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BUTTNER PROPERTIES, INC.
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May 9, 2014

Alameda County Environmental Health Services
Local Oversight Program
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Attention: Ms. Dilan Roe, LOP Program Manager

RE: 2250 Telegraph Avenue
Oakland, California

Dear Ms. Roe:

The Work Plan For Site Closure, 2250 Telegraph Ave., Oakland, CA, May 2014" ("Work Plan") was prepared by our consultant, Applied Water Resources ("AWR"), who we believe to be experienced and qualified to advise us in a technical area that requires a high degree of professional expertise. Therefore we have relied upon AWR's assistance, knowledge and expertise in their preparation of the Work Plan. I am unaware of any material inaccuracy in the information in the Work Plan or of any violation of government guidelines that are applicable to the Work Plan. Accordingly, I am not aware of any reason to question the conclusions and recommendations contained in the Work Plan.

This letter is submitted pursuant to the requirements of California Water Code Section 13267(b)(1).

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge.

Sincerely,

Marianne Robison

Marianne Robison
President

WORK PLAN FOR SITE CLOSURE

2250 Telegraph Ave, Oakland, CA 94612

Dave's Station

Fuel Leak Case No. RO0000359
GeoTracker Global ID T0600100431

May 2014

APPLIED WATER RESOURCES

Work Plan for Site Closure

2250 Telegraph Ave, Oakland, CA 94612
Dave's Station

Fuel Leak Case No. RO0000359
GeoTracker Global ID T0600100431

May 2014

Prepared on behalf of:
Buttner Properties, Inc.
600 W. Grand Ave, Oakland, CA 94612

PROFESSIONAL GEOLOGIST
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Project Geologist

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1. INTRODUCTION

Applied Water Resources (AWR) has prepared this *Work Plan for Site Closure* on behalf of Buttner Properties for the property located at 2250 Telegraph Ave, Oakland, California.

The objective of the Work Plan is to describe the methods to be used to collect the remaining information needed to evaluate the case for closure as outlined in the State Water Resources Control Board's *Low-Threat Underground Storage Tank Case Closure* Policy (LTCP) (February 2012).

A Closure Report will be prepared assuming the data collected by implementing this Work Plan is consistent with no significant risk as described in the LTCP.

2. BACKGROUND

2.1 Site Setting

The Site is located at 2250 Telegraph Avenue, situated at the northeast corner of Telegraph Avenue and West Grand Avenue, in Oakland, California. The Site and immediately adjacent properties are zoned for commercial development and use. The Site is currently paved and vacant.

The nearest significant surface water features are Lake Merritt, 0.4 mile to the east, and San Francisco Bay, 2.5 miles to the west. The Site is essentially flat at an approximate elevation of 24 feet above mean sea level (msl).

The adjacent property to the east, also owned by Buttner Properties, Inc. is occupied by a single story structure, and paved parking and use areas (460 West Grand Avenue). The 460 Grand Avenue site has been used as a nursery school since December 1988. The nursery school building is situated approximately 90 feet east of the former service station building, and cross- and downgradient of the former USTs which were removed in 1990.

According to previous borings, the Site is underlain by a layer of non-native fill consisting of clayey and sandy gravel varying in depth from about 2 to 5 feet. The fill material is underlain by layers of silty clay to lean clay to the maximum depth explored of 25 feet bgs. Fill materials consisting of sand and gravel exist in the former UST excavations.

Ground water at the Site has been monitored since 1994 and has fluctuated between depths of 8 to 13 feet bgs. Ground water monitoring has shown that the ground water flow direction is predominately toward the east-southeast.

2.2 Site History

In the early 1950's Union Oil Company entered into a lease to operate a service station at the Site. In 1958, Buttner Properties, Inc. acquired the property and the existing service station management and operator at that time were allowed to continue in their lease arrangement. Two USTs (sizes unknown) were previously located in the southwest corner of the Site and records indicated that the USTs were removed from the Site in the 1960's. Three USTs (two-10,000 gallon gasoline and one-280 gallon waste oil tank) were then installed at the Site along with two fuel dispensing islands (each with two dispensers). In the late 1980's, fuel dispensing ceased and the lease was changed to allow automobile servicing and repair activities. The Site was occupied by a one-story former service station building that included two vehicle servicing bays and an office. The three USTs and dispensing islands were removed in August 1990. The service station building was demolished in early 2013.

A remedial action was implemented in June 2013 which involved excavating soil in two "hotspot" areas with concentrations of petroleum above environmental screening levels (ESLs) and LTCP criteria, removing approximately 4,000 gallons of ground water, and spreading approximately 220lbs of oxygen releasing compound (ORC) advanced pellets on the bottom of the excavations.

MW-4 was removed during the remedial effort and was replaced downgradient of the excavation. Ground water at the Site had been monitored most recently in January 2014 and the data is available for review on Geotracker.

3. Current Site Conditions and Data Gap

Environmental conditions that remain at the Site can be found in the *Site Remediation Completion Report* (AWR December 2013) and *Corrective Action Plan* (Fugro 2011) both available on Geotracker.

In summary, data describing site conditions consist of:

- ground water quality samples collected from 8 monitoring wells;
- 19 soil borings and over 75 soil samples;
- 7 soil gas wells and 9 soil gas samples; and
- 3 remediation efforts involving substantial excavations and source removal.

With the exception of the soil gas analyses, all data collected to date are consistent with the requirements of the LTCP. Seven semi-permanent soil gas wells were installed to 5 feet bgs and sampled in July 2009. Soil gas samples were analyzed for TPHg, TPHd, BTEX, MTBE, methane, oxygen, and carbon dioxide. All concentrations measured in soil gas were below commercial ESLs for vapor intrusion and the LTCP criteria with no bioattenuation zone. However, none of the soil gas samples were analyzed for naphthalene, which is a criterion in the LTCP and is the only significant data gap remaining.

4. Proposed Investigation and Work Plan

The purpose of this proposed investigation is to address the data gap for soil gas listed in Section 3. With the completion of this investigation, it is anticipated that sufficient data will be available to adequately evaluate the Site pursuant to the LTCP and make a determination if the Site is eligible for closure. Based on the data collected to date, it is anticipated that the Site will qualify for closure under the LTCP.

The work proposed in this plan is a guide to the investigation and is subject to change depending on actual field conditions and findings. The scope of work consists of the following tasks:

- Task 1 - Utility Location, Permitting, and Health and Safety Plan
- Task 2 – Field Investigation of Soil Gas Quality
- Task 3 - Reporting

All fieldwork will be performed under the supervision of a California Professional Geologist.

4.1 Task 1 - Utility Location, Permitting, and Health and Safety Plan

As described below, investigation activities include drilling and collecting soil gas samples at the Site. Subsurface investigation permits will be acquired from the appropriate agencies at Alameda County and City of Oakland.

Underground Services Alert (USA) will be notified and the boring locations will be cleared for underground utilities. The proposed drilling locations are contingent upon access limitations (i.e., site features, utilities) and final locations may be moved to the closest accessible location.

As required by the Occupational Health and Safety Administration (OSHA) 29 CFR 1910.120, Hazardous Waste Operations and Emergency Responses, a site Health and Safety Plan (HSP) will be prepared for use while conducting proposed field sampling activities. The HSP will be read and approved by the AWR Project Manager, a Quality Assurance Reviewer, and the On-site Safety Officers of all subcontractors working at the Site.

4.2 Task 2 - Field Investigation of Soil Gas Quality

Due to the lack of analysis for naphthalene in soil gas, which is required to comply with LTCP evaluation criteria, it is recommended that soil gas be sampled from the following:

- SG-1 to assess effects of petroleum measured in the grab ground water collected at B-1 (Fugro 2011) and due to its proximity near former pump island.
- SG-4 (reinstall) to assess the benefits of the recent remedial effort at Excavation 1, and to assess potential affects from petroleum concentrations measured in the 2009 grab ground water samples B-4a, B-5, and B-12.
- SG-6 to assess effects of residual petroleum east of Excavation 2 and concentrations measured in the 2009 grab ground water sample of B-6.
- SG-7 (reinstall) to assess the benefits of the recent remedial effort at Excavation 2 and effects of residual petroleum.

- SG-8, (new near MW-3) to assess effects of residual petroleum south of Excavation 2 and to assess potential affects from petroleum concentrations measured in MW-3.

The locations of the proposed soil gas wells are shown in Figure 1.

Soil gas samples will be collected in accordance with AWR's Standard Operating Procedures (SOP) provided in Appendix A. The soil gas samples will be analyzed for all volatile organic compounds including naphthalene by EPA Method TO-15 and for atmospheric gases by ASTM D1946. The borings will be abandoned in coordination with Alameda County, as required.

4.3 Task 3 - Reporting

Assuming the soil gas samples reveal no concentrations of concern, AWR will prepare a comprehensive closure report following the guidelines and structure of the LTCP and presenting the results of activities described above. The report will include the following:

- Descriptions of the methodologies used to collect and analyze the data,
- Significant deviations from this Work Plan,
- Updated Site Conceptual Model based on the findings, including description of the Site, utility corridors, local geology, and hydrogeology
- Summary and interpretation of analytical results and laboratory data certificates, including an assessment of the extent of chemicals in soil gas and health risk to humans and the environment.
- Evaluation of the risk associated with residual petroleum constituents in accordance with the LTCP's general and media-specific criteria.
- Recommended additional actions, if any.

5. REFERENCES

California EPA, Department of Toxic Substances Control, Regional Water Quality Control Board San Francisco and Los Angeles Regions, *Advisory, Active Soil Gas Investigations,* April 2012

Fugro Consultants Inc., *Corrective Action Plan,* November 2011

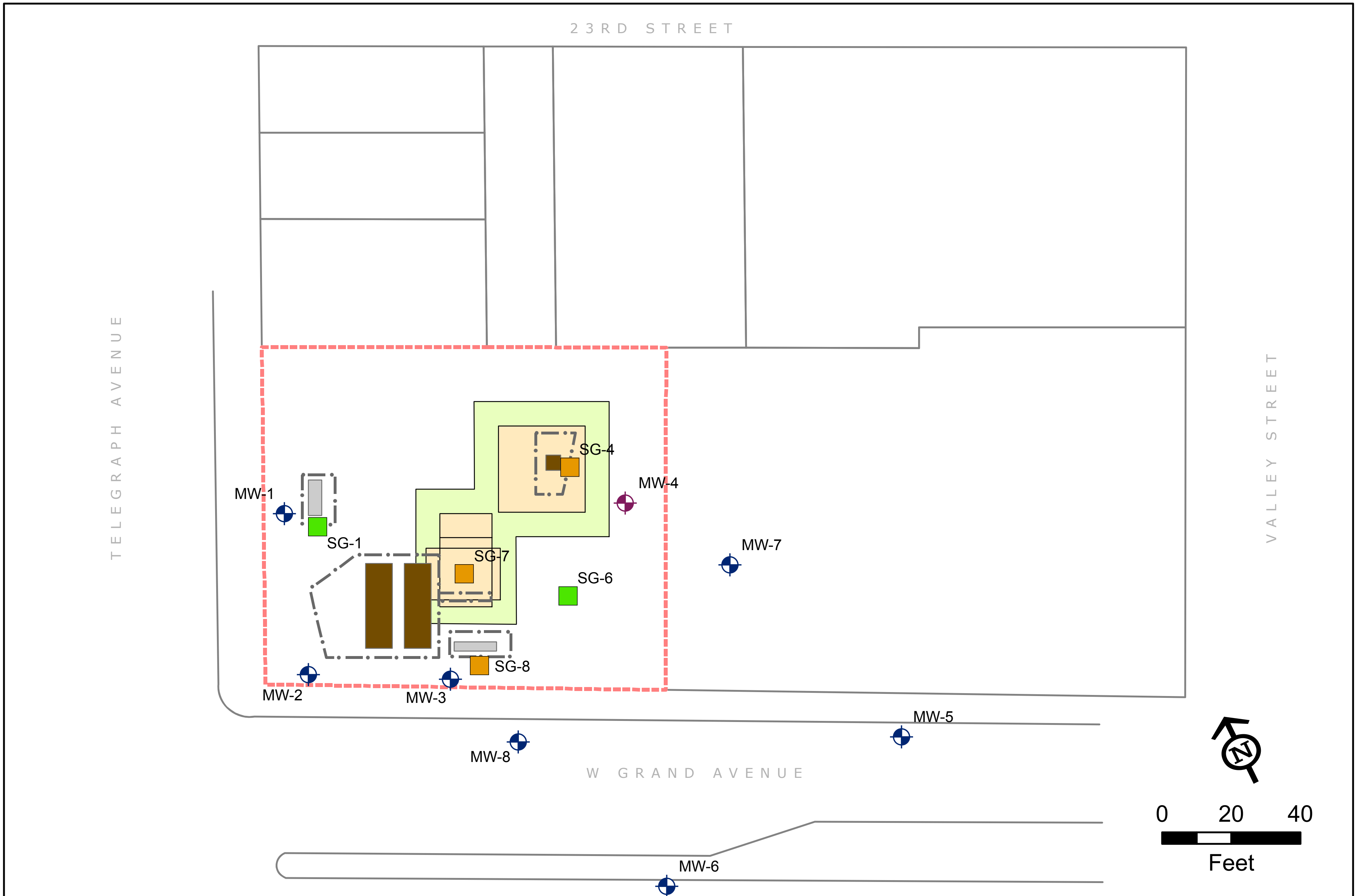
Fugro Consultants Inc., *Corrective Action Plan Addendum,* May 2012.

Fugro Consultants Inc., *Remediation Progress Report and Quarterly Groundwater Monitoring Report (4th Qtr 2012),* February 2013.

State Water Resources Control Board, *Low-Threat Underground Storage Tank Case Closure Policy*, 2012

San Francisco Bay Regional Water Quality Control Board, *Environmental Screening Levels*, Updated May 2013

FIGURES



APPLIED WATER RESOURCES

Figure - 1

Monitor Well and Soil Gas Well Locations

2250 Telegraph Ave Oakland, CA

- Existing Soil Gas Well
- Soil Gas Well To Be Installed
- Excavation
- Slope (1:1)
- Dispenser Island
- Previous Tank
- Historic Excavation
- Monitor Well To Be Installed
- Monitor Well
- Property Boundary

Created 12/6/2013

APPENDIX A

This document describes Applied Water Resources' standard operating procedures (SOPs) to install a temporary soil gas well and collect a sample of soil gas. This SOP is based on guidance from the soil gas investigations advisory (DTSC, 2012). Specific field procedures are summarized below.

Construction of a Temporary Soil Gas Well

Temporary soil gas wells are typically used for one or two sampling events and then decommissioned in accordance with the local regulating agency requirements and the methods described in the Well Abandonment Section.

The Work Plan and the objectives of the investigation should specify the depth at which the soil gas sample should be collected. The boring within which the soil gas well is constructed is typically created by using direct push drilling equipment, but can be advanced using hollow, solid stem, or hand auger. The borehole diameter will be a minimum of 2 inches. If soil conditions are stable, then the soil gas well can be constructed in an open, uncased, borehole. If soil conditions are unstable, then the borehole will be cased prior to well construction.

All equipment, tools, and materials used to construct the borehole and well must be clean, dry, and free of chemicals, including cleaning chemicals. Implement the following steps once the desired depth of the borehole and soil gas sampling depth has been determined:

1. Drill the borehole to the desired sampling depth.
2. Place a minimum 2-inch thick bed of sand in the bottom of the boring to ensure that the tubing is not in direct contact with the bottom. Sand will be RMC Lonestar 2/12 mix, or similar.
3. Place a clean 3/4-inch diameter PVC pipe into the borehole that extends from the top of the sand at the bottom of the borehole to 1 to 3 feet above ground surface.
4. Measure and cut a length of the sample tubing that is equal to the desired sampling depth plus 1 to 5 feet. The additional length of tubing will remain above ground surface to enable collection of the soil gas sample.
5. The sample tubing will be made of material that will not react with site contaminants (i.e. Teflon, stainless steel) and with an inside diameter of 1/8 to 1/4 inches that is appropriate for the equipment to be used to collect the soil gas sample. Attach a filter at the bottom of the tubing to prevent sand from entering the tubing.
6. Install the tubing into the borehole by threading the tubing through the PVC pipe to the top of the sand. Placement of the tubing within the PVC will keep the tubing centered within the borehole, keep the filter completely within the sand pack materials, and maintain integrity of the well seal by eliminating contact of the tubing with the native geologic materials.

7. Place a minimum of 6 inches and maximum of 10 inches of sand pack above the filter. Use a separate small diameter PVC pipe to tremie sand into borings deeper than 15 feet to avoid bridging. Do not place sand directly into the PVC pipe containing the tubing because the sand will likely bridge and lock the tubing within the PVC pipe, preventing proper completion of the well.

8. Lift PVC pipe containing the tubing to the top of the sand pack while keeping the tube bottom with filter at the desired depth. If present, also raise the borehole casing and tremie pipe to the top of the sand pack. Measure the depth to the top of the sand pack and add additional sand as necessary. Record all the final depth to the top of sand pack.

9. Place a minimum 6 inches and maximum of 12 inches of dry granular bentonite above the sand pack.

10. Prepare a thick bentonite grout mixture by hydrating bentonite within a container at ground surface. The mixture should approximate the consistency of applesauce.

11. Remove the PVC pipe containing the tubing. Remove the tremie pipe. While holding the sample tubing so that it is centered within the borehole, fill the borehole to the surface with hydrated bentonite grout mixture.

12. If present, remove the borehole casing and add more bentonite grout to top off the boring to ground surface.

13. Install a gas-tight valve or fitting at the end of the tubing and protect the temporary well and tubing with a barricade, flagging, or similar.

14. If the well is permanent, complete the installation with a traffic rated well box.

Preparation for Purging and Collecting a Soil Gas Sample

Subsurface conditions are disturbed during drilling and probe placement. To allow for the subsurface to equilibrate back to representative conditions, the purge volume test, leak test and sampling of soil gas will not be conducted for at least two hours following soil gas well installation. For soil gas wells installed with hollow stem or hand auger drilling methods, do not conduct the purge volume test, leak test and soil gas sampling for at least 48 hours after soil gas well installation. Do not collect soil gas screening samples during or within two days of a rainfall event (greater than ½ inches of rain over 24 hours). Soil gas samples will be free of water, and no sample will be collected if water is observed during purging. Purge volume tests, leak tests and soil gas sampling methods are based on the soil gas investigations advisory (DTSC, 2012).

Purge Volume Test

The purpose of purging is to ensure that stagnant air is removed from the well and sampling system and that samples are representative of subsurface conditions. The purge volume test is used to determine the appropriate amount of air to remove prior to sampling. A purge volume test will be conducted on permanent soil gas wells that will be used for routine monitoring. If there are multiple wells at a site, the purge volume test will be conducted at the location with the highest estimated concentrations of the target compound. For temporary soil gas wells, no purge volume test is required and a default of three purge volumes will be used.

The purge volume test is conducted by collecting and analyzing a sample for target compounds after removing one, three and ten purge volumes. The purge volume test samples should be analyzed with the same analytical method as the constituents of concern and bioattenuation indicators as applicable.

One purge volume is the sum of the following volumes:

- The internal volume of tubing,
- The void space of the sand pack around the bottom of the tubing and filter (assume 30% porosity), and
- The void space of the dry bentonite in the annular space, (assume 30% porosity). Assume this bentonite has not been hydrated.

Sample Vacuum Shut in Test

In order to note possible leaks in the sample canister, a shut-in test is conducted. A dedicated pressure gauge is used to record pressure in each sample canister for a minimum of five minutes prior to sampling. If a significant change in pressure is observed, a different sample canister will be used for sample collection.

Recording, Labeling, Storage, Handling, and Transport

All samples should be labeled with a unique sample identification, the location of the sample, date and time of collection. Purge and sample volume, flow rates, helium concentrations, vacuum check and shut in test data are recorded in the field form for soil gas sampling (Appendix B). Samples are stored away from direct sunlight in coolers or boxes and transported under standard chain of custody procedures to a NELAP certified analytical laboratory.

Unshrouded Soil Gas Sampling with Leak Check Compound

A leak test is used to evaluate whether ambient air is introduced into the soil gas sample during the collection process. A leak test will be conducted at every soil gas well each time a soil gas sample is collected to evaluate the integrity of the sample. Introducing ambient air may result in an underestimation of actual site contaminant concentrations or may introduce external contaminants into samples from ambient air. The leak check compound should be selected based on the target analytical compounds for the site. The compound should not interfere with the target analytes. Verify with the proposed analytical laboratory the appropriateness of a leak check compound prior to sampling and request that the compound is reported in addition to the target analytes.

1. Prior to removing any hardware, record the pressure on the gauge located on the sample train in order to note possible leaks. If the gauge reads 0, use a new sample train.
2. Connect the sample train to the downhole tubing with a nut and ferrule fitting.
3. To purge, connect the sample train to a 6-liter summa canister. Volume of air will be calculated either based on the flow rate indicated on the summa can flow reducer or the change in pressure observed in the summa canister.
4. Once the appropriate volume has been purged, remove the sample train from the purge canister and connect to a 1.4 liter summa canister for sampling.
5. Once the sample canister is connected and air is flowing based on the train pressure readings, apply a clean paper towel soaked in the liquid leak check compound (i.e. acetone, isopropyl alcohol) to the fittings and the top of the well seal.
6. Once the sample train pressure gauge reads less than 4 inches of mercury, disconnect the sample canister from the train and store as described.

Soil Gas Sampling with Helium Shrouds

Soil gas sampling using helium shrouds helps indicate whether a leak is present in the train or the well seal prior to sample collection. If a leak is detected during the purging of the well, corrective measures are implemented such as hydrating or molding the bentonite seal, tightening the fittings, or repairing any holes in the tubing. Helium per ASTM method D1946 will be analyzed in all samples to determine the presence of leaks in the sample train or the well seal. Soil gas sampling using helium shrouds is conducted as described in the field manual provided by Curtis and Tompkins Laboratory (Appendix A).

Well Abandonment

After sample collection ceases at a soil gas well, the well will be abandoned with concurrence from the local regulating agency. Unless otherwise directed by the regulatory agency, the following steps should be followed when decommissioning a soil gas well:

1. Either remove the tubing by pulling out of the borehole, or cut the well tubing as far below ground surface as possible;
2. Remove the hydrated bentonite grout to within approximately 1 foot of finished grade. If the borehole was advanced through hard surface materials (e.g. asphalt, concrete), fill the borehole with suitable materials to finished grade. If the borehole was advanced through soil, fill the last foot of the borehole hole with compacted native material.
3. If the borehole and soil gas well penetrates a confining clay unit, then overdrilling the borehole to remove all sand materials followed by tremie grouting is recommended to prevent potential contaminant migration across distinct lithologic zones. The driller will utilize methods that assure the overdrilling does not drift off the borehole and soil gas well. All overdrilled holes will be grouted in accordance with local regulatory specifications.
4. In all cases, restore pavement and vegetation to approximate original conditions, or as requested by the land owner.

References

DTSC, California EPA, and RWQCB San Francisco and Los Angeles; *Advisory, Active Soil Gas Investigations*, April 2012.

Table of Content

Figures & Diagrams

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.

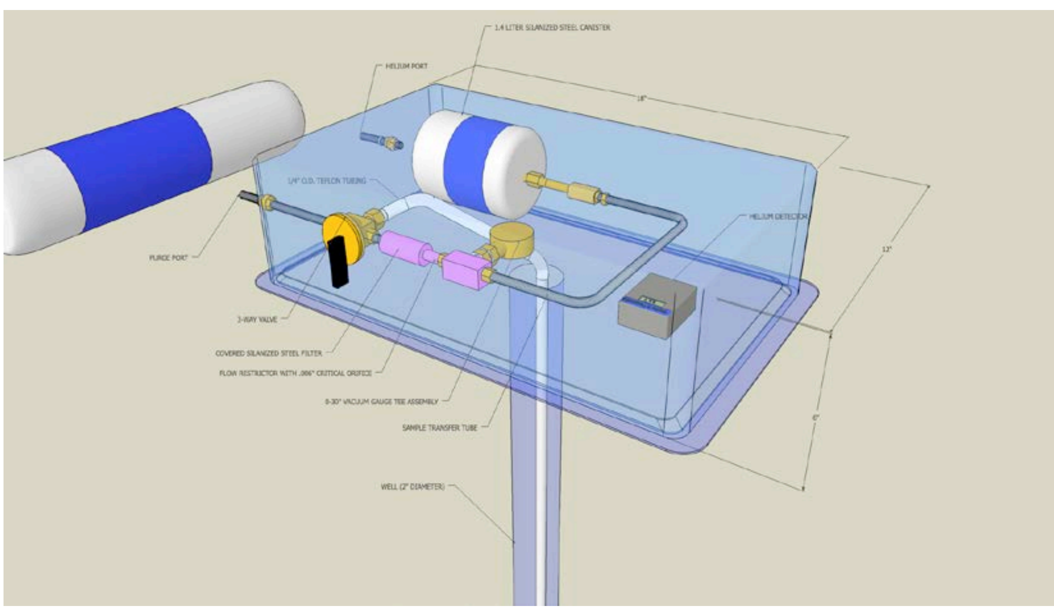
Equipment not Supplied by C&T: You will need the following items to complete your work; these items are not supplied by C&T unless specially requested:

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 then straight off the valve stem. Twisting the cap counterclockwise while removing or replacing on the valve stem can dissemble 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.

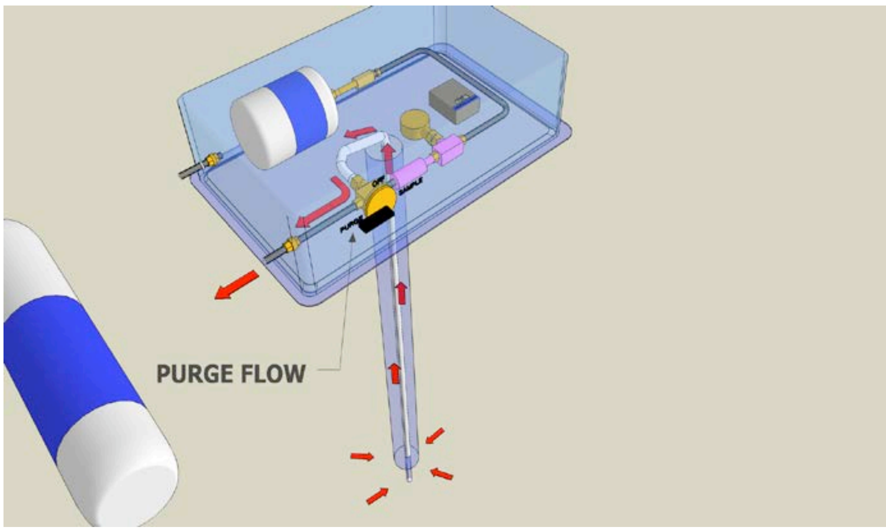
Locate and assemble the Lecture bottle, Helium transfer line, and the gas supply regulator. Tighten the brass nut attaching the regulator to the bottle one half turn past finger tight with a crescent or 9/16" open end wrench. The regulator is preset to deliver Helium at ideal pressure; ***you need not 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 ¼ 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

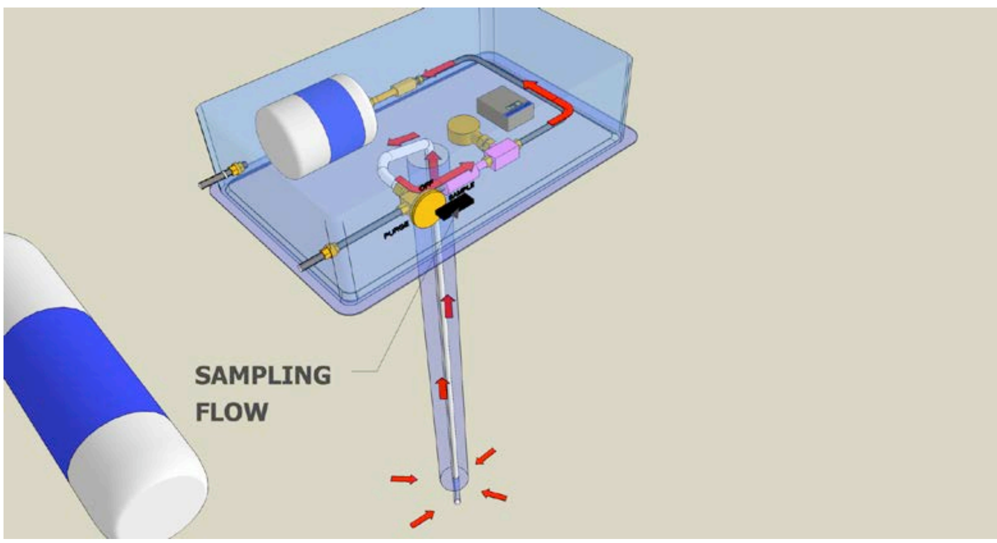


Figure 5**: Dual Depth Well Sampling Shroud**