Aspect
A Geosyntec Company

MEMORANDUM

Project No. AS230442

March 27, 2024

To: Ben Kleban, Stillwater Holdings, LLC

cc:

From:

3/27/2024

Carla E. Brock, LHG
Sr. Principal Geologist
carla.brock @aspectconsulting.com

Jeremy Porter, PE
Sr. Principal Remediation Engineer
jeremy.porter @aspectconsulting.com

Re: **Marcus Whitman Hotel Vapor Intrusion Evaluation Workplan**

This memorandum describes the investigation and evaluation of vapor intrusion (VI) of gasoline-range petroleum hydrocarbons (TPHg) and related volatile organic compounds (VOCs) from the subsurface into indoor air of the Marcus Whitman Hotel (Hotel). Aspect Consulting (Aspect) documented preliminary VI investigation and mitigation strategies in the Vapor Intrusion Mitigation and Conceptual Vapor Intrusion Assessment Plan (Preliminary Plan). This memorandum documents preliminary site visit findings and details the scope of work for a VI evaluation that was described in the Preliminary Plan for the Hotel. To date, monitoring of VOCs in indoor air has been conducted by Clean Harbors utilizing a photoionization detector (PID), which does not identify specific contaminants. Laboratory analytical data for TPHg and related VOCs in sub-slab vapor, and indoor and ambient air, has not been collected to date.

This VI evaluation will be conducted in accordance with the Washington State Department of Ecology (Ecology) Guidance for Evaluating Vapor Intrusion in Washington State, revised in March 2022 (Ecology VI Guidance), and includes a Tier II assessment to evaluate the presence of TPHg and related VOCs in indoor air and, if present, whether the source of those contaminants may be soil and/or groundwater beneath the Hotel. The Tier II assessment will include a building evaluation and collection of indoor air, ambient air, and sub-slab soil gas samples. The data will be used to design and evaluate VI mitigation methods. Aspect understands that the initial emergency response to mitigate VI is a temporary strategy; data from this VI evaluation will be used to evaluate permanent strategies for VI mitigation in the Hotel.

Site Walk and Building Evaluation Findings

Aspect conducted the building evaluation on January 3 and 4, 2024, to identify building construction characteristics, heating and ventilation system components, and possible background sources of VOCs that may influence the results of indoor air sampling.

As noted in the Preliminary Plan, a basement underlies the original portion of the Hotel and includes operations/utility rooms (electrical room, boiler room, air handler room, etc.), shop rooms used for various types of building maintenance, miscellaneous storage rooms, employee locker rooms, and employee offices. In the east corner of the basement, a lower-level basement (referred to as the sub-basement) contains a partial dirt floor and is used for storage of construction materials and hotel supplies. The approximate layout of the basement and the sub-basement is shown on the attached Figure 1 – Basement Floor Plan.

Chemical Storage

Two areas in the basement with chemical storage were identified during the site walk: a shelf on the southern perimeter of the basement in the Area 30 corridor, and chemical storage in the Area 1 Wood Shop located in the southwestern corner of the basement. Both areas are identified on the attached Figure 2 – Basement Indoor Air Evaluation Map. Chemical storage in the Area 30 corridor consisted primarily of 1-gallon paint cans along with sealants, lacquers, solvents, and lubricants. A 5-gallon metal bucket containing Diamond Clear sealant was stored in this area; the safety data sheet (SDS) for Diamond Clear lists xylene as a primary ingredient. The Wood Shop contained smaller quantities of sealants, lacquers, lubricants, and cleaning compounds.

Chemical storage should be consolidated into an enclosed space that can be sealed and that does not contain an HVAC return air register. An empty storage room is in the northern basement hallway that could serve this function. Aspect will coordinate with Hotel representatives and Clean Harbors to facilitate relocation of chemical storage and the selected storage room(s) will be sealed off with tape or plastic sheeting (consistent with the exclusion zone seals) for at least 1 week before and while indoor air sampling is conducted. Aspect will coordinate with Clean Harbors and the Hotel to ensure that chemicals needed for daily operation remain easily accessible.

HVAC Components and Design Considerations

Figure 2 and the attached Figure 3 (First Floor Indoor Air Evaluation Map) are provided on the current HVAC system sheets. These design sheets were reviewed in the Hotel blueprints during the site walk. Notable elements of the HVAC system and relevance to the VI evaluation are discussed below.

During the site walk, Aspect was informed by Clean Harbors that the 3-foot diameter green conduit that daylights in the exposed soil portion of the sub-basement is the sole supply air register for the sub-basement. Clean Harbors indicated that they coordinated with the Hotel to ensure that the supply air source is 100 percent fresh air from a roof-located intake. During a stakeholder meeting on March 6, 2024, the Hotel communicated that Clean Harbors would be the entity to verify any changes to the Hotel HVAC operations as part of the response. Aspect will confirm and document any changes made by Clean Harbors and the HVAC professional contracted for the modifications; additional HVAC operations testing and documentation may be required after this VI evaluation to evaluate additional modification.

As shown on Figure 2, this 3-foot sub-slab supply air conduit is routed beneath the slab to the west, terminating in the western basement air-handling room. Figure 2 also shows the primary return air register as a 28-inch diameter conduit. Aspect was not able to identify this feature above the slab, indicating that it is also likely routed beneath the slab to the respective air handling room. Typically, underground utilities are protected with a sand or other fine grained media bedding. These porous media, and the large diameter conduit present possible preferential pathways for vapor to travel beneath the building. Aspect has taken the location of these conduits in consideration while locating sub-slab sample locations for this VI evaluation, discussed more in the following sections.

Additionally, these large conduits can introduce isolation effects for future sub-slab depressurization (SSD) design, effectively cutting off the reach of shallow depressurization wells by creating discontinuity in the sub-slab soil. The supply and return air conduit locations, and the results of the VI evaluation, will inform design considerations for a future SSD system.

Clean Harbors informed Aspect that the only exhaust from the sub-basement exclusion zone consists of temporary blowers that collect vapors from the basement and route them to permanent ducting which runs from the sub-basement to the exterior of the building at street level on Rose Street. Aspect identified both a return air register and exhaust register in the HVAC plans on the southern end of the sub-basement (see Figure 2).

Based on the results of the preliminary VI evaluation, a thorough evaluation and documentation of the return-air design parameters of the basement may be required. As noted above, Aspect has not verified Clean Harbors' understanding that return air is not recirculated from the basement to upper levels of the Hotel or that the supply and return HVAC components indicated on the building plans are functioning as described above. Aspect will coordinate with Clean Harbors and the HVAC professional who is familiar with the HVAC system.

The design settings for return and supply air to each room in the basement may influence the positive or negative pressure environment in the respective zones. If the supply and return design induces a negative pressure environment for a particular HVAC zone, this could result in increased advection of vapors from below the slab into the building. Conversely, a positive pressure environment will decrease migration of vapors into the building. Pressure differential will be measured at each sub-slab sampling location prior to collecting samples (detailed below in the description of sampling methods and procedures), to document existing pressure conditions across the slab at the time of sampling. It should be noted that HVAC settings are not the only factor affecting pressure differential; barometric pressure has a significant effect on advection of soil gas. Barometric pressure trends at the time of sampling will be documented during sampling activities.

The presence of HVAC elements (supply, return, and/or exhaust) have been identified in the vicinity of sampling locations, if present. The presence of these elements suggest that air quality in the respective sampling areas is not stagnant and will be significantly influenced by HVAC circulation design settings. They may also be important if additional positive or negative pressure environments need to be further evaluated, as discussed above.

For the purposes of this VI evaluation, HVAC and temporary venting operations will continue in their current settings. This will allow for an evaluation of baseline VI under the current ventilation conditions the meet requirements for human health and safety. The VI data, along with current ventilation settings, will be utilized for an engineered mitigation design that may incorporate sub-slab, targeted ventilation and/or HVAC modification.

Preferential Pathway Analysis

Based on the site walk and Hotel blueprint review, the primary preferential pathway for vapors to enter basement indoor air are the exposed soil areas, vault, and sump in the sub-basement (see Figure 2). The Preliminary Plan identifies the preliminary mitigation design strategies to close these preferential pathways.

Based on a review of Hotel plumbing plans, water, gas, and sanitary utilities enter the Hotel building footprint on the north side of the building and are not currently considered a preferential pathway of concern. With respect to underground preferential pathways within the building footprint, the large diameter supply and return air registers noted above are currently considered a potential preferential pathway to transport vapors underneath the basement slab.

During the site walk, Clean Harbors identified the extensive interior preferential pathway sealing efforts that have been conducted in the basement. This includes larger vault-like features, slab cuts, and floor drains. These larger features were typically filled with expanding closed-cell foam. Additionally, smaller pathways were sealed including cracks in the floor slab/walls/ceiling and gaps around utility penetrations in the floor/walls/ceiling. Smaller spaces were sealed with a combination of caulking and expanding foam. Future mitigation design will include additional evaluation procedures for preferential pathways and will include an operations and maintenance plan (O&M Plan) that will specify future monitoring of the mitigation effectiveness.

Indoor and Ambient Air Sampling Scope of Work

Indoor and Ambient Air Sampling

Indoor air sampling will consist of collecting nine indoor air samples. Sampling locations will consist of six basement-level samples and three samples collected from the first-floor level. Indoor air samples collected in the basement will measure reasonable worst-case VI conditions. Pending further evaluation of air intakes to the basement and first floor HVAC zones, two to three ambient air samples will be collected at roof-mounted air intakes that approximately correspond with supply intakes to the basement and first floor-floor air supplies.

Basement Indoor Air Sampling

Basement indoor air sample locations are shown on Figures 1 and 2 and will consist of the following:

- One sample (BIA-01) will be collected from the central area of the sub-basement. This sample is anticipated to represent a baseline for the worst-case scenario VI under the current conditions. Venting operations detailed above, consisting of outside air supply and exhaust to Rose Street, will continue while the sampling is conducted.
- One sample (BIA-02) will be collected from the Elevator 2 pit. This will be conducted by placing a summa cannister at the bottom of the pit if possible or routing an approximate 10-foot length of ¼-inch diameter Teflon tubing into the lower pit space. This sample will allow for further evaluation of VI to the elevator shaft and implications for VI to above-grade hotel levels from the elevator.

- One sample (BIA-03) will be collected in the Area 33 hallway, co-located with sub-slab sample SS-03. This sample is located towards the eastern end of the basement (where subsurface TPHg and benzene concentrations are presumed highest), near the sub-slab return air conduit, and is located near a supply air register.
- One sample (BIA-04) will be collected from the Area 37 Office, co-located with sub-slab sample SS-04. This sample is located in the northeastern portion of the basement, in a confined office space setting. Figure 2 indicates that a return air register and 6-inch by 6-inch supply air source are located in the Area 37 office.
- One sample (BIA-05) will be collected from the Area 20 Men’s Locker Room, co-located with sub-slab sample SS-05. This sample location is in an employee-occupied space with supply, return, and exhaust HVAC components installed. An 18-inch sub-slab supply conduit is located approximately 10 to 15 feet to the west of the sample location. The 28-inch and 12-inch sub-slab return air conduits are located to the south and east of the sample location, respectively.
- One sample (BIA-06) will be collected from the central area of the Area 14 Banquet Storage Room, co-located with sub-slab sample SS-06. This room was noted by Clean Harbors to have a relatively higher concentration of VOCs (PID measurement) during the initial stages of the response. Sub-slab supply and return air conduits are located within approximately 10 feet. Figure 2 shows a large return air register in the northwestern corner of the room; a supply air source is not readily identifiable.

First Floor Indoor Air Sampling

Transport mechanisms for vapors in the basement to the first floor include air flow through unsealed utility penetrations through the floor, air flow up staircases or the elevator, and recirculation of the HVAC system. Elevator shaft sampling and evaluation for potential HVAC recirculation is included under basement sampling, above. Aspect understands that there is an approximate 3-foot tall false first floor, and there appear to be hundreds of utility penetrations from the basement ceiling into the false first floor, and presumably from there into the actual first floor above. During the site walk, Clean Harbors pointed out their basement utility penetration sealing efforts, including sealing all accessible penetrations through the basement ceiling into the false first floor. Although fully sealing all utility penetrations to the first floor is likely impracticable, the stairwells and elevator shafts represent the most significant potential migration potential. First floor indoor air sampling locations were chosen to reflect some potential worst case scenario conditions (near elevators or stairwells to the basement) and to provide general coverage of different HVAC zones.

Indoor air locations on the First Floor are shown on the attached Figure 3 – First Floor Map and will consist of the following:

- FFIA-01 is located near the first-floor entrance to the southeast elevator, mentioned above. This location corresponds with the elevator pit sample that will be collected in the basement and will allow for further evaluation of the elevator as a preferential pathway.
- FFIA-02 is located on the east side of the building, behind the reception counter. This is a consistently occupied area of the first floor and is adjacent to a stairwell that leads to the

eastern perimeter of the basement. HVAC influence to this area is anticipated to be consistent with other areas of the large and open reception area.

- FFIA-03 will be collected from an enclosed space with dedicated HVAC supply and return registers that will be determined in consultation with Hotel representatives at the time of sampling, based on conditions and use.

Ambient Sampling
Ambient (outdoor) air and indoor air samples will be obtained concurrently on the upwind side of roof-mounted air intakes to the building, as noted above. The ambient air samples will be collected using the same procedures as the indoor air samples, using a 6-liter (L) canister prepared under negative pressure and lab-certified clean for VOCs.

Indoor and Ambient Sampling Methods
Air samples will be collected using 6-L canisters prepared under negative pressure and lab-certified clean for VOCs. The canisters will be equipped with dedicated flow regulators at a fill rate set for an approximate 8-hour sampling event consistent with the commercial use of the basement and first floor.

The pressure in each canister prior to commencement of the sampling event will be noted, as will the time the canister is opened. During the sampling period, the pressure in the canister will be monitored to ensure that the flow regulator is functioning properly. The final pressure at the end of sampling should be -5 to -6 inches of mercury. Once the canister has reached this point, sampling is complete, and the final pressure is recorded. Sample collection will be considered complete after 8 hours, if the pressure in the canister is less than -10 inches of mercury.

Sub-slab Soil Gas Sampling Scope of Work
The day following completion of the indoor and ambient air sampling, nine sub-slab soil gas samples will be obtained from beneath the concrete floor slab of the basement using permanent vapor pins. The vapor pins will be installed in accordance with the manufacturer's Standard Operating Procedure (Attachment A) within the concrete slab at each location by drilling a 5/8-inch hole to a depth of approximately 3 to 6 inches, depending on the slab thickness, and installing a stainless-steel pin with a silicon seal.

The vapor pins will be flush with the concrete floor but will be installed outside of primary foot-traffic corridors to minimize potential trip hazards. The preliminary locations are shown on Figures 1 and 2 and the final locations may be modified in the field at the time of the installation based on access limitations and flooring conditions. All sampling locations will be cleared using a private utility locate contractor prior to installation.

Sub-Slab Sampling Locations
Nine sub-slab sample locations were identified to provide broad spatial coverage beneath the building with an emphasis on areas anticipated to be worst-case (near the southeast corner, where the highest groundwater TPHg concentrations are assumed to be located, and in particular beneath the sub-basement). These locations will also provide monitoring points for future SSD performance monitoring. Five of the nine locations (SS-01, SS-03, SS-04, SS-5, and SS-06) will be co-located with the indoor air sample locations detailed above. The four remaining locations consist of:

- SS-02: This location is designed to evaluate sub-slab conditions adjacent to the elevator shaft. Along with the elevator shaft air sample, this sub-slab sample will allow for further consideration of mitigation strategy of the shaft as a preferential pathway.
- SS-07: This location in the northeast portion of the sub-basement to evaluate sub-slab conditions in the vicinity of the known exposed-soil areas where free product and vapor suppression products were applied.
- SS-08: This location is in the southern portion of the western hallway, positioned between the large-diameter supply and return air sub-slab conduits to evaluate the extent of TPHg and VOCs in sub-slab soil gas beneath the basement slab.
- SS-09: This location is in the northern portion of the western hallway to evaluate the extent of TPHg and VOCs in sub-slab soil gas beneath the basement slab.

Sub-Slab Soil Gas Sampling Methods

Soil gas samples will be collected using laboratory-supplied and individually certified and evaluated 1-L canisters fitted with 150 milliliters per minute (mL/min) flow regulators and dedicated sampling trains.

Following installation of the soil gas sampling point, the barometric pressure will be recorded and noted to be rising or falling at the time of sample collection. In addition, a cross-slab differential pressure measurement will be collected using a digital micromanometer. The ventilation system/status of the building will be observed to determine whether it is likely to have an influence on cross-slab pressure differential. Barometric and cross-slab pressures at the time of sampling will be used to inform conservativeness of the sampling results.

Prior to sampling, a shut-in test will be performed by inducing a vacuum to the sampling train (including dedicated disposable Teflon tubing, fittings, and connections to the canister). A minimum vacuum of -10 inches of mercury will be applied for a period of 5 minutes. If no change in vacuum is observed during the shut-in tests, this indicates that the sampling train is free of leaks that could introduce ambient indoor air to the soil gas sample.

The soil gas sampling point will then be enclosed in a leak-testing shroud, and helium tracer gas will be applied at a concentration between 50 and 100 percent inside the shroud. Approximately 500 mL of air/vapor will be purged through each sampling point and tubing to ensure that any remaining ambient indoor air inside the sampling train is removed, to ensure a competent seal between the soil gas sampling point and the slab, and to facilitate field screening of subslab vapors prior to sampling. The helium level inside the shroud will be maintained at a constant concentration throughout the sample collection period and recorded. Analytical results for helium in the sample will be compared to the shroud concentration to ensure no significant dilution from ambient air occurred during the sampling.

After confirming that no significant leakage is present in the sampling train or around the soil gas sampling point seal, and that all remaining ambient indoor air has been removed from the sampling apparatus, the canisters will be opened and allowed to fill at 150 mL/min over approximately 5 minutes, or when the canister vacuum reaches -5 inches of mercury. A final vacuum of -5 inches of mercury will be maintained in the SUMMA canister and submitted to ALS in Seattle, Washington for verification that the SUMMA canister did not leak in transit.

Indoor Air, Ambient air, and Sub-Slab Soil Gas Samples Laboratory Analysis

Indoor air, ambient air, and soil gas samples will be analyzed using Massachusetts Department of Environmental Protection (MDEP) Method for Air Phase Hydrocarbons (APHs) and U.S. Environmental Protection Agency (EPA) Method TO-15 for BTEX and naphthalene. If possible, low-level analysis or Selective Ion Mode (SIM) analysis will be used to obtain the lowest achievable detection and reporting limits. Analytical results from air and soil gas sampling will be compared against applicable Model Toxics Control Act (MTCA) Method B cleanup and screening levels for commercial (worker) and unrestricted (residential) use for petroleum mixtures.

Table 1. Vapor Intrusion Screening Criteria

	Indoor Air Screening Levels (ug/m3)		Sub-Slab Soil Gas Screening Levels (ug/m3)	
Analyte	**Residential**	**Commercial**	**Residential**	**Commercial**
TPH	46 or site-specific	390 or site-specific	1,500	13,000
Benzene	0.32	1.5	11	50
Toluene	2,286	19,467	76,000	650,000
Ethylbenzene	457	3,893	15,000	130,000
Total Xylenes	45.7	389	1,500	13,000
Naphthalene	0.074	0.34	2.5	11

Note: ug/m3 = microgram per cubic meter

Technical Memorandum Preparation

The results of the VI assessment will be documented in a technical memorandum that includes a description of the work performed, a map showing the sample collection locations, data tables with results compared to the applicable commercial screening levels, and a discussion of the results. Analytical results from air and soil gas sampling will be compared against applicable MTCA Method B cleanup and screening levels for commercial use. Helium results for soil gas samples will also be evaluated to ensure no significant dilution from ambient air occurred during the sampling.

Based on the building evaluation, on-site use of chemicals such as cleaning solutions or elevator hydraulics are potential background sources of TPH contamination to indoor air. The sampling protocol above calls for isolation of chemicals from sampling areas, but complete isolation is unlikely to be feasible. These potential background sources will be considered when evaluating the data and determining the potential for VI.

Sub-Slab Physical Conditions Evaluation

Lastly, this investigation will also include 6-inch concrete cores through the basement slab at approximately 5 locations shown on Figures 1 and 2. The cores will allow for evaluation of sub-slab physical conditions including the following:

- Checking for the presence of non-native gravel and/or sand (typical base materials for slab pours). The evaluation of sub-slab material will include sieve particle size analysis to assist in the evaluation of screen-slot size for potential depressurization/venting pilot study parameters.
- Observing if a granular base material does not exist beneath the slab, Aspect will evaluate the soil lithology to determine if sufficient soil porosity exists for engineered depressurization methods.
- Visual Documentation of moisture content in the sub-slab material to determine if depressurization is viable (saturated conditions beneath the slab would decrease or eliminate porosity, a primary requirement for vacuum/depressurization propagation). A sample may be collected for moisture content testing.
- Visual documentation of any petroleum hydrocarbon saturation.

The locations of the cores have been selected primarily to evaluate sub-slab physical properties at preliminary locations where sub-slab depressurization (SSD) is considered, for design purposes. These design considerations include the following:

- The primary (SSD) short-circuit/cut-off potential for shallow extraction wells are the large-diameter (approximately 2- to 3-foot) supply and return air conduits, shown on the Figure 2. Core locations have been selected within the various zones delineated by these conduits.
- Core locations were located near walls or foundation columns to allow for potential routing of SSD infrastructure to exterior system locations.
- Core locations were distributed amongst the sub-slab vapor pin locations to allow for pilot testing monitoring from the respective vapor pin locations. Additional vapor pins will be added during the final SSD pilot study design phase.

Core locations will be cleared using a private utility locate contractor prior to installation. Material beneath the slab will be collected using hand tools and/or hand auger equipment. Material removed from the core locations will be replaced and the cores will be placed back in the void space. Quick-cure concrete mix will be used to restore the surface, then covered with tape to mark the locations. If conditions appear sufficient, these locations will later be used for SSD. If the locations are not used for SSD, they will be repaired by a contractor to the pre-cored condition.

Limitations

Work for this project was performed for the Stillwater Holdings, LLC (Client), and this memorandum was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This memorandum does not represent a legal opinion. No other warranty, expressed or implied, is made.

All reports prepared by Aspect Consulting, a Geosyntec company, for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client is at the sole risk of that party, and without liability to Aspect Consulting. Aspect Consulting's original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

Attachments: Figure 1 – Basement Floor Plan
Figure 2 – Basement Indoor Air Evaluation Map
Figure 3 – First Floor Indoor Air Evaluation Map
Attachment A – Vapor Pin Standard Operating Procedures
Attachment B – Quality Assurance and Quality Control Procedures

V:\230442 Singers Chevron\Deliverables\VI Eval MW Hotel\Final\Final MWH VI Eval Workplan_20240327.docx

FIGURES

Figure 1 - Basement Floor Plan (Not to scale, locations are approximate)

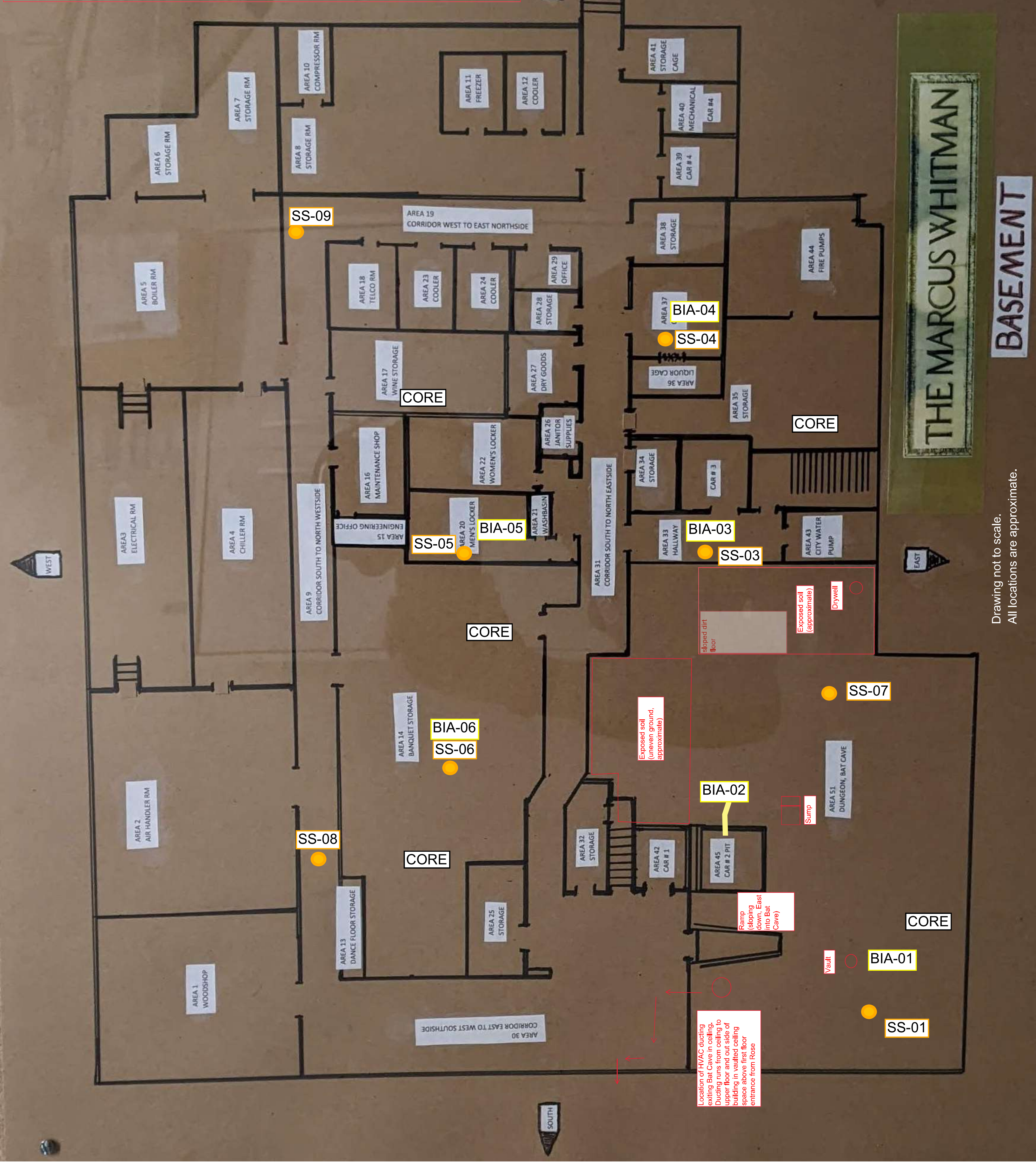


Figure 2 - Basement Indoor Air Evaluation Map

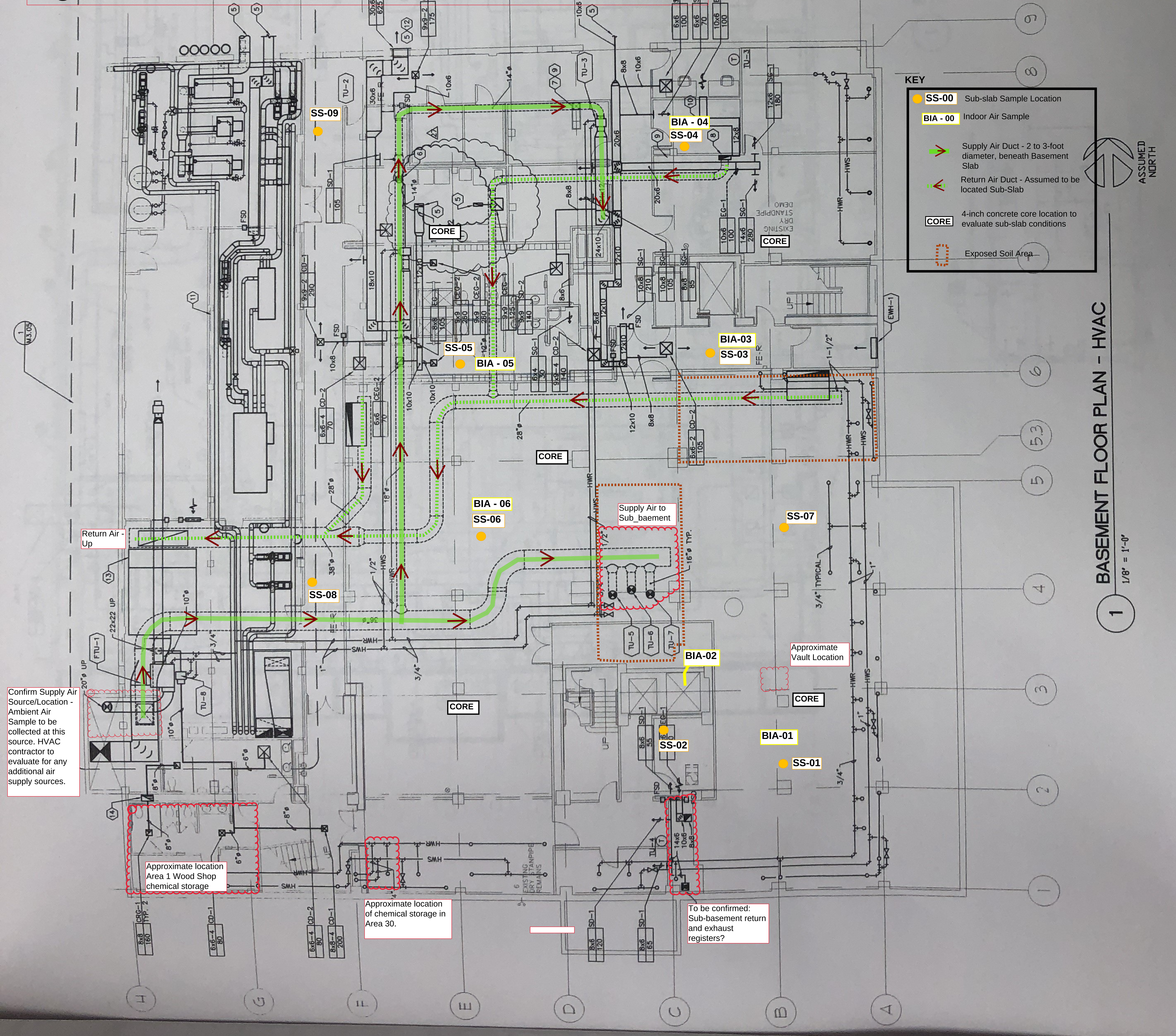
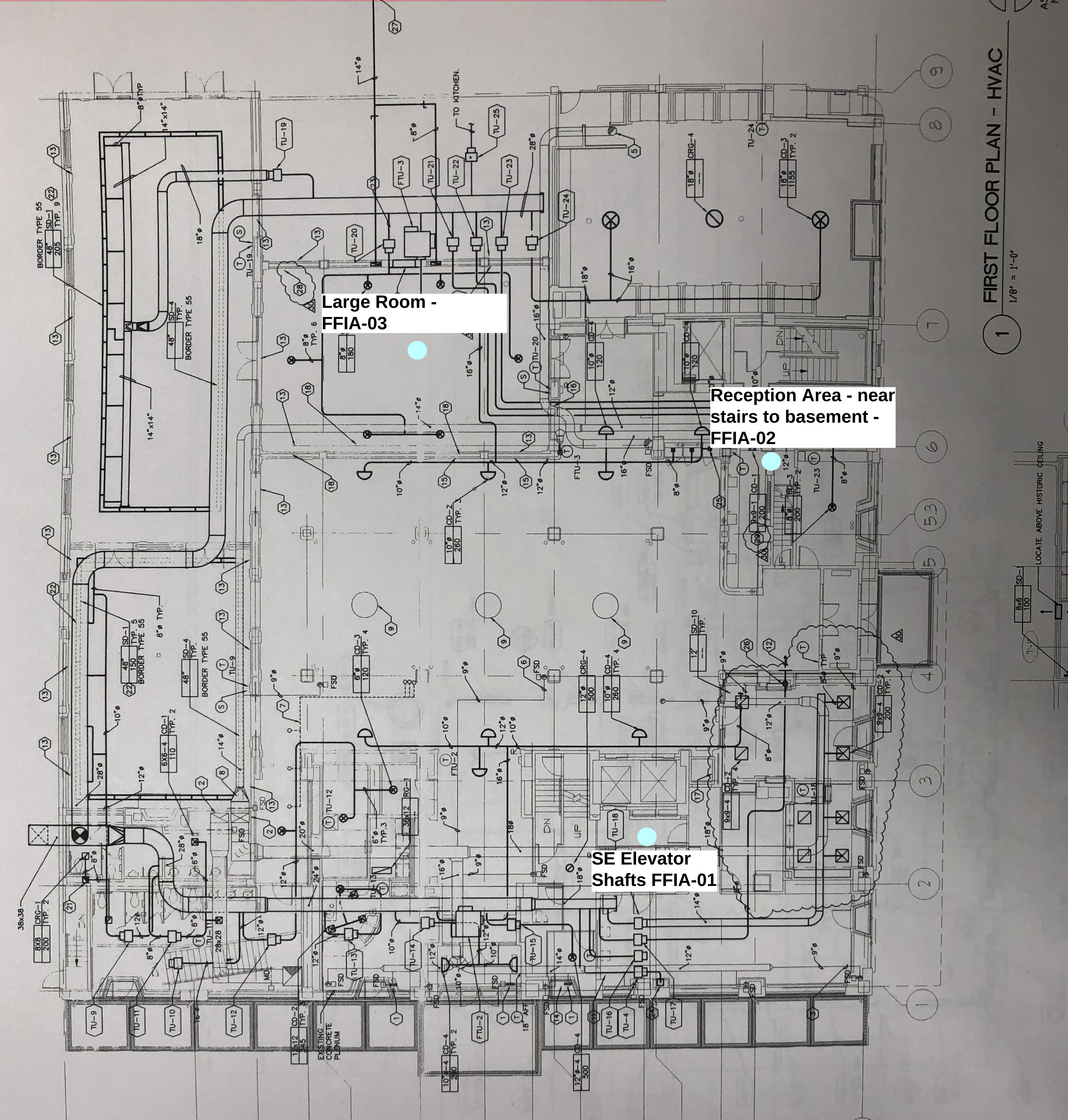


Figure 3 - First Floor Indoor Air Evaluation Map



Attachment A

Vapor Pin Standard Operating Procedures

Standard Operating Procedure

Installation and Extraction
Vapor Pin® Sampling Device

Scope & Purpose

Scope

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

Purpose

The purpose of this procedure is to assure good quality control in field operations and uniformity between field personnel in the use of the Vapor Pin® Sampling Device.

Equipment Needed

- Vapor Pin® Sampling Device
- Vapor Pin® Sleeves
- Vapor Pin® Cap
- Installation/Extraction Tool
- Rotary Hammer Drill
  - ⅝-Inch (16mm) diameter hammer bit
  - 1½-Inch (38mm) diameter hammer bit for flush mount applications
- ¾-Inch (19mm) diameter bottle brush
- Wet/Dry Vacuum with HEPA filter (optional)
- Dead Blow Hammer
- VOC-free hole patching material (hydraulic cement) and a putty knife or trowel
  - This is for repairing the hole following the extraction of the Vapor Pin® Sampling Device

Installation Procedure

1. Check for buried obstacles (pipes, electrical lines, etc.) prior to proceeding.
2. Set up wet/dry vacuum to collect drill cuttings.
3. For a temporary installation, drill a ⅝-inch (16mm) diameter hole through the slab and approximately 1-inch (25mm) into the underlying soil to form a void. The hole must be ⅝-inch (16mm) in diameter to ensure a seal.
   - If a flush mount installation is required, drill a 1½-inch (38mm) diameter hole at least 1¾-inches (45mm) into the slab. We highly recommend using the Stainless Steel Drilling Guide and to reference the Standard Operating Procedure Drilling Guide & Secure Cover.
4. Remove the drill bit, brush the hole with the bottle brush and remove the loose cuttings with the vacuum.
5. Assemble the Vapor Pin® Sampling Device and Vapor Pin® Sleeve (Figure 1).
6. Place the lower end of the Vapor Pin® Sampling Device assembly into the drilled hole. Place the small hole located in the handle of the Installation/Extraction Tool, over the Vapor Pin® to protect the barb fitting and tap the Vapor Pin® into place using a dead blow hammer (Figure 2). Make sure the Installation/Extraction Tool is aligned parallel to the Vapor Pin® to avoid damaging the barb.
   - During installation, the Vapor Pin® Sleeve may form a slight bulge between the slab and the Vapor Pin® Sampling Device shoulder.
7. Place the Vapor Pin® Cap on the Vapor Pin® to prevent vapor loss prior to sampling (Figure 3).
8. For flush mount installations, cover the Vapor Pin® with a flush mount cover, using either the plastic cover or the optional Stainless Steel Secure Cover (Figure 4).
9. Allow 20 minutes or more (consult applicable guidance for your situation) for the sub-slab soil-gas conditions to re-equilibrate prior to sampling.

Figure 1.

Figure 2.

Figure 3.

Figure 4.

Sampling

1. Remove the Vapor Pin® Cap and connect your sample tubing to the barb fitting of the Vapor Pin® Sampling Device.
2. Create a connection by using a short piece of Tygon™ tubing to join the Vapor Pin® Sampling Device with the Nylaflow tubing (Figure 5). Put the Nylaflow tubing as close to the Vapor Pin® Sampling Device as possible to minimize contact between soil gas and Tygon™ tubing. You do not **have** to use Nyflaflow tubing, any stiff tubing will suffice.
3. Prior to sampling, conduct a leak test in accordance with applicable guidance. If a leak test is not specified, refer to the SOP Leak Testing the Vapor Pin® Sampling Device, via Mechanical Means (Figure 6). For flush-mount installations, distilled water can be poured directly into the 1½ inch (38mm) hole.

Figure 5.

Figure 6.

Figure 7.

Extraction Procedure & Reuse Notes

1. Remove the protective cap, and thread the Installation/Extraction Tool onto the Vapor Pin® Sampling Device (Figure 7). Turn the tool clockwise continuously, don't stop turning, the Vapor Pin® Sampling Device will feed into the bottom of the Installation/Extraction Tool and will extract from the hole like a wine cork, **DO NOT PULL!**
2. Fill the void with hydraulic cement and smooth with a trowel or putty knife.
3. Prior to reuse, remove the silicon Vapor Pin® Sleeve and Vapor Pin® Cap and discard. Decontaminate the Vapor Pin® Sampling Device in a Alconox® solution, then heat in an oven to a temperature of 265° F (130°C). For Stainless – ½ hour, Brass 8 minutes.

Attachment B

Quality Assurance and Quality Control Procedures

Attachment B

Quality Assurance/Quality Control

The work will be conducted in accordance with standard quality assurance/quality control (QA/QC) procedures for the work being performed to produce defensible data quality. A discussion of general project QA/QC is provided below.

Summa Canister Handling and Custody

The Summa canisters will be handled in the manner described below:

- The canisters will be stored at all times in the original shipping containers supplied by the laboratory, except during sampling, to prevent potential damage.
- Following sampling, the canisters will be packed in their original shipping containers and sent within 3 days to ALS in Seattle, Washington for sample analysis.
- The appropriate Chain-of-Custody forms will be completed as well as any other pertinent sampling/shipping documentation to accompany the canisters.
- Custody of the canisters will be maintained from the time of sampling to receipt at the laboratory. “Custody” means that the canisters remain in direct possession of a person who is recorded on the Chain-of-Custody form or locked in secure vehicles or offices.

Data Quality Indicators

Data quality indicators (DQIs), including precision, accuracy, representativeness, comparability, and completeness (PARCC parameters), and data reporting limits are dictated by the data quality objectives, project requirements, and intended uses of the data. An assessment of data quality is based upon quantitative (precision, accuracy, and completeness) and qualitative (representativeness and comparability) indicators. Definitions of these parameters and the applicable QC procedures are presented below.

Precision and Accuracy

Precision measures the reproducibility of measurements, while accuracy measures correctness and includes components of random error (variability due to imprecision) and systemic error. Analytical precision is the agreement among multiple analyses of the same sample, which is quantitatively expressed as the relative percent difference (RPD) between duplicate sample results. Analytical accuracy is measured by comparing the percent recovery of analytes spiked (as compared to the expected value) to pre-established acceptance criteria. A single true-duplicate sample will be collected as part of indoor air sampling activities.

Representativeness

Representativeness measures how closely the measured results reflect the actual concentration or distribution of the chemical compounds in the matrix sampled. The goal of air sampling is to estimate long-term average VOC concentrations in indoor air resulting from VI. Because there is temporal variability in these concentrations, Aspect will review the result and may recommend that additional indoor air sampling is conducted during a warm outdoor temperature interval, if possible, which increases the likelihood that average VI impacts to indoor air quality will not be under-estimated.

While the second floor of the building will be occupied during the sampling event, it is not known whether the basement will be occupied. The following steps will be taken to increase the likelihood that vapor sampling results are representative:

- Time-integrated samples will be collected over sampling periods of 8-hours (for indoor and ambient air) and 30-minutes (for soil gas).

- Sampling will be conducted during the day.

Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. The use of standard techniques for sample collection and a certified analytical laboratory for laboratory analyses should make data collected comparable between air sampling events.

Completeness

Completeness is defined as the percentage of measurements made that are judged to be valid measurements. Results will be considered valid if all the precision, accuracy, and representativeness objectives are met and if reporting limits are sufficient for the intended uses of the data. VOC concentrations for indoor air canisters are considered critical and thus have a 100 percent target completeness goal.

If overall completeness is less than 100 percent for vapor canister COC data, Aspect will assess the reason for the lack of completeness. Further sample collection may be necessary and will be determined based on a review of the sampling results.