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Attention: Mr. Joseph Tapia, PE
Department of Toxic Substances Control
1515 Tollhouse Road
Clovis, CA 93611-0522

October 19, 2021

Subject: Pacific Gas & Electric Company (PG&E) Fresno-2 Former Manufactured Gas Plant (MGP) Site, Fresno, California – Submittal of Final Basque Hotel Soil Vapor Sampling Work Plan

Dear Mr. Tapia,

Jacobs Engineering Group Inc. (Jacobs) has prepared this *Basque Hotel Soil Vapor Sampling Work Plan* (Work Plan) on behalf of PG&E and for the subject facility (Site). This Work Plan was prepared at the request of the California Department of Toxic Substances Control (DTSC) (DTSC 2021a) and provides more detail to the approach presented in the Basque Hotel Site Visit Summary and Proposed Sampling Approach (Jacobs 2021a). In preparing this revised Work Plan, Jacobs addressed comments on the proposed sampling approach provided by DTSC (DTSC 2021b), consistent with responses to DTSC comments (PG&E 2021), and DTSC comments provided on the draft Work Plan (DTSC 2021c).

Objective and Overview

This Work Plan outlines the process by which soil vapor samples will be collected to assess the soil below the Basque Hotel as a potential vapor intrusion (VI) source. Exterior soil vapor samples collected adjacent to the Basque Hotel during the *Post-Remediation Soil Vapor Investigation* event (Jacobs 2021b) will also be used to assess the VI potential at the building. Soil vapor sample results will also be used to assess human health risk attributable to VI as part of an upcoming post-remediation human health risk assessment for the Site.

An overview of the soil vapor sampling follows and is described in greater detail in following sections of the Work Plan:

- Up to five locations at the Basque Hotel will be sampled following subslab vapor pin or soil vapor probe (SVP) installation.
- Up to two subslab vapor pins will be installed just below the concrete subslab within the Basque Hotel building footprint.
- Up to one SVP will be installed via hand auger within the Basque Hotel building footprint. The SVP will be set at 5 feet below ground surface (bgs) for soil vapor sample collection.
- Up to two locations will be sampled in the Jai Alai Court. These locations will either be soil vapor pins installed just below the concrete slab, or SVPs installed via hand auger to 5 feet bgs.
- Installation of the soil vapor probes and subslab vapor pins will occur only if installation can be conducted safely and without damaging cultural resources. Cultural resources monitoring will be performed at all proposed sampling locations.
- The samples will be submitted for laboratory analysis of volatile organic compounds (VOC).

This Work Plan will be implemented after review from the DTSC and Fresno historical preservation department. Field teams will mobilize only after obtaining access permission from the property owner.

Site Description

The Site is located in Fresno, California, in the east-central portion of the San Joaquin Valley and occupies approximately 1.8 acres of land. The Site, shown on Figure 1, is located between F and G Streets, centered on Mariposa Street, and extending across several parcels located primarily between F Street and China Alley.

The Site includes the following properties (Figure 2):

- Former Basque Hotel Property = 1102 F Street (Assessor's Parcel Number [APN] 467-062-08)
- Former Basque Hotel Parking Lot (BPL) Property = 1056 F Street (APN 467-063-34)
- Ford Property = 1136 F Street (APNs 467-062-09 and 467-062-10)
- Tuck Property = 1042 F Street (APN 467-063-33)
- Yuyama Property = 1091 G Street (APNs 467-63-03 and 467-063-38)

Remedial excavation of the BPL, Ford, and Yuyama properties was completed in May 2021, and post-remediation soil vapor sampling of the remediated areas will be performed under a separate work plan (Jacobs 2021b). The Former Basque Hotel is located on a parcel that formerly included the Fresno-2 MGP coal and retort houses, which operated from 1881 to 1918. The hotel, constructed in 1922, had a restaurant/bar on the first floor, with small apartments located on the second floor. The Basque Hotel ceased operation in 2011; however, it has been listed on the City of Fresno's Local Register of Historic Resources (Kleinfelder 2021). The two-story building has an "L" shaped footprint that encloses two sides of an outdoor Jai Alai court. According to the City of Fresno Historic Preservation, soil in the vicinity of the Former Basque Hotel has been previously disturbed due to the construction of the building and streets and subsequent alterations to the property (DTSC 2021b).

In its current condition, the hotel is not habitable, and the building would likely require significant renovations before occupancy. Indoor air samples collected in building's current condition would not be representative of future site conditions and calculating an attenuation factor (AF) at this time (under current building conditions) would not be representative for future occupants following building renovation. The proposed sampling of soil vapor below the building, described in the sections below, is intended to assess and better understand the potential as a VI source. PG&E concurs with using default AFs, per DTSC and US Environmental Protection Agency vapor intrusion guidance, in risk assessment calculations when assessing vapor intrusion at the Basque Hotel.

Basque Hotel Sample Location Considerations

The Basque Hotel is listed on the City of Fresno's Local Register of Historic Resources. This designation has previously presented issues for access associated with Fresno-2 MGP site work, and as a result sample collection on the Basque Hotel property has not previously occurred.

A site visit conducted at the Basque Hotel on June 24, 2021, informed selection of proposed soil vapor sampling locations (Jacobs, 2021a). The following observations were made during the site visit, and the impact on proposed sampling locations is noted. Figure 3 shows the first floor layout of the Basque Hotel and illustrates relevant details of the building interior. The following assumptions were made in preparing this work plan:

- The floor tile observed throughout much of the building has a high likelihood of containing asbestos and would likely require mitigation of asbestos prior to activities such as drilling that might involve breaking or puncturing the tile. Therefore, no sampling locations are proposed within areas of the Basque Hotel that have floor tile.

- Penetrating the concrete inside the building (e.g., cellar and garage) is acceptable from a historical preservation perspective (to be confirmed by Fresno historical preservation department).

- Penetrating the concrete outside the building (Jai Alai Court) is acceptable from a historical preservation perspective (to be confirmed by Fresno historical preservation department).

- Collection of a soil vapor sample from beneath the dining room hardwood flooring will need to occur within an existing opening in the flooring and will require enough working space to maneuver equipment needed to hand auger into the underlying soil to 5 feet bgs.

- Installation of the soil vapor probes and subslab vapor pins will occur only after a utility location survey has been conducted.

- Installation of the soil vapor probes and subslab vapor pins will occur only if this activity can be conducted safely. This will be assessed based on information from the utility location survey and by safety personnel during the field event.

- Cultural resources monitoring will be performed at all proposed sampling locations, and sample locations may be adjusted based on input from the cultural resources monitor and in order to avoid damaging cultural resources.

Proposed Sample Locations

The locations proposed for the soil vapor sampling locations are described below, shown on Figure 3, and summarized in Table 1.

- SVP-11 is proposed for collection of a soil vapor sample below the concrete surface of the Jai Alai Court, in the footprint of a former MGP site feature. This location is outdoors (no roof covers the court) and the concrete slab appears to be directly on-grade. The concrete slab is in poor condition throughout the Jai Alai Court with major cracks and with weeds growing through the cracks. Based on the condition of the concrete surface, the sample will be collected from an SVP installed at 5 feet bgs (below the slab).

- SVP-12 is proposed for collection of a soil vapor sample from a subslab vapor pin to be installed immediately below the cellar floor slab. The cellar dimensions are approximately 8’ x 8’ x 6’ deep with a wooden staircase for access and shelving around the perimeter for food storage. This location is indoors, and the concrete floor of the cellar appears to be directly on-grade.

- SVP-13 is proposed for collection of a soil vapor sample from a subslab vapor pin to be installed immediately below the concrete floor in the garage, in the footprint of a former MGP site feature. This location is indoors, and the concrete floor slab appears to be directly on-grade.

- SVP-14 is proposed for collection of a soil vapor sample below the concrete surface of the Jai Alai Court, in the footprint of a former MGP site feature. This location is outdoors (no roof covers the court) and the concrete slab appears to be directly on-grade. The concrete slab is in poor condition throughout the Jai Alai Court with major cracks and with weeds growing through the cracks. Based on the condition of the concrete surface, the sample will be collected from an SVP installed at 5 feet bgs (below the slab). The location of this sample may be adjusted based on the ability to sample location SVP-15: if a sample can successfully be collected at SVP-15, then the location of SVP-14 may be shifted to the northeast corner of the Jai Alai Court for broader lateral distribution of sample locations in the Jai Alai court.

- SVP-15 is proposed for collection of a soil vapor sample from the soil underlying the dining room within footprint of a former MGP feature. The sample will be collected from an SVP installed at 5 feet bgs. This location will go through the approximately 18-inch-high crawl space beneath the raised wooden floor. Sampling at this location can occur only if it is possible to do so without causing further damage to the dining room hardwood flooring.

Table 1. Proposed Soil Vapor Sampling Locations
Basque Hotel Soil Vapor Sampling Work Plan
Fresno-2 Former Manufactured Gas Plant Site, Fresno, California

New SVPs	Location	Type of Sampling Location and Proposed Sampling Depth
SVP-11	Jai Alai Court – within footprint of a former MGP feature	Soil Vapor Probe (5 feet bgs) ~~or~~
SVP-12	Cellar Floor Slab	Subslab Vapor Pin (immediately below slab)
SVP-13	Garage – within footprint of a former MGP feature	Subslab Vapor Pin (immediately below slab)
SVP-14	Jai Alai Court – within footprint of a former MGP feature Note: If SVP-15 is approved for sample collection, the location of SVP-14 may be shifted to the northeast corner of the Jai Alai Court.	Soil Vapor Probe (5 feet bgs) ~~or~~
SVP-15	Dining Room (crawl space beneath raised wooden floor) – within footprint of a former MGP feature	Soil Vapor Probe (5 feet bgs)

Field Methodology

Building Survey

A building survey will be conducted for the Basque Hotel to observe building characteristics in accordance with the SOP provided as an attachment to this Work Plan. The form provided in the SOP is intended to address most common building characteristics useful during VI investigation. The focus of survey will be to record information on the features and condition of the building related to the potential for vapor migration. The presence of potential indoor air sources will also be noted. Because of the current use and condition of the building this survey will be limited to information that is relevant to the VI investigation that can be observed safely and without disturbing cultural .

The building survey will be conducted approximately two weeks before the sampling event is scheduled in the presence of the building owner, DTSC, and the Fresno historical preservation department representative. Locations will be reviewed to ensure they are accessible and acceptable to the Fresno historical preservation department. If locations are inaccessible, the sampling team in consultation with DTSC, the Fresno historical preservation department representative and the property owner will assess whether obstructions can be moved, whether an alternate location is available that will meet the needs of the investigation, or whether the location should be eliminated from the investigation. Final agreed-upon locations will be marked for utility clearance as described below.

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Clearances and Monitoring

After marking the planned boring locations and before initiating intrusive work, Jacobs will notify DigAlert through Underground Service Alert. A third-party geophysical locator will additionally be contracted to mark underground utilities and clear each boring of subsurface utilities or other potential obstructions. Because all proposed sampling locations are within the footprint of the 1922 Basque Hotel and the associated Jai Alai court, cultural resources monitoring will be performed in all proposed sampling locations. After coring a 6-inch to 8-inch diameter core through the paved surfaces at each boring, hand augering will be performed to further clear the entire borehole diameter (approximately 3 inches) of utilities to a maximum depth of 5 feet bgs.

Soil Vapor Monitoring Probe Installation and Sampling

Semi-permanent SVPs will be installed at approximately 5 feet bgs, as soil vapor samples collected from depths of less than 5 feet are subject to atmospheric interference. A construction schematic for the SVPs is presented on Figure 4. Each SVP will be emplaced at the center of a 1-foot sand pack (#2/16 sand, or equivalent). Each SVP will be a 6-inch-long and 0.25-inch-diameter stainless steel probe connected to 0.25-inch-diameter Teflon tubing, or equivalent. A 1-foot transition seal of granular bentonite will be placed above the sand pack. The annular seal will be bentonite that is hydrated in 1-foot lifts on top of the transition seal to the surface. A well box will be installed to protect the SVPs following installation. The locations of the SVPs will be recorded using a hand-held GPS or, if access to satellites is blocked, the locations of the samples will be recorded by measurements from the closest walls.

When hand augering soil borings for SVP installation, Jacobs will use a calibrated photo-ionization detector (PID) to screen soil for VOCs. Approximately 100 grams of soil will also be placed in a sealable plastic bag from each 5-foot sample interval. The grab samples will be allowed to sit for about 5 minutes, and then a headspace reading will be collected with the PID. The PID readings will be documented on a sample collection log or in a field notebook. Jacobs will also use a LandTec GEM 5000 Landfill Gas Meter, or equivalent, to analyze for methane, carbon dioxide, carbon monoxide, and oxygen to perform safety monitoring.

Standard operating procedures (DTSC 2015) will be followed when purging and sampling the SVPs. Sampling will proceed a minimum of 48 hours after construction of SVPs. The soil vapor samples will be collected in 1-liter SUMMA canisters over 5-minute periods and from within a helium-filled enclosure. For quality control purposes, two duplicate soil vapor samples will be collected. Duplicate samples will be collected simultaneously with a dedicated T-connector. The whole assembly with the T-connector will be vacuum leak tested. Duplicates will be collected by attaching a flow controller to each canister and then connecting the T-connector to each flow controller.

Subslab Vapor Pin Installation and Sampling

Subslab vapor pins will be installed immediately below the concrete slab, as described in Attachment A, Installation and Abandonment of Vapor Pins as Subslab Soil Vapor Probes. The diameter of the subslab vapor pins will be approximately 1.5 inches to a depth of approximately 1.75 inches bgs and approximately 5/8-inch for the remainder of the pin. The subslab vapor pins will be installed by drilling through the building floor slab with a rotary hammer drill and driving the vapor pins (stainless steel flush Cox Colvin vapor pins) into the hole with a rubber mallet and the manufacturer's installation tool. The subslab vapor pins locations will be covered with a flush mount cover. The locations of the samples will be recorded by measurements from the closest walls.

After the subslab vapor pins are installed and subsurface conditions have equilibrated (at least two [2] hours following vapor pin installation), a shut-in test and a helium leak check will be performed to confirm there are no leaks within the sampling train (DTSC, 2015; USEPA, 2015). Soil vapor samples will be collected by leak checking each pin prior to sampling each time with helium, purging three volumes at approximately 200 milliliters per minute (mL/min) into a Tedlar bag, and screening the purged air for

helium using a MGD-2002 (or similar) helium detector and for total VOCs, oxygen, carbon dioxide, and methane using a GEM 5000 (or similar) landfill gas meter.

A section of 0.25-inch-outside-diameter Teflon tubing and a sampling manifold will be connected to the vapor pin with Masterflex tubing, and a minimum of three purge volumes will be purged at approximately 200 mL/min using a small air pump. Subslab soil vapor samples will be collected using evacuated 1-liter Summa canisters and flow controllers. The Summa canisters will be filled over a 5-minute period, based on filling the canister at a rate of 200 mL/min.

Laboratory Analysis of Soil Vapor Samples

The soil vapor samples will be submitted under chain-of-custody procedures to a California Environmental Laboratory Accreditation Program-certified laboratory. Soil vapor samples will be analyzed for VOCs by U.S. Environmental Protection Agency (EPA) Method TO-15 and for helium gas by EPA Method 3C. PG&E will request the laboratory provide newer SUMMA canisters (i.e., passivated stainless steel canisters) for soil vapor samples to be collected as the samples will be analyzed for naphthalene. One additional soil vapor sample will be collected for analysis by Method TO-17 for naphthalene (using sorbent-packed thermal desorption tube); this sample will serve as five percent of the soil vapor samples collected to confirm the results of Method TO-15 (DTSC, 2021b; PG&E 2021). The list of analytes are presented in Table 2 long with their Method TO-15 reporting limits. The naphthalene reporting limit for Method TO-17 is 2.2 µg/m^3.

Table 2. Soil Vapor Risk Based Screening Levels and Reporting Limits
Post-Remediation Soil Vapor Investigation Work Plan
Fresno-2 Former Manufactured Gas Plant Site, Fresno, California

Constituent	Soil Vapor to Indoor Air Risk-Based Screening Level (µg/m^3)[a]		Method Detection Limit (µg/m^3)[b]	Reporting Limit (µg/m^3)[b]
	Industrial/Commercial	Residential		
1,2,4-Trimethylbenzene	8,700	2,100	0.28	2.0
1,3,5-Trimethylbenzene	8,700	2,100	0.29	2.0
1,4-Dioxane	83	19	0.24	2.0
2-Butanone (MEK)	730,000	173,000	0.42	3.8
2-Propanol	29,000	7,000	0.83	3.8
4-Ethyltoluene	n/a	n/a	0.32	2.0
Acetone	47,000,000	1,067,000	4.5	20
alpha-Chlorotoluene	8.3	1.9	0.45	4.0
Benzene	14	3.2	0.29	2.0
Bromomethane	730	173	0.28	2.0
Carbon Disulfide	103,333	24,300	0.06	3.8
Chloromethane	13,000	3,100	0.32	2.0
Cyclohexane	870,000	210,000	0.57	3.8
Ethanol	n/a	n/a	1.4	20
Ethylbenzene	163	37	0.28	2.0
Freon 12	n/a	3,300	0.33	2.0
Heptane	60,000	14,000	0.32	2.0

Table 2. Soil Vapor Risk Based Screening Levels and Reporting Limits
Post-Remediation Soil Vapor Investigation Work Plan
Fresno-2 Former Manufactured Gas Plant Site, Fresno, California

Constituent	Soil Vapor to Indoor Air Risk-Based Screening Level (µg/m^3)[a]		Method Detection Limit (µg/m^3)[b]	Reporting Limit (µg/m^3)[b]
	Industrial/Commercial	Residential		
Hexane	100,000	24,300	0.42	2.0
Isopropylbenzene	60,000	14,000	0.29	2.0
m,p-Xylene	15,000	3,300	0.53	3.8
Methylene Chloride	400	33	0.57	2.0
Naphthalene	12	2.8	0.49	2.0
n-Propylbenzene	150,000	33,300	0.29	2.0
o-Xylene	15,000	3,300	0.29	2.0
Styrene	130,000	31,300	0.32	2.0

Notes:

µg/m^3 = microgram(s) per cubic meter

a: Soil vapor to indoor air risk based screening levels are based on DTSC (2020) HHRA Note 3 ambient air recommended screening levels and the EPA (2015) attenuation factor (0.03). In cases where the DTSC RSL is not available the USEPA (2021) Industrial Indoor Air Regional Screening Level is used. RBSLs for cancer effects correspond to an incremental cancer risk of 1×10^{-6} for a residential scenario. RBSLs for noncancer effects correspond to a target hazard quotient of 1 for a residential scenario. The soil vapor remediation goal is the lower of the cancer and noncancer RBSL.

b: Provided by ALS Environmental. This lab, or a lab with similar values will perform analysis on the soil vapor samples.

Equipment Decontamination and Waste Management

Downhole drilling and sampling equipment will be decontaminated between sample locations and before and after working at the Site.

Waste generated during field activities is expected to include soil cuttings, decontamination water, and general refuse. Waste soil and water will be segregated, containerized, and stored drums approved by the U.S. Department of Transportation, in accordance with the requirements outlined in the Waste Management and Transportation Plan (Jacobs 2020). The waste drums will be appropriately labeled and stored within secondary containment placed at an onsite staging location within the fenced Ford Property. Upon receipt of the analytical results from waste profile sampling, waste soil and water will be profiled and transported by a licensed waste transported to a licensed disposal facility. General refuse will be disposed as municipal waste.

Decommissioning of Soil Vapor Probes and Subslab Vapor Pins

The SVPs and subslab vapor pins will be decommissioned at a later date in accordance with State of California requirements. SVPs will be decommissioned per the following steps:

1) Remove the well box.
2) Excavate the borehole to approximately 3 feet bgs to expose the upper portions of the tubing.
3) Cut or pull the tubing to remove as much tubing as possible.
4) Fill the open hole with cement grout to within 1 foot of the surface grade.
5) Restore upper 1 foot of the borehole to original surface conditions.

Subslab vapor pins will be decommissioned per the following steps:

1) The vapor pins will be removed from the ground.
2) The floor slab will be repaired by backfilling the hole with cement.

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Data Evaluation and Reporting

Soil vapor sample results will be evaluated against applicable risk-based screening levels (RBSLs) and using the available lines of evidence gathered during the investigation to assess the potential for a vapor intrusion source in soil and if further action is needed. The RBSLs are derived based on USEPA vapor intrusion guidance (USEPA, 2015; USEPA, 2021) and the California Toxicity Criteria Regulation toxicity values presented in HHRA Notes 3 and 10 – (DTSC, 2019, 2020) [Table 2]. The soil vapor to indoor air RBSLs used to evaluate the samples collected at the Basque Hotel will be derived based on generic attenuation factors, per USEPA (2015, 2021) vapor intrusion guidance.

Jacobs will submit an electronic letter report to DTSC for review following receipt of analytical results. The letter report will summarize the field activities performed, the analytical results as reported by the laboratory, the validated results, results of a comparison to RBSLs, and conclusions with any recommendations for further action. The analytical results will be tabulated and depicted, as needed, in tables and figures that will accompany the letter report and analytical reports. Field sampling sheets that record information on the SVP and vapor pin installation and the sample collection will be completed and included in the anticipated investigation reports.

Tentative Implementation Schedule

Implementation of this Work Plan is anticipated to begin in November 2021, based upon DTSC's approval of this work plan and access being provided by the property owner. DTSC will be notified at least three weeks before the start of field work so a public notice can be issued and Site visit can be scheduled, if desired.

A second soil vapor sampling event will be conducted during a different season from the first event, to assess temporal variation. The schedule for the second event will be determined in conjunction with DTSC.

Please do not hesitate to contact me at (510) 289-4606 or Jacobs project manager Ellen Hedfield at (530) 917-4551 should you have any questions concerning this Work Plan and its implementation.

Sincerely,

Anne Estabrook
Senior Project Manager

Enclosures: References, Figures 1 to 4, SOP

Copies to: Ellen Hedfield/Jacobs
Project Files

References

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Figures

N

0 500 1,000
Feet

FIGURE 1
Site Location Map
Basque Hotel Soil Vapor Sampling Work Plan
Fresno-2 Former MGP Site
Pacific Gas and Electric Company
Fresno, California

Jacobs

LEGEND

PARCELS INCLUDED IN VOLUNTARY CLEANUP AGREEMENT

PARCELS SUBJECT TO REMEDIATION DURING REMEDIAL ACTION

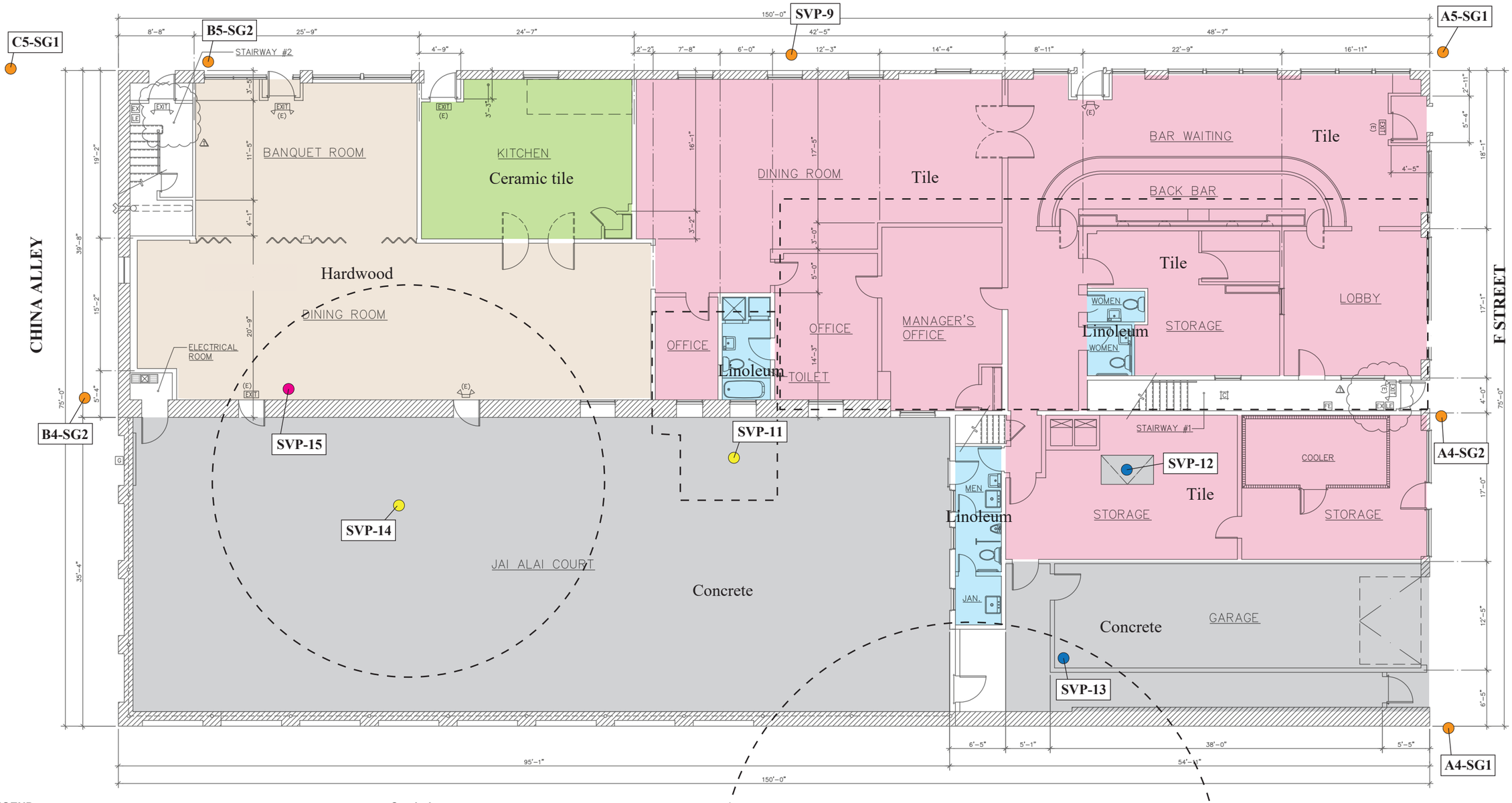
NOTES:

1. MAP NUMBER (MN) 467
2. BLOCK NUMBERS (BN), SHOWN IN ELLIPSES
3. PARCEL NUMBER (PN), SHOWN IN CIRCLES
4. APN = MN-BN-PN (e.g. 467-63-34)
5. PARCEL BOUNDARIES ARE APPROXIMATE (SOURCE: https://www.co.fresno.ca.us/departments/public-works-planning/divisions-of-public-works-and-planning/cds/gis-shapefiles. ACCESSED JUNE 2021.)

0 80 160 Feet

N

FIGURE 2
Parcel Map
Basque Hotel Soil Vapor Sampling Work Plan
Fresno-2 Former MGP Site
Pacific Gas and Electric Company
Fresno, California



LEGEND

- Proposed Subslab Vapor Pin Sampling Location
- Fresno-2 MGP Post-Remediation SVP (existing or proposed)
- Proposed Soil Vapor Sampling Location (5 ft bgs)
- Proposed Soil Vapor Sampling (5 ft bgs) or Subslab Vapor Pin Sampling Location
- Historical Structure Footprint

- Hardwood
- Ceramic Tile
- Asbestos Tile
- Concrete
- Linoleum

Symbols

Symbol	Description	Symbol	Description
	Existing Masonry Wall	ER	Tactical Exit Route Signage
	Interior Partitions	ES	Tactical Exit Stair Sign
FE	Fire Extinguisher Location	EXIT (E)	Existing Illuminated Exit Sign
LE	Low Level Exit Sign	EXIT (E)	Exit Sign With Illumination
EXIT	Illuminated Exit Sign	(E)	Existing Exit Illumination
EX	Tactical Exit Signage		

North

0 10 20

Approximate scale in feet

Figure 3. Proposed Sampling Locations
Basque Hotel Soil Vapor Sampling Work Plan,
Fresno-2 Former MGP Site, Fresno, California

Source: The Vincent Company, Drawing: 140615 - Basque Hotel\A3 - Ground Floor.dwg, 9/25/2015

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Jacobs	PROJECT NUMBER	IMPLANT NUMBER SHEET OF

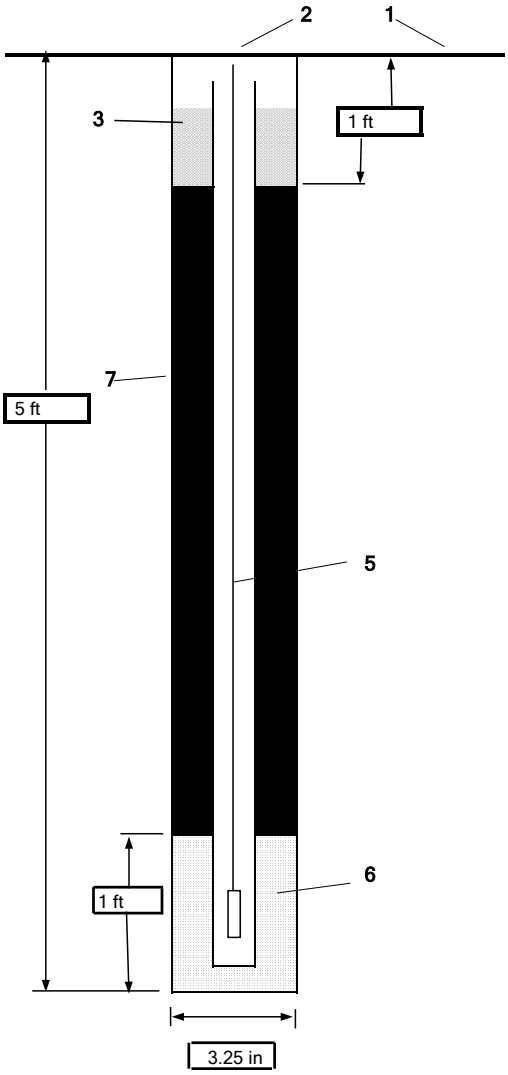
Figure 4 SOIL VAPOR PROBE COMPLETION DIAGRAM

PROJECT : LOCATION :

DRILLING CONTRACTOR :

DRILLING METHOD AND EQUIPMENT USED :

WATER LEVELS : START : END : LOGGER :



1- Ground elevation at well

2- Top of casing elevation
a) vent hole?

3- concrete pad dimensions 1 ft x 3 inch

4- Dia./type of implant 1/4 inch stainless steel, 6 inch

5- Type/slot size of screen NA - 1/4-inch Teflon tubing

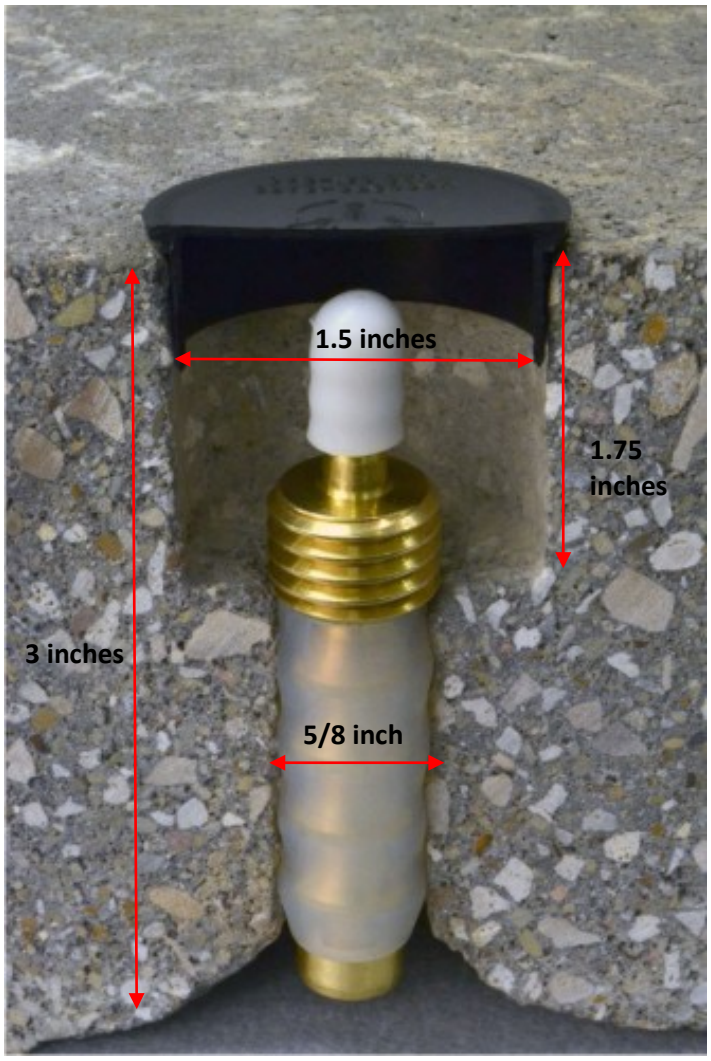
6- Type screen filter #2/16 sand
a) Quantity used

7- Type of seal Hydrated granular or chipped bentonite
a) Quantity used

8- Grout NA
a) Grout mix used
b) Method of placement
c) Vol. of well casing grout

Comments

Figure 5. Subslab Vapor Pin Diagram



STANDARD OPERATING PROCEDURE

Conducting Building Surveys for Vapor Intrusion Investigations

Purpose

This Standard Operating Procedure (SOP) presents general guidelines for conducting building surveys for vapor intrusion (VI) investigations. A building survey is performed as part of a VI investigation to obtain information for development of the building-specific aspects of a conceptual site model (CSM) and to prepare for VI sampling (for example, select optimal sampling locations and determine if there are potential confounding indoor sources of volatile organic compounds [VOCs]).

A CSM for VI pathway investigation describes potential VOC subsurface sources, migration pathways, and potential human receptors under current and/or future land uses at the site. The important building characteristics for VI pathway investigation include the following:

- Building use and occupancy
- Condition of the building envelope
- Presence of a basement or crawl space
- Presence of preferential pathways for vapor intrusion
- Dimensions of the building and interior compartments
- Condition of the slab and basement walls and presence of potential VI pathways
- Type, zoning, and typical operational settings of the heating, ventilation, and air conditioning (HVAC) system
- Presence of potential indoor sources of VOCs
- Evidence of groundwater infiltration into the structure

This SOP can be used to perform building surveys in residential, commercial, or industrial buildings.

Scope

This SOP provides a general description of the information that should be observed and documented during building surveys. Sources of information about the building can include conversations with the occupants, landlords, visual observations, and possibly building plans or building inspection reports the occupant may be willing to share. The level of detail to which each building characteristic is evaluated will depend on the data quality objectives for each project.

Equipment and Materials

- Jacobs Building Survey Form – to record survey information (either electronic or paper)
- Figure showing the footprint of the building (if available) – to mark up during the building survey
- Flashlight
- Laser measuring tool, walking wheel, or measuring tape – to measure building and room dimensions

- Camera – to photograph the building (interior and exterior)
- Recommended – field instrument such as a MultiRAE photoionization detector (PID) to measure total VOC and carbon monoxide concentrations in the breathing zone for health and safety monitoring
- Optional – ppbRAE PID to assist with identifying indoor VOC sources

Procedures and Guidelines

Procedures for Performing a Building Survey

- **Gain access to the building**. Field staff should be trained for their role in courteous public interaction, aware of common safety hazards that may exist in buildings, and work closely with risk communication specialists.
- **Obtain occupant information**. The building occupants are the potential receptors in the VI CSM. Is the building use residential, commercial, or industrial? How many people typically occupy the building? Are there sensitive receptors (children, elderly, pregnant women, or immune-impaired) in the building? How much time do occupants spend in the building? What areas of the building do the occupants typically use (that is, where do they spend the most time)? If there is a basement, it is helpful to understand the amount of time people spend in the basement – for example, is there a family room in it or is it just storage or laundry?
- **Obtain building information.** How old is the building? What was its original use? Have there been additions or other significant modifications? Additions will likely have slabs that are separate from the original building. Differing shingles or roof pitches can sometimes indicate additions as well. How many floors does the building have? Does the building have a basement? If so, how far does it extend below grade? Is the slab on grade? Is the slab elevated above the ground surface? Is there a crawlspace? If so, where is the crawlspace access?
- **Survey the building envelope**. Walk around the inside and outside of the building and record information on the building construction and condition. How many doors/windows/loading docks are there, what condition are they in, and are they typically left open or closed? Are there obvious cracks in the walls or at the eaves that provide ventilation? What are the building construction materials? Look up at the roof for signs of a whole-house fan or other exhaust ventilation. Observe any exhaust fans that may be present in the walls or ceilings.
- **Determine the indoor air volume and the location and volume of separate indoor air compartments within the building**. Measure the building dimensions (length, width, and height). Measure the dimensions of compartments or rooms within the building. How are rooms connected? Are interior doors typically kept open or shut? Are there separate compartments within the building (that is, areas that are not connected to other areas such that the indoor air does not mix)?
- **Observe the slab condition**. How thick is the slab? What is the general condition of the slab? What is the floor covering in each room of the lowest floor (carpet, tile, or wood)?
- **Identify potential vapor intrusion pathways**. Any openings, cracks, or penetrations in the slab or basement walls may be entryways for subslab soil vapor.

  Are there utilities that penetrate the slab or basement walls? Are they sealed properly? It may be helpful to inventory utilities systematically by asking where the water line comes in, and where the sewage line goes out. Ask if the building has central utility services for water and sewer or uses septic and/or well. Similarly, telecommunications, cable TV, and power lines can come into the building overhead or underground. Overhead services can frequently be identified on the exterior of

the structure and are unimportant for vapor intrusion. Underground services can either be directly buried wire/cable or installed in a conduit.

Are there cracks in the slab or basement walls? If so, note where these cracks are and their approximate size. Are there sumps? If so, note the dimensions of each and their typical operating conditions (is pump present? Is the top of the sump sealed? Where does the sump discharge?). Is the wall/floor juncture sealed well? Is there a french drain? Is there an open drain provided in the laundry room or for draining water from the furnace or gas fired hot water heater? Has the basement been waterproofed? Are there expansion joints in the slab? If so, note their condition.

- **Evaluate the HVAC system**. Record the type and model of the systems and the typical operating conditions. Is there one air conditioning zone or multiple zones (look for multiple thermostats)? Does the HVAC system use radiant heat or forced air? If the HVAC system is forced air, where are the heating and cooling and return air vents? Where is the HVAC system's fresh air intake? What is the heating fuel source (that is, natural gas, oil, or propane)? Are there ventilation fans (such as bathroom exhaust, kitchen exhaust and/or whole house fans)? If so, note where and their typical operating conditions. Are there window air conditioning units? Is a heat recovery ventilator in use? Is there a fireplace or woodstove, and if so, how frequently is it used?
- **Identify any existing vapor mitigation systems.** Is there a radon mitigation system or other subslab depressurization system? Is there sealant on any cracks or crevices? Is there a sealant coat on the floor or basement walls for vapor or water mitigation?
- **Identify if the building experiences seasonal flooding**. Ask the building owner and/or occupants if seasonal flooding in the building is experienced. If so under what conditions/how frequently/how bad? If the building experiences flooding, document the condition of gutters/downspouts and whether the lot is graded away from the foundation. This will help assess the source of the water.
- **Sketch the building floor plan**. Include building dimensions, locations of windows/doors/loading docks, outdoor surface cover (such as, grass and asphalt), and locations of potential indoor or outdoor VOC sources. Attached garages or attached storage sheds can be important sources of VOCs. Fully detached garages or storage buildings do not normally need to be surveyed unless they are routinely occupied.
- **Identify potential indoor VOC sources within the building**. Record the location of the potential sources and determine if they can be removed before indoor air sampling is performed. Potential indoor sources of VOCs may include cleaning products, paint, dry-cleaned clothes, craft glues, air fresheners, gasoline, cosmetics, or cigarette smoke. Recent remodeling activities, including painting, installing new carpeting or flooring, and moving in new furniture should be identified, because they could be potential sources of VOCs. A field instrument can also be used to pinpoint potential indoor VOC sources. In situations with numerous products such as numerous cleaning supplies, it can be efficient to photograph both the front and back of the containers lined up.
- **Identify potential outdoor contaminant sources**. These may include gas stations, major roadways, dry cleaners, repair shops, industries, outdoor cooking areas, or landfills.
- **Identify possible indoor air, outdoor air, crawl space air, and subslab soil vapor sample locations** that meet the project-specific data quality objectives and are acceptable to building occupants.

Quality Control and Quality Assurance

Adequate time should be reserved for performing building surveys and detailed notes should be recorded at the time of the building survey. Verify that indoor air samples are collected no less than 24-hours after chemical products that may contain VOCs are temporarily removed from the building. The field notes should be reviewed by the Field Quality Manager at the end of each workday performed.

Attachments

- Jacobs Building Survey Form

References

Interstate Technology and Regulatory Council. 2007. V*apor Intrusion Pathway: A Practical Guideline. Prepared by The Interstate Technology & Regulatory Council Vapor Intrusion Team*. Available at http://www.itrcweb.org/documents/VI-1.pdf.

U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. 2015. *Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air*. June.

Building Survey Form for Vapor Intrusion Investigations

Property ID: _____

Site/Project Name: _____

_____

Date of Survey: _____

Preparer(s): _____

Building Occupancy and Use

1. What is the estimated number of building occupants?

_____

_____

(Make general observations about age range and percentage of male to female ratio)

2. Are there any sensitive receptors in the building? (elderly, children, immuno-compromised, women of child bearing age, etc.)

_____

3. How long have the current occupants occupied the building? _____

4. What is the building type/use? Circle all that apply and describe.

Residential (single family, duplex, apartments) / Office / Strip Mall / Commercial / Industrial / Other:

_____

Describe building use (circle all that apply):

Residential / Manufacturing / Storage / Chemical Storage / Administrative / Instrumentation / Other:

_____

_____

5. What are the historical activities within the building (if different than above)?

_____

_____

Building Occupancy and Use - continued

Questions 6 - 8 are applicable to non-residential buildings only.

6. What type of work is performed within the building? _____

_____

_____

7. How many hours per day or week do workers spend in the building?

_____

_____

8. Is the building accessed by the public? (Describe approximate number of persons, frequency of visits, and duration of visits.)

_____

_____

Building Construction

1. What year was the building constructed? _____

2. Have there been additions to the building? If so, when? (Identify on building sketch)

_____

_____

3. What are the approximate dimensions of the building? _____

4. What are the construction materials of the exterior of the building?

_____

_____

5. How many floors does the building have? _____

Does the main floor sit on, below, or above grade? _____
(How many feet above or below grade?)

Number of floors at or above grade? _____

Number of floors below grade? _____
(How many feet below grade?)

Building Construction - continued

6. Describe the basement (if present):

Does the building have a basement and/or crawl space? _____

_____

How many feet below grade? _____

Approximate square footage: _____

Approximate ceiling height (give range if varying height): _____

Is the basement separated into multiple rooms? Describe (note use, if space is finished/unfinished):

_____

_____

Construction materials of walls (i.e. poured concrete, cinderblock, brick, etc.; are the walls covered with epoxy?):

_____

Are significant cracks present in the walls? _____

7. Describe the main floor:

Approximate square footage: _____

Approximate ceiling height (give range if varying height): _____

Is the main floor separated into multiple rooms? _____

_____

_____

Construction materials of walls (i.e. framing, siding, cinderblock, etc.):

_____

_____

Building Construction - continued

8. Describe the building slab:

Construction materials of floor/slab: _____

_____

Describe the floor coverings (epoxy paint, carpet, tile, etc.) _____

_____

If concrete slab, are expansion joints present? _____

Are they sealed/showing deterioration? _____

Are significant cracks present in the slab? _____

Are there any penetrations in the slab? (utility conduits, etc.) _____

_____

Is there a subslab vapor/moisture barrier in place? _____

Are any floor drains or sumps present? Is there standing water in them? _____

_____

Are there any subsurface vaults present? (if so describe and add locations to building sketch)

_____

9. Does the building have a moisture/dampness problem?

No / Rarely (less than 1 time per year) / Occasionally (1-2 times per year) / Frequently

10. Does the building ever flood?

No / Rarely (less than 1 time per year) / Occasionally (1-2 times per year) / Frequently

11. Is there a septic system? ☐ Yes ☐ Yes, but not in use ☐ No

12. Is there irrigation or a private well? ☐ Yes ☐ Yes, but not in use ☐ No

13. Type of ground cover outside: Grass / Concrete / Gravel / Asphalt / Other _____

14. Additional notes on building construction:

_____

_____

_____

Existing Vapor Mitigation Systems

1. Has a radon or vapor mitigation system been installed in this building? (Show location on building sketch)

If yes: Installation Date: _____

Type of System: Passive Venting / Active Subslab Depressurization
Crack and Crevice Sealing / Dilution Ventilation Control / Other

Notes: _____

Air Flow Within the Building and Outdoor Air Exchange

1. Are there any areas of the building that are positively or negatively pressurized (look for doors not opening and/or closing properly, perceptible air flow, audible fan noises)?

2. Is there one HVAC zone or multiple zones? How many zones? Add thermostat locations to building floorplan, if available.

3. Type of ventilation system (circle all that apply):

Central Air Condition / Mechanical Fans / Bathroom Ventilation Fans / Individual Air Condition Units
Kitchen Range Hood Fan / Outside Air Intake / Industrial Floor Fans
Whole-Building Attic Exhaust Fan / Other: _____

4. Type of heating system (circle all that apply):

Forced Hot Air / Hot Air Radiation / Wood / Steam Radiation / Heat Pump / Individual Heater / Hot Water Radiation
Kerosene Heater / Fireplace / Electric Baseboard / Other: _____

5. Type of fuel utilized (circle all that apply):

Natural Gas / Electric / Fuel Oil / Wood / Coal / Solar / Kerosene / Other: _____

6. Are there any sources of outdoor air?

☐ Mechanical (AHU) ☐ Doors

☐ Windows ☐ Other

Are windows/doors left open routinely (seasonal differences)? _____

Evaluation of Potential Indoor VOC Sources

1. Are SDSs available for chemicals used with in the building? If possible, obtain a copy of the Table of Contents. List items in additional notes section (include approximate quantities and frequency).

☐ Yes ☐ No

2. Do any of the products stored in the building contain VOCs?

☐ Yes ☐ No

3. Are any of the target analytes used in the building?

☐ Yes ☐ No

If yes, is the usage confined to a specific room/area?

☐ Yes ☐ No

4. Are pesticides used for indoor pest control?

☐ Yes ☐ No

If yes: Name of product: _____

Frequency of use: _____

Has there been an application within the last 6 months? _____

5. Is smoking permitted inside the building?

☐ Yes ☐ No

If yes, does smoking typically occur within a specific room/area?

☐ Yes ☐ No Notes: _____

How often? _____

Last time someone smoked in the building? _____

6. Has there been any remodeling or construction within the past 6 months (i.e. new carpeting/tiling, painting, additions, new furniture, etc.)

☐ Yes ☐ No

Is there any planned for the near future?

☐ Yes ☐ No

Evaluation of Potential Indoor VOC Sources - continued

7. Does the building have an attached garage or do vehicles regularly enter the space (example: a vehicle repair shop)?
☐ Yes ☐ No

8. Are gas-powered equipment or cans of gasoline/fuels stored in the building or attached garage?
☐ Yes ☐ No

9. Do building occupants dry clean their clothes? ☐ Yes ☐ No

If yes, how often? Weekly / Monthly / Infrequently (3-4 times a year)

10. Has there ever been a fire in the building? ☐ Yes ☐ No

11. Has there ever been a known chemical spill immediately outside or inside the building?
☐ Yes ☐ No

12. Was the building screened with a ppbRAE to identify indoor VOC sources? If yes, describe the results:
☐ Yes ☐ No

Evaluation of Potential Outside VOC Sources

1. Are there stationary sources nearby (i.e. gas stations, emission stacks, hazardous waste storage, etc.):
☐ Yes ☐ No

2. Is there heavy vehicular traffic nearby (or other mobile sources)?
☐ Yes ☐ No

Building Survey Form for Vapor Intrusion Investigations

Attachment 1 - Confidential Information

Building Location:

Property ID: _____

Address: _____

_____

Business Name (if applicable): _____

Contact Information:

Name(s): _____

Occupation/Role: _____

Phone Number: (Home or Office) _____ (Mobile) _____

E-mail Address: _____

Name of person being interviewed, if different than above: _____

Do the occupants rent or own the building? _____

Provide owner contact information if different from above:

Name(s): _____

Phone Number: (Home or Office) _____ (Mobile) _____

E-mail Address: _____

Building Survey Form for Vapor Intrusion Investigations

Attachment 2 - Room-Specific Information

Questions from the generic building survey may apply to individual rooms if the building is partitioned into separate work spaces, especially if work spaces differ in daily activities. Please include room name and any applicable details below. If available, add room names to building floor plan for future reference.

Example: Women's Restroom (Room 112A) - Room measurements are 7' long, 5' wide, and 9' high. Typical cleaning supplies stored under sink (including products XYZ). Exhaust fan in ceiling that only runs when room is in use. One floor drain in center of room. Floor is tiled, so slab is unable to be observed. No cracks in walls. Room recently painted (approximately 3 months ago, as of survey date). Window unit dedicated to the room.

Building Survey Form for Vapor Intrusion Investigations

Attachment 3 - Additional Notes

If additional room is needed for capturing information collected during the building survey, include all notes here: