

June 5, 2018

Mr. Keith Nowell, PG, CHG
Alameda County
Department of Environmental Health
1131 Harbor Bay Parkway
Alameda, California 94502

Re: Work Plan for Vapor Intrusion Evaluation for 309 63rd Street Property in Oakland, California
Former Red Hanger Kleaners
6235-6239 College Avenue
Oakland, California

Dear Mr. Nowell:

On behalf of Ila Gordon (Red Hanger Kleaners), Roux Associates, Inc. (Roux) has prepared this Work Plan for a Vapor Intrusion Evaluation for 309 63rd Street Property in Oakland, California (Workplan) for vapor intrusion evaluation activities to be conducted at the property located at 309 63rd Street, Oakland, California (Site), adjacent to the north of the former Red Hanger Kleaners (RHK) at 6235-6239 College Avenue, Oakland California, and adjacent to the west of Kay Cleaners at 6251-6255 College Avenue, Oakland, California. The Site plan and local vicinity is shown in Attachment 1. Currently the Red Hanger Kleaners is an open environmental case with Alameda County Department of Environmental Health (ACDEH) Local Oversight Program (LOP).

This Work Plan was developed to address the technical comments by ACDEH LOP in a letter titled "Notification of Environmental Conditions of Concern and Request for Site Access 309 63rd Street, Oakland, California" dated April 20, 2017. ACDEH requested an investigation for delineation of the soil vapor impacts that might have intruded into the subsurface of the Site due to the historic neighboring drycleaner operations. This Work Plan does not include activities to further evaluate the off-site source from the neighboring former dry cleaners.

To prepare this Workplan, we have reviewed site documents the following:

- Supplemental Remedial Investigation Report, Former Red Hanger Kleaners, 6235-6239 College Ave, Oakland CA RO00000002981, dated September 27, 2017; and
- A letter from the ACDEH LOP to Responsible Parties regarding the preparation of a workplan to further delineate the extent of contamination in soil, groundwater, and soil gas, dated April 18, 2017.

Current Site Use and Project Understanding

The Site is currently used as storage and residential housing. The ground floor of the property is divided into four quadrants with a stairwell entrance between the two north quadrants that lead to the second and third story apartments (Attachment 1). The two northern quadrants are currently concrete slab floors and used as storage for a neighboring retail store. The two south quadrants are dirt floors, with the southwest quadrant mostly vacant except for a water heater, and the southeast quadrant is used to store miscellaneous building products (e.g. paint, grout, ceramic tile), assorted household furniture, and tools.

It is understood that the Site is adjacent to two former dry cleaning operations under Red Hanger Kleaners at 6235-6239 College Avenue as well as the former Kay Kleaners operations at 6251-6255 College Avenue. Based on the April 20, 2017 ACDEH letter to the Mehta Family Trust, previous environmental investigations for RHK have not fully delineated the impacts to soil vapor. ACDEH suggested that a soil vapor intrusion evaluation should be conducted at the Site, and to determine if any, mitigation measures may be warranted.

Scope of Work

The purpose of this Workplan is to evaluate the soil vapor concentrations in the subsurface below the 309 63rd street building. Four soil borings will be advanced to install paired soil vapor points at approximately 2 and 7 feet below ground surface (bgs) in the two southern quadrants (SG-15 and SG-16) and two soil vapor pins will be installed in the two northern quadrants (SS-01 and SS-02). Proposed locations are shown on Attachment 1. Location SG-16 was chosen to assess the potential of a preferential pathway from a sewer line that comes into the building from the alleyway.

The following provides details associated with the implementation of the scope of work.

Health and Safety Plan

Roux will prepare a site-specific Health and Safety Plan (HASP) to provide guidelines to all Site workers and visitors during fieldwork. The HASP will be kept on-site at all times when fieldwork is occurring and will be reviewed and signed by all site workers prior to work each day.

Utility Location and Borehole Clearance

Roux will contact Underground Service Alert (USA) a minimum of 48 hours prior to subsurface activities to notify utility operators of the planned work and to request marking of nearby utilities (i.e., natural gas, electric, water, sewer, telephone, fiber optic, etc.). Additionally, Roux will contract with a private geophysical services and utility locating firm to evaluate the proposed boring locations and mitigate the risk of disrupting potential subsurface utility lines. Proposed locations will be finalized in the field.

Permits

Permits for the installation of temporary soil vapor points will be obtained from the Alameda County Department of Public Works, as required.

Soil Vapor Probe and Vapor Point Installation

Roux will install temporary soil vapor points, as shown on Figure 1. Protocols and procedures utilized by Roux for the soil vapor well investigation will be conducted in accordance with the July 2015, California Environmental Protection Agency (Cal/EPA), DTSC, and San Francisco Regional Water Quality Control Board (SF RWQCB), *Advisory, Active Soil Gas Investigations* (Soil Gas Advisory). Vapor probes SG-15 and SG-16 will consist of two vapor probes installed at 2 and 7 feet bgs within its own separate 2-inch diameter boring. The probes will consist of a new stainless steel filter probe tip with a ¼-inch push-to-connect fitting attached to ¼-inch diameter Teflon tubing.

The deeper soil vapor wells will be advanced using a hand auger to 7 feet bgs. A 12-inch sand pack of #3 sand will be placed from 6 feet bgs to 7 feet bgs surrounding the probe tip midway in the sand pack to minimize the disruption of airflow to the sampling tip. Above the sand, 12 inches of dry granular bentonite will be placed above the sand pack, followed by hydrated bentonite to the surface.

The shallow soil vapor wells will be advanced to 2 feet bgs using hand auger at least 2 feet distance from the 7 feet bgs well, and a 12-inch sand pack of #3 sand will be placed from 1 feet bgs to 2 feet bgs surrounding the probe tip. Above the sand pack will be 6 inches of dry bentonite, followed by hydrated bentonite to the surface.

The soil vapor probes' tubing will be labeled, capped, and sealed with a flush to grade traffic-rated well at each location. The bentonite/cement grout will be hydrated in a container at the surface and poured slowly into the borehole. The dry bentonite layer prevents the hydrated bentonite layer from infiltrating the sand pack. A schematic of the vapor probe construction is presented in Figure 1.

Two Vapor Pin® samplers (SS-01 and SS-02) will be installed in accordance with the Soil Gas Advisory, the Vapor Pin® manufacturer's Standard Operating Procedures (Attachment 2) and the Helium Shroud Standard Operating Procedures (Attachment 3). The sub-slab probes will be installed with a barb fitting that connects to tubing for sampling. After sampling, the Vapor Pin® will be removed, and the hole will be sealed with cement. If the Vapor Pin® samplers are infeasible based on floor construction, then 1.5 foot soil vapor wells will be installed following the methodology described above.

At least 48 hours after the installation of the soil vapor probes and sub-slab Vapor Pins®, vapor samples will be collected using certified-clean Summa canisters. Prior to the collection of the samples, a "shut-in" test will be performed to check for leaks in the above ground soil vapor sampling equipment.

Following the shut-in test, approximately three purge volumes will be purged from the sampling tubing using the "purge Summa canister" before soil vapor sample collection begins. Purge activities will be conducted at the same flow rate used for soil vapor sample collection (approximately 175 milliliters per minute). During purging and soil vapor sample collection activities, a leak test will be performed using a rigid shroud, which will enclose the soil vapor probe vault, probe tubing, and the entire sampling manifold and helium as a tracer gas. A minimum helium concentration of 20 percent will be maintained within the rigid shroud during the purging and soil vapor sample collection period.

All vapor samples will be labeled, logged on a chain of custody form, and transported to a California certified laboratory for analysis.

Analytical Suite

All vapor samples will be analyzed by a California certified laboratory for the following parameters:

- VOC by U.S. EPA Method TO-15, unless vapor concentrations exceed the limits of TO 15 and will be analyzed by U.S. EPA Method 8260
- Helium by American Society for Testing and Materials (ASTM) D1946

Soil Disposal

Soil cuttings from the drilling activities will be temporarily stored in properly labeled 55-gallon drum. Following waste profiling, the waste will be transported to an appropriate disposal facility by a licensed transporter.

Reporting

Roux will submit a vapor intrusion evaluation report to ACDEH certified by a California Professional Geologist. The vapor intrusion report will include a summary of the field activities, field observations, boring logs, laboratory analytical results, a comparison of the analytical results to applicable regulatory standards, assessment of the findings, and conclusions and recommendations for development at the Site.

If you have any questions, please contact the undersigned at (415) 967-6000.

Sincerely,

ROUX ASSOCIATES, INC.



Christine Pilachowski, P.G.
Senior Geologist



Michael Marsden, P.G., C.Hg.
Principal Hydrogeologist

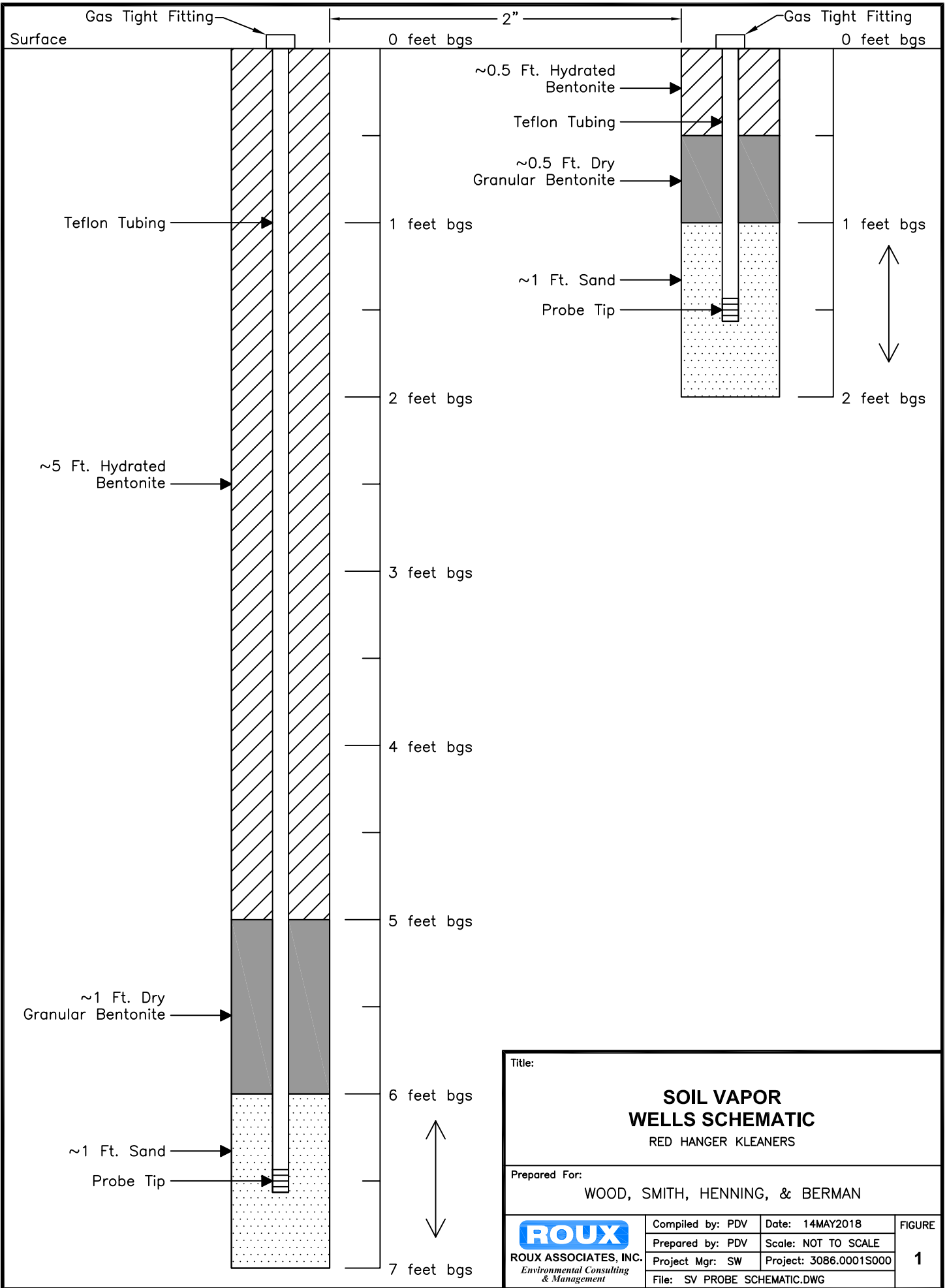
Attachments:

- Figure 1: Soil Vapor Probe Schematic
- Attachment 1: Sampling Locations Map
- Attachment 2: Vapor Pin ® Standard Operating Procedures
- Attachment 3: Soil Vapor Helium Shroud Standard Operating Procedures

FIGURE

1. Soil Vapor Probe Schematic

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Title:

SOIL VAPOR WELLS SCHEMATIC

RED HANGER KLEANERS

Prepared For:

WOOD, SMITH, HENNING, & BERMAN

 ROUX ASSOCIATES, INC. <i>Environmental Consulting & Management</i>	Compiled by: PDV	Date: 14MAY2018	FIGURE 1
	Prepared by: PDV	Scale: NOT TO SCALE	
	Project Mgr: SW	Project: 3086.0001S000	
	File: SV PROBE SCHEMATIC.DWG		

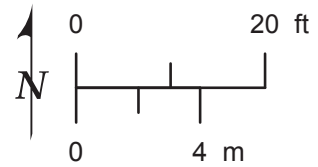
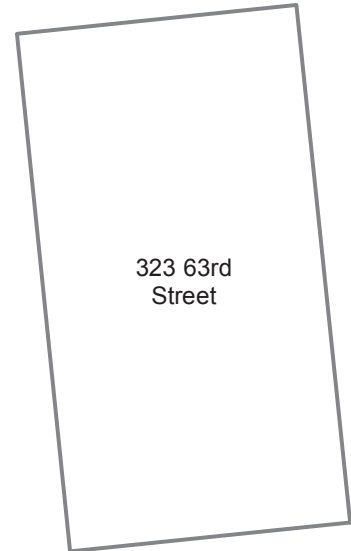
Work Plan for Vapor Intrusion Evaluation
309 63rd Street Property in Oakland, California

ATTACHMENT 1

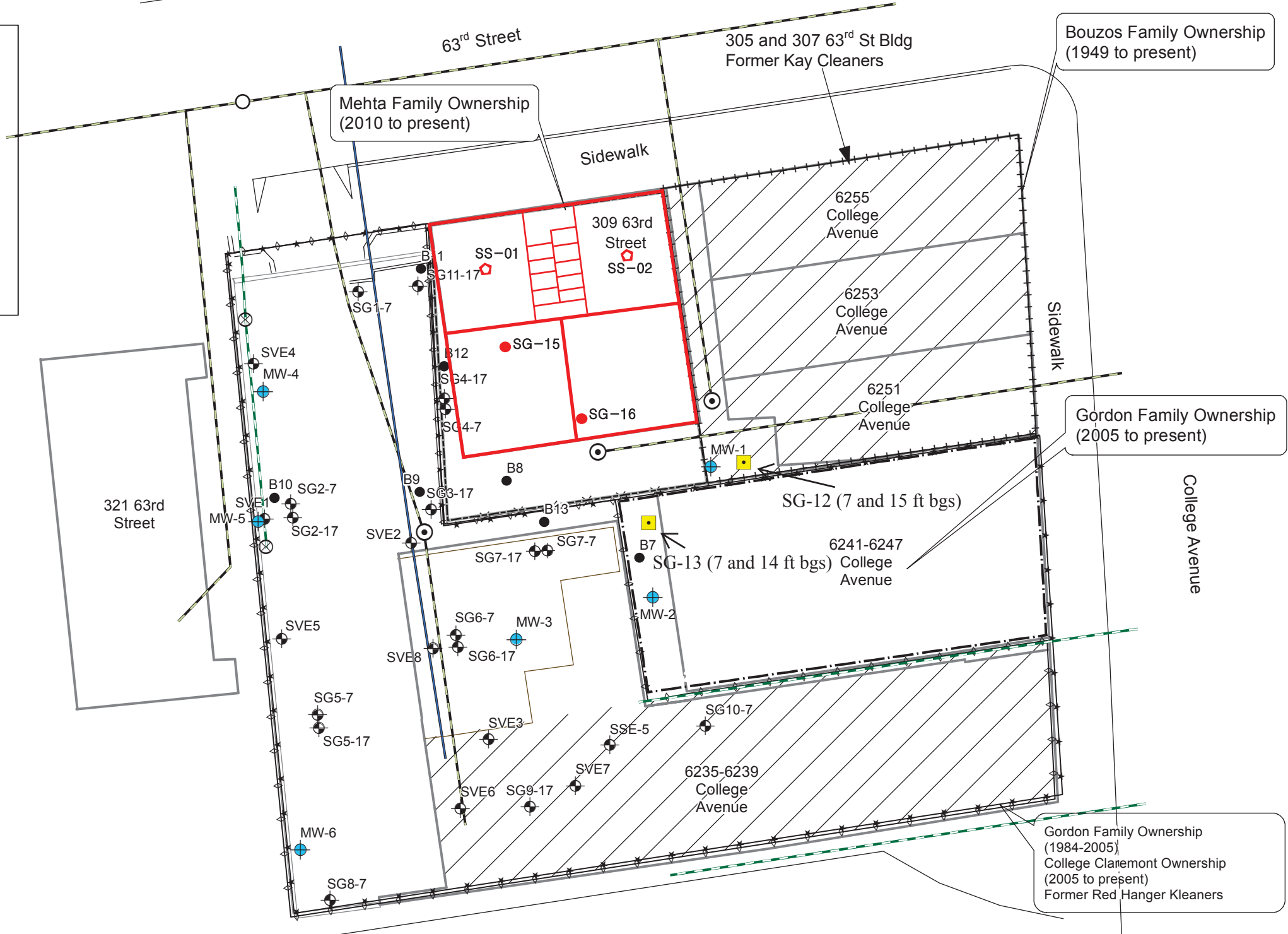
Sampling Locations Map

Legend

- Proposed Sub-Slab Vapor Pin
- Proposed Nested Soil Vapor Well
- 309 63rd Street Property Boundary and Approximate Improvements
- Groundwater Monitoring Well
- Soil gas well, 7 and 14/15 feet bgs
- Water line
- Sanitary sewer line
- Storm drain

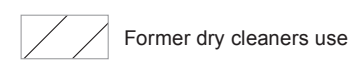


Note: Building extents at 321 and 323 63rd Street are approximate.
 Building extents at 309 63rd Street are approximate.



- Manhole
- ⊗ Drain inlet
- ⊙ Sanitary sewer cleanout
- ⊕ Soil vapor extraction point
- Previous boring
- Building outline
- × × × Fence
- Garage

- Property Ownership**
- ▭ Bouzos Family, 1949 to present
 - ▭ College Claremont, 2005 to present
 - ▭ Gordon Family, 1984-2005
 - ▭ Gordon Family, 2005 to present
 - ▭ Mehta Family, 2010 to present



Basemap Source: Fuguro, 2017

SOIL VAPOR AND GROUNDWATER MONITORING LOCATIONS	
FORMER RED HANGER KLEANERS OAKLAND, CALIFORNIA	
	Date: 8/17/2017
Figure: 1	

Work Plan for Vapor Intrusion Evaluation
309 63rd Street Property in Oakland, California

ATTACHMENT 2

Vapor Pin ® Standard Operating Procedures



Standard Operating Procedure Installation and Extraction of the Vapor Pin®

Updated March 16, 2018

Scope:

This standard operating procedure describes the installation and extraction of the VAPOR PIN® 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 or pressure readings.

Equipment Needed:

- Assembled VAPOR PIN® [VAPOR PIN® and silicone sleeve(Figure 1)]; Because of sharp edges, gloves are recommended for sleeve installation;
- Hammer drill;
- 5/8-inch (16mm) diameter hammer bit (hole must be 5/8-inch (16mm) diameter to ensure seal. It is recommended that you use the drill guide). (Hilti™ TE-YX 5/8" x 22" (400 mm) #00206514 or equivalent);
- 1½-inch (38mm) diameter hammer bit (Hilti™ TE-YX 1½" x 23" #00293032 or equivalent) for flush mount applications;
- ¾-inch (19mm) diameter bottle brush;
- Wet/Dry vacuum with HEPA filter (optional);
- VAPOR PIN® installation/extraction tool;
- Dead blow hammer;
- VAPOR PIN® flush mount cover, if desired;
- VAPOR PIN® drilling guide, if desired;

- VAPOR PIN® protective cap; and
- VOC-free hole patching material (hydraulic cement) and putty knife or trowel for repairing the hole following the extraction of the VAPOR PIN®.



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 (38mm) diameter hole at least 1¾-inches (45mm) into the slab. Use of a VAPOR PIN® drilling guide is recommended.
- 4) Drill a 5/8-inch (16mm) diameter hole through the slab and approximately 1-inch (25mm) into the underlying soil to form a void. Hole must be 5/8-inch (16mm) in diameter to ensure seal. It is recommended that you use the drill guide.

VAPOR PIN® protected under US Patent # 8,220,347 B2, US 9,291,531 B2 and other patents pending

- 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 installation/extraction tool over the vapor pin to protect the barb fitting, and tap the vapor pin into place using a dead blow hammer (Figure 2). Make sure the installation/extraction tool is aligned parallel to the vapor pin to avoid damaging the barb fitting.



Figure 2. Installing the VAPOR PIN®

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 3).



Figure 3. Installed VAPOR PIN®

- 7) For flush mount installations, cover the vapor pin with a flush mount cover, using either the plastic cover or the optional stainless-steel Secure Cover (Figure 4).



Figure 4. Secure Cover Installed

- 8) Allow 20 minutes or more (consult applicable guidance for your situation) for the sub-slab soil-gas conditions to re-equilibrate prior to sampling.
- 9) Remove protective cap and connect sample tubing to the barb fitting of the VAPOR PIN®. This connection can be made using a short piece of Tygon™ tubing to join the VAPOR PIN® with the

Nylaflow tubing (Figure 5). Put the Nylaflow tubing as close to the VAPOR PIN® as possible to minimize contact between soil gas and Tygon™ tubing.



Figure 5. VAPOR PIN® sample connection

10) Conduct leak tests in accordance with applicable guidance. If the method of leak testing is not specified, an alternative can be the use of a water dam and vacuum pump, as described in SOP Leak Testing the VAPOR PIN® via Mechanical Means (Figure 6). For flush-mount installations, distilled water can be poured directly into the 1 1/2 inch (38mm) hole.



Figure 6. Water dam used for leak detection

11) Collect sub-slab soil gas sample or pressure reading. When finished, replace

the protective cap and flush mount cover until the next 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). Turn the tool clockwise continuously, don't stop turning, the VAPOR PIN® will feed into the bottom of the installation/extraction tool and will extract from the hole like a wine cork, DO NOT PULL.
- 2) Fill the void with hydraulic cement and smooth with a trowel or putty knife.



Figure 7. Removing the VAPOR PIN®

- Prior to reuse, remove the silicone sleeve and protective cap and discard. Decontaminate the VAPOR PIN® in a hot water and Alconox® wash, then heat in an oven to a temperature of 265° F (130° C) for 15 to 30 minutes. For both steps, STAINLESS – 1/2 hour, BRASS 8 minutes

- 3) Replacement parts and supplies are available online.

Work Plan for Vapor Intrusion Evaluation
309 63rd Street Property in Oakland, California

ATTACHMENT 3

Soil Vapor Helium Shroud
Standard Operating Procedures

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Introduction

Sampling soil gas wells using Helium leak tracer is not inherently difficult using C&T's equipment, it is relatively unforgiving of mistakes. The equipment has been field tested and through these tests we've learned that good results necessitate reviewing this document and following the procedures specified here. We strongly encourage practicing set-up, Helium charging the shroud, using the detectors, and breakdown. We've seen a very strong correlation between a thorough equipment orientation and successful sampling events. User errors related to a lack of orientation and preparation are the primary root cause of sampling errors and equipment failures.

The equipment supplied by C&T has been critically cleaned, assembled, and leak tested using both pressurized Helium and vacuum decay methods. The preparation of all sampling equipment and media has been thoroughly documented.

If you suspect the sampling equipment is damaged or not functional, before using it please inform your project manager by calling the lab at 510-486-0900. Used and returned damaged equipment will be assessed cost for repair and replacement. Please do not disassemble and reassemble sampling trains and shrouds. They have been critically cleaned, assembled and leak checked for your use without further need for alteration. By breaking connections in sampling trains, users invalidate the lab's cleaning and prep effort.

Use of and Care for the C&T Helium Detectors

When used properly, C&T's diffusion cell He sensors provide real time measurement of Helium concentration in air from 1% to 99% Helium to accuracies of 0.1%. Prior to delivery, C&T He sensors are calibrated and performance verified. If, upon initial check, you discover the He gauge is apparently not working properly, call your C&T project manager immediately; repair and replacement costs will be assessed for all sensors returned damaged to the lab.

Figure 1: Diffusion Cell (left) and flow through cell (right) Helium Detectors



Battery Charges last 4 hours: Helium Detectors using rechargeable NiCd batteries are fully charged before leaving the lab and hold a charge for 4 hours of use. Turn detectors on for use and off immediately after use and you'll make it through a day's sampling event without losing charge. The lab does not supply rechargers to users because the Diffusion and Flow through types use employ different voltages, using the wrong charger damages the detectors.

3 position switch: **On** is up, **Off** is neutral and down.

Required use technique for accurate Helium tracer measurements: These He sensors are sufficiently durable for portable field use; however they are precision measurement devices unforgiving of mistreatment or abuse, accordingly;

- Keep the He sensor clean at all times, particularly around the white diffusion membrane cell opening. Dirt on, or in the diffusion cell well will compromise calibration and result in extra fees for cleaning and recalibration.
- The C&T He sensors are shock sensitive. Dropping the gauges onto a hard surface from a height of 2' or more can compromise calibration and may irreversibly damage the sensor and cause replacement or maintenance cost assessments. Please store and transport the gauges in the foam lined box provided.
- Helium detectors are moisture sensitive, don't get them wet

Accepting C&T He sensors binds your firm to the following conditions of use.

Replacement costs are \$900 + applicable shipping costs and sales tax. Minimum diagnostic, recalibration, and maintenance charges for damaged sensors are \$120.

1.0 Setting Up

Equipment: The following equipment should be present in the supply kit provided from the lab:

- 1) Integral shroud box and sampling train with 3 port valve
- 2) Helium supply components a) Helium bottle(s) (one bottle supplies enough for 4 wells), b) Braided steel Helium transfer tube with male QT connectors and; 3) Helium supply regulator with female QT connector
- 3) Helium Detector: Diffusion cell type (4 hours use on one charge)
- 4) Helium Detector: Flow through type (4 hours use on one charge)
- 5) Male QT ¼" OD Teflon tubing connector for connecting in port on flow through Helium detector to Purge port on Shroud
- 6) QT Vacuum gauge
- 7) 1.4 liter Sample canisters, one for each sample to be taken, some users request an extra to cover any aborted sampling events, well relocations etc...
- 8) Graphite or Ceramic ferules for joining ¼" OD Teflon tubing to well, one provided in each shroud/train inside the nut in the open port of the 3 port valve used to connect the soil gas well to the train.

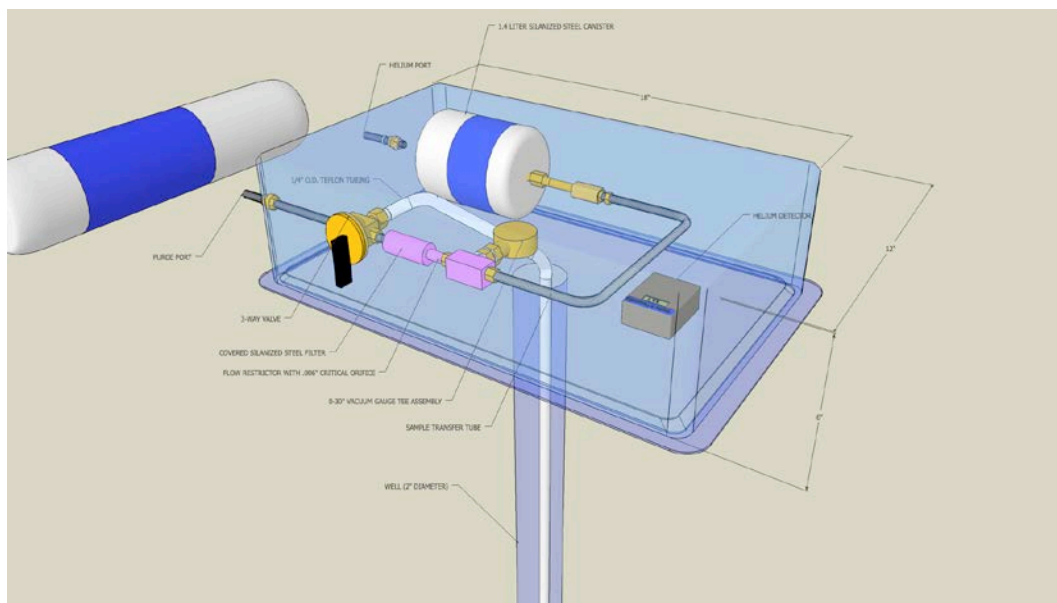
Equipment not Supplied by C&T: You will need the following items to complete your work; these items are not supplied by C&T unless specially requested:

- 1) Well purge suction source, alternatives available from the lab are: a) 50 ml disposable syringe with tubing adapters, b) evacuated 6 liter summa canister with 180 ml/min flow restrictor and filter, c) battery powered vacuum pump, d) 110V VAC powered vacuum pump
- 2) ½" x 9/16" open end combination wrench and one small crescent wrench. These are the tools needed to make compression fitting connections. C&T does not rent wrenches.
- 3) Extra Graphite or ceramic ferules as needed to insure you make a good well to train connection
- 4) ¼ OD Teflon tubing...Typically the well drillers have a lot of this stuff, if you need it
- 5) Knife (for cutting Teflon tubing)

Position the shroud lid over the well. Consistent Helium concentrations arise when the shrouds are used with the wellhead box lids provided. Some user protocols specify no box lid, in these cases, piling dirt around the edges of the box works to keep Helium inside the shroud. On windy days, a plastic windscreen employed either as a cover over the shroud or as an "air dam" has provided good results. We've experimented with using yoga mat material as "gaskets" for subslab sampling with mixed results.

If you're using the lid, and we recommend you do, position the lid over the wellhead with the tubing arising through the hole in the lid. There is an audible snap when the lid is optimally attached.

Figure 2: Helium Tracer Shroud Components



Once the shroud lid is positioned over the well, check that the 3 way valve is in the **off** position and the train pressure gauge showing a vacuum. This is your indication that the train is leak free since leaving the lab and all you need do is make a tight connection from the well to the open port on the 3 way valve. If the 3 way valve is not in the **off** position as a result of some error in shipment, there may be no

vacuum on the gauge. At this point, your sampling protocols will determine whether the train can be used or not.

All trains leave the lab holding vacuum with decay rates less than 5" in 12 hours. Many shroud trains have inconsequentially slow leaks; trains are stored more than 3 days since being shipped from the lab may have no vacuum showing on the gauge. In these cases, you can check the vacuum decay rate by connecting an extra canister to the train and observing the vacuum decay rate.

2.0 Connecting the Well to the Train 3-port valve

To connect the soil gas well to the sampling train, you will be joining ¼" Teflon tubing to the 3 port valve. Either a ceramic or graphite ferule has been provided inside the nut on the open port of the 3 port valve for you to make this connection. The most important component in a compression fitting is the ferrule, which is prone to damage. Care should be used when installing it although if ceramic or graphite ferules become defective, it is easy to install a replacement.

A "straight" even tubing end in the ¼" OD Teflon tubing from the well to the 3 port valve is important to making a "tight" connection. Use a knife rather than scissors to cut the tubing at a 90 degree angle to the tube axis. Remove any "burrs" or irregularities in the tubing end before attempting the connection. Slip the nut over the tubing, then the ferule. The ferule should "point" toward the 3-port valve. Usually, it is not possible to install ferules "backwards".

Keeping the 3 way valve in the **off** position, attach the well tubing to the open 3 way valve port. Avoid excessive force when tightening the nut. If the nut is over-tightened, the ceramic or graphite ferrule frequently deforms improperly causing the joint to fail. Over-tightening is the most common cause of leaks in compression fittings. A good way to make these connections is to tighten the nut first by hand until it is too difficult to continue and then tightened the nut a full 360 degree turn with a 9/16" open end wrench; no more than a 1 and 1/4 turn should be needed to create a leak tight connection.

3.0 Attaching the Sample Canister to the Train

Check the vacuum in the sample canister using the QT Vacuum gauge, it should read -30" of Hg (full vacuum) if it reads less, use another sample canister. While keeping the 3 way valve in the **off** position, attach the canister to the female QT fitting at the rear of the sampling train as follows:

Pull the external sleeve of the female QT connector back to its stop, insert the male valve stem and allow the sleeve to return to its spring loaded position. When the QT connection is made the canister (male) valve is open to the train. Try to pull the canister off the train without retracting the female QT sleeve. A correctly made QT connection cannot be broken without retracting the sleeve on the female valve stem.

A word about Micro QT Fittings: Micro Quick connect valves (QT) offer superior performance and ease of use compared to alternative tubing connections and valves. QT fittings provide highly reliable leak free connections without tools especially for fittings that are made and broken frequently.

Fine sand and/or grit (such as dry bentonite) damages male and female QT valves and connections. Keep both male and female QT valve components scrupulously clean. Please use the orange or red plastic caps provided for the male QT fittings, they protect the valve stem while shipping and protect your sample during return shipment to the lab.

When removing or replacing orange plastic protective caps on the male QT fittings, push them straight on and pull them straight off the valve stem. Twisting the cap counterclockwise while removing or replacing on the valve stem can disassemble the valve stem causing vacuum and/or sample loss.

4.0 Positioning the Shroud over the Well

Position the diffusion Helium gauge out of the way on a portion of the lid that allows you a good view of the display with the shroud in place. Then invert the shroud assembly over the lid and snap lid into position.

With the shroud assembled in place, you should be able to view the vacuum gauge well enough to verify that vacuum is holding and you can see the Helium detector display. Our apologies for the opaque portions of the boxes, if you know of hard plastic boxes, with clear panels we'd love to learn about them.

5.0 Charging the Shroud with Helium

C&T provides Aluminum lecture bottles filled with 300 psi Helium; each bottle of Helium contains 48 liters at atmospheric pressure, enough to easily supply 20% Helium atmospheres to 6 single Shrouds and 3 double shrouds. The amount of Helium used depends predominantly on wind and time required to sample the well, with experience, you'll use less Helium. Your protocol will specify the Helium concentration in the shroud. The following guidance is based on sampling under a 20-25% Helium in air atmosphere. Regardless of your target helium concentration, your objective should be to maintain a steady concentration of Helium during the sampling event at levels above 10% Helium in air.

Locate and assemble the Lecture bottle, Helium transfer line, and the gas supply regulator. Tighten the brass nut attaching the regulator to the bottle one half turn past finger tight with a crescent or 9/16" open end wrench. The regulator is preset to deliver Helium at ideal pressure; **you need not adjust the regulator**. Add Helium to the shroud by opening and closing the valve at the top of the bottle. Attach the Helium transfer line using the QT fittings at the regulator and at the Helium port on the shroud.

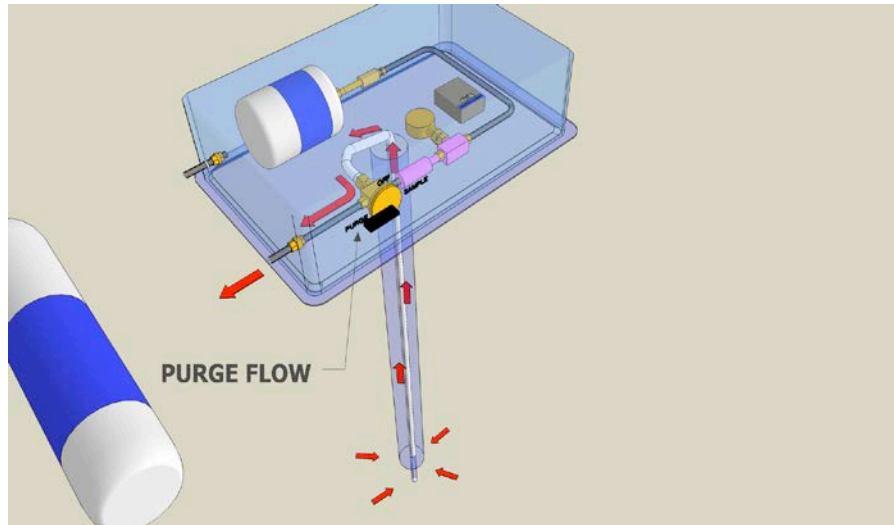
To provide Helium flow, slowly open the lecture bottle valve by twisting **counterclockwise** about ¼ turn.

Deliver 10 lbs of Helium at a time to the **single** shroud and 20 lbs to the **double**. The diffusion cell Helium detector will respond in about 30 seconds to the new concentration. Unstable Helium detector readings reflect turbulent gas mixing inside the shroud. Plug holes between the shroud and the surface, use plastic sheeting to create an "air dam" or take other measures to air movement around the shroud and thus turbulence inside the shroud.

Monitor the Helium concentration displayed on the gauge in the shroud for about a minute in single shrouds, 90 seconds or longer in doubles. Under ideal conditions, 40 psi from the bottle will charge a

single shroud to 25% helium concentration; double shrouds will require 80 psi. 25% Helium concentrations are maintained in the lab (zero wind) for 6-10 minutes. You may add more helium while purging and sampling. We suggest 10 psi increments for singles and 20 psi for doubles by opening the lecture bottle valve $\frac{1}{4}$ turn. We suggest users record/document the Helium concentration in the shroud at a minimum of 2 minute intervals during sampling.

Figure 3: Purge Flow Diagram



6.0 Purge Testing the Well under Helium

This test will help you establish the integrity of the well and the train to well connection. If no Helium is detected in the purge gas flow using this technique, one can assume the well is tight to breakthrough, and the train connections are all tight, and thus there will be no Helium detected in the sample that goes to the lab.

While getting the Helium concentration established, assemble the well purge train. Place the inline Helium detector between the shroud and whatever device (evacuated canister, syringe, or vacuum pump) that you're using to provide purge suction.

With the Helium atmosphere established in the shroud at 20% or more, and the purge system ready to operate, begin purging by moving the 3 way valve selector position to **Purge** and then establishing suction on the purge line.

Observe the inline Helium detector display while applying suction on the purge line. If you've purged enough vapors from the well to represent the entire volume of the path from the surface (under Helium atmosphere) to the distal end of the sampling tube and back up the tube and through the detector without detecting any Helium, your well shows signs of integrity and you may have a good leak free sample.

CA-DTSC guidance provides the opinion that a 5% ambient air dilution is inconsequential to sample integrity. When sampling under a 20% Helium in air atmosphere, 1% Helium detected in the purge gas represents a 5% ambient air sample dilution.

7.0 Sampling the Well under Helium

After you've completed purging the well, verify the reading on the Vacuum gauge of the train is -30 inches and that you have a steady state concentration of Helium between 20-25%, and then begin sampling by moving the 3 way selector valve to the **Sample** position.

Monitor the Helium concentration in the shroud by recording the reading on the diffusion cell detector inside the shroud every other minute or so. Add Helium from the bottle as needed to maintain a steady state concentration of Helium under the shroud.

Figure 4: Sampling Flow Diagram

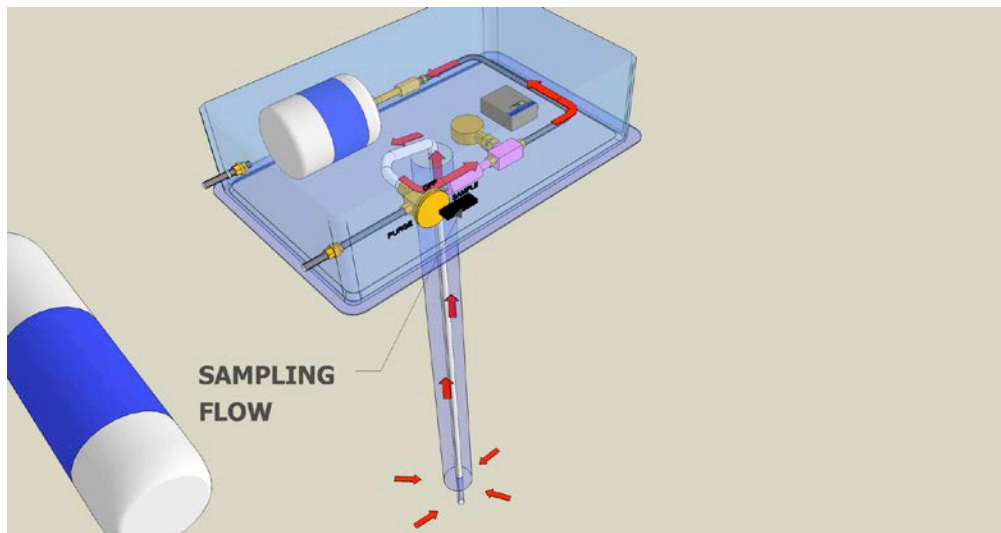


Figure 5: Dual Depth Well Sampling Shroud

