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October 30, 2015

Mr. Mark Detterman
Hazardous Materials Specialist
Alameda County Environmental Health Services
Environmental Protection, Local Oversight Program
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Subject: **Letter of Transmittal for Data Gap Investigation Workplan, Former McGrath Steel, 6655 Hollis Street, Emeryville, California 94608, ACEH Fuel Leak Case No. RO0000063, GeoTracker Global ID No. T0600102099**

Dear Mr. Detterman:

As required in your letters of September 15, 2014 and July 16, 2015, and discussed in our meeting, we submit this transmittal letter and accompanying *Data Gap Investigation Workplan.*

I declare under penalty of perjury, that the information and/or recommendations contained in the attached document or report is true and correct to the best of my knowledge.

Sincerely,

MCG Investments LLC,
A California Limited Liability Company

Walter F. Merkle
Authorized Agent

AllWest Environmental

DATA GAP INVESTIGATION WORKPLAN

Former McGrath Steel, 6655 Hollis St. & 1471 67th St., Emeryville, CA 94608

Alameda County Fuel Leak Case #RO0000063
GeoTracker Facility Global ID #T0600102099

PREPARED FOR:

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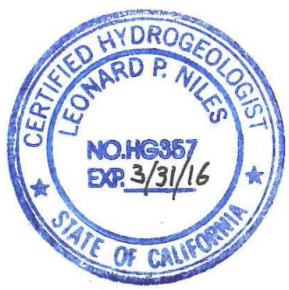
ALLWEST PROJECT 15179.23
October 30, 2015



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I. INTRODUCTION

AllWest Environmental, Inc. (AllWest) has prepared this workplan to describe tasks to further characterize soil, groundwater and soil vapor conditions at the subject site referenced above (Figures 1 and 2). This proposed work will be performed in response to a request by Alameda County Health Care Services Agency (ACHCS) for a *Data Gap Investigation Workplan* in their letters dated September 15, 2014 and July 16, 2015, and as discussed between ACHCS and our client in a subsequent meeting. This work will be completed after approval and with oversight of the ACHCS.

The purpose of the proposed work is to assess the potential presence and lateral and vertical extent of petroleum hydrocarbons and volatile organic compounds (VOCs) in soil, soil vapor and groundwater at the subject site in the vicinity of the warehouse building at 1471 67th Street, and to evaluate the potential soil vapor intrusion impact of petroleum hydrocarbons and VOCs to the indoor air quality at the subject site.

II. PROJECT BACKGROUND

A. Site Location and Description

The subject property is located at the southwest corner of the intersection of Hollis and 67th Streets in a commercial and industrial district of the City of Emeryville, Alameda County, California. A site vicinity map is included as Figure 1.

The subject property consists of two parcels (Assessor's Parcel Numbers 049-1511-01 and 049-1511-014). Parcel 01, on the southwest corner of Hollis and 67th Streets at the 6655 Hollis Street address, is developed with an approximately 4,100 square foot two-story commercial office building constructed in 1947, and a smaller metal tool shed building. Parcel 14, to the west of Parcel 1 at the 1471 67th Street address, is developed with an approximately 15,246 square foot light industrial warehouse building constructed circa 1946 (Stellar, 2011).

The subject property was last occupied by CMC Rebar and is currently vacant. Two USTs formerly present under the sidewalk in front of the warehouse at 1471 67th Street were removed in 1996. A site plan with former UST locations and historical and current boring and monitoring well locations is included as Figure 2.

B. Site Geology and Hydrogeology

The subject site is located on a generally level parcel at an elevation of approximately 20 feet above mean seal level (msl) with a slight slope to the west towards San Francisco Bay approximately ½ mile to the west. The subject site is located within the East Bay Plain Sub-Basin of the Santa Clara Valley Groundwater Basin, an alluvial plain located along the east shore of San Francisco Bay. Although groundwater in the subject site vicinity is not currently used for drinking water purposes, the East Bay Plain Sub-Basin, including the subject site vicinity, has been designated as a zone where groundwater is a potential drinking water resource by the SFRWQCB *Water Quality Control Plan (Basin Plan)* dated June 29, 2013 (SFRWQCB, June 2013).

According to an e-mail communication on February 6, 2013 with Maurice Kaufman, director of the City of Emeryville Public Works Department, use of groundwater for drinking water purposes within the City of Emeryville is prohibited by a City ordinance due to widespread regional contamination. No plans exist for future beneficial use of groundwater within the City of Emeryville. Therefore, AllWest does not regard groundwater in the subject site vicinity as a potential drinking water resource.

The lithology encountered in most borings during subsurface investigations performed by AllWest in 2013 consisted of interbedded silts, clays, and sands. Occasional lenses of silty gravel and gravelly silt were encountered to depths of 12 feet below ground surface (bgs) in borings B16, B17, B19 and B22. Gravelly clay was encountered between 13 and 18 feet bgs in B19. Silty sand was encountered between approximately 15 and 21 feet bgs in borings AMW-1, AMW-2 and AMW-3. Fine sand was encountered to a depth of approximately 9 feet bgs in boring B23 (AllWest, 2013e). Boring and well locations are shown in Figure 2.

Groundwater was encountered during the 2013 investigations between approximately 9 to 30 feet bgs, and rose to static levels of approximately 9 to 11 feet bgs. The direction of groundwater flow was to the southeast at a gradient of 0.0167 feet per foot. During groundwater monitoring events conducted by AllWest from July 2012 to February 2015, depths to groundwater in monitoring wells at the subject site have ranged from 7.26 to 11.52 feet below top-of-casing (TOC). Groundwater flow direction has been predominantly to the southwest, but has varied to the west-northwest at gradients ranging from 0.0107 to 0.02 feet per foot.

C. Site Background

From the early 1900s until circa 1946, the subject property Parcel 01 was developed as a residence, and Parcel 14 was undeveloped. Between circa 1946 and 1950, the subject property was developed with the current office and light industrial warehouse buildings. The McGrath Steel Company operated a steel warehouse and/or the Pacific Rolling Door Company from circa 1950 until about 2007. The McGrath Steel business was sold and relocated in 2007 (Stellar, 2011). CMC Rebar subsequently leased the subject property until circa 2012-2013. The subject property has since been unoccupied.

Two (2) 2,000-gallon single-wall steel underground storage tanks (USTs) were formerly located beneath the 67th Street sidewalk in front of the warehouse building. The diesel and gasoline USTs were installed in 1979 and 1981, respectively. The USTs were removed in July 1996 [Subsurface Environmental Corp. (SEC), *Tank Removal Closure Report*, September 16, 1996 (SEC, 1996)].

D. Previous Investigations

Several subsurface investigations, groundwater monitoring events and remedial actions have been performed since removal of the USTs in 1996. Summaries of previous investigations, remedial actions and monitoring activities have been included in our *Additional Site Characterization and Interim Remedial Action Workplan* (AllWest, 2011), *Additional Site Characterization Workplan Addendum* (AllWest, 2012a), *Subsurface Investigation* (AllWest, 2013b), *Additional Site Characterization and Monitoring Well Installation Report* (AllWest, 2013e), *Indoor Air Quality Monitoring Report (*AllWest, 2014e), and *First Semiannual 2015 Groundwater Monitoring Report* (AllWest, 2015). Historical soil boring and groundwater monitoring well locations are shown in Figure 2.

A brief summary of previous subsurface investigations, groundwater monitoring events and remedial activities is included below.

The two USTs were removed in July 1996 by Subsurface Environmental Corp. (SEC). No holes were noted in the USTs, but obvious discoloration and petroleum hydrocarbon odor were noted in the surrounding soil. No information was included in the SEC report regarding any product piping removal. Elevated concentrations of petroleum hydrocarbons were detected in confirmatory soil samples following the UST removal. Additional soil was over-excavated to a depth of approximately 12 feet bgs for a total of approximately 70 cubic yards of soil removed. Confirmatory soil samples collected following over-excavation contained low to moderate concentraio0ns of total petroleum hydrocarbons as gasoline (TPH-g) and diesel (TPH-d), (SEC, 1996).

Weiss Associates (WA) conducted a subsurface investigation at the subject property in May 1998. Three (3) soil borings (B-1, B-2 and B-5) were advanced to depths ranging from 16.5 to 24 feet bgs in the vicinity of the former USTs along the north and south sides of 67th Street. Additional borings B-6 and B-7 were attempted but encountered refusal in gravel base rock material at approximately 2 feet bgs and were not sampled. Proposed borings B-3 and B-4 were not attempted. Low concentrations of petroleum hydrocarbons were detected in soil samples collected only from boring B-5 at 12 feet bgs. Elevated concentrations of petroleum hydrocarbons were detected in grab groundwater samples from all three borings (WA, 1998).

WA conducted an additional subsurface investigation in December 2005. Six (6) soil borings (B-8 through B-14) were advanced to a maximum depth of approximately 22 feet bgs in the vicinity of the former USTs and downgradient to the west, along the north and south sides of 67th Street and within the sidewalk on the south side of 67th Street. Low to moderate concentrations of petroleum hydrocarbons were detected in soil samples from all six borings. Elevated concentrations of dissolved phase petroleum hydrocarbons were detected in groundwater samples from all six (6) soil borings, and in monitoring well MW-3 located adjacent to the former USTs (WA, 2006). Monitoring well MW-3 was installed in 1995 as part of an investigation of the former Clearprint Paper Company leaking UST (LUST) site at 1482 67th Street, located to the northwest across 67th Street from the subject site in the downgradient direction (ACHCS *Fuel Leak Site Case Closure, Clearprint Paper Co.*, June 27, 2005).

Petroleum hydrocarbon concentrations in soil and groundwater detected in the WA investigations exceeded applicable commercial/industrial Environmental Screening Levels (ESLs) where groundwater is not a drinking water resource, as established by the San Francisco Bay Regional Water Quality Control Board (SFRWQCB), (WA, 2006).

The ACHCS, in their letters of April 7, 2006, November 19, 2010 (revised December 6, 2010) and May 2, 2012 requested additional characterization of the downgradient extent and distribution of dissolved phase petroleum hydrocarbons and residual free product, and implementation of interim remedial action, at the subject site.

Groundwater sampling of monitoring well MW-3 was attempted by Stellar Environmental Solutions, Inc. (Stellar) in May 2011; however a sample was not collected due to the presence of free product in the bailer. During a site visit on September 14, 2011, AllWest measured a floating free product thickness of approximately 3 feet in MW-3. Quarterly groundwater monitoring of well MW-3, and interim free product removal by bailing, was conducted by AllWest commencing in August 2012.

AllWest conducted a subsurface assessment at the subject property in January 2013 and August 2013 consisting of the advancement of eleven (11) direct push technology (DPT) soil borings (B15 through B25), three (3) groundwater monitoring well installations (AMW-1, AMW-2 and AMW-3), and the collection of soil and groundwater samples. The DPT borings were advanced to depths of 9 to 30 feet bgs, and the groundwater monitoring wells were installed to depths of 23 to 24 feet bgs.

TPH-g, TPH-d, total petroleum hydrocarbons as mineral spirits (TPH-ms), Benzene, toluene, ethylbenzene, and total xylenes (BTEX), and methyl tertiary butyl ether (MTBE), 2-methylnaphthalene, naphthalene and benzo (a) anthracene were detected in soil and/or groundwater samples at elevated concentrations exceeding their applicable commercial/industrial ESLs where groundwater is not a drinking water resource. Lower concentrations of various other volatile organic compounds (VOCs) and polynuclear aromatic hydrocarbons (PNAs/PAHs) were also detected in soil and/or groundwater samples at concentrations not exceeding applicable ESLs.

AllWest concluded that the downgradient extent of the adsorbed and dissolved phase petroleum hydrocarbon plume in soil and groundwater was largely defined and extended from the vicinity of the former McGrath Steel USTs to the west along 67th Street to the vicinity of monitoring well AMW-1 west of the former Clearprint Paper Company USTs. The cross-gradient extent of the adsorbed and dissolved phase hydrocarbon plume had not been fully defined. AllWest recommended conducting quarterly groundwater monitoring at the subject site in the new monitoring wells AMW-1, AMW-2 and AMW-3 and existing monitoring well MW-3. AllWest also recommended implementing interim remedial action of free product in the vicinity of the former USTs at the subject site by installing a passive skimming device in monitoring well MW-3 (AllWest, 2013e).

AllWest conducted quarterly groundwater monitoring of the existing monitoring well MW-3 and new monitoring wells AMW-1, AMW-2 and AMW-3 from August 2012 to June 2014, at which time monitoring frequency was reduced to semiannual per the ACHCS letter dated September 15, 2014. AllWest subsequently conducted a semiannual groundwater monitoring event in February 2015. Interim removal of free product in well MW-3 by bailing and skimming was conducted by AllWest commencing in July 2012. Free product thickness measured in MW-3 has declined from 2.65 feet in July 2012 to none measured since December 2013. A passive hydrocarbon skimming device was installed in well MW-3 in December 2013 and was removed in February 2015. Free product has not been observed in any of the other site monitoring wells (AllWest, 2015).

AllWest conducted indoor air quality (IAQ) monitoring in June, 2014 at the subject property. Five IAQ samples were collected inside the warehouse building at 1471 67th Street. One outdoor ambient air (OAA) control sample (OAA-1) was collected on the exterior second floor balcony at the 6655 Hollis Street office building. Benzene concentrations detected in four of the five collected IAQ samples exceeded the RWQCB indoor air commercial ESL for benzene. Carbon tetrachloride exceeded its applicable ESL in all five indoor air samples as well as the outdoor ambient air sample OAA-1. Naphthalene exceeded its applicable ESL in one indoor air sample. None of the other detected VOC concentrations exceeded their respective applicable RWQCB commercial indoor air ESLs. AllWest concluded that benzene, carbon tetrachloride and several other detected VOCs were atmospheric contaminants and do not originate from the UST source area (AllWest, 2014e).

III. PURPOSE AND SCOPE OF WORK

The purpose of this proposed investigation is to further assess the potential presence and lateral and vertical extent of petroleum hydrocarbons and their VOC constituents in soil, groundwater and soil vapor at the subject site, and to evaluate potential soil vapor intrusion impact to the indoor air quality at the subject site.

The proposed scope of work consists of the following tasks:

1) Prepare a written workplan for conducting an additional subsurface investigation including soil, groundwater and soil vapor sampling at the subject site. Submit the workplan to the ACHCS for review and concurrence;

2) Update the site-specific health and safety plan;

3) Obtain a drilling permit from Alameda County Public Works Agency (ACPWA);

4) Engage the service of Underground Service Alert (USA) and a private underground utility locator to locate and clear underground utilities within the proposed investigation area so that the potential of accidental damage to underground utilities will be reduced during proposed subsurface investigation. Notify the ACPWA, ACHCS and facility owners, maintenance personnel and tenants prior to the start of field work;

5) Retain the services of a C-57 licensed drilling contractor for the advancement by Geoprobe® DPT methods of one (1) boring (B-26) in the driveway between the office and warehouse buildings to approximately 25-30 feet bgs. Collect soil samples for analytical testing at depths of approximately 4.5-5, 9.5-10 and 14.5-15 feet bgs. Install temporary PVC well screen and casing and collect a “grab” groundwater sample;

6) Retain the services of a C-57 licensed drilling contractor for the advancement and installation of six (6) temporary soil vapor probes (SVP-1 through SVP-6) using DPT methods to 5 feet bgs. Probes SVP-1 through SVP-5 will be located inside the warehouse building at 1471 67th Street. Probe SVP-6 will be located in the driveway between the office building at 6655 Hollis Street and warehouse building at 1471 67th Street adjacent to boring B-26. Core the concrete floor slab and install five (5) semi-permanent sub-slab soil vapor probes (SVP-7 through SVP-11) inside of the warehouse building at 1471 67th Street. Sub-slab vapor probe installations will consist of either the Vapor Pin™ type installed within the floor slab, or conventional sub-slab vapor probe installations to approximately 0.5 to 1 feet bgs. Soil vapor probe installations will be in general accordance with California Environmental Protection Agency (CalEPA) Department of Toxic Substance Control (DTSC) *Final, Guidance for the Evaluation and*

Mitigation of Subsurface Vapor Intrusion to Indoor Air (Vapor Intrusion Guidance), October 2011 and *Advisory – Active Soil Gas Investigations*, April, 2012;

7) Collect eleven (11) soil vapor samples from the temporary soil vapor probes and semi-permanent sub-slab vapor probes, and one (1) ambient leak detection gas sample, using Summa canisters in general accordance with the DTSC *Advisory – Active Soil Gas Investigations*, April, 2012. Retain one soil vapor sample from each probe and one ambient leak detection gas sample for analytical testing. The five (5) semi-permanent sub-slab vapor probes will be left in place for future monitoring;

8) At the completion of drilling and sampling activities, remove Geoprobe® drive casings and temporary PVC well screen, casings and vapor probes and tubing, and backfill each boring with a "neat" cement grout slurry and restore the interior floor slabs by backfilling with a concrete slurry. Store all soil spoils generated during the assessment in a drum onsite pending profiling for disposal at an appropriate offsite facility;

9) Maintain soil and groundwater samples under chain-of-custody and transport to a Department of Health Services (DHS) certified analytical laboratory (McCampbell Analytical of Pittsburg, California) for chemical analyses. Analyze three (3) soil and one (1) groundwater samples for total petroleum hydrocarbons as gasoline (TPH-g) and volatile organic compounds (VOCs) including benzene, toluene, ethylbenzene and total xylenes (BTEX), naphthalene, and fuel oxygenates including methyl-tertiary-butyl ether (MTBE) by EPA Method modified 8260B;

10) Maintain soil vapor and ambient leak detect gas samples under chain-of-custody and transport the samples to a Department of Health Services (DHS) certified analytical laboratory (Eurofins/Calscience of Garden Grove, California) for chemical analyses. Analyze eleven (11) soil vapor samples for TPH-g by EPA Method TO-3(M), BTEX, naphthalene and MTBE by EPA Method TO-15(M), and the leak detection gas helium by ASTM D1946. Analyze one (1) ambient leak detection gas sample for helium by ASTM D1946; and

11) Prepare a written Subsurface Investigation Report describing the field activities, summarizing the laboratory data, presenting investigation findings, and providing conclusions and recommendations. Upload the report and associated electronic data deliverable files to the GeoTracker database.

IV. INVESTIGATIVE ACTIVITIES

A. Permitting

AllWest will prepare and submit a drilling permit application for the Geoprobe® DPT borings to ACPWA for review and approval. Upon permit approval, AllWest will notify ACPWA and ACHCS of the drilling schedule a minimum of 5 working days in advance to allow scheduling of drilling and grouting inspection.

B. Health and Safety Plan

AllWest will prepare a site specific health and safety plan prior to mobilizing to the site. A tailgate safety meeting will be given prior to commencing work. All site personnel will be required to review the health and safety plan.

C. Underground Utility Inspection

To avoid damage to underground utility installations during the course of the subsurface investigation, AllWest will contact Underground Service Alert (USA), an organization for public utility information, on the pending subsurface investigation. USA will then notify public and private entities that maintained underground utilities within the site vicinity to locate and mark their installations for field identification. A private underground utility locator, Subtronic, Inc. of Concord, California, will also be employed by AllWest to conduct a magnetometer and GPR sweep investigation to locate marked and unmarked underground utilities in the vicinity of the proposed boring locations. Other qualified contractors may be used if necessary

D. Geoprobe® DPT Boring Advancement and Soil Sampling

To further characterize the vertical and lateral extent of petroleum hydrocarbons in soils and groundwater upgradient of the former USTs and fuel dispensers, one (1) soil boring (B-26) will be advanced with Geoprobe® direct push technology (DPT) methods in the driveway between the office and warehouse buildings. The boring will be advanced to first encountered groundwater at a total depth of approximately 25 to 30 feet bgs. The proposed boring location is shown in Figure 2.

The boring will be advanced using continuous core Geoprobe® DPT sampling methods. Soil samples will be collected for lithologic characterization and potential laboratory analysis using a nominal 4-foot long, 2-inch outside diameter (OD) stainless steel core barrel drive probe and extension rods. The drive probe will be equipped with nominal 1 ½-inch inside diameter (ID) clear PVC plastic tubes that line the interior of the probe. The probe and insert tubes are together hydraulically driven using a percussion hammer to the specified depth (approximately 1 foot bgs). After the specified drive interval, the drive probe and rods are retrieved to the surface. The PVC tube containing subsurface soil is then removed. Selected soil sample intervals will be cut from the PVC tube for analytical testing. The ends of samples for possible analytical testing are sealed using Teflon™ squares and plastic end caps. The samples are labeled, and stored in an iced cooler.

At least three (3) soil samples will be collected for laboratory analysis from the boring at depth intervals of approximately 4.5-5 feet bgs, 9.5-10 feet bgs and 14.5-15 feet bgs. Soil samples will also be collected for analysis in discrete water-bearing zones and noticeable changes in lithology, and in zones of suspected contamination or elevated organic vapor concentrations as measured by photo-ionizer detector (PID) screening.

An AllWest environmental professional will oversee field work and drilling activities. The recovered soil samples are inspected after each drive interval with lithologic and relevant drilling observations recorded. Soil samples are screened for organic vapors using a PID or other appropriate device by taking readings of headspace vapor concentrations of the soil inside a zip-lock plastic bag. PID readings, soil staining and other relevant observations are recorded on the boring logs. Geoprobe® DPT soil sampling procedures are included in Appendix A.

E. Groundwater Sampling

Water levels will be measured and a "grab" groundwater samples will be collected from the DPT boring B-26 after the completion of soil coring to the anticipated total depth (approximately 12 to 15 feet bgs). The rods and drive probe will be removed from the borehole, and new, temporary nominal 0.5 to 0.75-inch ID PVC solid well casing with a 5-foot slotted screened interval will be lowered into the borehole.

Prior to groundwater sampling, depth to water is measured using an electronic water level probe through the temporary PVC casing. Groundwater samples will then be collected from the temporary PVC casing using disposable polyethylene sample tubing connected to an electric peristaltic pump, or fitted with a check ball valve device which recovers the groundwater sample by oscillation, or using a small-diameter polyethylene or Teflon® disposable bailer. Geoprobe® DPT groundwater sampling procedures are included in Appendix A.

Upon retrieval of the groundwater samples, the retained water will be transferred to appropriate sample bottles furnished by the analytical laboratory. Samples for TPH-g and VOC analysis will be collected in three (3) 40-milliliter (ml) glass volatile organic analysis (VOA) vials preserved with hydrochloric acid (HCl). Sample bottles will be labeled and immediately placed on ice to preserve the chemical characteristics of its content.

To prevent cross-contamination, all groundwater sampling equipment that comes in contact with the groundwater will be decontaminated prior to sampling. To minimize the possibility of cross contamination, new disposable sample tubing or a new disposable bailer will be used to collect each groundwater sample. Sampling, sample handling, storage, and transport procedures described in Appendix A will be employed.

F. Temporary Soil Vapor Probe Advancement and Installation

Following coring of the concrete floor slab or asphalt pavement, six (6) borings will be advanced to 5 feet bgs using Geoprobe® DPT methods, either with a continuous core barrel sampler or a drive point. Following the advancement of the borings to 5 feet bgs, temporary soil vapor probes (SVP-1 through SVP-6) will be installed in the boreholes in accordance with the DTSC *Vapor Intrusion Guidance, Appendix G, (DTSC,* 2011). Probes SVP-1 through SVP-5 will be located within the warehouse building at 1471 67th Street. Probe SVP-6 will be located adjacent to the DPT boring B-26 in the driveway between the 1471 67th Street warehouse and 6655 Hollis Street office buildings. The proposed temporary soil vapor probe locations are shown in Figure 2.

A plastic or stainless steel soil vapor probe, ½-inch diameter by 2-inches long and tipped with a porous plastic membrane, will be inserted to the bottom of the 2.25-inch diameter borehole at 5 feet bgs. The probe tip is attached to a 7-foot length of 0.25-inch OD Teflon™ tubing extending to above the top of the pavement. A fine sand filter pack approximately 1 foot thick is placed in the borehole annulus around the probe. A 1 foot layer of non-hydrated granular bentonite is used to fill the annular space above the filter pack. Hydrated granular bentonite is then used to fill the annular space above the non-hydrated bentonite to the top of the pavement. The bentonite is allowed to hydrate and borehole conditions to equalize for 2 hours prior to sampling activities, per DTSC vapor sampling guidelines. Temporary soil vapor probe installation procedures will be performed in general accordance with guidelines presented in the DTSC *Advisory – Active Soil Gas Investigations*, April, 2012.

Alternatively, Geoprobe® DPT methods will drive extension rods with a nominal 1 ½-inch diameter PRT soil vapor probe into native soil to 5 feet bgs (twelve probes). The probes are retracted slightly to detach the expendable drive point, expose the vapor sampling inlet and open a small void in the soil. New disposable polyethylene sample tubing with a PRT fitting is inserted into the drive rod and connected to the PRT vapor probe. Hydrated granulated bentonite is used to seal the borehole annulus around the drive rods to the surface of the concrete slab. At least 2 hours will elapse prior to collecting vapor samples to allow the bentonite seal to hydrate and borehole conditions to equalize, per DTSC vapor sampling guidelines (DTSC, 2012). Temporary soil vapor probe installation procedures and schematic diagrams are included in Appendix B.

G. Semi-Permanent Sub-Slab Soil Vapor Probe Installation

A State of California C-57 licensed drilling contractor (Gregg Drilling and Testing, Inc. of Martinez, California) will core through the concrete floor slab (anticipated to be approximately 6-inches thick) and approximately 1 to 4 inches into the sub-base using a power-operated coring bit or Roto-Hammer at five (5) locations within the 1471 67th Street warehouse building. Other qualified drilling contractors may be used if necessary. The borings will be completed as semi-permanent sub-slab soil vapor probes SVP-7 through SVP-11. The sub-slab soil vapor probes will be located adjacent to the temporary 5 feet bgs soil vapor probes SVP-1 through SVP-5 within the 1471 67th Street warehouse building. Proposed sub-slab vapor probe locations are shown in Figure 2.

<u>Vapor Pin™ Probe Installation</u>

AllWest proposes completion of the semi-permanent sub-slab soil vapor probes SVP-7 through SVP-11 using the Vapor Pin™ consisting of a hollow brass sampling device with barbed nipple fitting and outer silicone sleeve installed within the floor slab. The Vapor Pin™ is driven to the base of the floor slab, into a 5/8-inch diameter hole drilled within the slab, set within a 1 ½-inch diameter countersunk hole for flush mounting below the slab surface. Since the silicone sleeve seals the probe in the borehole, no filter pack, hydrated bentonite, or cement grout seal is required; therefore, no setting or curing time is required. A flush-mounted plastic cap covers the Vapor Pin™ and a second cap seals the barbed nipple fitting. The Vapor Pin™ installation standard operating procedure is included in Appendix C.

AllWest proposes a 2-hour equilibrium period between the Vapor Pin™ installation and soil vapor sampling activities in order to ensure compliance with the equilibrium times recommended in DTSC *Final, Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (Vapor Intrusion Guidance), Appendix G,* October 2011 (DTSC, 2011), DTSC *Advisory – Active Soil Gas Investigations*, April 2012 (DTSC, 2012), and DTSC *Frequently Asked Questions, 2012 Advisory – Active Soil Gas Investigations (ASGI)*, March 2013.

<u>Conventional Sub-Slab Probe Installation</u>

Depending upon ACHCS approval of the Vapor Pin™ method, or drilling contractor preferences, "conventional" semi-permanent sub-slab soil vapor probes SVP-7 though SVP-11 may alternatively be installed in each concrete floor slab borehole per the DTSC *Vapor Intrusion Guidance, Appendix G, (DTSC,* 2011).

Stainless steel or plastic vapor probes, ½-inch diameter by 2-inch long and tipped with porous plastic membranes, will be inserted through the 1 to 2-inch diameter boreholes into the subgrade material approximately 4 inches beneath the base of the floor slab. The probe tips will be attached to approximately 8-inch lengths of 0.25-inch outside diameter (OD) Teflon™ or stainless steel tubing extending to about 1 inch below the top of the floor slab. The top of the Teflon™ or stainless steel tubing in each probe will be attached to a brass threaded male Swagelock™ fitting and cap recessed below the concrete floor. A fine sand filter pack approximately 2 to 4 inches thick will be placed in the borehole annulus around the probes. A Teflon™ sealing disk will be placed around the tubing above the filter pack.

Dry granular bentonite will be placed in the borehole annulus above the Teflon™ sealing disk to above the base of the concrete floor slab. Hydrated granulated bentonite will then be used to fill the annular space above the dry granular to approximately 2 inches above the bottom of the floor slab, and will be hydrated from the surface using deionized water. Quick-drying cement/bentonite grout will then be used to fill the remaining annular space to the Swagelock fitting approximately ¾ to 1 inch below the top of the slab. A watertight plastic cap or metal vault box will be installed flush with the top of the floor slab within a 2 to 4-inch diameter countersunk hole to protect the probe fitting. At least 2 hours will elapse prior to collecting vapor samples to allow the bentonite and cement grout seal to hydrate and borehole conditions to equalize, per DTSC sub-slab vapor sampling guidelines (DTSC, 2011). Typical semi-permanent sub-slab probe construction procedures and diagram are included in Appendix B.

H. Soil Vapor Sampling

AllWest will collect soil vapor samples from the eleven (11) temporary 5 feet bgs and semi-permanent sub-slab soil vapor probes following a minimum 2-hour period after hydration of the bentonite and cement grout surface seals. Soil vapor sampling will be performed in general accordance with the DTSC *Advisory – Active Soil Gas Investigations*, April 2012. Soil vapor sampling procedures and schematic diagrams are included in Appendices B, C and D.

AllWest will collect one soil vapor sample from each probe in laboratory prepared 1-liter capacity SUMMA canisters. Prior to vapor purging and sample collection, a vacuum leak shut-in test of the flow-controller/gauge manifold assembly is performed for a minimum of 2 minutes, with a maximum allowable vacuum drop of 0.2 inches of mercury (in Hg). If maximum allowable vacuum drop is exceeded, the manifold fittings will be tightened or manifold replaced and the shut-in test redone. Vacuum gauges will be sensitive enough to register a minimum of 0.2 in Hg.

The approximate sampling system volume of a temporary soil vapor probe to 5 feet bgs is 230 milliliters (ml), assuming a borehole diameter of 2 inches, tubing and probe inside diameter of 0.17 inches, sand pack interval of 1 feet and porosity of 0.3, and a sample train length (internal and external tubing) of 10 feet. The approximate sampling system volume of a semi-permanent Vapor Pin™ sub-slab soil vapor probe is 40 milliliters (ml), assuming a borehole diameter of 5/8 inches and a 3 1/4-inch high void space below the probe within the 6-inch thick concrete floor slab, tubing and probe inside diameter of 0.17 inches, and a sample train length (internal and external tubing) of 5 feet. The approximate sampling system volume of a semi-permanent "conventional" sub-slab soil vapor probe is 70 milliliters (ml), assuming a borehole diameter of 2 inches, sand pack interval of 4 inches below the concrete floor slab and porosity of 0.3, tubing and probe inside diameter of 0.17 inches, and a sample train length (internal and external tubing) of 5 feet.

Prior to sample collection, a maximum of 3 sample system volumes of soil vapor (per DTSC, 2012) is purged at a flow rate of approximately 150-200 milliliters per minute (ml/min) from each soil vapor probe, using a dedicated 6-liter capacity SUMMA purge canister. Three sample system volumes equals approximately 690 ml from each temporary vapor probe, 120 ml from each Vapor Pin™ sub-slab soil vapor probe, or 210 ml from each "conventional" sub-slab soil vapor probe.

While sampling, a leak detection test is conducted using helium as a leak tracer inside an airtight plastic shroud covering the entire sampling apparatus, as recommended in the DTSC *Advisory – Active Soil Gas Investigations* (DTSC, 2012). A valve is fitted in the sample tubing train between the probe and SUMMA canister manifold system, with the valve handle passing through the shroud wall where it can be turned from the outside without leakage of helium. The helium concentration within the shroud is monitored with a helium gas detection meter with a minimum precision of 0.1% to keep the concentration at approximately 10% (or two orders of magnitude above the minimum meter detection limit). The helium tracer gas will be infused into the shroud at the required concentration at least 5 minutes prior to sample collection, as recommended in the DTSC *Advisory – Active Soil Gas Investigations* (DTSC, 2012).

If necessary, additional helium will be infused into the shroud to maintain the desired concentration, which will be monitored and recorded in the field log sample collection remarks column until sampling is completed. To verify helium detection meter accuracy, one (1) ambient air sample per day is collected inside the leak detection shroud during the sampling of one probe to measure helium concentrations inside the shroud. Depending upon helium availability, other leak detection gases such as isopropyl alcohol (IPA) or difluoroethane may be substituted. A schematic diagram of the soil vapor sampling system and leak detection shroud is included in Appendix D.

Flow rates of approximately 150-200 ml/min are used to fill the sample canisters. The canisters are filled to approximate 80% of capacity (approximately 5 inches of mercury vacuum remaining). All pertinent field observations, pressure, times and readings are recorded. After filling and closing the sample valve, all SUMMA canisters are removed from the manifold, labeled with sampling information, including initial and final vacuum pressures, placed in a dark container and transported under chain-of-custody to the analytical laboratory, McCampbell Analytical, Inc., in Pittsburg, California. The analytical laboratory will record the final SUMMA canister vacuum upon receipt. A copy of the soil vapor sampling field form is included in Appendix E.

I. Borehole Backfilling

At the completion of drilling and sampling activities, Geoprobe® DPT drive casings and temporary PVC well screen and casings will be removed and the borings will be backfilled with a "neat" Portland Type I or II cement grout slurry that is tremied into the borehole through a PVC pipe. The level of grout will be checked to ascertain if any settling has occurred and will be "topped off" if required. The SMCEH GPP will be notified 72 hours in advance of the anticipated grouting time in order to schedule inspection.

J. Investigative Derived Waste Containment and Disposal

Investigative derived waste including soil cores and decontamination rinseate will contained in a secure area onsite in sealed 5-gallon pails or 55-gallon drums pending analytical results, profiling and transport to an appropriate disposal facility.

V. QUALITY ASSURANCE / QUALITY CONTROL PROGRAM

A. Sample Preservation, Storage and Handling

To prevent the loss of constituents of interest, all soil and groundwater samples will be preserved by storing in an ice chest cooled to 4°C with crushed ice immediately after their collection and during transportation to the laboratory. Samples will be stored within the cooler in separate zip-lock plastic bags to avoid cross-contamination. All SUMMA canisters are removed from the manifold, labeled with sampling information, including initial and final vacuum pressures, and placed in a dark container for transport to the analytical laboratory

B. Chain-Of-Custody Program

All samples collected for this project will be transported under chain-of-custody protocol. The chain-of-custody program allows for the tracing of possession and handling of individual samples from the time of field collection through laboratory analysis. The document includes the signature of the collector, date and time of collection, sample number, number and type of sample containers including preservatives, SUMMA canister ID numbers, initial and final SUMMA canister vacuums, parameters requested for analysis, signatures of persons and inclusive dates involved in the chain of possession. Upon delivery to the laboratory the document will also include the name of the person receiving the samples, and date and time samples were received.

VI. ANALYTICAL METHODS

All soil and groundwater samples selected for analysis will be analyzed by a State of California certified independent analytical laboratory. McCampbell Analytical, Inc. (MAI), of Pittsburg, California will likely perform all soil and groundwater analysis. Eurofins Calscience, Inc. (ECI) of Garden Grove, California, will perform all soil vapor sample analysis. However, other qualified laboratories may be utilized dependent on work load and time frame considerations.

The three (3) soil and one (1) groundwater samples collected during this investigation will be analyzed for TPH-g and VOCs including BTEX, naphthalene and fuel oxygenates by EPA Method 8260B. The soil vapor samples collected during this investigation will be analyzed for TPH-g by EPA Method TO-3(M), BTEX, naphthalene and MTBE by EPA Method TO-15(M), and the leak detection gas helium by ASTM D1946. One ambient leak detection gas sample will be analyzed for helium by ASTM D1946. Depending upon helium availability, analyses for other leak detection gases such as isopropyl alcohol (IPA) or difluoroethane by EPA Method TO-15 may be substituted instead.

VII. REPORT PREPARATION

A written *Data Gap Investigation Report* will be prepared for this investigation after the completion of all field work and receipt of analytical results. Included in the report will be analytical data summary tables, sample location and contaminant distribution maps, soil boring logs, field sampling logs, chain-of-custody documents, copies of the analytical laboratory reports, and conclusions and recommendations. The report will be reviewed by a California Professional Geologist. The report and associated documents (laboratory analytical reports, site plans, boring logs, etc.) will be uploaded to the GeoTracker database.

VIII. PROJECT STAFF AND SCHEDULE

Mr. Leonard P. Niles, P.G., C.H.G., a California Professional Geologist (PG 5774) and Certified Hydrogeologist (CHG 357), will provide technical oversight for this project and act as the project manager and regulatory liaison. Additionally, AllWest's staff of engineers, geologists, and technicians will be employed to perform the various tasks of the project. AllWest will inform the ACHCS and

ACPWA at least 5 days prior to the start of field activities. AllWest will inform the ACHCS of any significant developments during the course of the investigations.

IX. LIMITATIONS

AllWest has prepared this *Data Gap Investigation Workplan* for the exclusive use of MCG Investments, LLC (Client) for this particular project and in accordance with generally accepted practices at the time of the work and with our written proposal dated September 2015. No other warranties, either expressed or implied is made as to the professional advice offered. This plan is not a specification for the proposed work and should not be used to bid out any of the proposed work found within. Reliance on this plan by any party other than the Client is at the user's sole risk.

Background information that AllWest has used in preparing this workplan, including but not limited to previous field measurements, analytical results, site plans, and other data, has been furnished to AllWest by the Client, its previous consultants, and/or third parties. AllWest has relied on this information as furnished. AllWest is not responsible for nor has it confirmed the accuracy of this information.

X. REFERENCES

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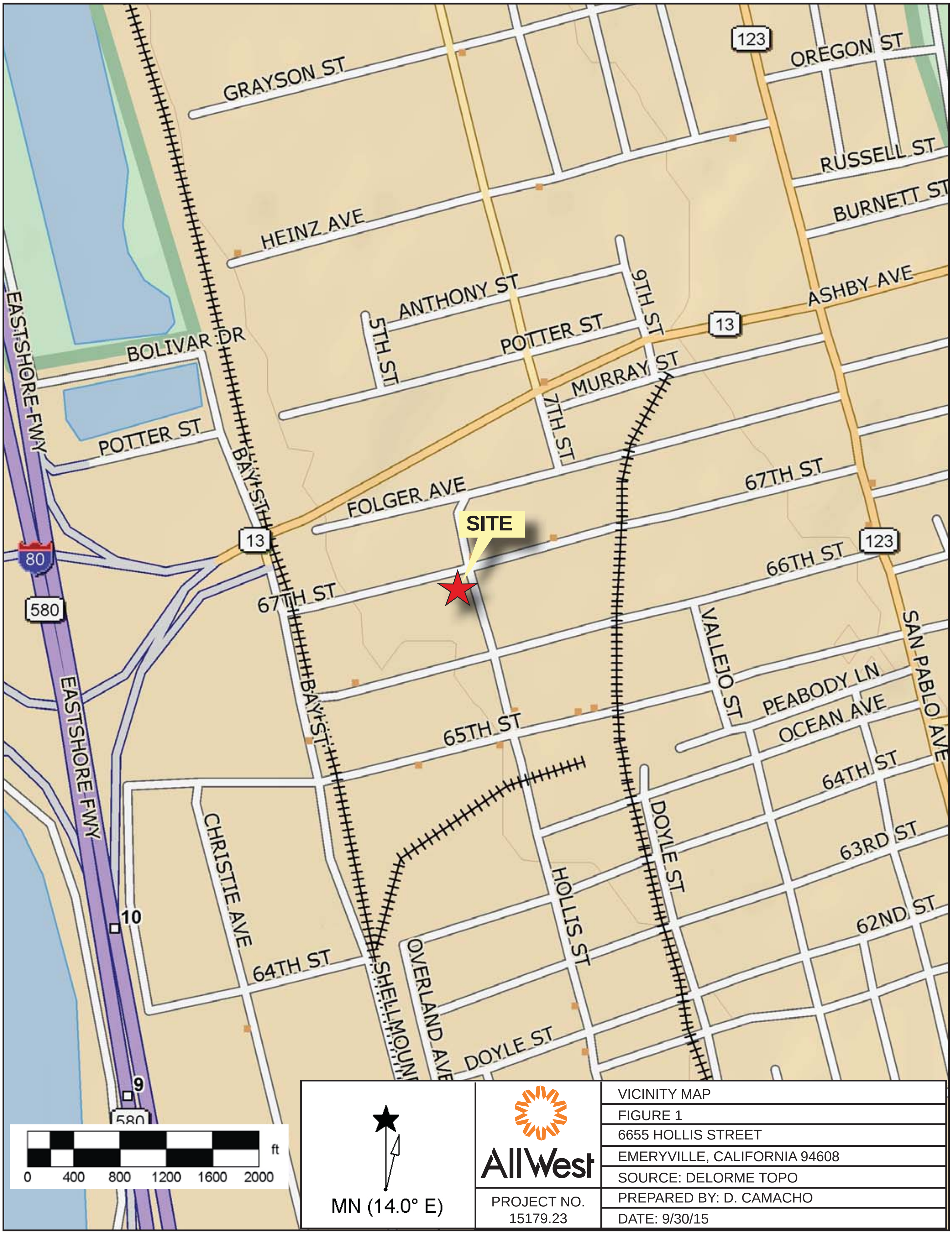
FIGURES

DELORME

Topo USA® 8



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PROJECT NO. 15179.23

VICINITY MAP

FIGURE 1

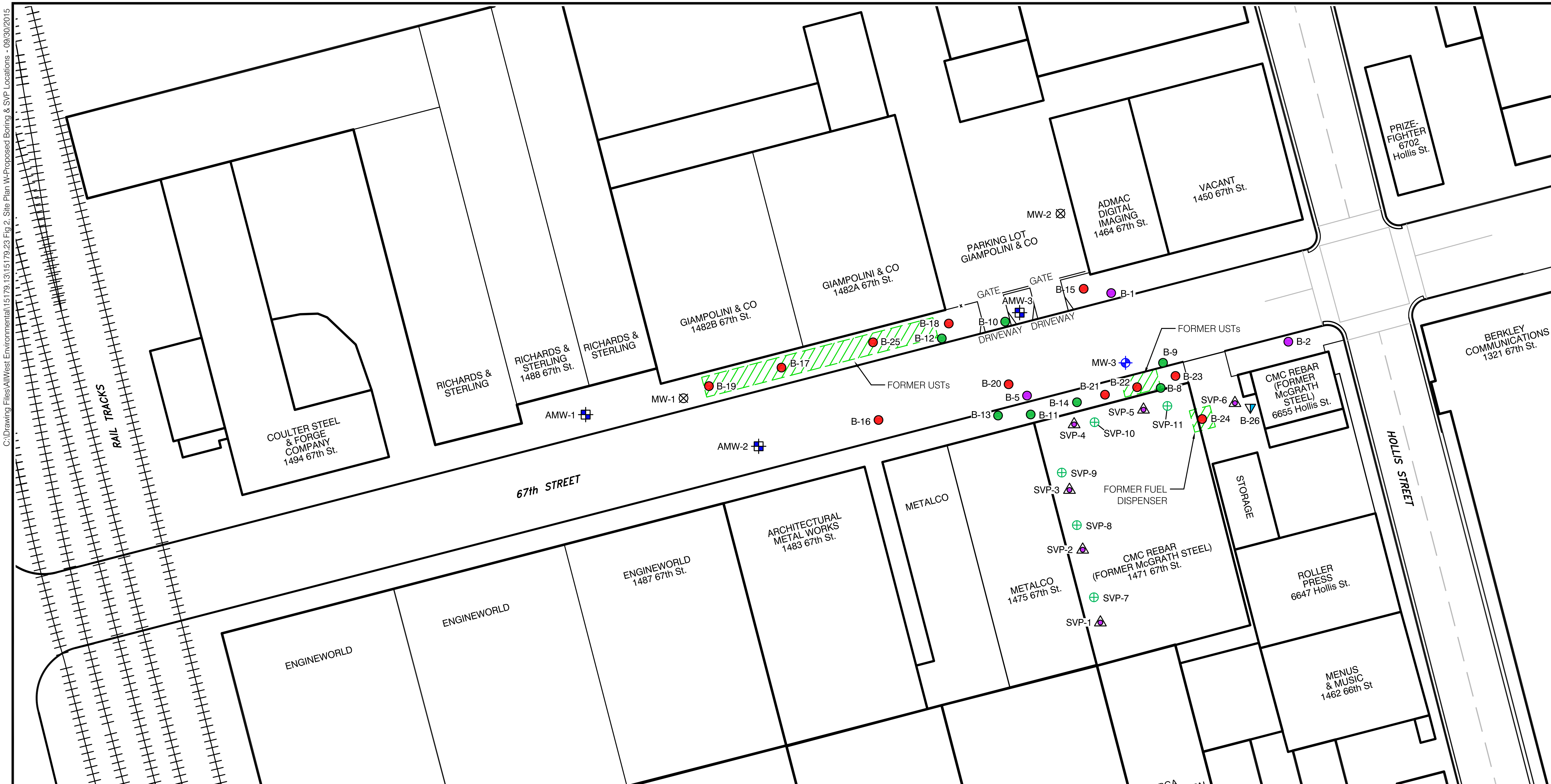
6655 HOLLIS STREET

EMERYVILLE, CALIFORNIA 94608

SOURCE: DELORME TOPO

PREPARED BY: D. CAMACHO

DATE: 9/30/15



LEGEND

B-26	Proposed Geoprobe Soil Boring
SVP-1	Proposed Temporary Soil Vapor Probe (5 Feet bgs)
SVP-7	Proposed Semi-Permanent Sub-Slab Soil Vapor Probe
MW-2	Monitoring Well (Clearprint/ESC - Destroyed, 2005)
MW-3	Monitoring Well (Clearprint/ESC, 1995)
AMW-3	Monitoring Well (AllWest, 2013)
B-5	Soil Boring (Weiss Associates, 1998)
B-14	Soil Boring (Weiss Associates, 2005)
B-25	Soil Boring (Weiss Associates, January 16, 17, & 18, 2013)
	Former USTs, Fuel Dispensers (Removed 1994 & 1996)
—x—	Fence

N

0 60 120

APPROXIMATE SCALE IN FEET

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PROJECT NO.
15179.23

FIGURE 2

SITE PLAN WITH PROPOSED BORING AND SOIL VAPOR PROBE LOCATIONS

Former McGrath Steel

6655 Hollis Street, Emeryville, California

SOURCE: Morrow Surveying and Google Earth

DRAWN BY: CM (09/30/2015)

APPENDIX A

AllWest

STANDARD GEOPROBE™ DPT SAMPLING PROCEDURES

Soil Sampling

Direct push technology (DPT) soil core sampling using Geoprobe™ or similar methods is accomplished using a nominal 4-foot long, 2-inch diameter stainless steel steel drive probe and extension rods. The drive probe is equipped with nominal 1-1/2 inch diameter clear plastic poly tubes that line the interior of the probe. The probe and insert tubes are together pneumatically driven using a percussion hammer in 4-foot intervals. After each drive interval the drive probe and rods are retrieved to the surfaced. The poly tube containing subsurface soil is then removed. The drive probe is then cleaned, equipped with a new poly tube and reinserted into the boring with extension rods as required. The apparatus is then driven following the above procedure until the desired depth is obtained. The poly tubes and soil are inspected after each drive interval with lithologic and relevant drilling observations recorded. Soil samples are screened for organic vapors using an organic vapor meter (OVM), photo-ionization detector (PID) or other appropriate device. OVM/PID readings, soil staining and other relevant observations are recorded. Selected soil sample intervals can be cut from the 4-foot intervals for possible analytical or geotechnical testing or other purposes.

The soils contained in the sample liners are then classified according to the Uniform Soil Classification System and recorded on the soil boring logs.

Sample liners selected for laboratory analyses are sealed with Teflon sheets, plastic end caps, and silicon tape. The sealed sample liner is then labeled, sealed in a plastic bag, and placed in an ice chest cooled to 4°C with crushed ice for temporary field storage and transportation. The standard chain-of-custody protocol is maintained for all soil samples from the time of collection to arrival at the laboratory.

Groundwater Sampling

Groundwater sampling is performed after the completion of soil sampling and when the boring has reached its desired depth. The steel probe and rods are then removed from the boring and new, nominal 1-inch diameter PVC solid and perforated temporary casing is lowered into the borehole. Alternatively, a retractable screen sampling device such as a Hydropunch™ can be driven to the desired depth and pulled back to expose the screened interval. Depth to water is then measured using an electronic groundwater probe. Groundwater samples are collected using a stainless steel bailer, disposable Teflon™ bailer, or check valve or peristaltic pump with disposable Teflon™ or polyethylene sample tubing.

After the retrieval of the bailer, groundwater contained in the bailer (or discharged from sample tubing) is decanted into laboratory provided containers. The containers are then sealed with Teflon coated caps with no headspace, labeled, and placed in an ice chest for field storage and transportation to a state certified analytical laboratory. The standard chain-of-custody protocols are followed from sample collection to delivery to the laboratory. A new bailer (or sample tubing) is used for each groundwater sampling location to avoid cross contamination.

APPENDIX B

AllWest

STANDARD GEOPROBE® AND SUB-SLAB PROBE SOIL VAPOR SAMPLING PROCEDURES

Geoprobe® DPT PRT Temporary Soil Vapor Probe Advancement

The Geoprobe® Direct Push Technology (DPT) Post Run Tubing (PRT) soil vapor sampling process involves driving into the subsurface a disposable Geoprobe® DPT sampling probe with expendable tip and a PRT adapter that are connected to 4-foot sections of Geoprobe® 1.25-inch inside diameter (ID) extension rods. The PRT adapter has a reverse-thread adapter at the upper end to allow the connection of flexible soil vapor sampling tubing with a PRT tubing adaptor after the installation (post-run) of the tip. The entire sampling assembly, the sampling tip, PRT adapter, and the Geoprobe® extension rods, is driven into the subsurface by a truck-mounted hydraulic percussion hammer. The sampler is driven to the desired depth as additional rods are connected. At the desired sampling depth, typically 5 feet below ground surface (bgs) a sufficient length of disposable flexible polyethylene or Teflon® sample tubing is first lowered through the center of the extension rod and connected to the PRT adapter. The extension rod is then retracted 3 to 4 inches to create a small void around the PRT adapter and the expendable sampling tip for extracting a soil vapor sample from that location. Bentonite chips will be used to fill the annular space between the probe and the subgrade material to the ground surface. The bentonite will then be hydrated with distilled water. The temporary Geoprobe® PRT soil vapor probe will be sampled at least 2 hours following driving of the probe, to allow vapor conditions to equalize in subsurface materials and the bentonite surface seal to hydrate in general accordance with guidelines presented in the CalEPA Department of Toxic Substance Control (DTSC) *Advisory – Active Soil Gas Investigations*, April, 2012..

Geoprobe® DPT Borehole Advancement and Temporary Soil Vapor Probe Installation

Alternatively, borings will be advanced using truck-mounted or limited access Geoprobe® DPT equipment, or a hand-operated slide hammer, to drive 1-inch outside diameter (OD) rods and probes with expendable steel tips to 5 feet bgs, without recovering soil cores. Or, borings will be advanced using Geoprobe® DPT continuous coring equipment using a nominal 4-foot or 5-foot long, 2-inch OD stainless steel core barrel drive sampler and extension rods. The drive probe will be equipped with nominal 1 ½-inch inside diameter (ID) clear PETG plastic tubes that line the interior of the probe. Continuous soil sample cores are recovered for potential lithologic characterization and laboratory analysis. After the probes or core barrels are advanced to the specified depth, typically 5 feet bgs, the probes and drive rods are removed, leaving the borehole open with the expendable probe tip (if used) at the bottom.

Plastic or stainless steel soil vapor probes, ½-inch diameter by 2-inches long and tipped with porous plastic membranes, are then inserted to the bottom of the 1-inch diameter boreholes at 5 feet bgs. The probe tips are attached to 7-foot lengths of 0.25-inch OD Teflon™ tubing extending to the top of the floor slab. A fine sand filter pack is placed in the borehole annulus around the probe. Hydrated bentonite chips are then used to fill the annular space above the filter pack to the top of the floor slab. The bentonite is allowed to hydrate and borehole conditions to equalize for 2 hours prior to sampling activities, per DTSC vapor sampling guidelines. Temporary soil vapor probe installation procedures will be performed in general accordance with guidelines presented in the DTSC *Advisory – Active Soil Gas Investigations*, April, 2012.

Sub Slab Soil Vapor Probe Installation

Semi-permanent sub-slab soil vapor probes are emplaced as follows: A 1-inch diameter hole is drilled through the concrete floor slab using a portable electric drill. The boreholes are advanced approximately

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0.5 feet bgs into the subgrade material beneath the floor slab. Stainless steel or plastic vapor probes 2 inches long by 0.5 inches in diameter, tipped with porous plastic membranes, will be inserted to the bottom of each sub-slab borehole. The probe tips will be attached to lengths of 0.25-inch diameter Teflon™ or stainless steel tubing extending to approximately 1 inch below the top of the floor slab. The top of the Teflon™ or stainless steel tubing in each probe will be attached to a brass threaded male Swagelock™ fitting and cap recessed below the concrete floor. A fine sand filter pack approximately 2 to 4 inches thick will be placed in the borehole annulus around the probes. A Teflon™ sealing disk will be placed around the tubing above the filter pack.

Dry granular bentonite will be placed in the borehole annulus above the Teflon™ sealing disk to above the base of the concrete floor slab. Hydrated granulated bentonite will then be used to fill the annular space above the dry granular to approximately 2 inches above the bottom of the floor slab, and will be hydrated from the surface using deionized water. Quick-drying cement/bentonite grout will then be used to fill the remaining annular space to the Swagelock fitting approximately ¾ to 1 inch below the top of the slab. A watertight plastic cap or metal vault box will be installed flush with the top of the floor slab within a 2 to 4-inch diameter countersunk hole to protect the probe fitting. At least 2 hours will elapse prior to collecting vapor samples to allow the bentonite and cement grout seal to hydrate and borehole conditions to equalize, per DTSC sub-slab vapor sampling guidelines (DTSC, 2011).

<u>Soil Vapor Sampling via Summa Canister</u>

Soil vapor sampling procedures will be similar for Geoprobe® PRT and continuously cored temporary soil vapor probes, and semi-permanent sub-slab soil vapor probes, and will be in general accordance with *and DTSC Advisory – Active Soil Gas Investigations*, April 2012. Soil vapor sampling will not be performed if significant precipitation (greater than ½ inch in a 24 hour period) has occurred within the previous five days.

AllWest will collect soil vapor samples in laboratory prepared 1-liter capacity SUMMA canisters. Prior to vapor purging and sample collection, a vacuum leak shut-in test of the flow-controller/gauge manifold assembly we be performed for a minimum of 2 minutes. Prior to sample collection, approximately 3 sampling system volumes of soil vapor will be purged at a flow rate of approximately 150-200 milliliters per minute (ml/min) from each vapor probe using a dedicated 6-liter capacity SUMMA purge canister. Typical sampling system volumes are 4.5 ml/feet for ¼-inch OD/0.17-inch ID tubing, and 200 ml/feet for a 2-inch diameter borehole with sand filter pack (minus tubing volume). Assuming a 2-inch diameter borehole with a 0.5 feet sand filter pack interval, the typical system volume would be approximately 130 ml for a 5-feet bgs temporary probe, and 115 ml for a 1–feet bgs sub-slab probe, including 2-3 feet of tubing above grade. Therefore, 3 system volumes would typically be approximately 350 to 400 milliliters (ml) depending on tubing length and borehole diameter, depth and filter pack interval.

While sampling, a leak detection test is conducted using helium as a leak tracer inside an airtight plastic shroud covering the entire sampling apparatus, as recommended in the DTSC *Advisory – Active Soil Gas Investigations* (DTSC, 2012). The helium concentration within the shroud is monitored with a helium gas detection meter with a minimum precision of 0.1% to keep the concentration at approximately 10% (or two orders of magnitude above the minimum meter detection limit). The helium tracer gas will be infused into the shroud at the required concentration at least 5 minutes prior to sample collection. To verify helium detection meter accuracy, one (1) ambient air sample per day is collected using a 1-liter SUMMA canister inside the leak detection shroud during the sampling of one probe to measure helium concentrations inside the shroud. Depending upon helium availability, other leak detection gases such as isopropyl alcohol (IPA) or difluoroethane may be substituted.

Flow rates of approximately 150-200 ml/min are used to fill the sample canisters. The canisters are filled to approximate 80% of capacity (approximately 5 inches of mercury vacuum remaining). All pertinent field observations, pressure, times and readings are recorded. After filling and closing the sample valve, all SUMMA canisters are removed from the manifold, labeled with sampling information, including initial and final vacuum pressures, placed in a dark container and transported under chain-of-custody to the analytical laboratory. The analytical laboratory will record the final SUMMA canister vacuum upon receipt.

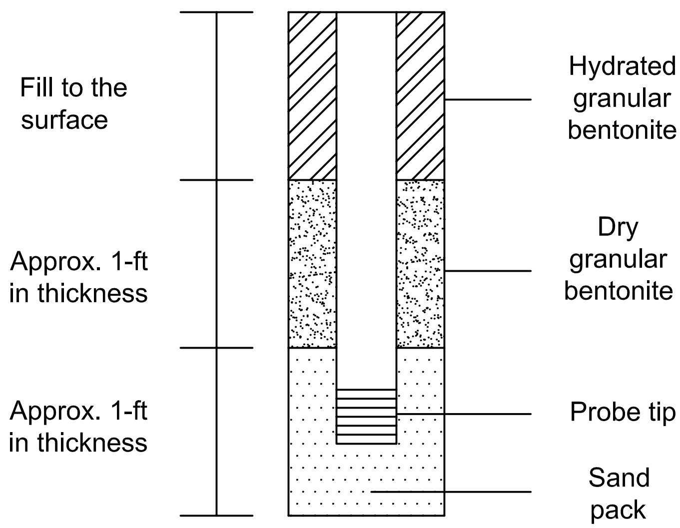
Soil Vapor Sampling via Tenax™ Sorbent Tubes

For collecting soil vapor samples in sorbent tubes for analysis by EPA Method TO-17, the sampling manifold setup, shut-in leak checks, system purging and leak detect shroud setup are similar to that using Summa canisters. However, instead of using Summa canisters for sample collection, samples are collected in stainless steel sample tubes filled with Tenax™ sorbent material. The sorbent tubes are attached with Swagelock™ fittings to the sample manifold downstream from the gauges, filters, flow restrictors, and purge canister or pump, and within the leak detection shroud. In areas of suspected high contaminant concentrations, two (2) Tenax™ sorbent tubes may be placed in series to prevent contaminant breakthrough. A vacuum pump, 100 ml syringe or SUMMA purge canister is attached outside of the leak detection shroud to the downstream end of the Tenax™ sorbent tubes, with the sample train tubing passing through the shroud wall. Helium detection meter concentration readings will be collected from the outflow port of the vacuum pump, if used. Alternatively, helium readings will be collected from the vapor filled syringe, or the SUMMA purge canister used for laboratory helium analysis. A schematic diagram of the sorbent tube soil vapor sampling manifold system and leak detection shroud is included in Appendix B.

Flow rates of approximately 50 to 100 ml/min are used to fill the sorbent tubes with a total sample volume of approximately 1 to 4 liters, depending on the desired laboratory detection limits. The sampling system vacuum should not exceed 100 inches of water (or 7.4 in Hg). All pertinent field observations, pressure, times and helium concentration readings are recorded. After the desired sample volume is withdrawn through the sorbent tubes, the tubes are removed from the manifold, capped with Swagelock™ caps, wrapped in aluminum foil, placed in a sealed plastic tube container, labeled with sampling information, placed in an ice chest cooled to 4°C with crushed ice, and transported under chain-of-custody to the analytical laboratory.

Soil Gas Probe Emplacement Methods

Figure 1
Permanent/Semi-permanent
Gas Probe
Construction



Temporary
Gas Probe Method

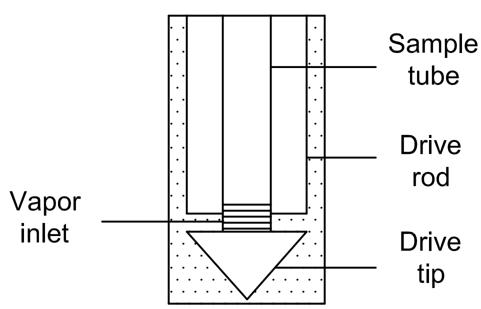
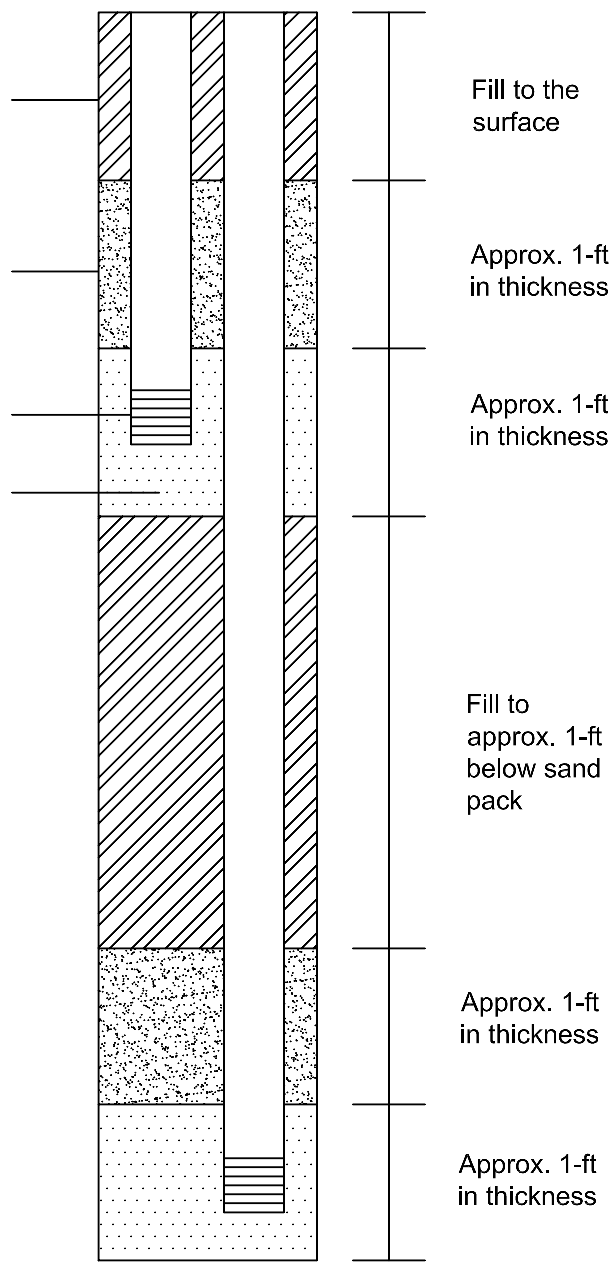
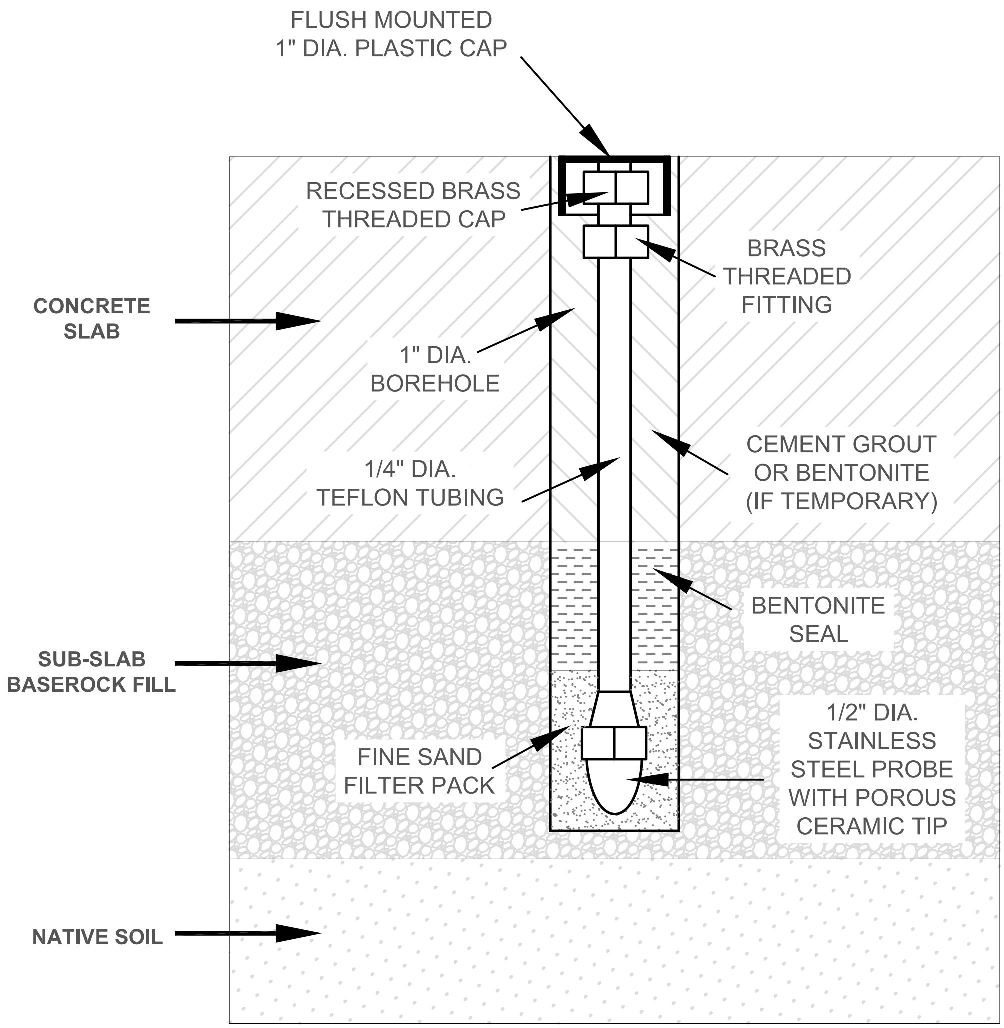


Figure 2
Multi-depth
Gas Probe
Construction



General Schematic of Sub-Slab Vapor Probe



NOT TO SCALE

AllWest	STANDARD OPERATING PROCEDURE
	SOIL VAPOR SAMPLING
	SUB-SLAB PROBE
	SOURCE: ALLWEST
	PREPARED BY: C. RAMELB

APPENDIX C

Standard Operating Procedure
Installation and Extraction of the Vapor Pin™

May 20, 2011

Scope:

This standard operating procedure describes the installation and extraction of the Vapor Pin™[1] for use in sub-slab soil-gas sampling.

Purpose:

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

Equipment Needed:

- Assembled Vapor Pin™ [Vapor Pin™ and silicone sleeve (Figure 1)];
- Hammer drill;
- 5/8-inch diameter hammer bit (Hilti™ TE-YX 5/8" x 22" #00206514 or equivalent);
- 1½-inch diameter hammer bit (Hilti™ TE-YX 1½" x 23" #00293032 or equivalent) for flush mount applications;
- ¾-inch diameter bottle brush;
- Wet/dry vacuum with HEPA filter (optional);
- Vapor Pin™ installation/extraction tool;
- Dead blow hammer;
- Vapor Pin™ flush mount cover, as necessary;
- Vapor Pin™ protective cap; and
- VOC-free hole patching material (hydraulic cement) and putty knife or trowel.

[1] Cox-Colvin & Associates, Inc., designed and developed the Vapor Pin™; a patent is pending.

Figure 1. Assembled Vapor Pin™.

Installation Procedure:

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

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

3) If a flush mount installation is required, drill a 1½-inch diameter hole at least 1¾-inches into the slab.

4) Drill a 5/8-inch diameter hole through the slab and approximately 1-inch into the underlying soil to form a void.

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

6) Place the lower end of Vapor Pin™ assembly into the drilled hole. Place the small hole located in the handle of the extraction/installation tool over the Vapor Pin™ to protect the barb fitting and cap, and tap the Vapor Pin™ into place using a

dead blow hammer (Figure 2). Make sure the extraction/installation tool is aligned parallel to the Vapor Pin™ to avoid damaging the barb fitting.

Figure 2. Installing the Vapor Pin™.

For flush mount installations, unscrew the threaded coupling from the installation/extraction handle and use the hole in the end of the tool to assist with the installation (Figure 3).

Figure 3. Flush-mount installation.

During installation, the silicone sleeve will form a slight bulge between the slab and the Vapor Pin™ shoulder. Place the protective cap on Vapor Pin™ to prevent vapor loss prior to sampling (Figure 4).

Figure 4. Installed Vapor Pin™.

7) For flush mount installations, cover the Vapor Pin™ with a flush mount cover.

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

9) Remove protective cap and connect sample tubing to the barb fitting of the Vapor Pin™ (Figure 5).

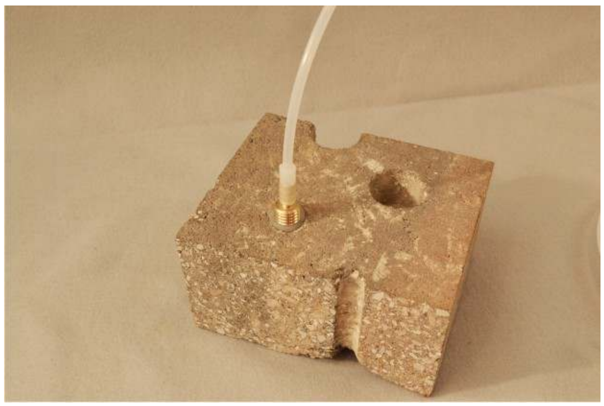


Figure 5. Vapor Pin™ sample connection.

10) Conduct leak tests [(e.g., real-time monitoring of oxygen levels on extracted sub-slab soil gas, or placement of a water

dam around the Vapor Pin™) Figure 6]. Consult your local guidance for possible tests.

Figure 6. Water dam used for leak detection.

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

Extraction Procedure:

1) Remove the protective cap, and thread the installation/extraction tool onto the barrel of the Vapor Pin™ (Figure 7). Continue turning the tool to assist in extraction, then pull the Vapor Pin™ from the hole (Figure 8).

Figure 7. Removing the Vapor Pin™.

Figure 8. Extracted Vapor Pin™.

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

3) Prior to reuse, remove the silicone sleeve and discard. Decontaminate the Vapor Pin™ in a hot water and Alconox® wash, then heat in an oven to a temperature of 130° C.

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

Replacement Parts:

Vapor Pin™ Kit Case - VPC001
Vapor Pins™ - VPIN0522
Silicone Sleeves - VPTS077
Installation/Extraction Tool - VPIE023
Protective Caps - VPPC010
Flush Mount Covers - VPFM050
Water Dam - VPWD004
Brush - VPB026

STANDARD VAPOR PIN™ SUB-SLAB PROBE INSTALLATION AND SOIL VAPOR SAMPLING PROCEDURES

Vapor Pin™ Sub-Slab Soil Vapor Probe Installation

The Cox-Colvin Vapor Pin™ semi-permanent sub-slab soil vapor probes are emplaced as follows: For a flush-mount installation, a 1 ½-inch diameter countersunk hole is drilled at least 1 3/4 inches into the concrete floor slab using a portable electric drill. A 5/8-inch diameter hole is then drilled below the countersunk hole through the concrete floor slab using a portable electric drill, and approximately 1-inch into the underlying soil to form a void. The concrete corings are removed using a brush or vacuum. Place the lower end of Vapor Pin™ assembly into the drilled hole. Place the small hole located in the handle of the extraction/installation tool over the Vapor Pin™ to protect the barb fitting and cap, and tap the Vapor Pin™ into place using a dead blow hammer. Make sure the extraction/installation tool is aligned parallel to the Vapor Pin™ to avoid damaging the barb fitting.

For flush mount installations, unscrew the threaded coupling from the installation/extraction handle and use the hole in the end of the tool to assist with the installation. During installation, the silicone sleeve will form a slight bulge between the slab and the Vapor Pin™ shoulder. Place the protective plastic cap on the Vapor Pin™ barbed fitting to prevent vapor loss prior to sampling. For flush mount installations, cover the Vapor Pin™ with a threaded metal flush mount cover. Allow 2 hours or more (per DTSC sub-slab vapor sampling guidelines) for the sub-slab soil-gas conditions to equilibrate prior to sampling.

Vapor Pin™ Sub-Slab Soil Vapor Sampling via Summa Canister

Soil vapor sampling procedures will be in general accordance with *DTSC Advisory – Active Soil Gas Investigations*, April 2012. Soil vapor sampling will not be performed if significant precipitation (greater than ½ inch in a 24 hour period) has occurred within the previous five days. The 0.25-inch outside diameter (OD)/0.17-inch inside diameter (ID) Teflon sample tubing will be placed over the Vapor Pin™ barbed fitting. Since the 0.17-inch ID tubing may be too small and too rigid to fit over the barbed fitting, it may be necessary to construct a connector sleeve using a short length of 3/8-inch OD/3/16-inch ID flexible silicone Masterflex® or similar tubing to fit over both the Vapor Pin™ barbed fitting and the end of the 0.25-inch OD/0.17-inch ID sample tubing. The sample tubing will then be connected to the sample manifold system via threaded SwageLok™ connectors.

AllWest will collect soil vapor samples in laboratory prepared 1-liter capacity SUMMA canisters. Prior to vapor purging and sample collection, a vacuum leak shut-in test of the flow-controller/gauge manifold assembly will be performed for a minimum of 2 minutes, with a maximum allowable vacuum drop of 0.2 inches of mercury (in Hg). If maximum allowable vacuum drop is exceeded, the manifold fittings will be tightened or manifold replaced and the shut-in test redone. Vacuum gauge sensitivity will register a minimum of 0.2 in Hg. Prior to sample collection, approximately 3 sampling system volumes of soil vapor will be purged at a flow rate of approximately 150-200 milliliters per minute (ml/min) from each vapor probe using a dedicated 6-liter capacity SUMMA purge canister (approximately 200 ml per in Hg vacuum). Typical sampling system volumes are 4.5 ml/feet for ¼-inch OD/0.17-inch ID tubing and 0.17-inch ID Vapor Pin™ probe, and 155 ml/feet for a 1-inch diameter borehole within the concrete floor slab. Assuming a 1-inch diameter borehole with a 3-inch deep void space in the floor slab below the Vapor Pin™ probe, the typical system volume would be approximately 60 ml including 5 feet of tubing and manifold above grade. Therefore, 3 system volumes would typically be approximately 180 milliliters (ml) depending on sample tubing and manifold length, borehole diameter, and floor slab borehole void depth below the installed Vapor Pin™ probe.

While sampling, a leak detection test is conducted using helium as a leak tracer inside an airtight plastic shroud covering the entire sampling apparatus, as recommended in the DTSC *Advisory – Active Soil Gas Investigations* (DTSC, 2012). The helium concentration within the shroud is monitored with a helium gas detection meter with a minimum precision of 0.1% to keep the concentration at approximately 10% (or two orders of magnitude above the minimum meter detection limit). The helium tracer gas will be infused into the shroud at the required concentration at least 5 minutes prior to sample collection. To verify helium detection meter accuracy, one (1) ambient air sample per day is collected using a 1-liter SUMMA canister inside the leak detection shroud during the sampling of one probe to measure helium concentrations inside the shroud. Depending upon helium availability, other leak detection gases such as isopropyl alcohol (IPA) or difluoroethane may be substituted.

Flow rates of approximately 150-200 ml/min are used to fill the sample canisters. The canisters are filled to approximate 80% of capacity (approximately 5 inches of mercury vacuum remaining). All pertinent field observations, pressure, times and readings are recorded. After filling and closing the sample valve, all SUMMA canisters are removed from the manifold, labeled with sampling information, including initial and final vacuum pressures, placed in a dark container and transported under chain-of-custody to the analytical laboratory. The analytical laboratory will record the final SUMMA canister vacuum upon receipt.

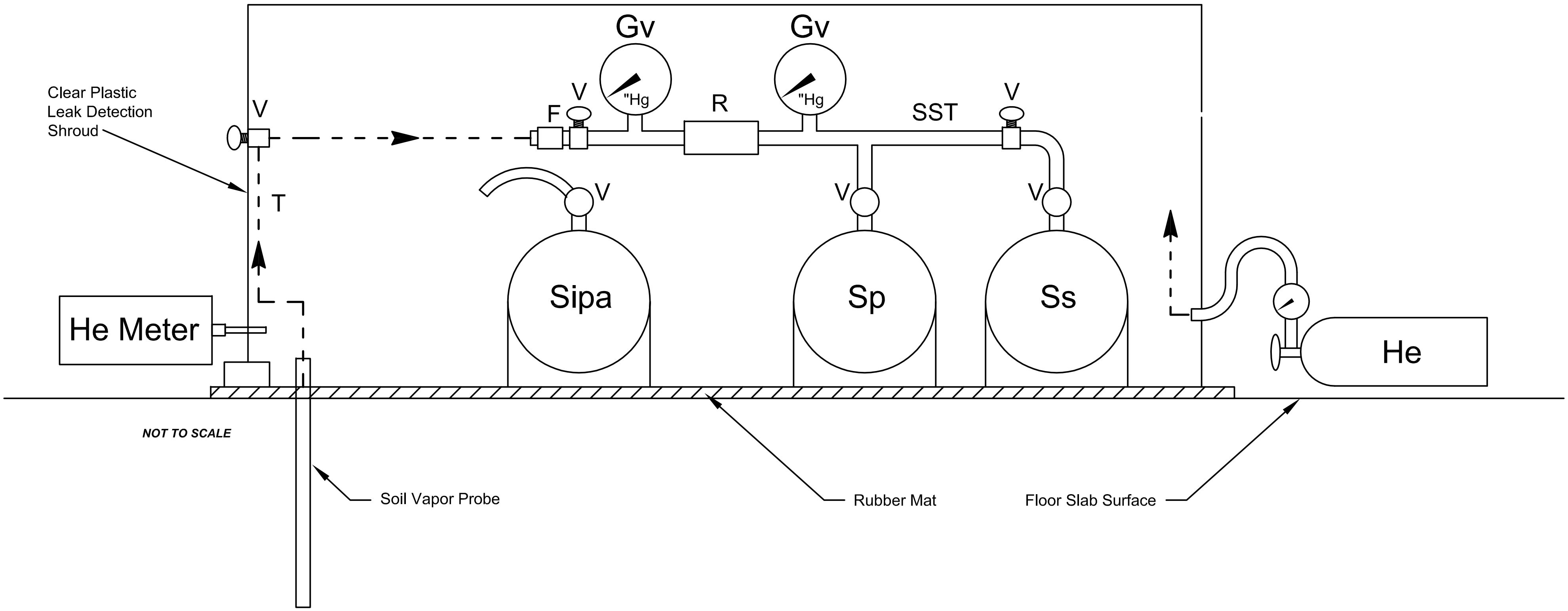
Soil Vapor Sampling via Tenax™ Sorbent Tubes

For collecting soil vapor samples in sorbent tubes for analysis by EPA Method TO-17, the sampling manifold setup, shut-in leak checks, system purging and leak detect shroud setup are similar to that using Summa canisters. However, instead of using Summa canisters for sample collection, samples are collected in stainless steel sample tubes filled with Tenax™ sorbent material. The sorbent tubes are attached with Swagelock™ fittings to the sample manifold downstream from the gauges, filters, flow restrictors, and purge canister or pump, and within the leak detection shroud. In areas of suspected high contaminant concentrations, two (2) Tenax™ sorbent tubes may be placed in series to prevent contaminant breakthrough. A vacuum pump, 100 ml syringe or second SUMMA sample purge canister is attached to the downstream end of the Tenax™ sorbent tubes. If the sample manifold train is too large to fit in the leak detection shroud, the pump, syringe or second sample purge SUMMA may be located outside the shroud with the sample train tubing passing through the shroud wall. A cotton ball saturated with isopropyl alcohol (IPA) will be used as the leak detection gas agent. A photo-ionization detector (PID) is used to monitor IPA concentrations within the leak detection shroud through an access port.

Flow rates of approximately 50 to 100 ml/min are used to fill the sorbent tubes with a total sample volume of approximately 1 to 4 liters, depending on the desired laboratory detection limits. The sampling system vacuum should not exceed 100 inches of water (or 7.4 in Hg). All pertinent field observations, pressure, times and helium concentration readings are recorded. After the desired sample volume is withdrawn through the sorbent tubes, the tubes are removed from the manifold, capped with Swagelock™ caps, wrapped in aluminum foil, placed in a sealed plastic tube container, labeled with sampling information, placed in an ice chest cooled to 4°C with crushed ice, and transported under chain-of-custody to the analytical laboratory.

APPENDIX D

General Soil Gas Sampling Manifold Schematic with Leak Detection Shroud



LEGEND

F	=	Filter
V	=	Valve
Gp	=	Pressure Gauge
R	=	Flow Regulator
Gv	=	Vacuum Gauge
Sp	=	Purge Summa Canister
Ss	=	Sample Summa Canister
Sipa	=	Ambient Air Helium Leak Detect Gas Summa Canister
He Meter	=	Helium detector for He concentration readings
T	=	Disposable Teflon or Polyethylene Tubing
SST	=	Stainless Steel Tubing and Fittings
He	=	Helium tank, leak detect gas, regulator and tubing

AllWest

STANDARD OPERATING PROCEDURE
SOIL VAPOR SAMPLING
HELIUM SHROUD
SOURCE: ALLWEST
PREPARED BY: C. RAMELB / C. MONAHAN

APPENDIX E

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Specialists in Physical Due Diligence and Remedial Services
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San Francisco, CA 94105
Tel 415.391.2510
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SOIL GAS VAPOR FIELD LOG

Project No: ____________________ **Project Name:** ____

Date: _________________________ **Vapor Probe No:** _________ **Serial No:** _______________

Regulatory Agencies: ____

Contractor: ____

Hole Diameter: __________ **Total Depth:** ______ **Grout/Bentonite:** _____________________

Probe Diameter: _________ **Line Length:** ______ **Purge Volume:** _______________________

Tracer Gas: ___________________ **Flow Regulator:** _________ **(ml/min)** **Leak Test: Pass/Fail**

Laboratory Name and Number: ____

SAMPLE COLLECTION

Start Time	Time Elapsed	Pressure	Remarks

Remarks: ____

____

____

____

____

____

____

Sampler: __________________________________