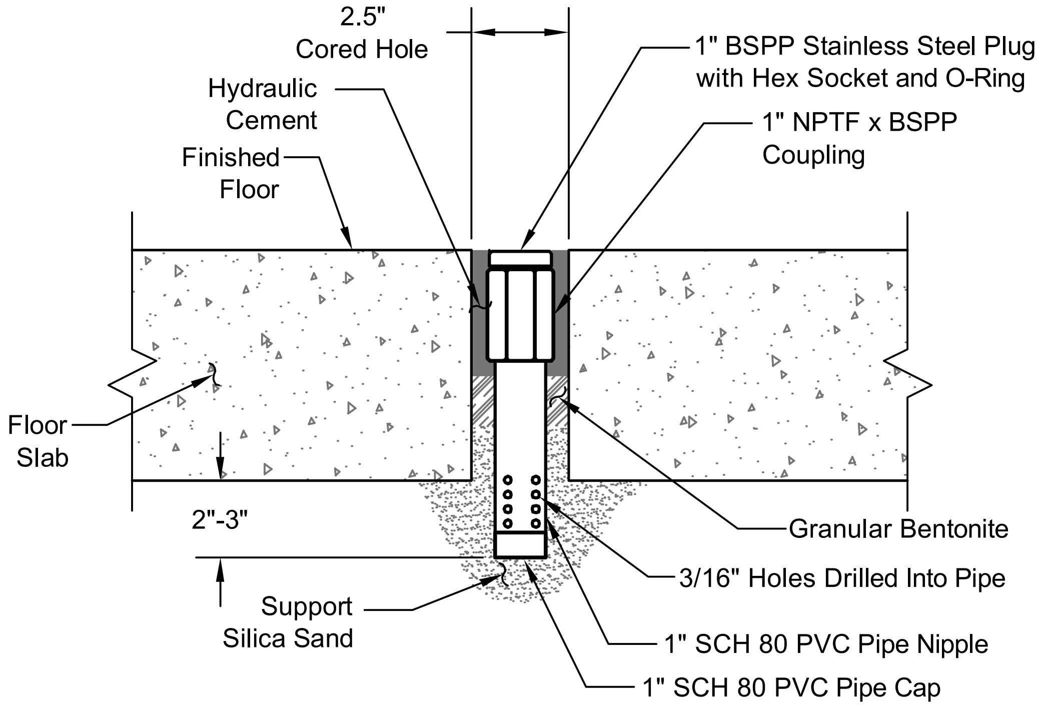
Laboratory QA/QC included analysis of Method Blanks, Laboratory Control Samples (LCS), and LCS Duplicates. Sanborn Head reviewed the QA/QC measures conducted by the laboratory and did not observe deficiencies with the data quality. Microseeps flagged results that were detected at concentrations below the reporting limit and above the method detection limit as estimated ("J").

TABLE B.4.1
Soil Vapor Implant Integrity Testing Summary
Report of Findings - Building 003 VOC Source Assessment
IBM Poughkeepsie Facility
Poughkeepsie, New York

Location	SSV1043	SSV1046	SSV1051	SSV1012	SSV1059	SSV1053	SSV1030	EP1010
Sanborn Head Field Representative	M. Stein	M. Stein	M. Stein	M. Stein	M. Stein	M. Stein	M. Stein	M. Stein
Vacuum (H2O)	0.15	0.3	0.5	0.1	1	0.2	0.1	0.6
Pressure Differential	0.026	0.017	0.013	0.006	-0.017	0.012	0.000	0.000
Start Time	14:29	14:47	15:06	15:20	15:35	15:47	16:01	16:18
Stop Time	14:37	14:53	15:11:30	15:25:15	15:40	15:52:15	16:06	16:23:30
Time to fill 1 liter bag (min:sec)	8:00	6:00	5:30	5:15	5:00	5:15	5:00	5:30
Approx. Flow Rate (L/min)	0.13	0.17	0.18	0.19	0.20	0.19	0.20	0.18
Helium Tracer gas applied?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Helium Concentration (ppmv)	ND	ND	ND	ND	ND	ND	ND	ND
O2 (%)	20.5	20.4	19.1	20.3	20.4	20.7	19.5	20.0
CH4 (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CO2 (%)	0.2	0.2	1.3	0.2	0.2	0.0	0.9	0.7
PID (ppbv)	7,430	9,373	9,775	14,100	18,900	25,600	16,100	801,000
Date	2/13/2013	2/13/2013	2/13/2013	2/13/2013	2/13/2013	2/13/2013	2/13/2013	2/13/2013
Time	14:29	14:47	15:06	15:20	15:35	15:47	16:01	16:18
Ambient Air Temp. (°F)	70.9	74.5	73.4	72.3	73.0	73.4	72.0	70.5

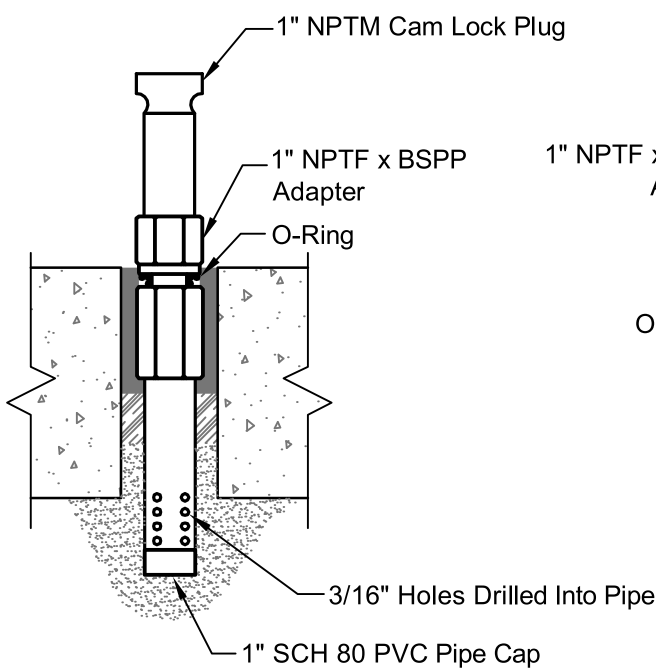
Notes:
1. Meters used:
PID: MiniRAE 2000 or ppbRAE
O2/CH4/CO2 Meter: CES Landtec GEM 2000
Helium Meter: Dielectric MGD-2002
Dwyer Series 475 Mark III Digital Manometer

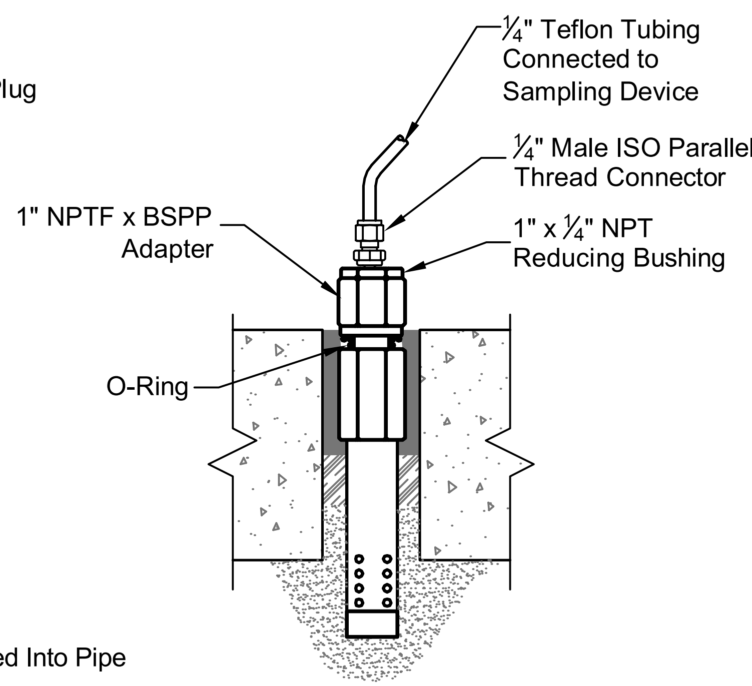
2. "ND" indicates not detected.
"ppmv" indicates parts per million by volume.
"ppbv" indicates parts per billion by volume.



1 Subslab Vapor Extraction Test Port

Not To Scale





2 Vapor Extraction Testing Configuration

Not To Scale

3 Subslab Vapor Sampling Configuration

Not To Scale

Drawn By: E. Wright
Designed By: S. Soos
Reviewed By: D. Shea
Project No: 3463.00
Date: May 2013

Scale As Noted

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Figure B.4.1

Subslab Vapor Extraction Port

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

APPENDIX C

SUMPPLEMENTAL FIGURES

Group 1 – Subslab Pressure Response to Vapor Extraction Testing

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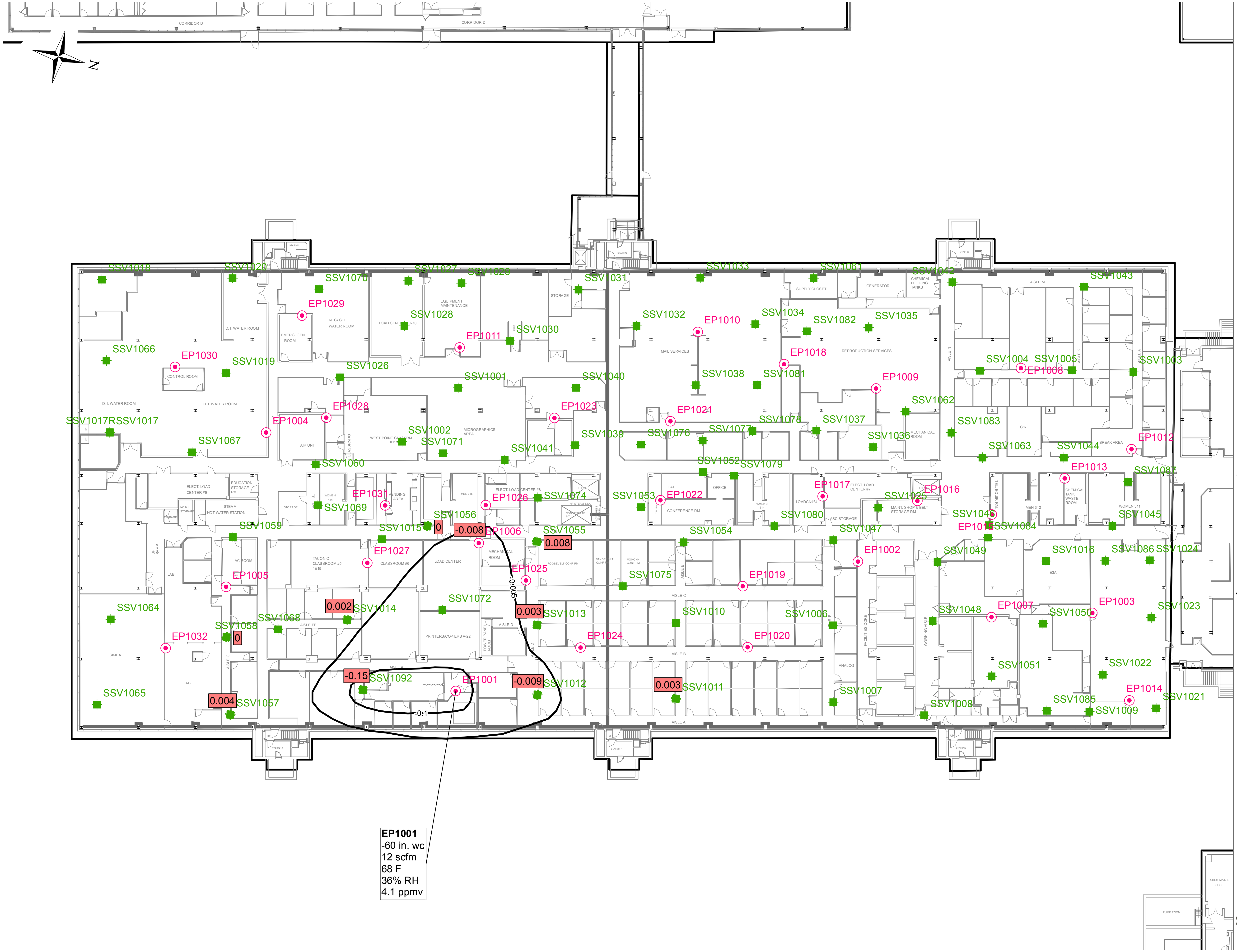

Figure C - 1

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1001

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 — Subslab Vapor Monitoring Location

EP1001 — Vapor Extraction Port

-0.005 — Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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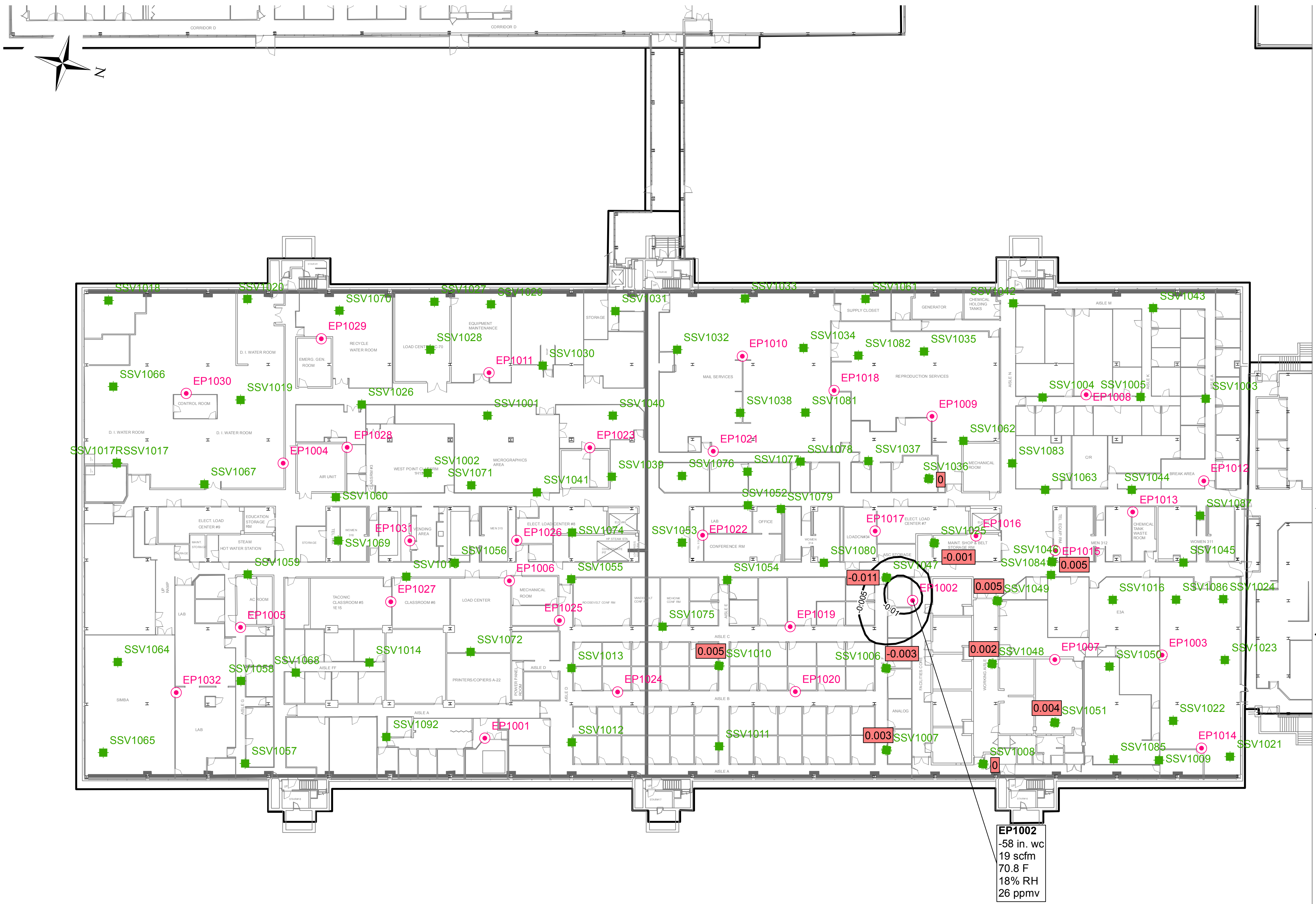

Figure C - 2

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1002

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By: S. Warner
Designed By: S. Warner
Reviewed By: S. Soos/ D. Shea
Project No: 3463.00
Date: May 2013

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

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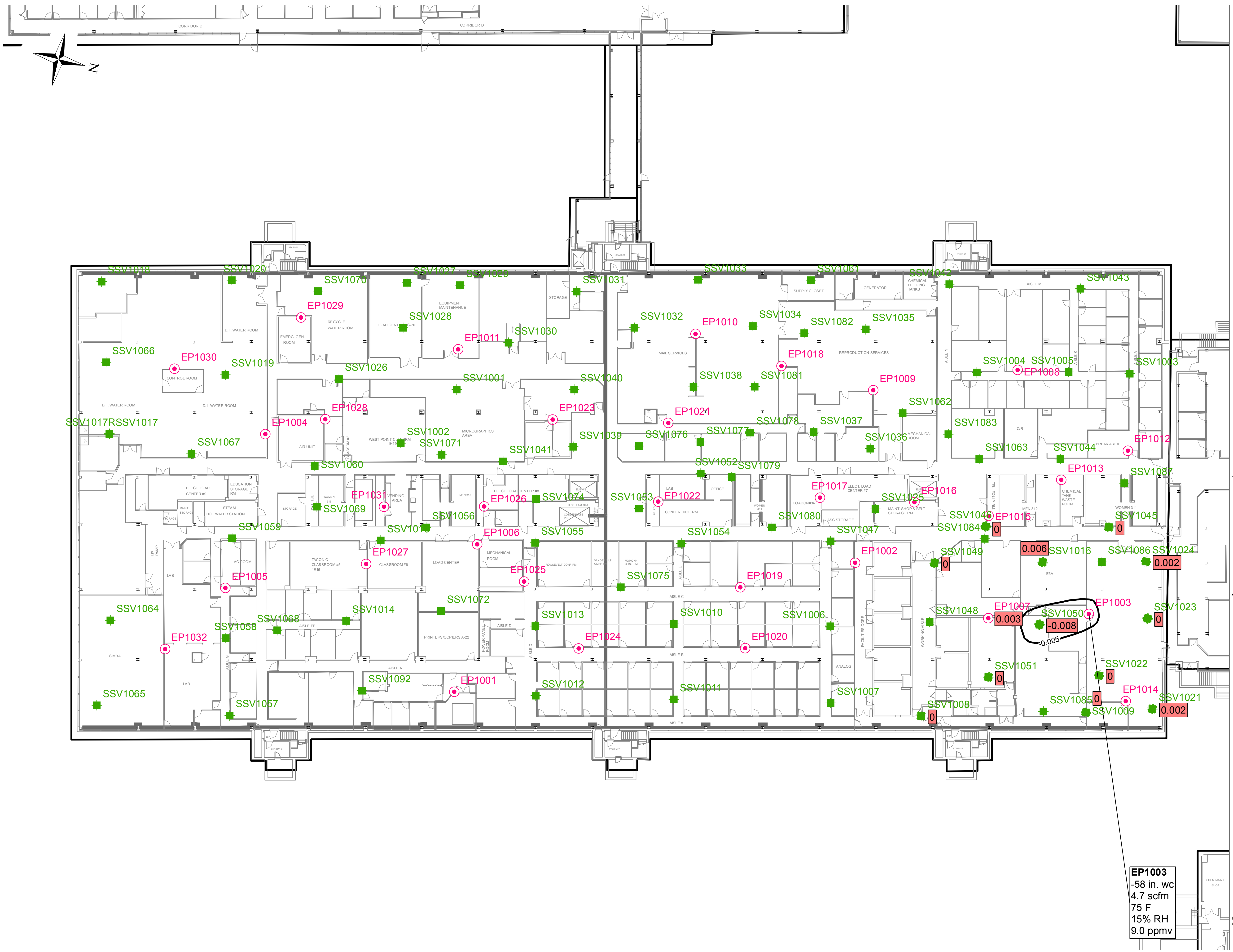

Figure C - 3

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1003

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By: S. Warner
Designed By: S. Warner
Reviewed By: S. Soos/ D. Shea
Project No: 3463.00
Date: May 2013

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 — Subslab Vapor Monitoring Location

EP1001 — Vapor Extraction Port

-0.005 — Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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Figure C - 4

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1004

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

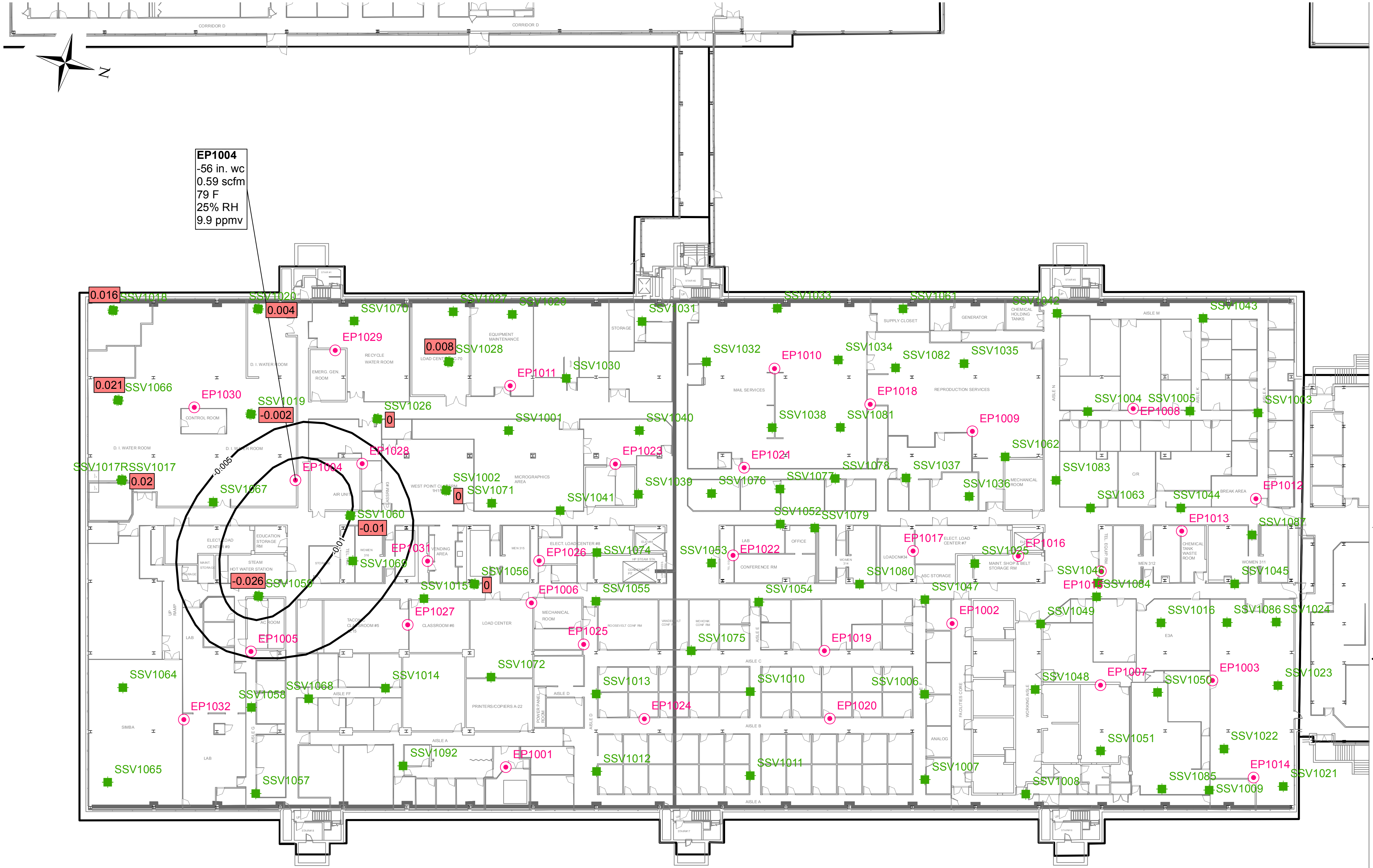

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 Subslab Vapor Monitoring Location

EP1001 Vapor Extraction Port

-0.005 Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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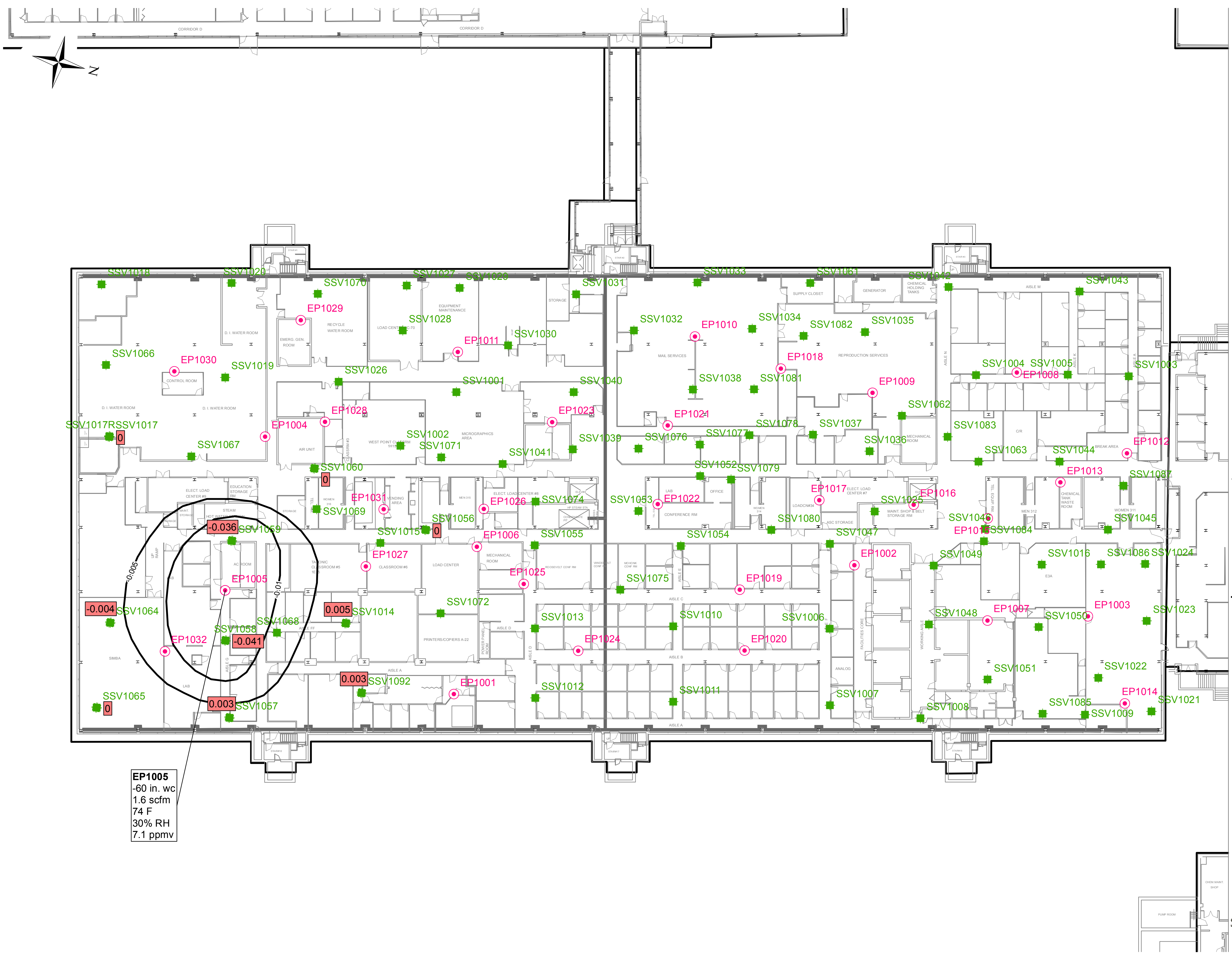

Figure C - 5

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1005

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 — Subslab Vapor Monitoring Location

EP1001 — Vapor Extraction Port

-0.005 — Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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Figure C - 6

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1006

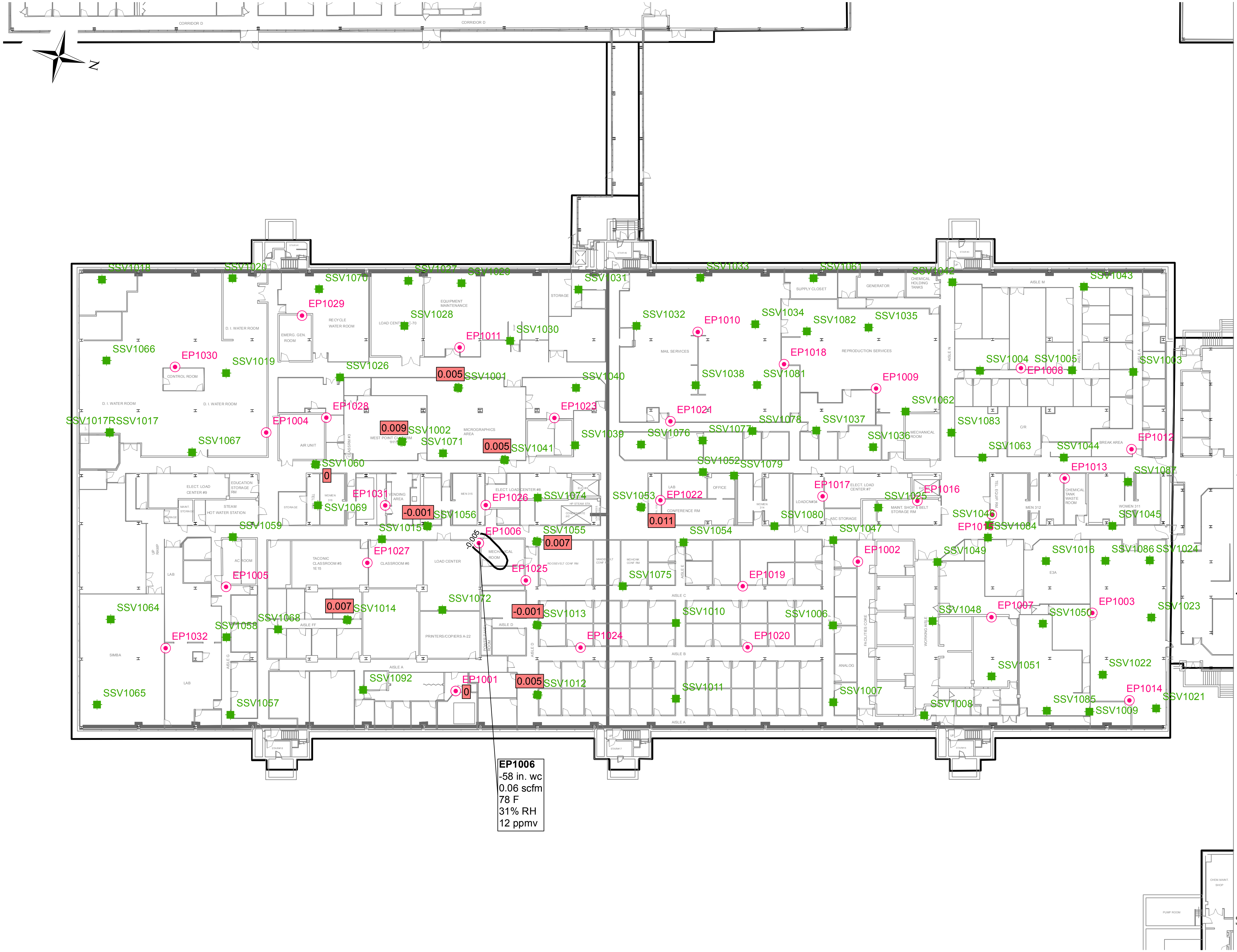
Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.



Legend

SSV1001 Subslab Vapor Monitoring Location

EP1001 Vapor Extraction Port

-0.005 Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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Figure C - 7

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1007

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

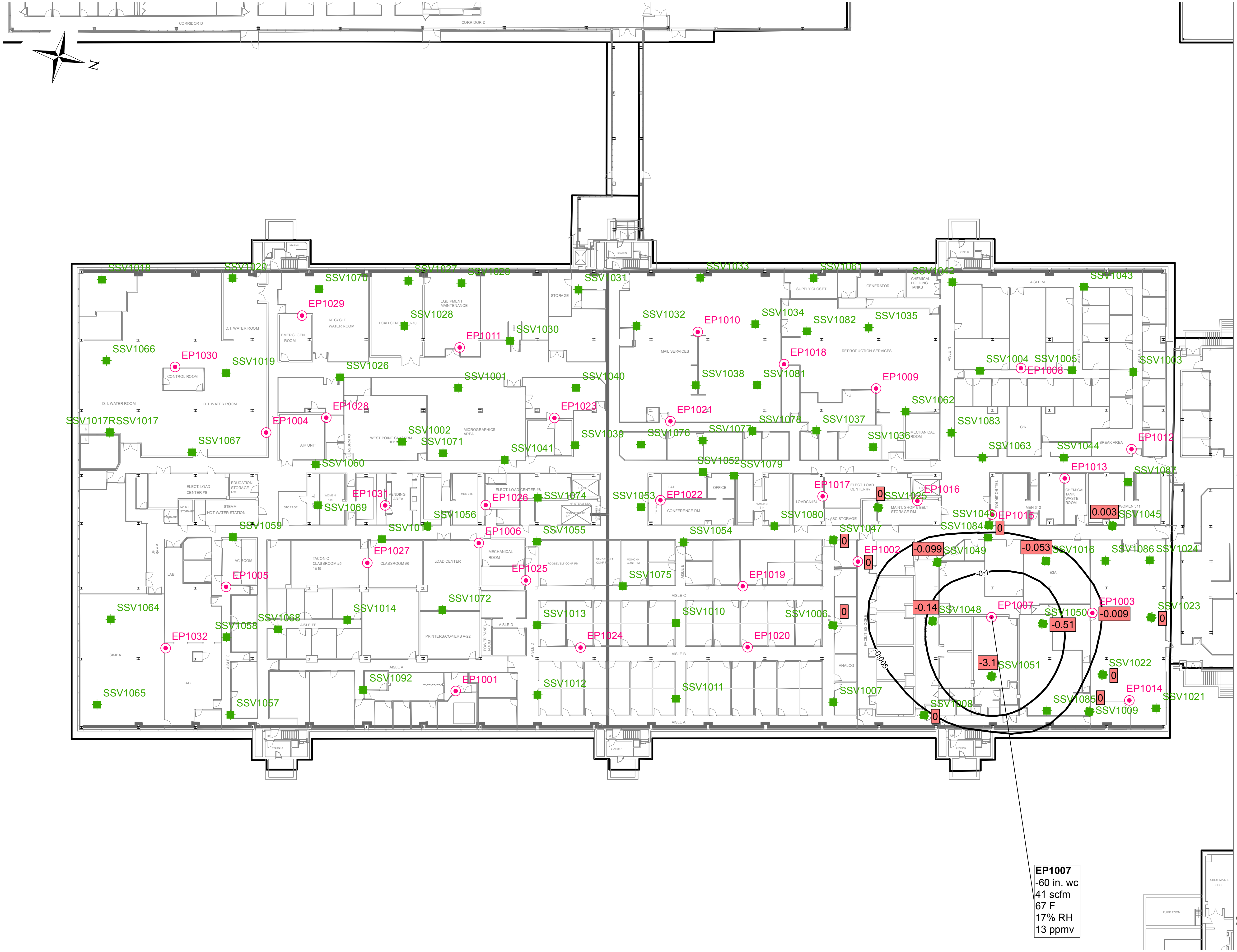

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 Subslab Vapor Monitoring Location

EP1001 Vapor Extraction Port

-0.005 Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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Figure C - 8

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1008

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

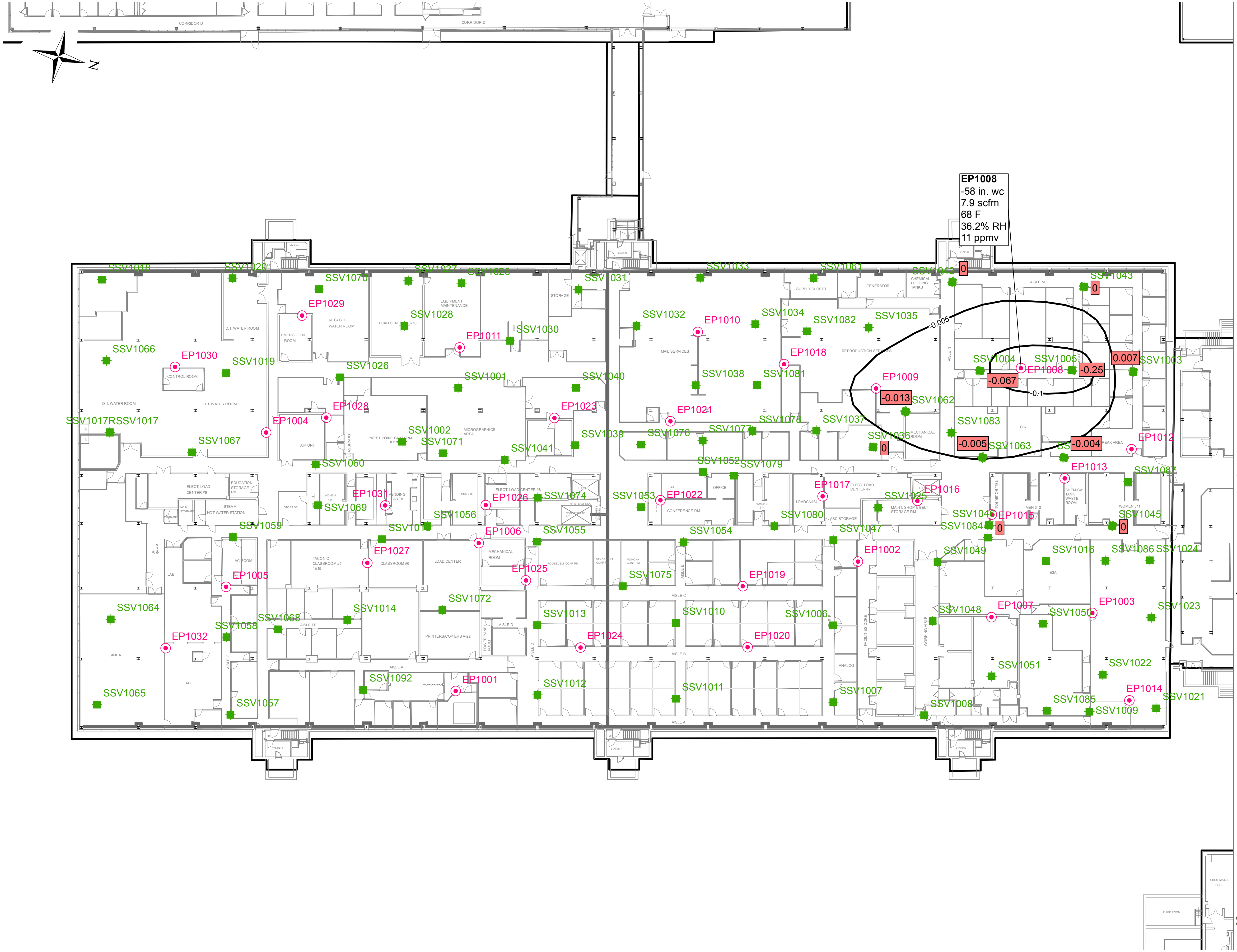

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 Subslab Vapor Monitoring Location

EP1001 Vapor Extraction Port

-0.005 Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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Figure C - 9

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1009

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

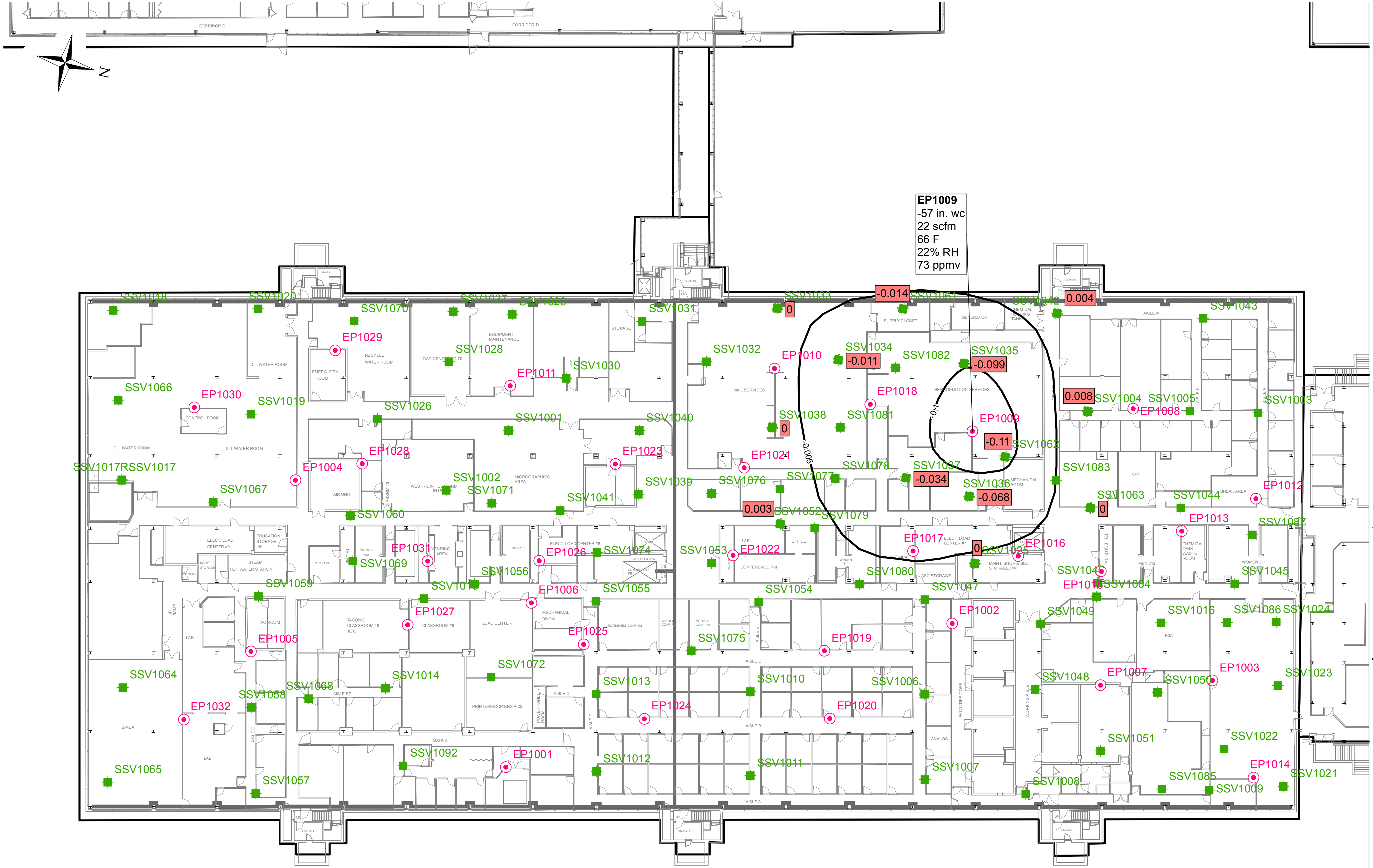

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 — Subslab Vapor Monitoring Location

EP1001 — Vapor Extraction Port

-0.005 — Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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Figure C - 10

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1010

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

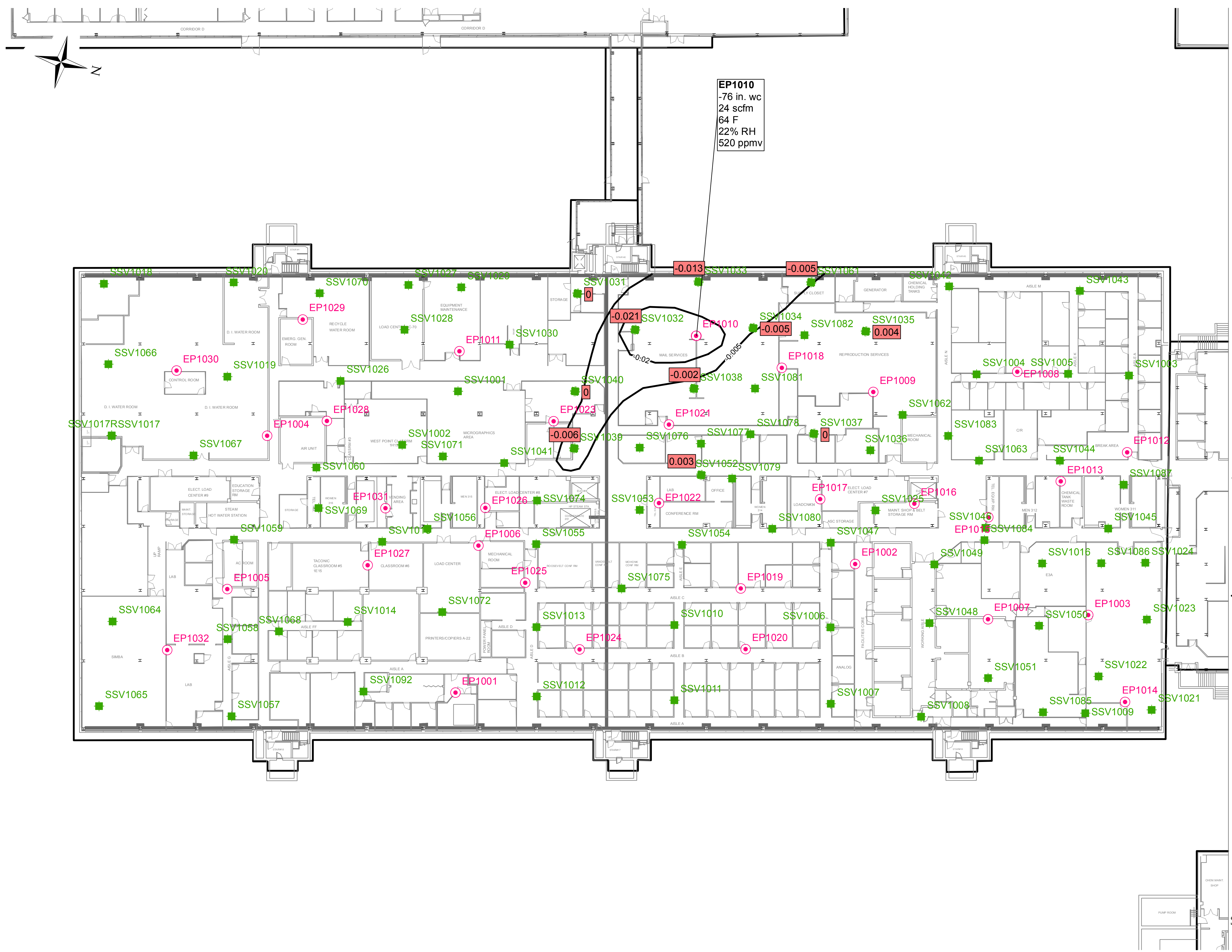

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 Subslab Vapor Monitoring Location

EP1001 Vapor Extraction Port

-0.005 Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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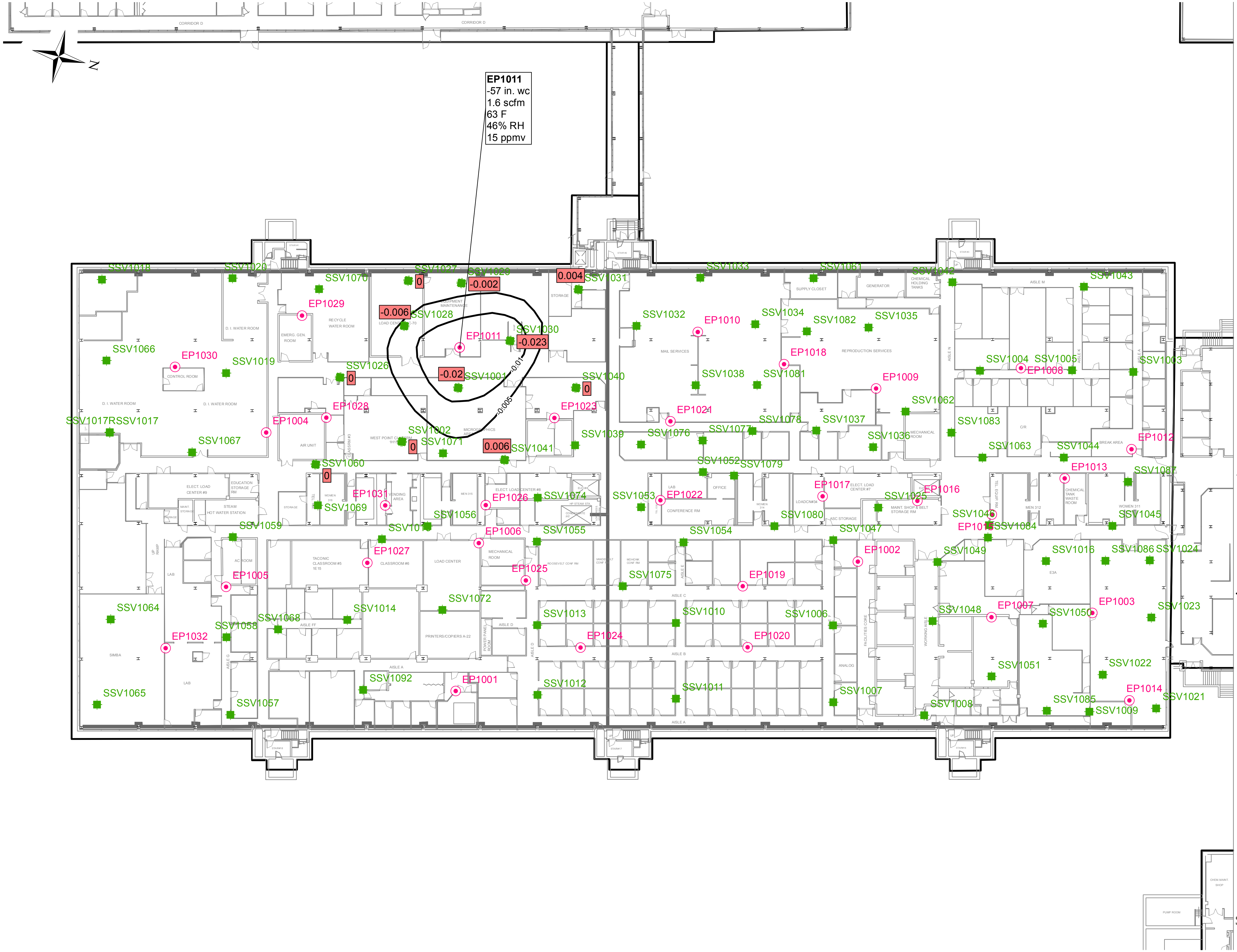

Figure C - 11

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1011

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 Subslab Vapor Monitoring Location

EP1001 Vapor Extraction Port

-0.005 Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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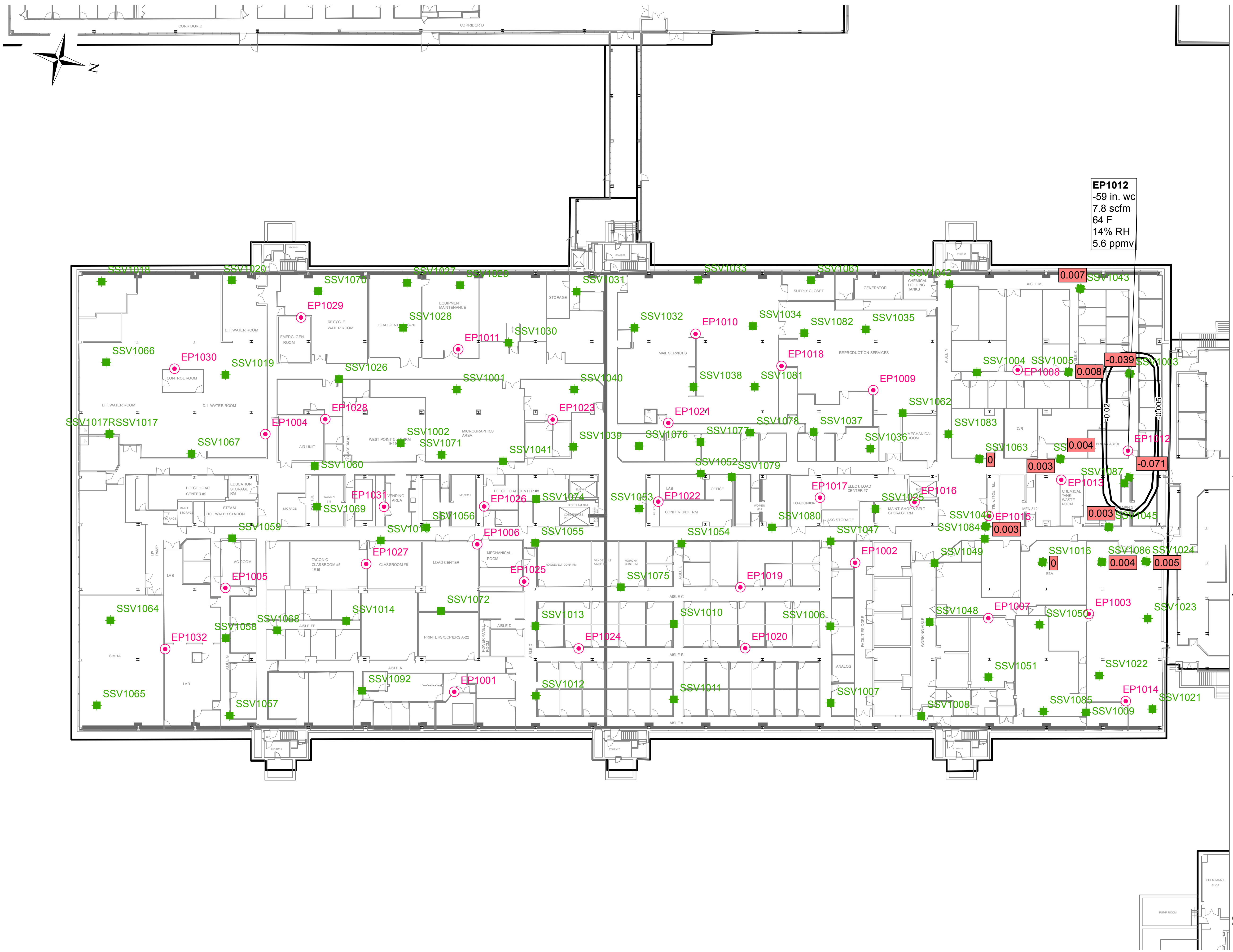

Figure C - 12

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1012

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By: S. Warner
Designed By: S. Warner
Reviewed By: S. Soos/ D. Shea
Project No: 3463.00
Date: May 2013

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 — Subslab Vapor Monitoring Location

EP1001 — Vapor Extraction Port

-0.005 — Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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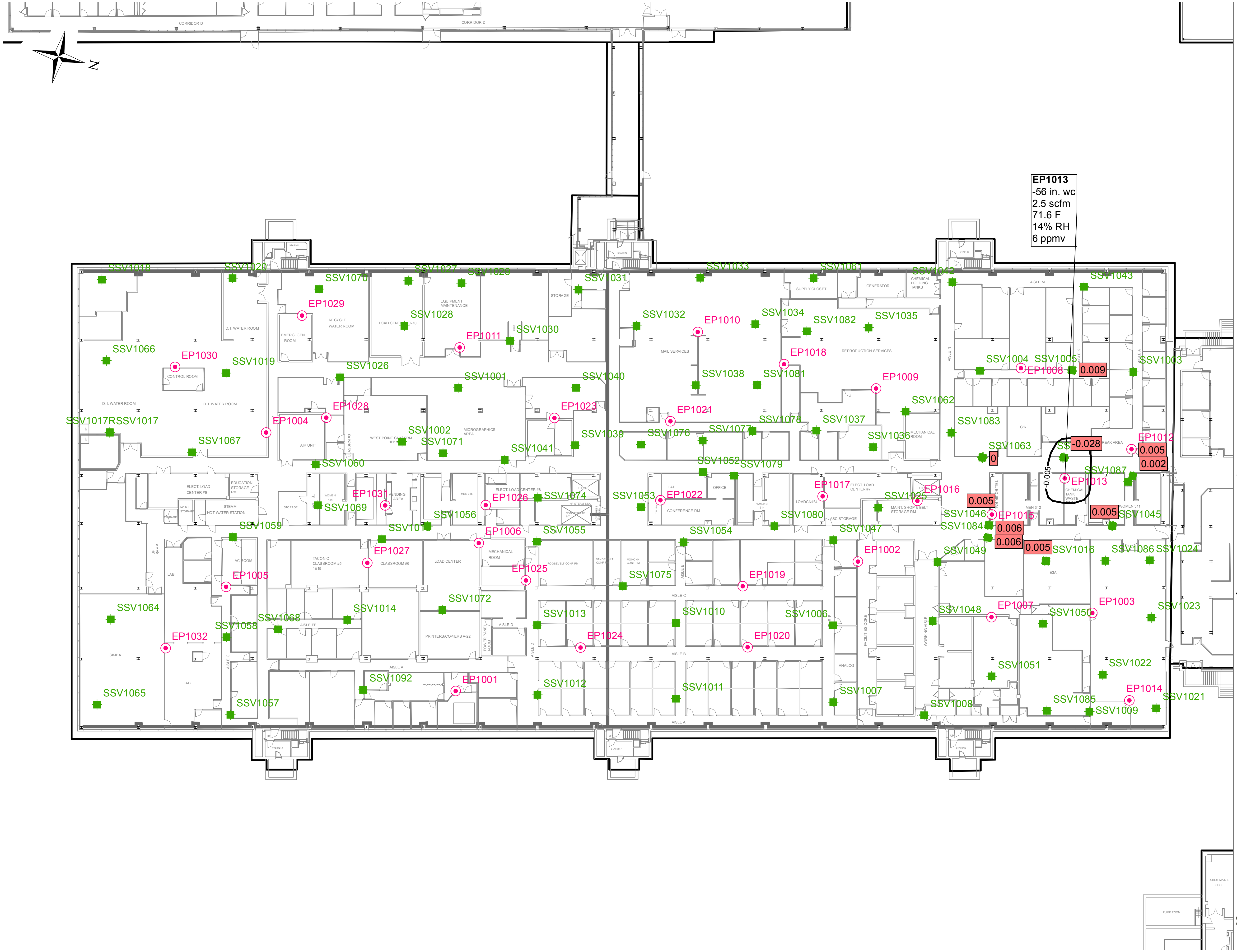

Figure C - 13

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1013

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 — Subslab Vapor Monitoring Location

EP1001 — Vapor Extraction Port

-0.005 — Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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Figure C - 14

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1014

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

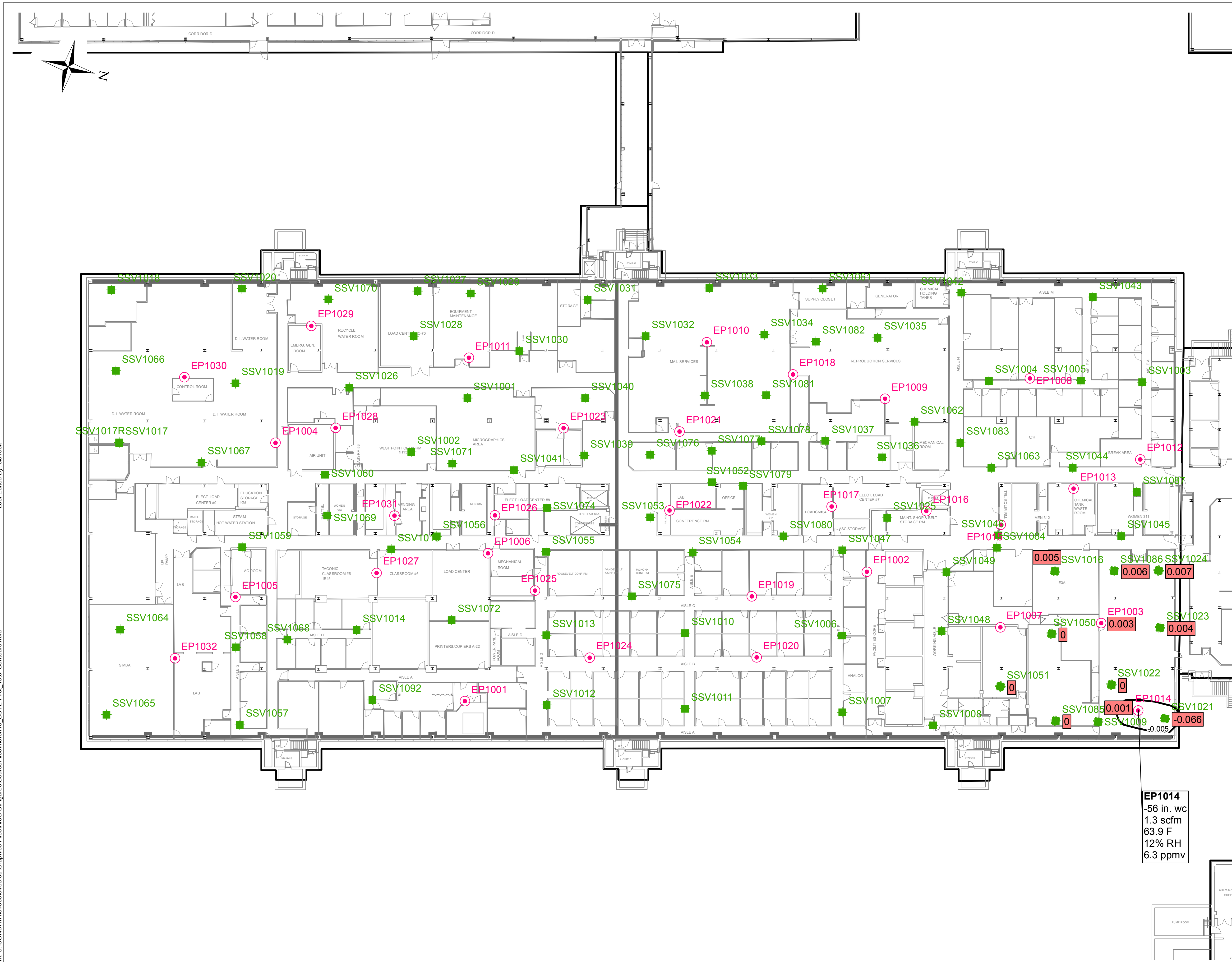

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 — Subslab Vapor Monitoring Location

EP1001 — Vapor Extraction Port

-0.005 — Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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Figure C - 15

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1015

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

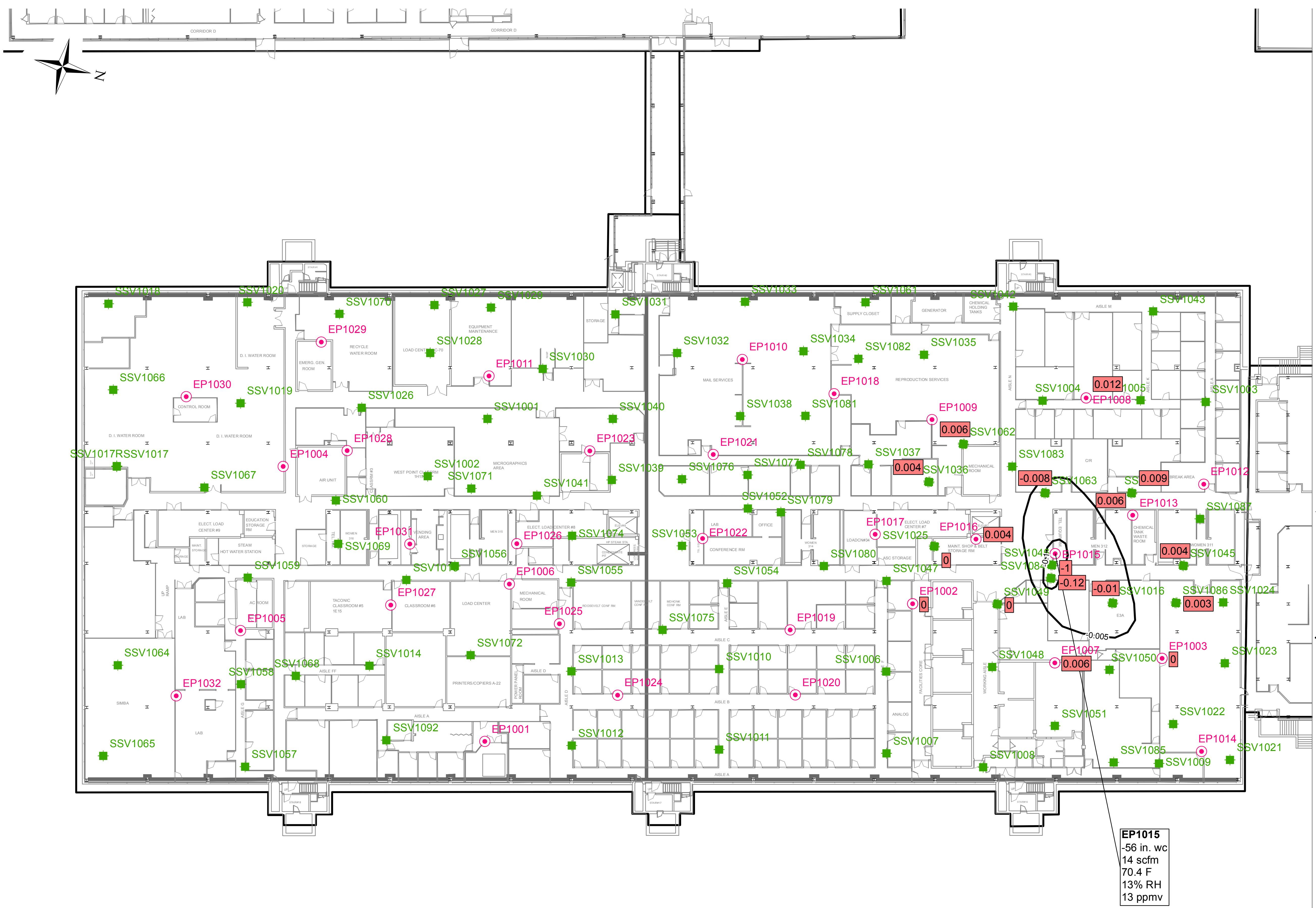

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 Subslab Vapor Monitoring Location

EP1001 Vapor Extraction Port

-0.005 Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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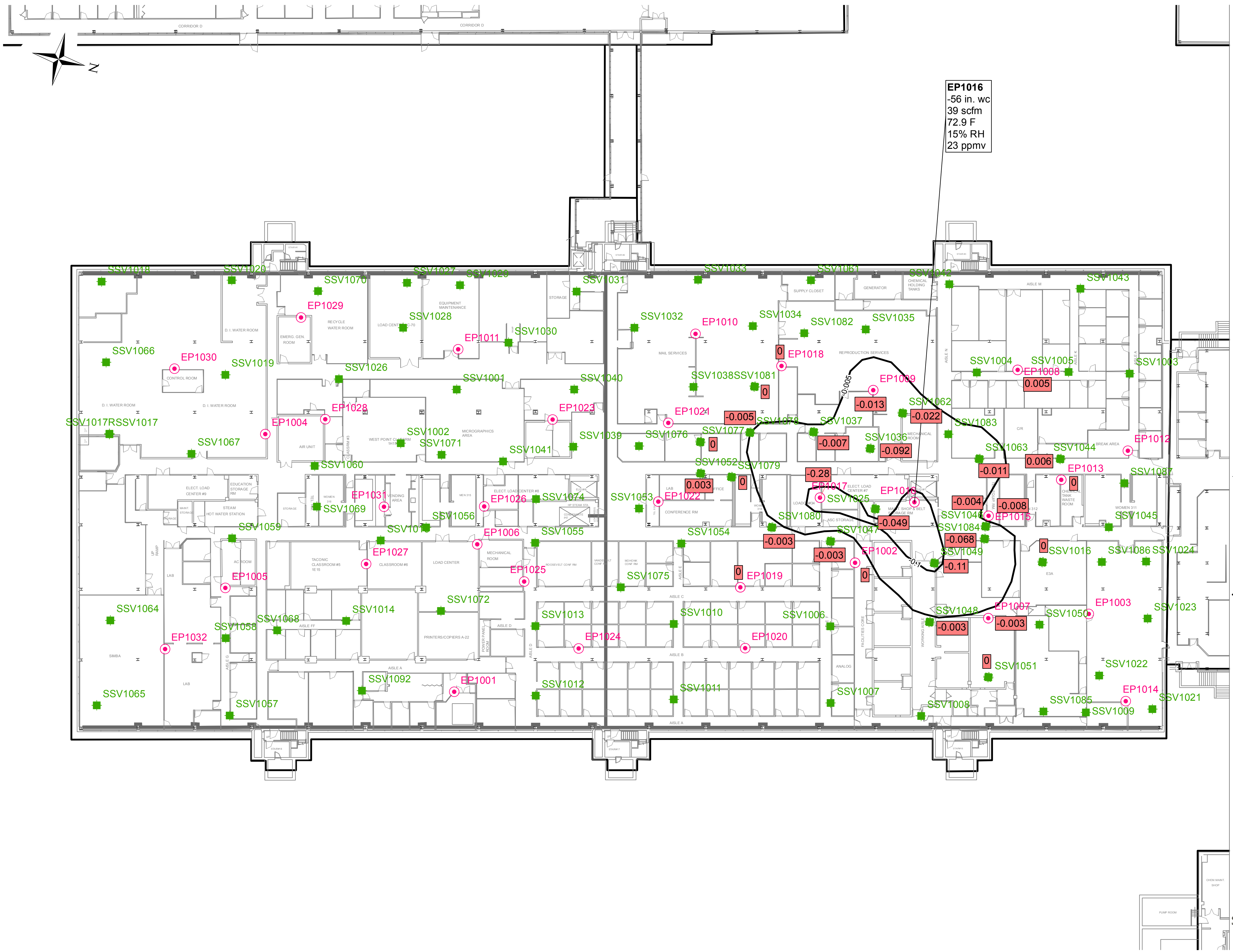

Figure C - 16

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1016

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 — Subslab Vapor Monitoring Location

EP1001 — Vapor Extraction Port

-0.005 — Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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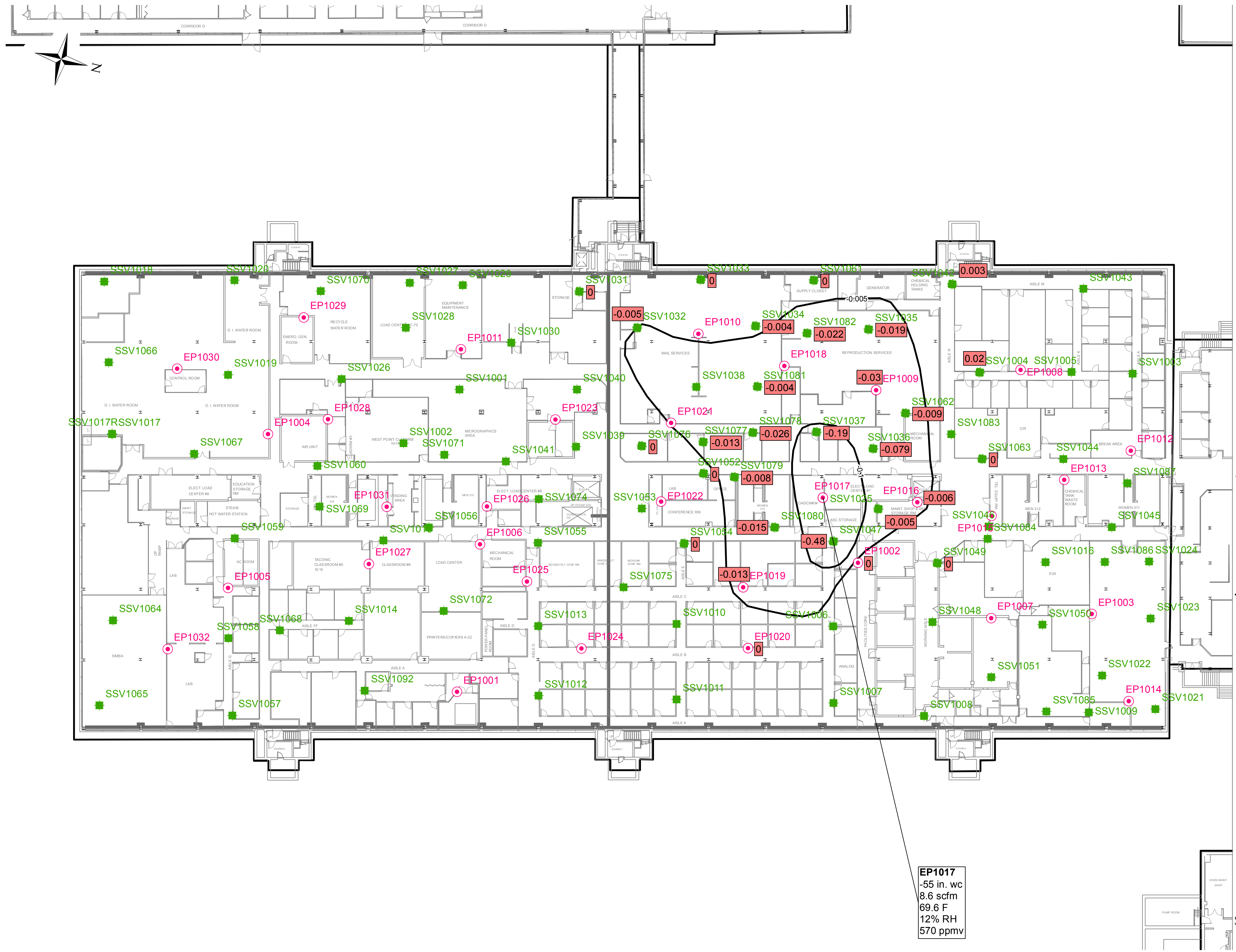

Figure C - 17

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1017

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 — Subslab Vapor Monitoring Location

EP1001 — Vapor Extraction Port

-0.005 — Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

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Figure C - 18

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1018

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

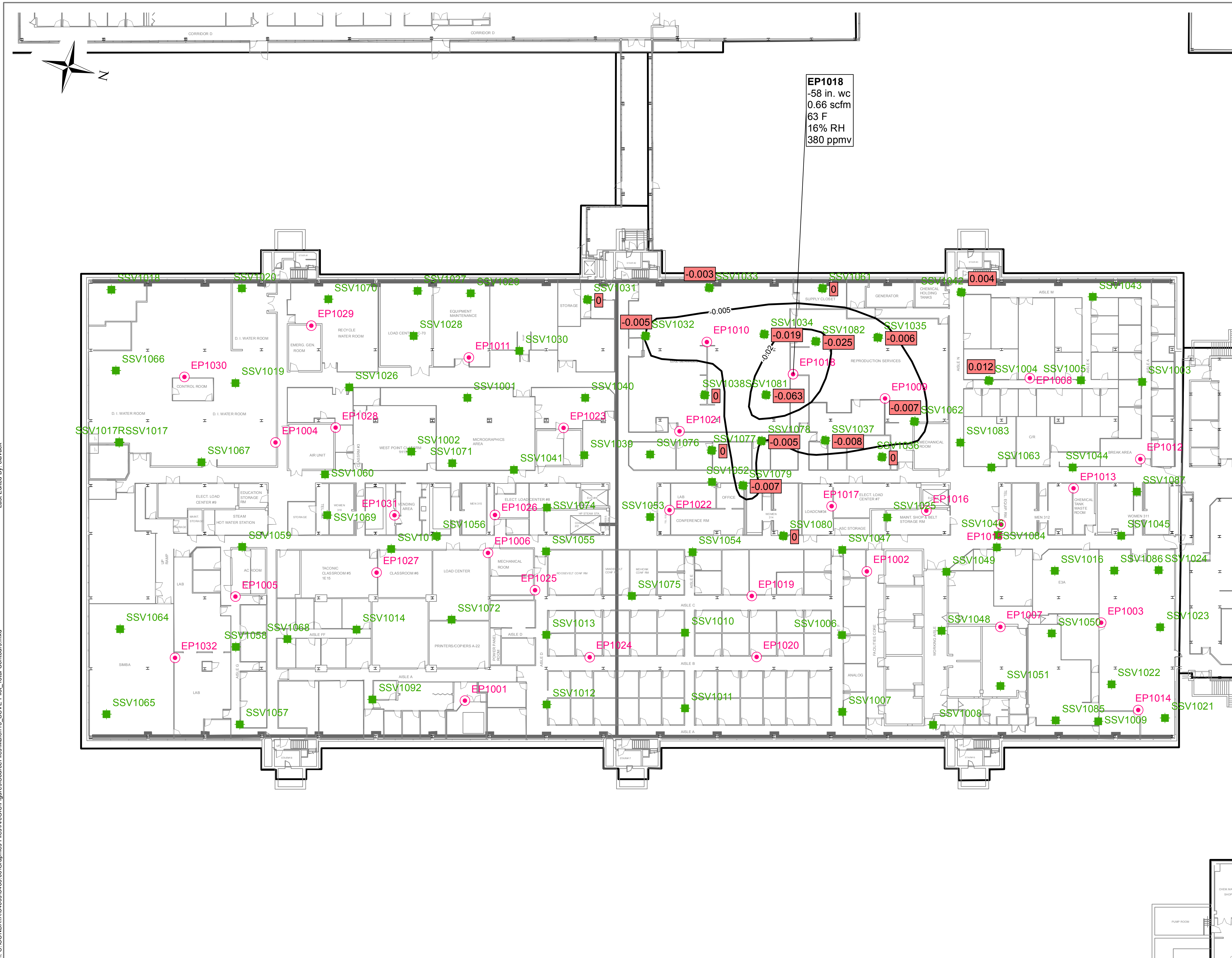

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 Subslab Vapor Monitoring Location

EP1001 Vapor Extraction Port

-0.005 Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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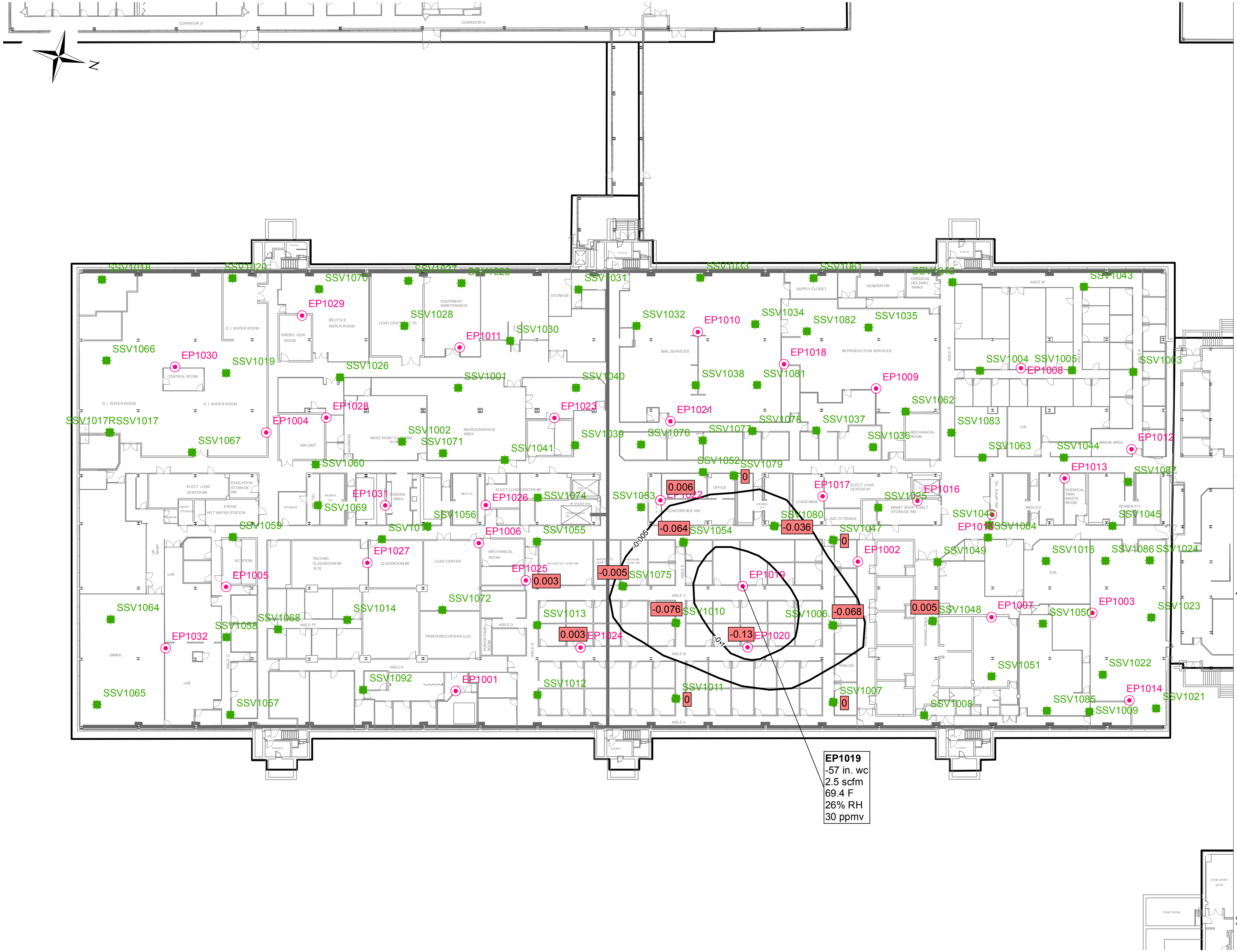

Figure C - 19

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1019

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 — Subslab Vapor Monitoring Location

EP1001 — Vapor Extraction Port

-0.005 — Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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Figure C - 20

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1020

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

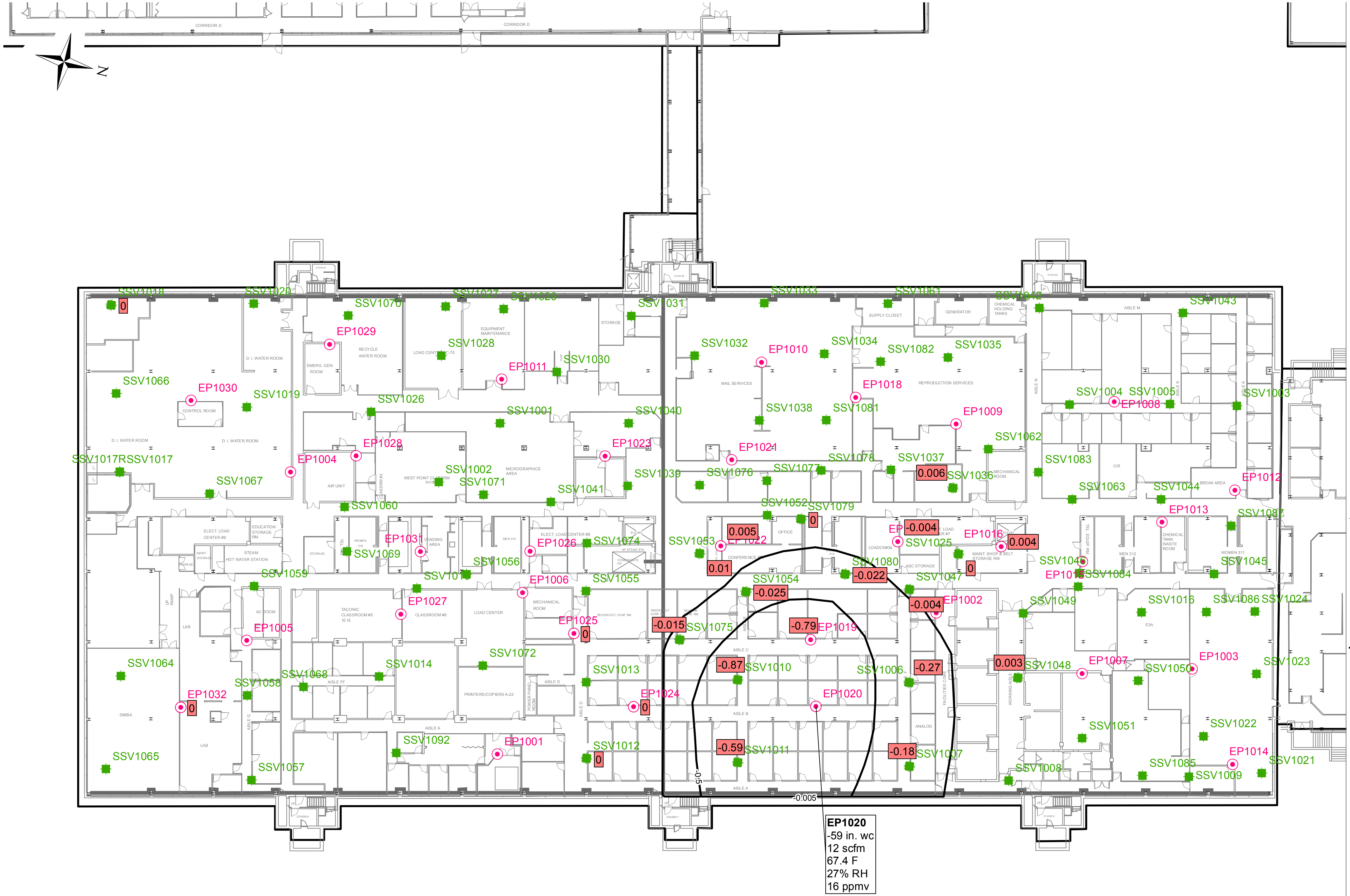

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 — Subslab Vapor Monitoring Location

EP1001 — Vapor Extraction Port

-0.005 — Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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Figure C - 21

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1021

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By: S. Warner
Designed By: S. Warner
Reviewed By: S. Soos/ D. Shea
Project No: 3463.00
Date: May 2013

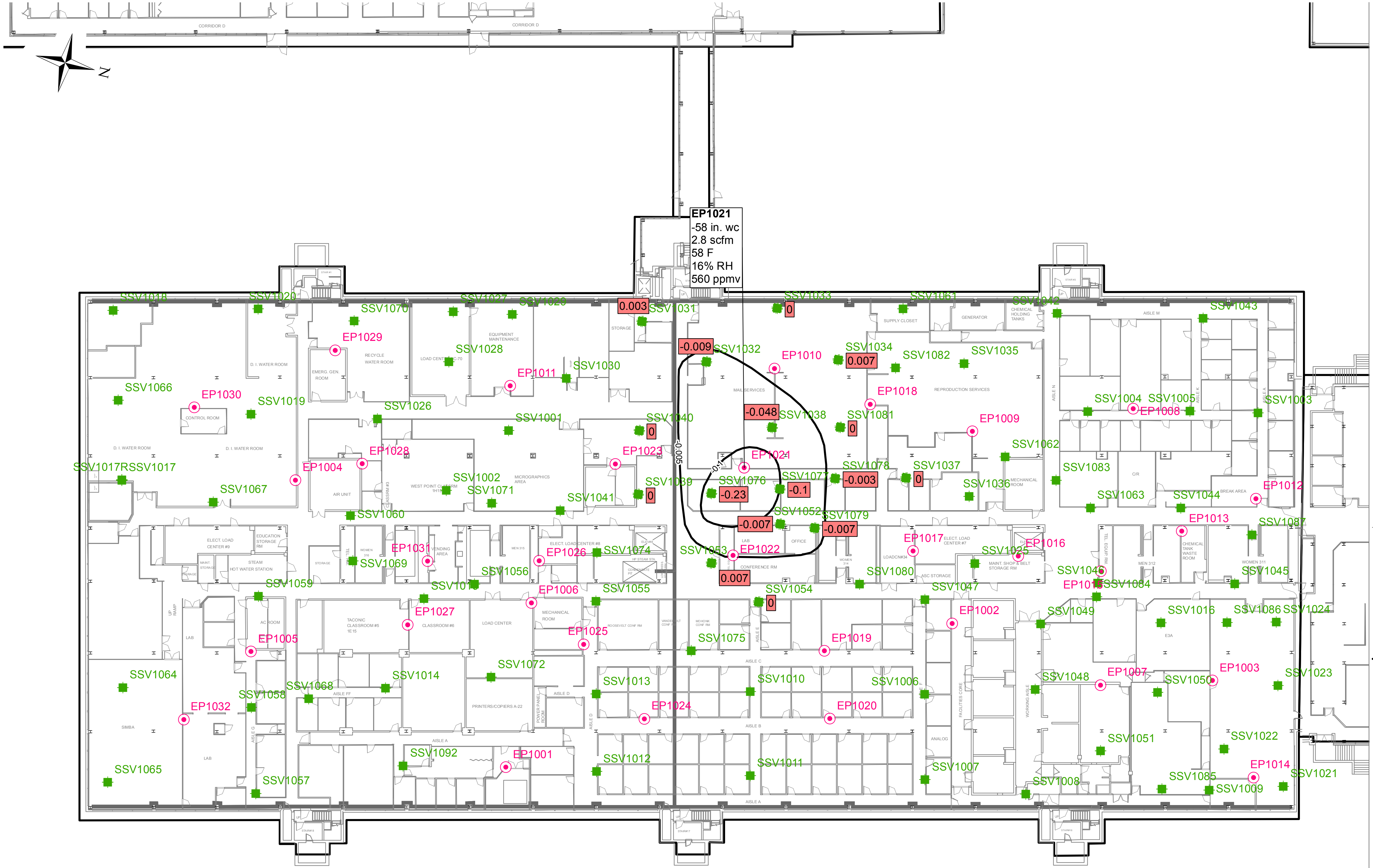

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 — Subslab Vapor Monitoring Location

EP1001 — Vapor Extraction Port

-0.005 — Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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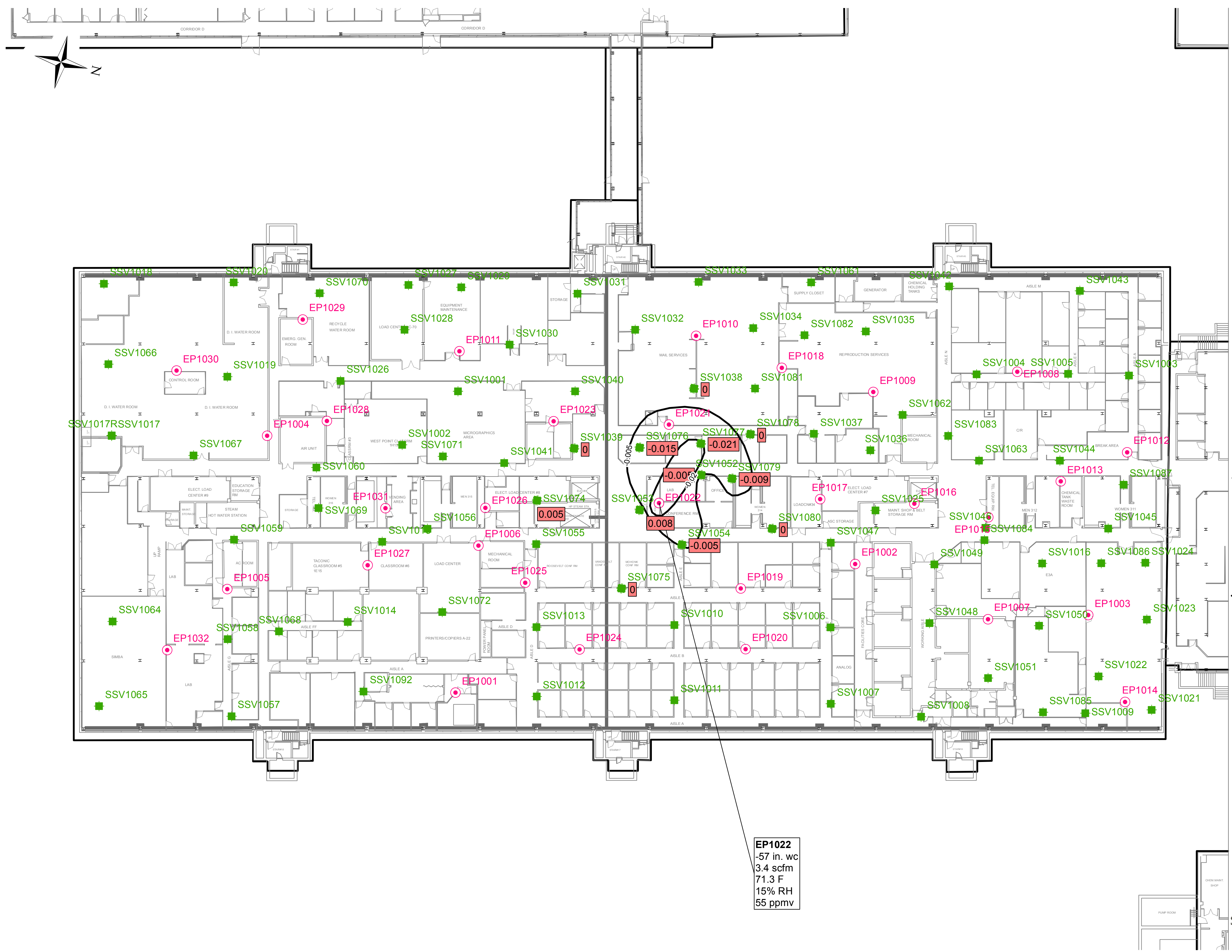

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Figure C - 22

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1022

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 — Subslab Vapor Monitoring Location

EP1001 — Vapor Extraction Port

-0.005 — Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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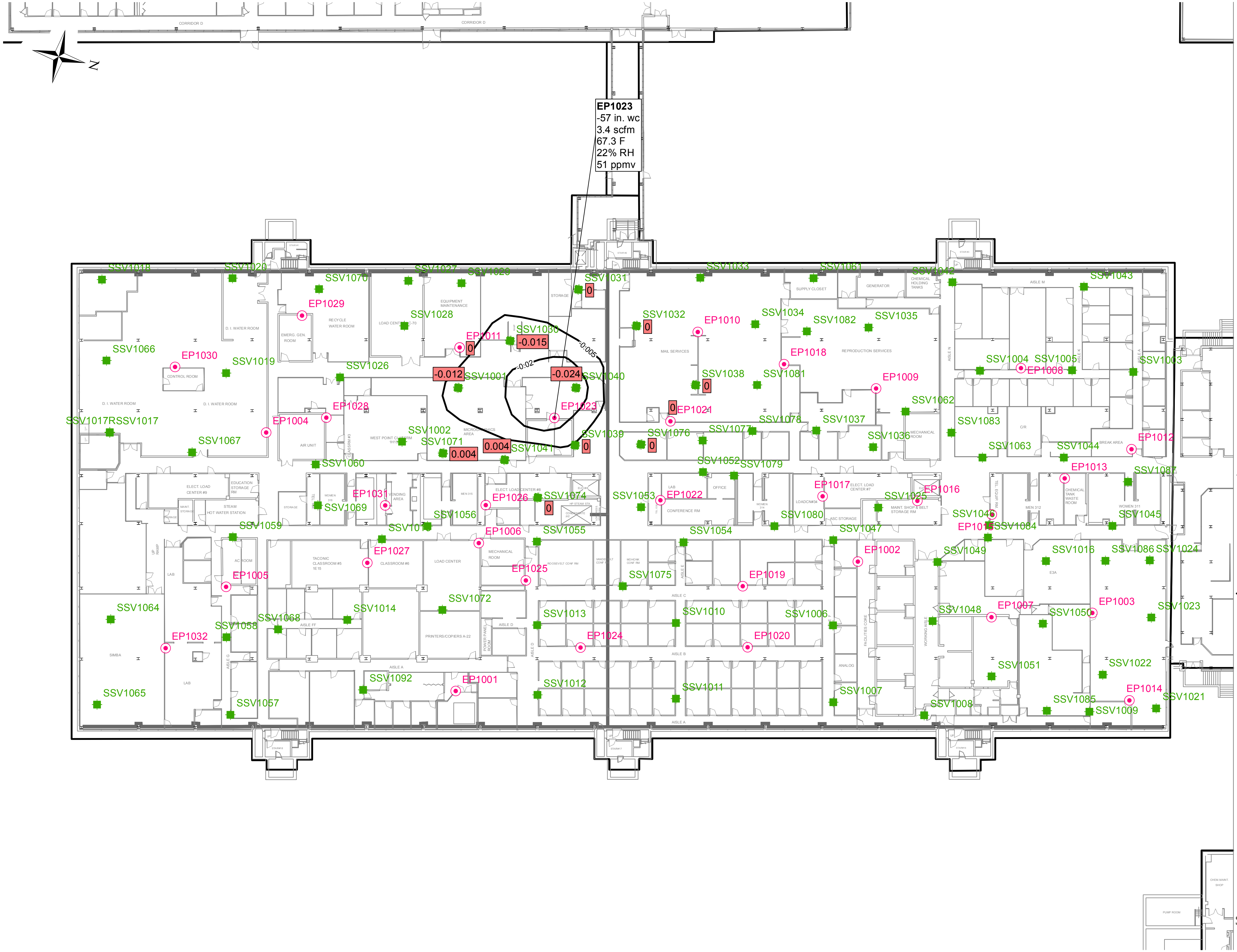

Figure C - 23

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1023

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 Subslab Vapor Monitoring Location

EP1001 Vapor Extraction Port

-0.005 Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

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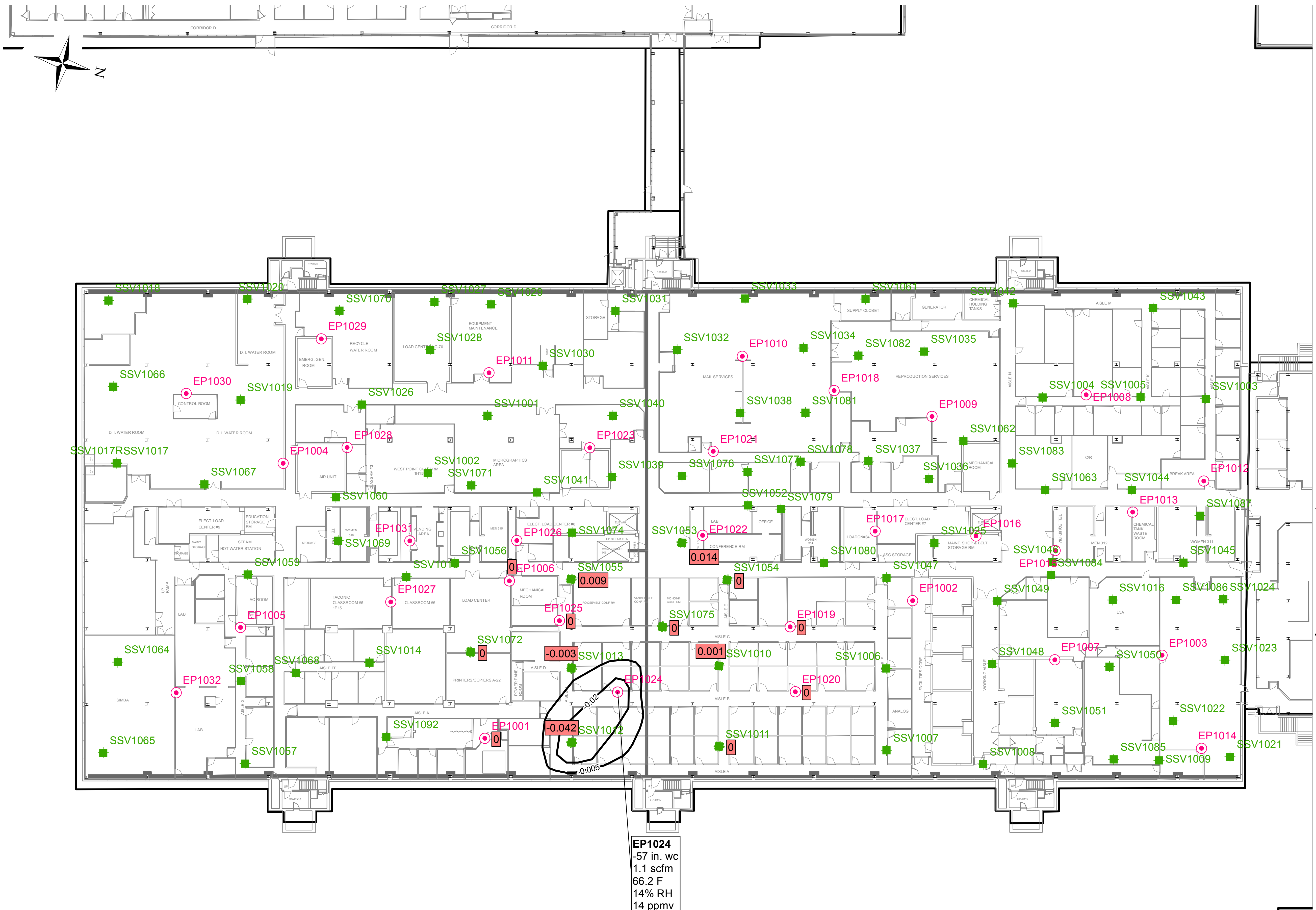

Figure C - 24

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1024

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 Subslab Vapor Monitoring Location

EP1001 Vapor Extraction Port

-0.005 Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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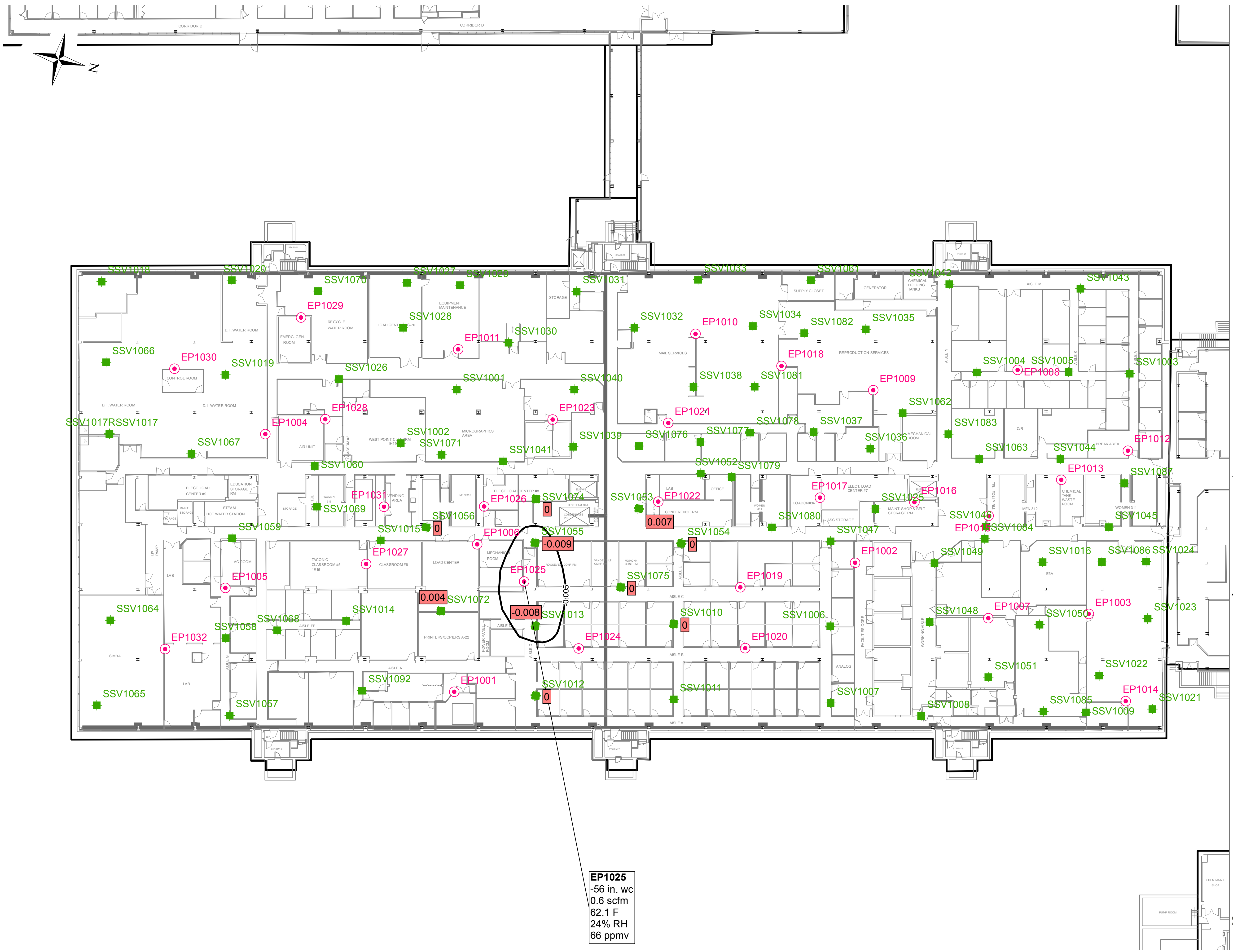

Figure C - 25

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1025

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
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Project No:	3463.00
Date:	May 2013

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 Subslab Vapor Monitoring Location

EP1001 Vapor Extraction Port

-0.005 Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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Figure C - 26

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1026

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

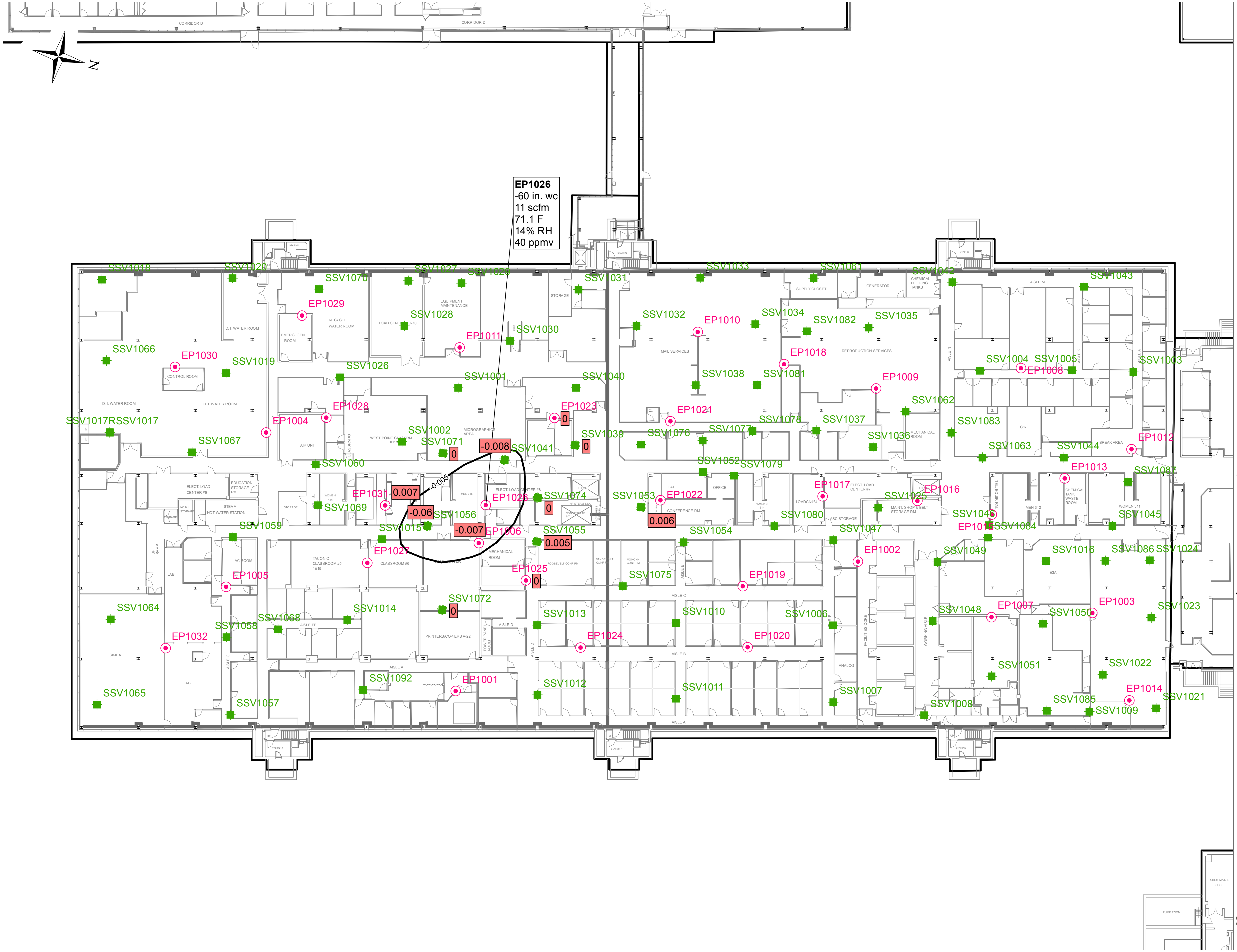

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 Subslab Vapor Monitoring Location

EP1001 Vapor Extraction Port

-0.005 Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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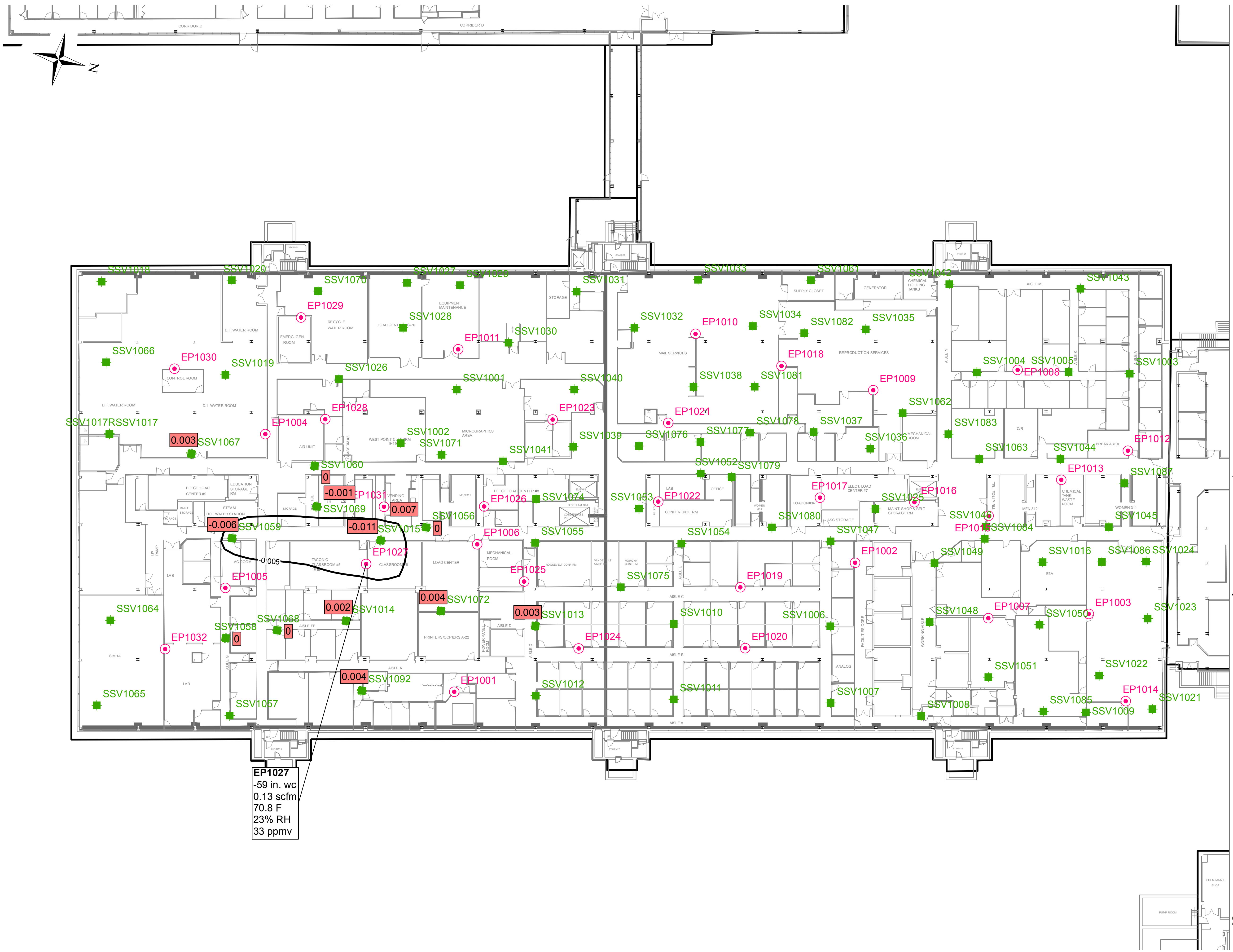

Figure C - 27

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1027

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 Subslab Vapor Monitoring Location

EP1001 Vapor Extraction Port

-0.005 Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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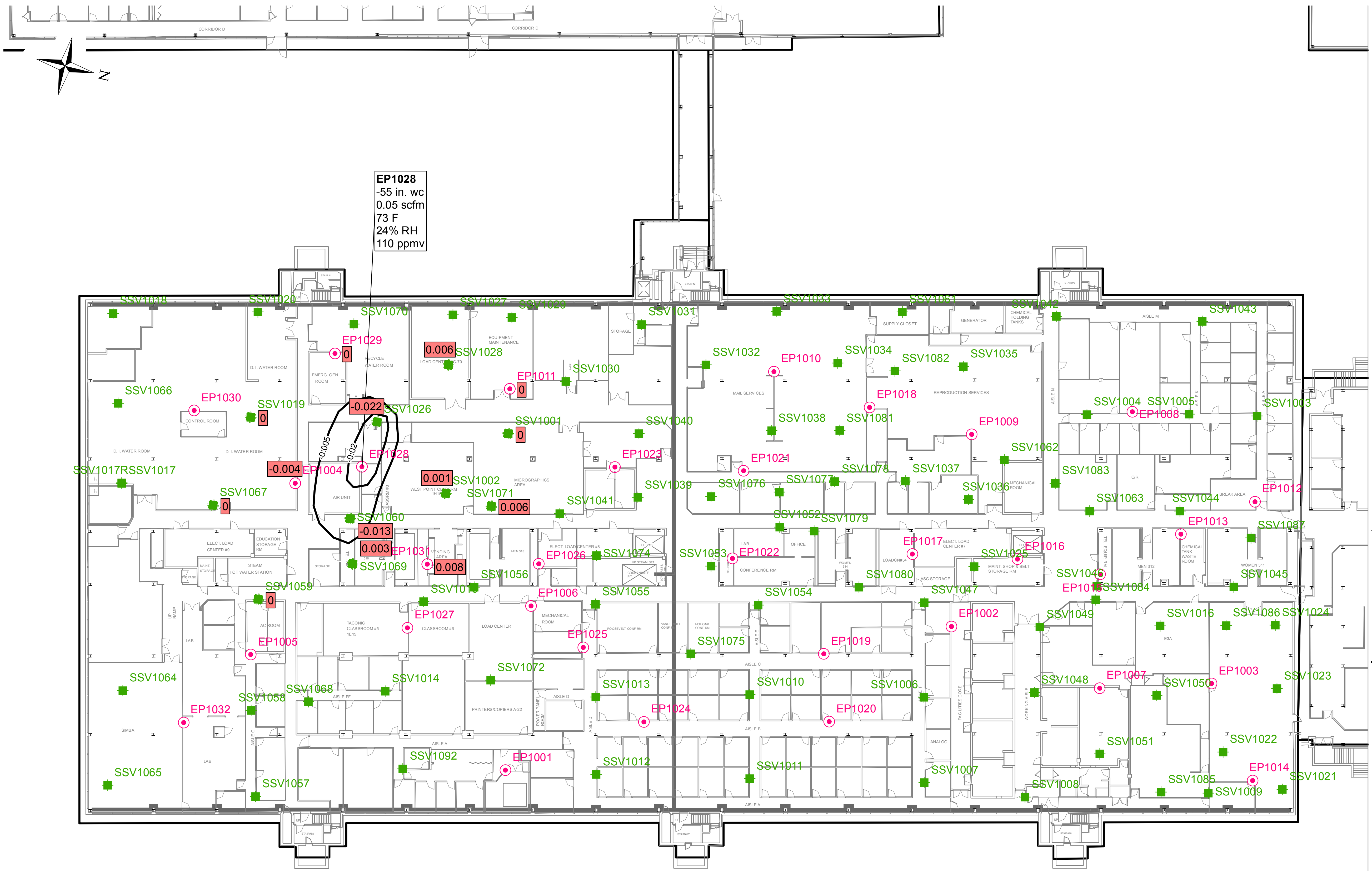

Figure C - 28

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1028

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 Subslab Vapor Monitoring Location

EP1001 Vapor Extraction Port

-0.005 Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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Figure C - 29

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1029

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

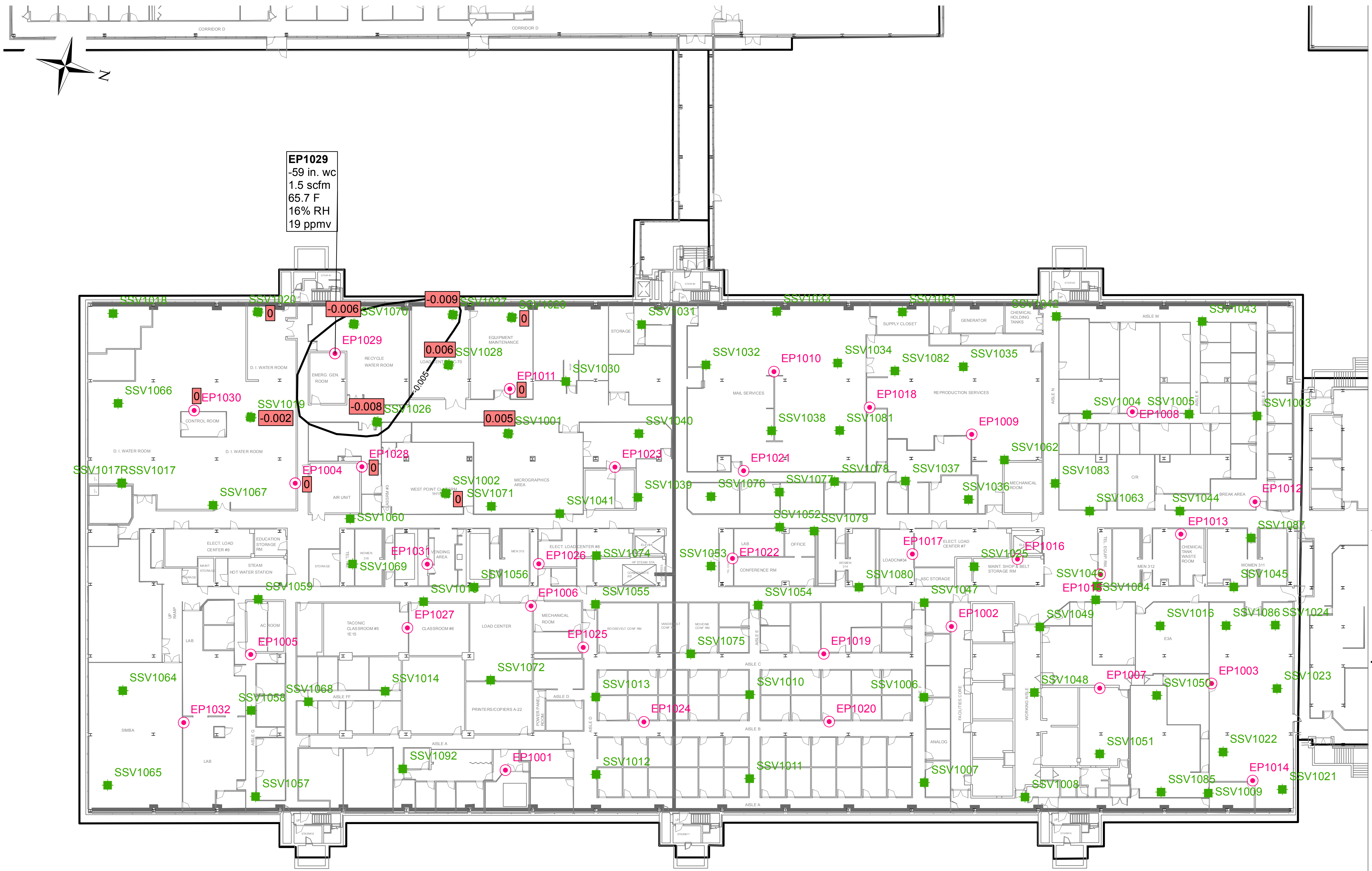

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 Subslab Vapor Monitoring Location

EP1001 Vapor Extraction Port

-0.005 Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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Figure C - 30

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1030

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

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Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

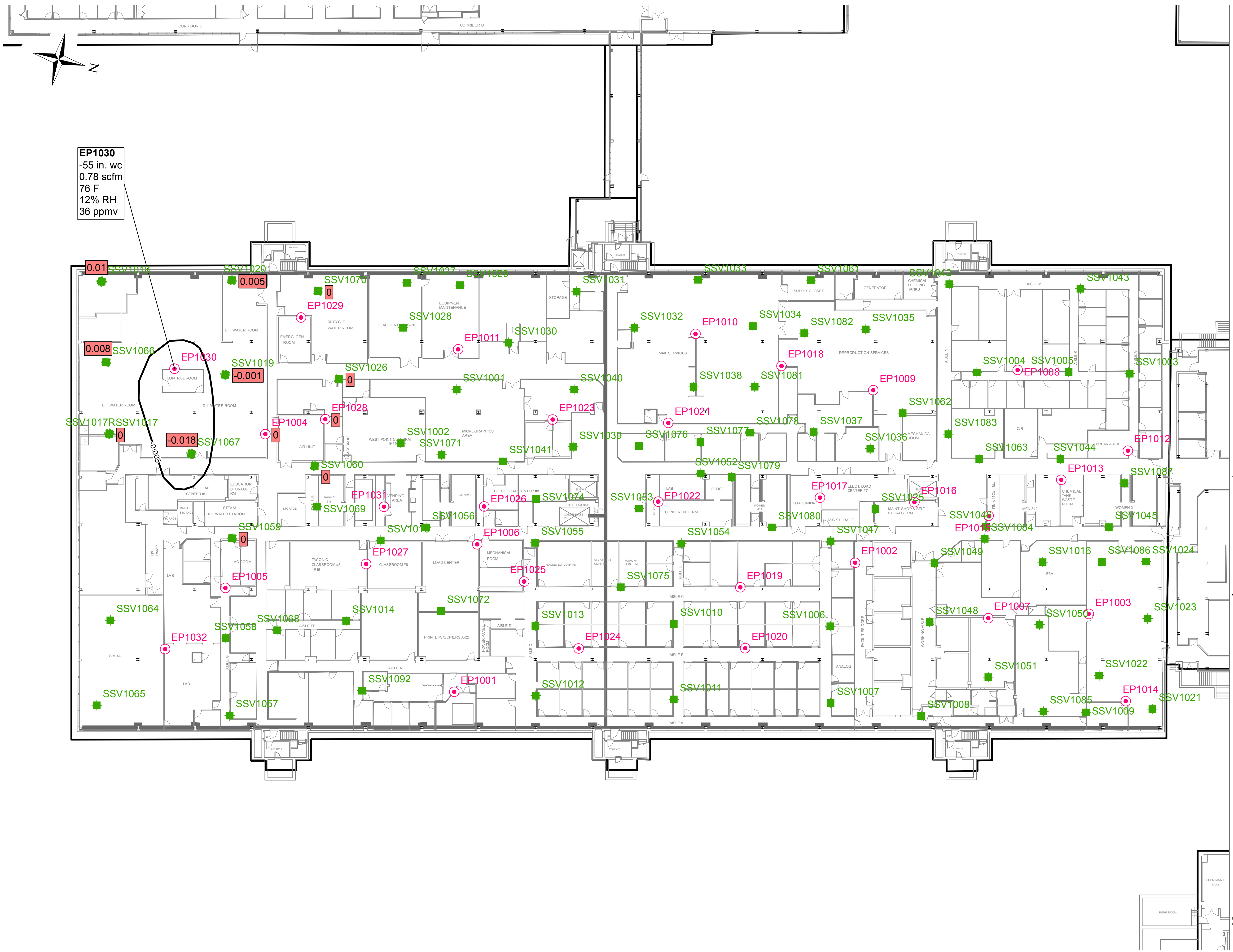

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 Subslab Vapor Monitoring Location

EP1001 Vapor Extraction Port

-0.005 Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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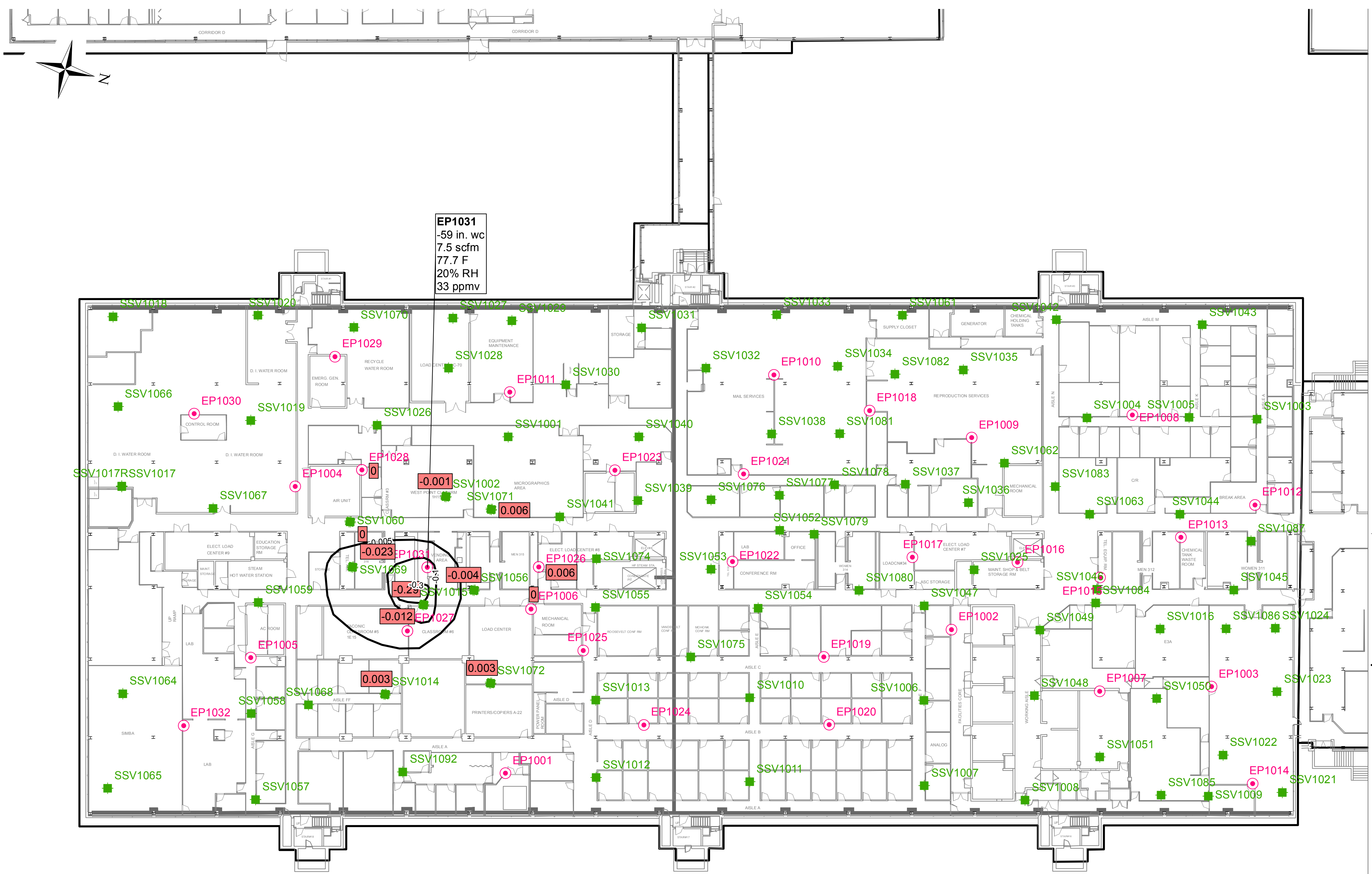

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Figure C - 31

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1031

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 — Subslab Vapor Monitoring Location

EP1001 — Vapor Extraction Port

-0.005 — Differential Pressure Contour (in wc)

EP1001	Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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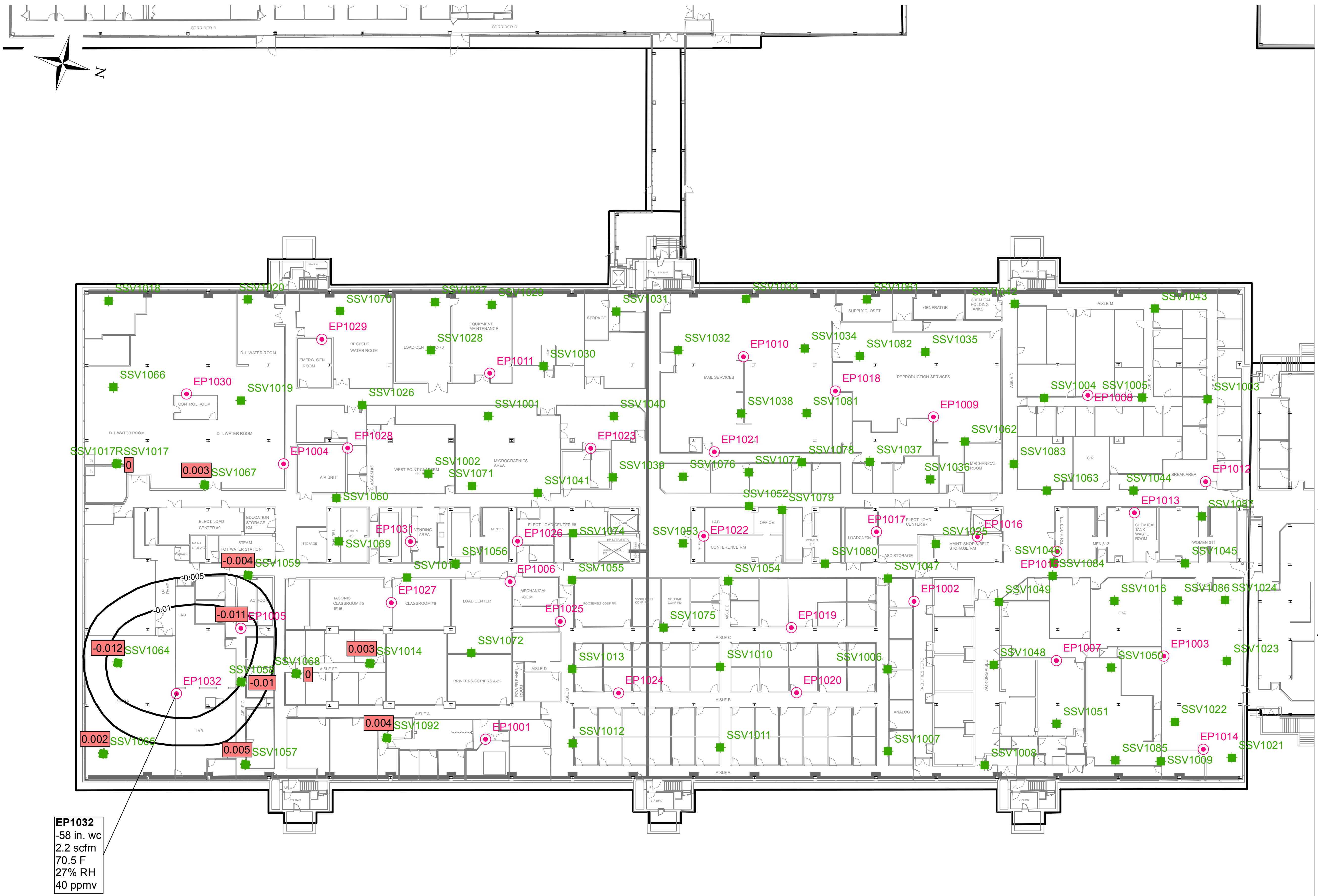

Figure C - 32

Subslab Pressure Response to Vapor Extraction Testing

Vapor Extraction Test EP1032

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	S. Warner
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

Figure Narrative

This figure shows the individual vapor extraction test data and observed subslab pressure response. Subslab pressure was monitored using a digital manometer referenced to the indoor air pressure. Negative values indicate subslab pressure is less than indoor air pressure.

Legend

SSV1001 — Subslab Vapor Monitoring Location

EP1001 — Vapor Extraction Port

-0.005 — Differential Pressure Contour (in wc)

EP1001	
in. wc	Extraction Port Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

20 10 0 20 40
Feet

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Group 2 – Pressure Response from Floor Trench Vapor Extraction

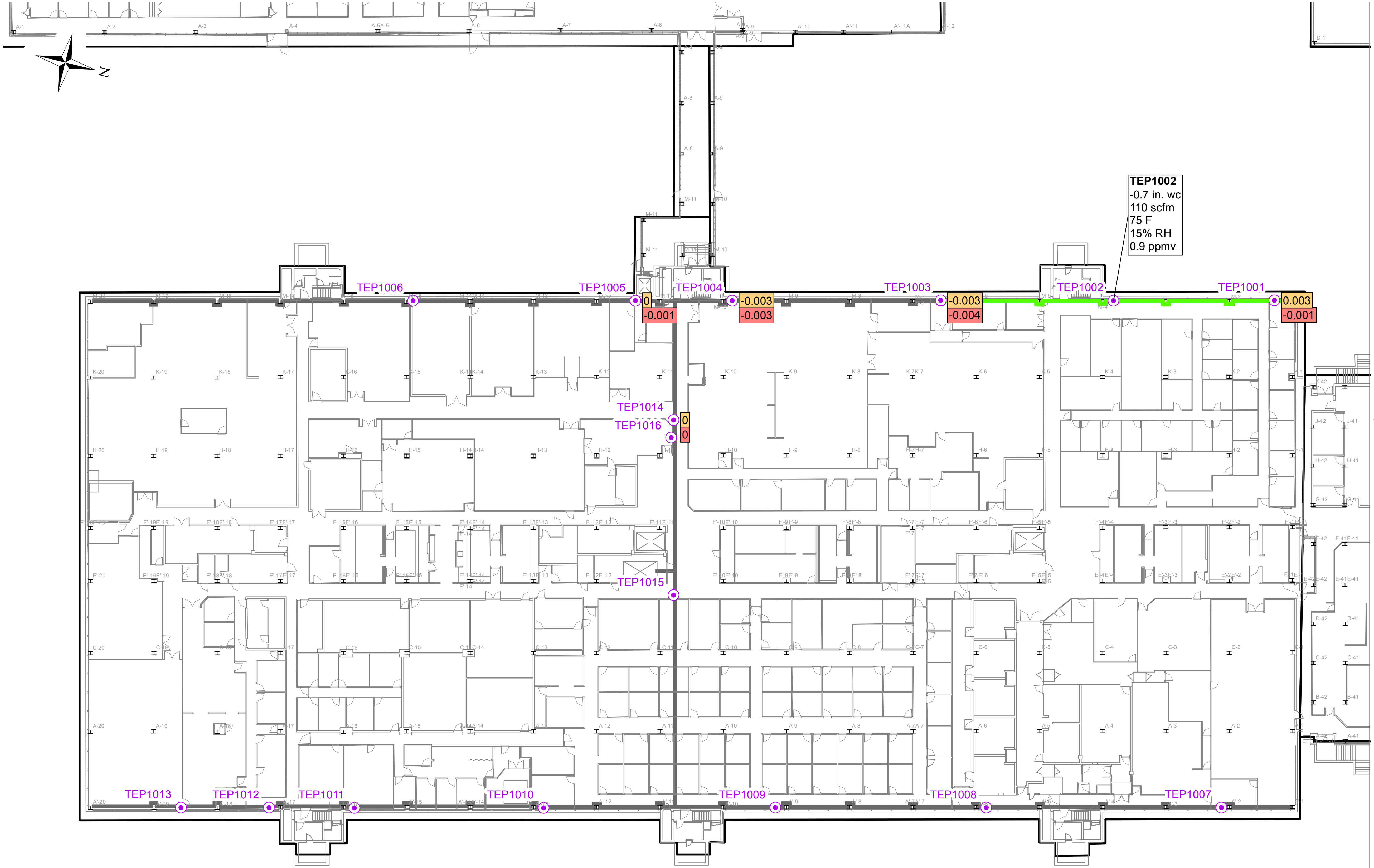

Figure C-33

Pressure Response from Floor Trench Vapor Extraction TEP1002

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	E. Wright
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

Figure Narrative

This figure shows the extraction test data and observed pressure response within the floor trench at the locations indicated. The pressure differential between the trench and indoor air was monitored using a digital manometer referenced to the indoor pressure. Negative values indicate pressure within the trench less than room air pressure. Positive values indicate pressure within the trench greater than room air pressure.

Legend

Existing Sampling Locations

TEP1001 — Trench Extraction Port

Inferred pressure difference in response to vapor extraction based on test observations

TEP1002	Trench Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

0.003 — Observed baseline equilibrium pressure differential (in. water) between the trench and room prior to vapor extraction from trench

-0.005 — Observed equilibrium pressure differential (in. water) between the trench and room during vapor extraction from trench

20 10 0 20 40
Feet

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Figure C-34

Pressure Response from Floor Trench Vapor Extraction TEP1004

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	E. Wright
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

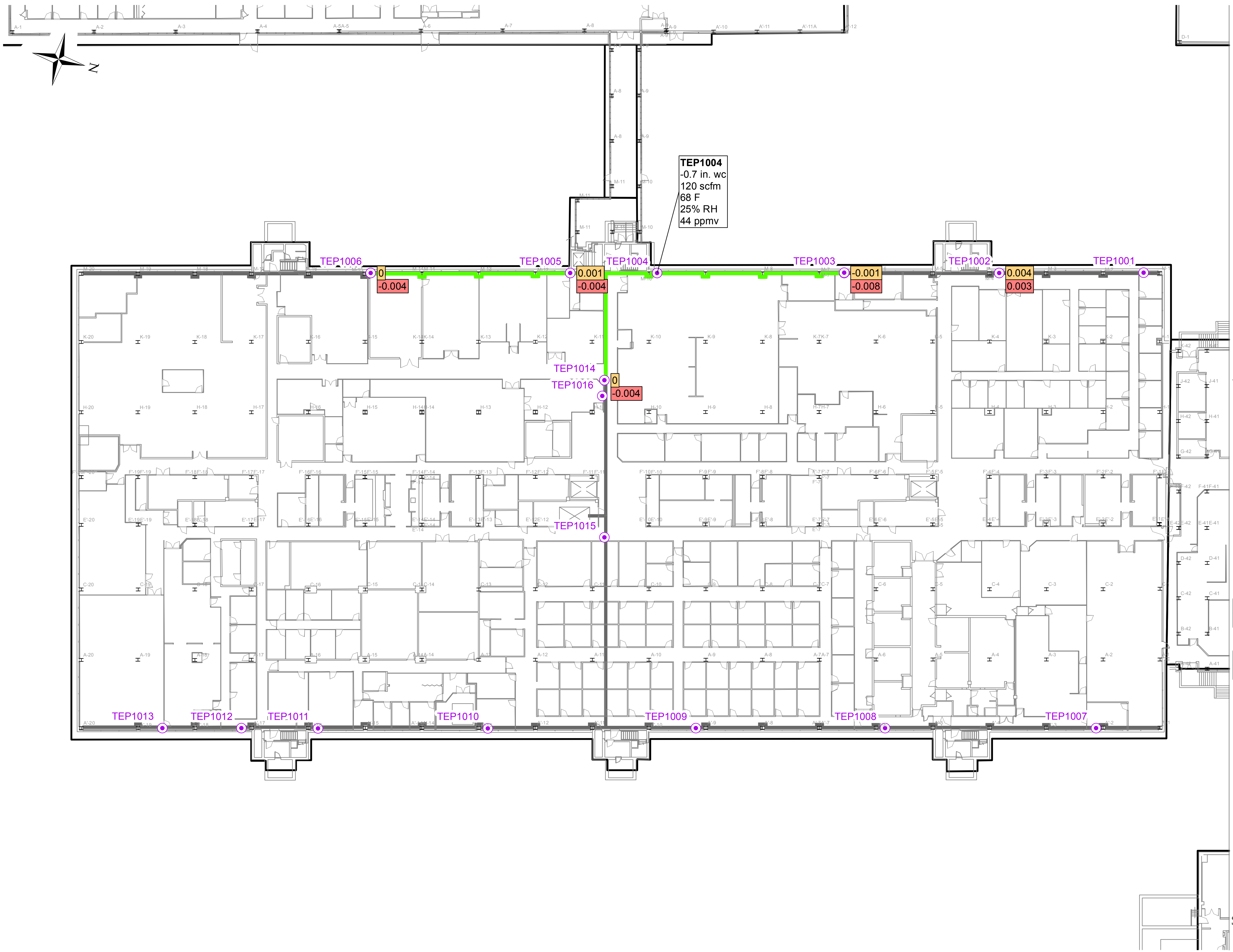

Figure Narrative

This figure shows the extraction test data and observed pressure response within the floor trench at the locations indicated. The pressure differential between the trench and indoor air was monitored using a digital manometer referenced to the indoor pressure. Negative values indicate pressure within the trench less than room air pressure. Positive values indicate pressure within the trench greater than room air pressure.

Legend

Existing Sampling Locations

TEP1001 — Trench Extraction Port

Inferred pressure difference in response to vapor extraction based on test observations

TEP1002	Trench Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

0.003 — Observed baseline equilibrium pressure differential (in. water) between the trench and room prior to vapor extraction from trench

-0.005 — Observed equilibrium pressure differential (in. water) between the trench and room during vapor extraction from trench.

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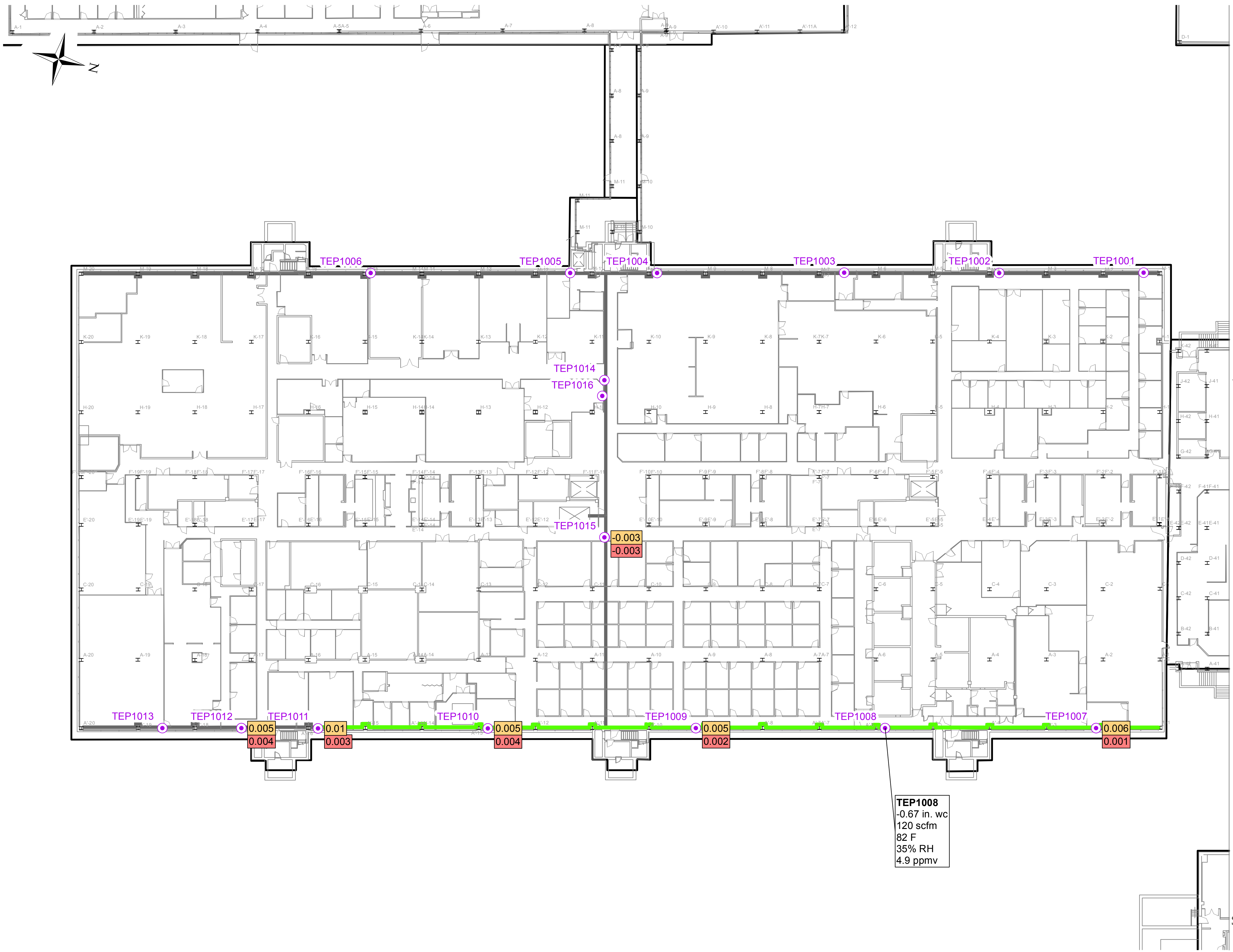

Figure C-35

Pressure Response from Floor Trench Vapor Extraction TEP1008

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	E. Wright
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

Figure Narrative

This figure shows the extraction test data and observed pressure response within the floor trench at the locations indicated. The pressure differential between the trench and indoor air was monitored using a digital manometer referenced to the indoor pressure. Negative values indicate pressure within the trench less than room air pressure. Positive values indicate pressure within the trench greater than room air pressure.

Legend

Existing Sampling Locations

TEP1001 — Trench Extraction Port

Inferred pressure difference in response to vapor extraction based on test observations

TEP1002	Trench Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

0.003 — Observed baseline equilibrium pressure differential (in. water) between the trench and room prior to vapor extraction from trench

-0.005 — Observed equilibrium pressure differential (in. water) between the trench and room during vapor extraction from trench

20 10 0 20 40
Feet

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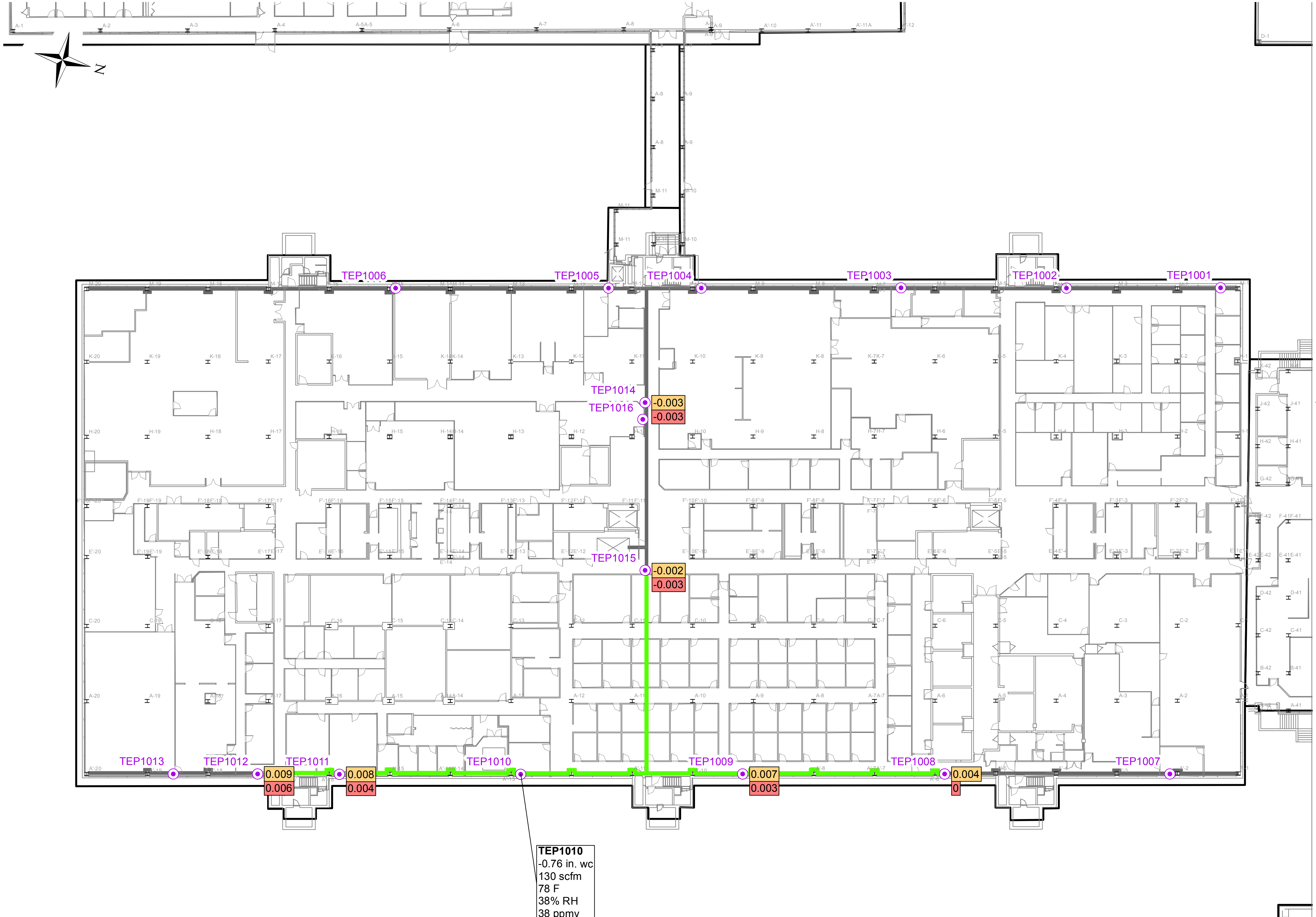

Figure C-36

Pressure Response from Floor Trench Vapor Extraction TEP1010

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By: E. Wright
Designed By: S. Warner
Reviewed By: S. Soos/ D. Shea
Project No: 3463.00
Date: May 2013

Figure Narrative

This figure shows the extraction test data and observed pressure response within the floor trench at the locations indicated. The pressure differential between the trench and indoor air was monitored using a digital manometer referenced to the indoor pressure. Negative values indicate pressure within the trench less than room air pressure. Positive values indicate pressure within the trench greater than room air pressure.

Legend

Existing Sampling Locations

TEP1001 Trench Extraction Port

Inferred pressure difference in response to vapor extraction based on test observations

TEP1002	Trench Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

0.003 — Observed baseline equilibrium pressure differential (in. water) between the trench and room prior to vapor extraction from trench

-0.005 — Observed equilibrium pressure differential (in. water) between the trench and room during vapor extraction from trench

20 10 0 20 40
Feet

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Figure C-37

Pressure Response from Floor Trench Vapor Extraction TEP1011

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By:	E. Wright
Designed By:	S. Warner
Reviewed By:	S. Soos/ D. Shea
Project No:	3463.00
Date:	May 2013

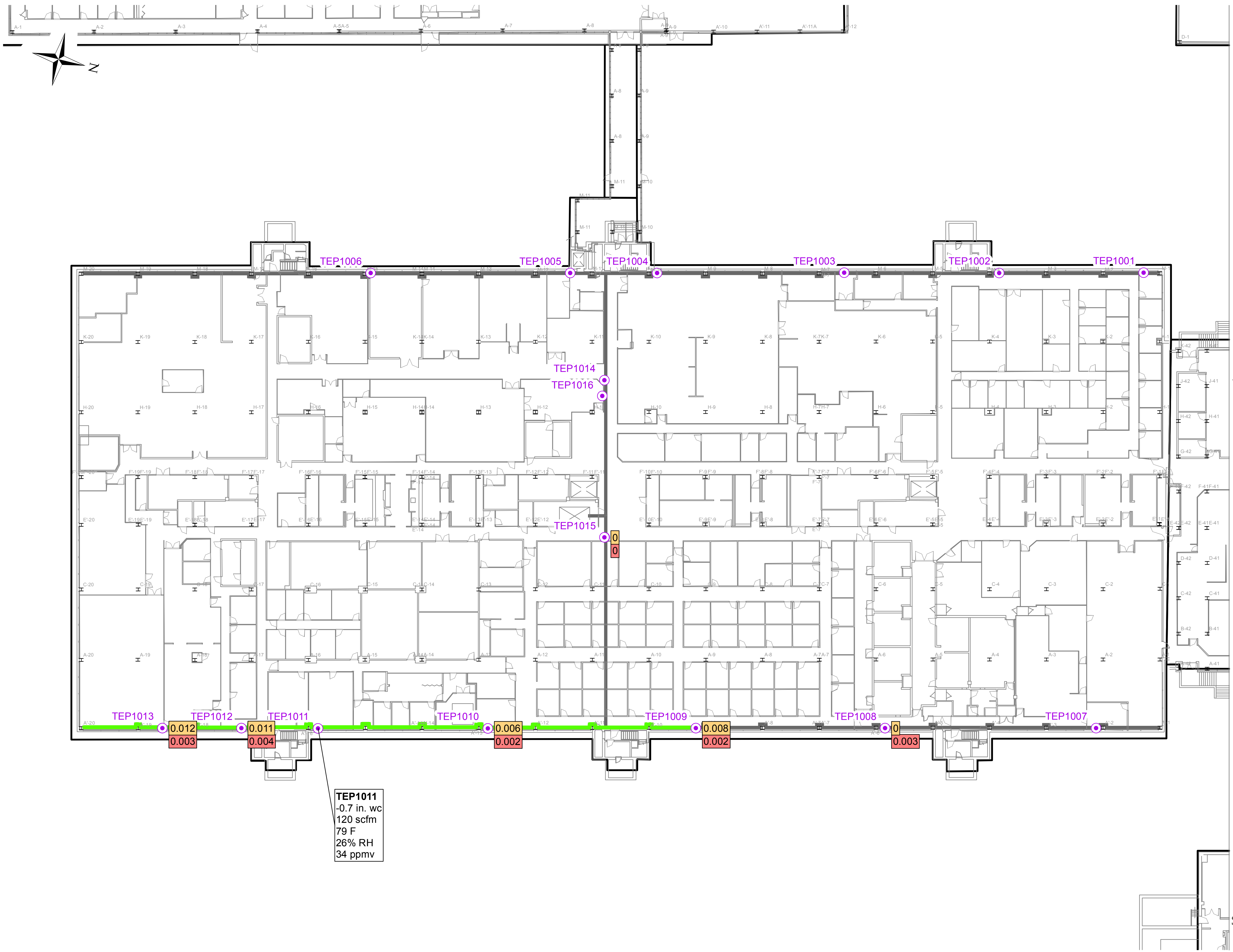

Figure Narrative

This figure shows the extraction test data and observed pressure response within the floor trench at the locations indicated. The pressure differential between the trench and indoor air was monitored using a digital manometer referenced to the indoor pressure. Negative values indicate pressure within the trench less than room air pressure. Positive values indicate pressure within the trench greater than room air pressure.

Legend

Existing Sampling Locations

TEP1001 — Trench Extraction Port

Inferred pressure difference in response to vapor extraction based on test observations

TEP1002	Trench Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

0.003 — Observed baseline equilibrium pressure differential (in. water) between the trench and room prior to vapor extraction from trench

-0.005 — Observed equilibrium pressure differential (in. water) between the trench and room during vapor extraction from trench

20 10 0 20 40
Feet

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Figure C-38

Pressure Response from Floor Trench Vapor Extraction TEP1014

Report of Findings
Building 003 VOC Source Assessment

IBM Poughkeepsie Facility
Poughkeepsie, New York

Drawn By: E. Wright
Designed By: S. Warner
Reviewed By: S. Soos/ D. Shea
Project No: 3463.00
Date: May 2013

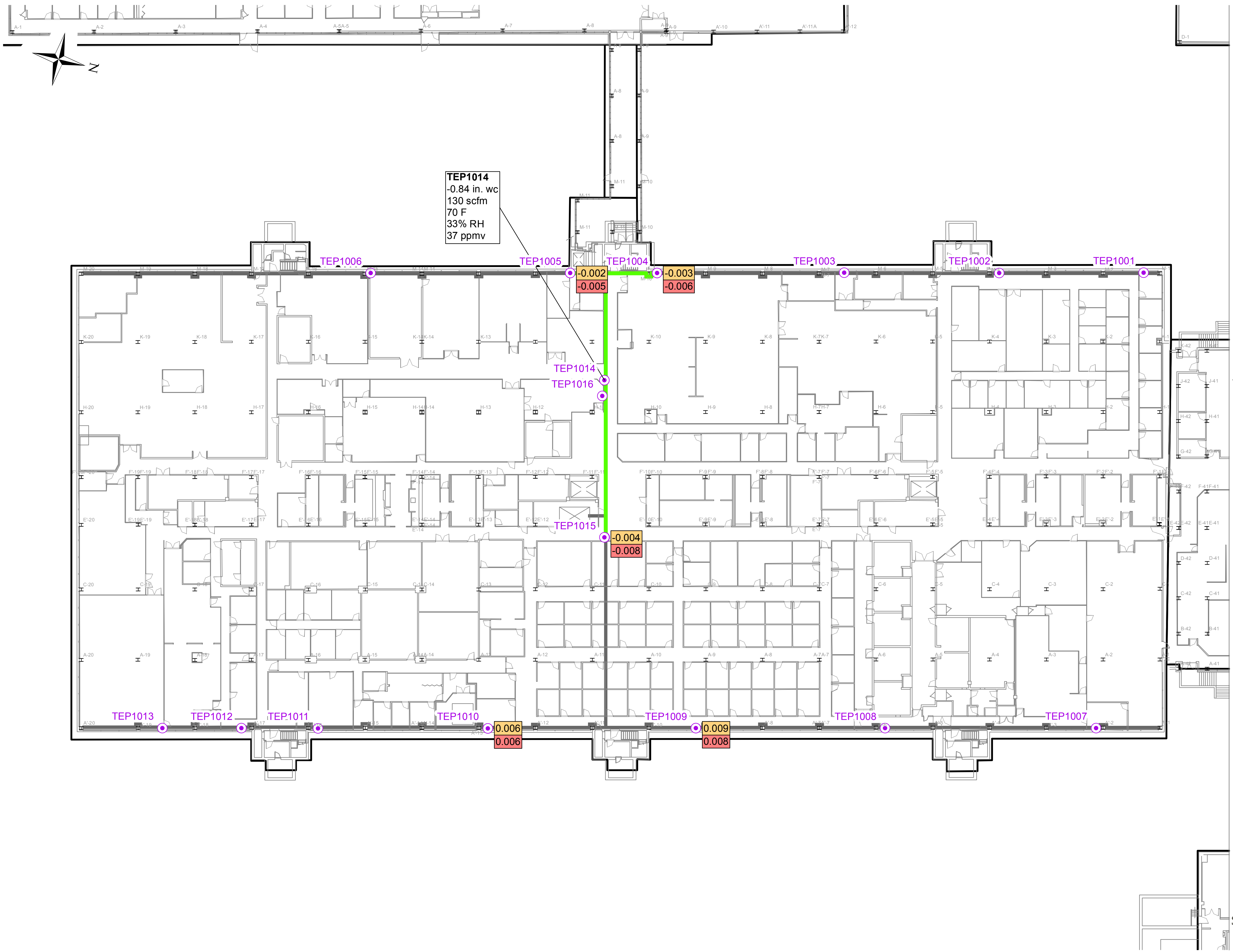

Figure Narrative

This figure shows the extraction test data and observed pressure response within the floor trench at the locations indicated. The pressure differential between the trench and indoor air was monitored using a digital manometer referenced to the indoor pressure. Negative values indicate pressure within the trench less than room air pressure. Positive values indicate pressure within the trench greater than room air pressure.

Legend

Existing Sampling Locations

TEP1001 — Trench Extraction Port

Inferred pressure difference in response to vapor extraction based on test observations

TEP1002	Trench Extraction Port
in. wc	Vacuum (extraction port)
scfm	Flow Rate (std. cu. ft. per min.)
F	Temperature
% RH	Relative Humidity
ppmv	PID Concentration

0.003 — Observed baseline equilibrium pressure differential (in. water) between the trench and room prior to vapor extraction from trench

-0.005 — Observed equilibrium pressure differential (in. water) between the trench and room during vapor extraction from trench.

20 10 0 20 40
Feet

SANBORN HEAD ENGINEERING

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APPENDIX D

LABORATORY ANALYTICAL REPORTS

(LOCATED ON ENCLOSED CD)

APPENDIX E

DATA VALIDATION REPORT

In- Depth Data Usability Review
Method TO-15 SIM Analysis

Client: Sanborn, Head & Associates, Inc., Concord, New Hampshire (SHA)

Site: IBM Poughkeepsie Facility, Poughkeepsie, New York

Laboratory: Alpha Analytical, Mansfield, Massachusetts

SDG: L1221714

Date(s) of Collection: November 29, 2012

Number and type Samples & analyses: 11 Indoor Air, 1 Ambient Air, and 1 Field Blank sample for eight project-specific VOCs by Method TO-15 SIM

Senior Data Reviewers: Dr. Nancy C. Rothman, New Environmental Horizons, Inc.
Susan D. Chapnick, New Environmental Horizons, Inc.

Date Completed: December 26, 2012

An In-Depth Data Usability Review (DUR) was performed on the Work Orders identified with the following intentions: 1) to determine if the data were generated and reported in accordance with the *RFI Work Plan, VOC Source Assessment, IBM Poughkeepsie Facility, Poughkeepsie, New York*, prepared by Sanborn, Head & Associates, October 2012; NYSDEC Analytical Services Protocol, June 2005 with NYSDEC Modifications to the EPA Region 9 TO-15 QA/QC Criteria, February 2008; 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; 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; 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; and *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*; Publication USEPA540/R-07/003, July 2007; 2) to determine if the data met project data quality objectives for acceptable accuracy, precision, sensitivity; and technical usability; and 3) to update the project database with appropriate data quality qualifiers.

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I. Sample Descriptions and Analytical Parameters

The sample IDs, date of sampling, identification of quality control (QC) samples, if applicable, and the analytical parameters reviewed in this In-Depth data usability review are listed in Table 1. Any deviations noted for sample collection or receipt (*e.g.*, temperature or preservation issues) are included in Section III, below.

Table 1. Sample Descriptions and Analytical Parameters

Sample ID	Lab Sample ID	Collection Date	Matrix	Analytical Parameters	Sample Type
IA1001	L1221714-01	11/29/12	Indoor Air	VOCs	Field Sample [used for Laboratory Duplicate]
IA1012	L1221714-02	11/29/12	Indoor Air	VOCs	Field Sample
IA1018	L1221714-03	11/29/12	Indoor Air	VOCs	Field Sample
IA1030	L1221714-04	11/29/12	Indoor Air	VOCs	Field Sample
IA1034	L1221714-05	11/29/12	Indoor Air	VOCs	Field Sample
IA1061	L1221714-06	11/29/12	Indoor Air	VOCs	Field Sample
IA1062	L1221714-07	11/29/12	Indoor Air	VOCs	Field Sample
IA1063	L1221714-08	11/29/12	Indoor Air	VOCs	Field Sample
IA1064	L1221714-09	11/29/12	Indoor Air	VOCs	Field Sample
IA1065	L1221714-10	11/29/12	Indoor Air	VOCs	Field Sample
AA1001	L1221714-11	11/29/12	Ambient Air	VOCs	Field Sample
DUP1	L1221714-12	11/29/12	Indoor Air	VOCs	Field Duplicate of IA1018
FB1	L1221714-13	11/29/12	Air	VOCs	Field Equipment Blank

Analytical method references:
VOC: Method TO-15 with Selected Ion Monitoring (SIM) analysis for eight project-specific VOCs

II. Data Deficiencies, Analytical Protocol Deviations, and Quality Control Problems

The following QC elements, as applicable to the analytical methods, were reviewed during this validation:

- Data package completeness and reporting protocols
- Sample receipt, holding times, and canister condition
- Calibration criteria (instrument tuning, initial and continuing calibration verifications)
- Method and field blank results
- Laboratory Control Sample (LCS) recoveries
- Internal Standard (IS) Recoveries
- Sample/Laboratory Duplicate (LD) or sample/Field Duplicate (FD) Relative Percent Differences (RPDs)
- Sample result reporting (including reporting limits and units)
- Other method-specific QC if applicable and reported
- Deficiencies or protocol deviations as noted in the Laboratory Narrative

During this review of VOCs, several results were estimated (J, UJ, or EB) due to QC issues. Table 2 summarizes the actions taken during this review. NEH generated a validated data spreadsheet based on the electronic project database file (EDD) received from Alpha for this SDG. There were no rejected results; therefore, all results were considered acceptable compared to QAPP and method criteria, with the understanding of the potential uncertainty (bias) in the qualified results.

Table 2. Summary of Data Validation Actions

Field Sample ID	**Analyte**	**Qualifier**	**Bias**	**Validation Comments**
IA1012	All VOCs	J / UJ	I	High Receipt Vacuum
IA1064	All VOCs	J / UJ	I	Flow Controller outside criteria
AA1001	cis-1,2-Dichloroethene Trichloroethene	EB	H	Equipment Blank Action

Qualifiers: U = Analyte is non-detect at the "DV Result" value; UJ = Non-detect is estimated; J = Result is estimated; EB = detected in Field Equipment Blank; R = Result is rejected and is unusable for project decisions.

Bias: L = Low; H = High; I = Indeterminate

The following sections document the QC reviewed and the issues that required action or affected the data certainty in terms of the project data quality objectives (DQO) of accuracy, precision, representativeness, comparability, and sensitivity. The attached In-Depth Data Usability Review Checklist includes all QA/QC reviewed during validation (including QC results that were acceptable) and details on the justification for actions taken. The DQO of completeness can be evaluated by the project manager after all data are generated.

Data Package Completeness and Reporting Protocols

- Canister certifications, receipt vacuums, and flow controller check information were not contained in the Category B deliverable. However, this information was available in the Alpha Analytical Standard Laboratory Report, which was also submitted with this SDG. Therefore, both the Category B and Standard Laboratory Report are required to evaluate the data completely.
- The laboratory reported results for all eight compounds listed in Table B.1 of the Work Plan from a single TO-15 SIM analysis. The Work Plan indicated that all compounds except trichloroethene and vinyl chloride would be analyzed by full scan electron impact GC/MS and TO-15 SIM would be used only for trichloroethene and vinyl chloride. The laboratory was given approval by SHA to perform the singe TO-15 SIM analysis on these samples.
- The initial and continuing calibrations for VOCs contained many compounds in addition to the targets requested. During this review, only the target compounds were assessed.

Sample Receipt, Holding Times, and Canister Condition

- The samples were received intact and the canister vacuums (initial field, field final, and lab receipt) were considered acceptable for all samples except IA1012. The final field and lab receipt vacuums for IA1012 were > 10.0 ″ Hg, which is above the highest acceptable vacuum specified in the Work Plan. All results for this one sample were estimated (J or UJ) with indeterminate bias due to high receipt vacuum.
- The flow controller on the canister for sample IA1064 did not meet pre- and post-sample collection flow rate precision of RPD < 20% as required by the Work Plan. All results for this one sample were estimated (J or UJ) with indeterminate bias due to the Flow Controller being outside criteria.
- All samples were analyzed within holding time.

Calibration Criteria

- There were no issues with the instrument tuning or initial and continuing calibrations.

Method and Field Blank Results

- One of the method blanks and the field equipment blank (FB1) reported low-level results for trichloroethene and cis-1,2-dichloroethene. A comparison was made between the levels of these compounds in the blanks and samples and the following actions were taken:
  - Trichloroethene and cis-1,2-dichloroethene were estimated (EB) in sample AA1001 since the sample results may be biased high based on the presence of these compounds in the associated equipment blank.

Laboratory Control Sample (LCS) Recoveries

- There were no issues with the accuracy and precision of the laboratory control samples (LCS and LCSD).

Internal Standard Recoveries

- There were no issues with internal standard recoveries.

Matrix Quality Control (Laboratory Duplicate and Field Duplicate Samples)

- There was one laboratory duplicate (LD) performed on sample IA1001. LD precision was acceptable for all detected VOCs; therefore, no action was required.
- The field duplicate pair IA1018 and DUP1 results met criteria for all eight target compounds. The sample/LD and FD results are an indication of acceptable precision and representativeness of the samples to the locations collected for VOC analysis in air.

Sample result reporting (including reporting limits and units)

- Sensitivity requirements compared to the Reporting Limits (RLs) defined in Table B.1 of the Work Plan were met for all samples.
- Five samples were initially analyzed without dilution (dilution factor (DF) =1) and one or more results were reported above the instrument calibration range (flagged "E" by the laboratory). These samples were re-analyzed at secondary dilutions to report all data properly. Both sets of data for each sample were evaluated and the following data were accepted for reporting of results:
    - IA102: all DF=1 data were accepted except trichloroethene, which was accepted from the DF=5 analysis
    - IA1018: all DF=1 data were accepted except trichloroethene, which was accepted from the DF=3.33 analysis
    - IA1030: all DF=1 data were accepted except cis-1,2-dichloroethene and trichloroethene, which were accepted from the DF=5 analysis
    - IA1063: all DF=1 data were accepted except cis-1,2-dichloroethene and trichloroethene, which were accepted from the DF=5 analysis
    - DUP1: all DF=1 data were accepted except trichloroethene, which was accepted from the DF=3.33 analysis

  Data not accepted for reporting were eliminated from the EDD so that only one valid result per compound is reported for each sample.
- A check on the calculations made by Alpha to report calibration statistics, sample-specific RLs, and results indicated that the laboratory reported the data properly. See the Data Usability Review Checklist (attached) for details.