STELLAR ENVIRONMENTAL SOLUTIONS, INC.
2198 SIXTH STREET, SUITE 201·BERKELEY, CA 94710
TEL: (510)644-3123 · FAX: (510)644-3859
GEOSCIENCE & ENGINEERING CONSULTING

RECEIVED
By Alameda County Environmental Health 3:29 pm, Sep 09, 2015

September 9, 2015

Mr. Mark Detterman
Alameda County Health Care Services Agency
Environmental Health Services
Local Oversight Program
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502

Subject: Additional Investigation Workplan to Address Potential Impact of Soil-Gas related to a Former Leaking Underground Heating Oil Tank located at 811 Paramount, Oakland, CA. (Alameda County Fuel Leak Case No. RO0003143 and CA GeoTracker Global ID T10000006106)

Dear Mr. Detterman:

## INTRODUCTION AND BACKGROUND

On behalf of the property owners (Mr. Mark A. Jacobson & Ms. Ilona J. Frieden) and their counsel (Mr. Amitai Schwartz) Stellar Environmental Solutions, Inc. (Stellar Environmental) is providing this Workplan to Alameda County Health Care Services (ACHCS). The Workplan covers the additional data gap investigation at the subject property to address potential environmental impacts, as discussed in the ACHCS letter, dated August 19, 2015. The subject property is located in a residential area at 811 Paramount Road in Oakland, California. Attached Figure 1 shows the general site location.

The underground storage tank (UST) removal report, dated January 14, 2014 prepared by Golden Gate Tank Removal, Inc. documents the December 2013 removal of one 350-gallon heating oil UST at the subject site. The UST was found to be in poor condition with at least one visible hole. Soil discoloration and hydrocarbon odors were noted to be associated with overburden soil and soil underlying the UST. Two soil samples were collected at 7 feet below ground surface (bgs) from the east and west ends of the UST on December 16, 2013. The general groundwater gradient in this area of Oakland is toward the west and slightly southwest.

The initial soil samples were collected at a depth of 7 feet on both the east end and west end beneath the UST after its removal. The analytical at 7 feet bgs on the east end (sample E7) was reported at 9,290 milligrams per kilogram (mg/kg) Total Petroleum Hydrocarbons in the carbon C10-C28 range, which includes the upper C8-C10 range of gasoline (TPHg), the full (C10-C23) range of diesel (TPHd) and into the motor oil (C18-C35) range (TPHmo). The 9,290 mg/kg exceeds the applicable Environmental Screening Limits (ESLs) for TPHg, TPHd and TPHmo. Also reported in sample E7 was 1.1 mg/kg ethylbenzene, 1.37 mg/kg total xylenes and 47.3 mg/kg naphthalene, with naphthalene above the ESL. Benzene and toluene were both below the laboratory method detection limit of 380 µg/kg.

The west end sample (sample W7) concentrations at 7 feet bgs were detected at 1,390 mg/kg in the C10-C28 range. The BTEX concentrations were near to or below the laboratory Reporting Limits (RLs) of 79 µg/kg or less, and naphthalene concentration was 7.72 mg/kg, which is above its ESL.

Over-excavation to 12 feet bgs was subsequently performed on December 24, 2013. East end sample (sample E12) concentrations decreased two to three orders of magnitude to 28.0 mg/kg of TPH C10-C28, while BTEX and naphthalene concentrations were near to below RLs. The west end sample (sample E12) concentrations increased with depth to 3,960 mg/kg TPHd, and naphthalene concentrations increased to 25.2 mg/kg, in excess of their respective ESLs; BTEX concentrations were near to below RLs. MTBE was not analyzed in any of the samples.

ACHCS in their letter dated December 15, 2014, requested additional investigation of the residual soil contamination that was indicated by detections of TPHd and napththalene above applicable ESLs that was reported in the UST removal report (GGT 2013). Stellar Environmental was retained by the property owners to prepare an investigation Workplan which was approved with the incorporation of modifications by ACHCS in their review and approval letter, dated March 30, 2015. The Workplan was implemented by Stellar Environmental in June 2015 and showed no detectable TPHd, TPHmo or fuel related VOCs in site soils indicating the potential residual soil contaminantion is neither laterally or vertically extensive. Groundwater was not encountered in any of the 3 bores that were advanced during the investigation, with the deepest bore extending to 36 feet bgs. The absence of residual soil contaminantion indicates no threat to groundwater by potential contaminants of concern (COCs). However, soil-gas collected from soil-gas well SG5.5 feet bgs showed 880,000 $\mu g/m^3$ TPHg in excess of the Water Board residential ESL of 300,000 $\mu g/m^3$ for potential risk of vapor intrusion into the nearby building, is the focus of this current Workplan investigation. The detection of residual TPHg soil-gas is anomalous for a residential heating oil UST but appears to rapidly attenuate with depth as there were no detections of COCs at 13 feet bgs immediately below the target contaminant depth where elevated TPHd and naphthalene in soil were reported in the UST removal report (GGT 2013).

Attached Figure 2 is a site plan showing the locations of the former UST, historical borings and sampling points and the soil-gas wells, of which soil-gas well SG5.5 is being proposed to be resampled in this Workplan investigation.

## REGULATORY CONSIDERATIONS

The Water Board has established ESLs for evaluating the likelihood of environmental impact. The ESLs were developed as the lowest screening values for contaminants of concern that might be indicative of site source origin and/or pose a significant risk to human health or the environment, assuming all possible exposure pathways. ESLs are conservative screening-level criteria for soil and groundwater, designed to be generally protective of both drinking water resources and aquatic environments; they incorporate both environmental and human health risk considerations. ESLs are not cleanup criteria (i.e., health-based numerical values or disposal-based values). Rather, they are used as a preliminary guide in determining whether remediation and/or investigation may be warranted. Exceedance of ESLs suggests that additional investigation and/or remediation is warranted. However, because some environmental and human health concerns considered in determining ESLs may not be applicable where exposure routes are not complete, soil that exceeds ESLs does not necessarily pose a significant risk to human health or the environment. There are also ESLs published for commercial/industrial vs. residential land use for indoor air. This is based on a potential exposure of 24 hours a day, seven days a week over 30 years for residential versus 40 hour a week over 15 years for commercial.

Different ESLs are published for commercial/industrial vs. residential land use, for sites where groundwater is a potential drinking water resource vs. is not a likely drinking water resource, and for the type of receiving water body. The appropriate ESLs for the subject site are based on the following:

- In our professional opinion, the appropriate ESLs for the subject site are residential land use and groundwater is considered a drinking water resource.
- This is based on both the property zoning status (residential) and the designation of this area of Oakland as "Zone A – Significant Drinking Water Resource (Water Board, 1999).
- The receiving body for groundwater discharge is an estuary (San Francisco Bay).

The State of California has also promulgated drinking water standards (Maximum Contaminant Levels [MCLs]) for some of the site contaminants. Drinking water standards may also be utilized by regulatory agencies to evaluate the potential risk associated with groundwater contamination. For the site contaminants, MCLs are generally the same as the ESLs (except that there is no MCL for gasoline). Once ESLs or drinking water standards are exceeded, the need for additional investigative and corrective actions are generally driven by the potential risk associated with the contamination.

Significant exceedance of the ESLs suggests that additional investigation and/or remediation is warranted. Factors that are evaluated include what pathways of exposure there may be (to surface water, groundwater, or indoor air) and the likelihood of the identified exposure pathways continuing without remediation of the source area. Identification or monitoring of indoor air fluctuations, groundwater plume stability, or residual soil contamination to demonstrate no risk to sensitive receptors is typically completed as part of site closure evaluations.

A risk assessment can also be completed using actual site data (versus the conservative assumptions built into the ESLs) that would include air-exchange rates, soil permeability, etc., or, alternatively, the collection of indoor air samples. If the risk assessment shows that the potential cumulative exposure is less than the $10^{-6}$ excess cancer risk then, assuming they are satisfied with the extent of characterization work, no breathing zone data need be collected.

The analytical results from the June 2015 investigation qualified the Site for closure under the strict criteria of the Water Board Low Threat Closure Policy (LTCP), however due to the exceedance of TPHg over the Water Board ESL, ACHCS requested the re-sampling of soil-gas, and additional Site evaluation of potential toxic vapor intrusion into the Site residence be investigated.

## TECHNICAL OBJECTIVES AND PROPOSED SCOPE OF WORK

The objective of the proposed scope of work is specifically designed to evaluate whether residual Site soil-gas related to the former UST poses a health risk to the site occupants via vapor intrusion of toxic vapors into the Site residence. Specifically, this Workplan is designed to verify the presence of residual contaminated soil-gas in excess of the applicable Water Board ESLs. This Workplan has been prepared to address ACHCS letter correspondence, dated August 19, 2015 requesting investigation of the anomalous TPHg detection in soil-gas that could pose health risk to Site inhabitants via intrusion of residual toxic TPHg vapor into the indoor air of the Site residence. This proposed Workplan evaluation will begin with an initial resampling of the Site soil-gas well SG5.5 and an evaluation of the construction and ventilation of the site residence crawl space. If the analytical results exceed the applicable Water Board Environmental Screening Limits (ESLs) for the COCs, then additional investigation and sampling of the site indoor air will be advanced.

## TECHNICAL OBJECTIVES AND SCOPE OF WORK

The anticipated tasks to be conducted, following Water Board approval, are: 1) Regulatory Liaison, and Work Plan Response; 2) Field Investigation Preparation; 3) Crawl Space Documentation; 4) Soil-Gas Well SG5.5 Re-sampling; 5) Indoor Air Sampling, if needed; 6) Technical Report Preparation; and 7) Electronic Data Reporting.

### Task 1: Regulatory Liaison and Work Plan Response

The strategy for implementation of this Workplan has been discussed with the ACHCS regulator. Modification of this Workplan may occur based on input from ACHCS before the field work elements begin.

### Task 2: Field Investigation Preparation

To prepare for the field work, the following preparatory tasks will contract with the laboratory to rent and obtain the helium shroud soil-gas collection apparatus and Summa™ canister. The Site health and safety plan from the previous investigation will require no updating and will be utilized in this current investigation. Stellar Environmental will coordinate fieldwork with the regulator, client, and analytical laboratory.

### Task 3: Crawl Space Documentation

The Site residential building crawl space will be evaluated as part of this investigation. The evaluation will entail measuring of the of the space dimensions and the locations of access and vents and will include photographs of the significant crawl space features

### Task 4: Soil-Gas Sampling of Well SG5.5 (Re-Sampling)

Soil-gas will be collected from the soil-gas well SG5.5 location that showed the anomalous TPHg detection in the June 2015 sampling (sample SG6). Soil-gas will be collected in accordance with Department of Toxic Substances Control (DTSC)/Cal EPA Soil-Gas Advisory (April 2012) procedures and methodology. The purge volume will be calculated from the boring filter pack diameter and length of the tubing and a purge volume test will be conducted to evaluate the optimum purge volume. Purging will be conducted using a dedicated purging Summa™ vacuum canister. A purge volume test is not being planned to be conducted, and the sampling procedure will default, as per DTSC guidance to purging 3 calculated purge volumes prior to collecting the sample. A shut-in test will be conducted on the sampling train to check for leaks in the above-ground fittings at each sampling point. A shut-in test will be conducted using an in-line vacuum gauge and evacuating the sampling train to a measured vacuum of about 100 inches of water, then shutting the vacuum in with a closed valve. The vacuum gauge is observed for 1 minute, and all aboveground connections are considered "air-tight" if the pressure on the gauge does not noticeably dissipate.

As requested by ACHCS, a Helium Shroud Apparatus (HSA) will be utilized for evaluation of ambient leakage during the soil-gas collection process. The HSA will be used to test for ambient air leaks around the sampling train, and at the soil-gas tubing interface with the ground surface as will be indicated with the helium gas tracer. The HSA will be set over the well head and laboratory grade helium will be flooded into the shroud initially to a concentration of approximately 35% helium. A concentration of 25-30 % will be maintained in the HSA throughout the sampling procedure and verified every few minutes using a helium meter supplied by the laboratory. All readings will be recorded on the laboratory chain-of-custody and presented in the final documentation report.

The HSA to be used during this sampling event will be rented from McCampbell Analytical Laboratory, the operating procedure and technical specifications for the apparatus have been included in Attachment A.

The soil-gas sample from soil-gas well SG5.5 will be analyzed using the following methods:

- TPHg, naphthalene, benzene, toluene, ethylbenzene, and xylenes (BTEX) and methyl tertiary-butyl ether (MTBE) - by EPA Methods TO-15/Gas Range Organics (GRO) and 8260 to acquire data in SIM/ scan mode; and
- Helium, the leak check compound by ASTM 1946-90.

Due to high organic/gas content detected in the June 2105 SG5.5 sample, the laboratory will set up a method to analyze TO15 by 8260 which acquires data for the samples in sim/scan mode, to ensure meeting the ESLs. The soil-gas samples will be collected in 1-liter Summa™ canisters and maintained at ambient temperature and out of direct sunlight prior to delivery to the analytical laboratory. The previous investigation analytical results were discussed with the analytical laboratory and they will be advised of potentially high COC concentration or in the soil-gas so that they can adjust their analysis accordingly so that the reporting limits are comparable to the residential ESLs. Samples will be transported by courier under chain of custody and are anticipated to go to McCampbell Analytical Laboratory of Pittsburg, CA, a California Environmental Laboratory Accreditation Program (ELAP) -certified laboratory.

**Task 5: Indoor Air Sampling (if needed)**

In the event that the soil-gas well SG5.5 sample analytical results exceed the applicable ESLs concentration criteria or the laboratory RLs cannot meet the residential ESL criteria, additional sampling for indoor-air will be conducted. Indoor-air will be collected in accordance with the DTSC/Cal EPA Vapor Intrusion Guidance (October 2011) procedures and methodology.

An indoor air study for residential property evaluations involves a 24-hour air sampling test per procedures and protocols of the DTSC guidance. Stellar Environmental personnel will set up the 24-hour test apparatus in two (2) locations: within the residential building crawl space as near to the north side (near the former UST source) as accessible, with modification based on our professional judgment and any obvious constraints occurring within the crawl space. An additional ambient "control" sample location would be placed outside the interior space, nominally on the roof if that is accessible. The locations for the indoor air samples are not shown on Figure 2. The 24-hour test apparatus will be set up at the beginning of the day, to begin at 8 AM. After testing and confirming that all the equipment is operating properly, Stellar Environmental personnel will return the next day to dissemble the sampling apparatus after the 24-hour of run time. The flow control regulator controls the air inflow rate and the test will utilize Summa™ canisters equipped with an air intake rate set for a 24-hour test.

The analyses would be performed by McCampbell Analytical, an ELAP-certified laboratory for analysis of:

- TPHg, naphthalene, benzene, toluene, ethylbenzene, and xylenes (BTEX) and methyl tertiary-butyl ether (MTBE), - by EPA Method TO-15/Gas Range Organics (GRO).

Following the collection of indoor-air samples, the Summa™ canisters will be maintained at ambient temperature and out of direct sunlight prior to delivery to the analytical laboratory under chain-of-custody record.

**Task 6: Technical Documentation and Reporting**

Stellar Environmental will prepare the following documentation report summarizing the implementation and results of the soil-gas, documentation of the Site crawl space construction and ventilation and indoor-air sampling results if conducted conclusions and recommendations in the context of regulatory case closure.

The Sampling and Investigation report will contain the following elements:

- Project Introduction and Background;
- Investigation Scope and Objectives and Procedures;
- Description of the Fieldwork, Sampling Protocols, Analytical Methods;
- Tabulation of Data Compared to Relevant Regulatory Environmental Screening Criteria;
- Relevant figures showing site location, site plan showing location of former UST, current and historical investigation sampling points, cross-sectional view of site ressidence and contaminant distribution; and
- Technical Appendices (i.e.photographs, summary analytical data tables, certified analytical reports and chain-of-custody records).

An electronic ‘pdf’ copy of the report will be submitted to the client and one hard copy will be submitted if requested

**Task 7: Electronic Data Reporting**

As required, the site is subject to the California Water Board’s GeoTracker requirements, for electronic uploads of investigation data and reports. All required reports and documents, including this Workplan and related data will be uploaded to the Water Board GeoTracker fileserver.

The site is also subject to the separate ACHCS’s electronic upload system (“ftp”) that requires upload of reports to their system. We will make those uploads and provide notification to ACHCS when they have been uploaded.

## ESTIMATED SCHEDULE

We anticipate this project can be completed in 3-4 weeks upon receiving ACHCS’s concurrence with this Workplan with minimal comments or modifications to the scope that need to be addressed. If ACHCS’s concurrence is not received within the 60 day lead agency review period stipulated by California Code of Regulations, Title 23, Division 3, Chapter 16, Underground

Tank Regulations, we will proceed with the fieldwork at the soonest possible time thereafter, and will notify ACHCS's of the sampling dates as soon as it is determined.

Upon notice to proceed, we anticipate that preparatory tasks (subcontractor scheduling) can be completed in 1 day and the fieldwork effort can be completed in 1 day. Analytical laboratory results will be completed on normal turnaround (10 working days). The documentation report will be submitted within approximately 2 weeks following receipt of analytical results. If the initial soil–gas analytical results indicate additional evaluation of indoor-air is necessary, an additional 2 weeks will be required for turnaround of these laboratory analytical results.

We 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 our knowledge

We trust that this submittal meets your agency's needs. If you have any questions regarding this report, please contact me if you have any questions.

Sincerely,

Mark A. Jacobson
Property Owner-Responsible Party

Ilona Frieden
Property Owner-Responsible Party

Henry Pietropaoli, P.G
Principal Geologist and Project Manager

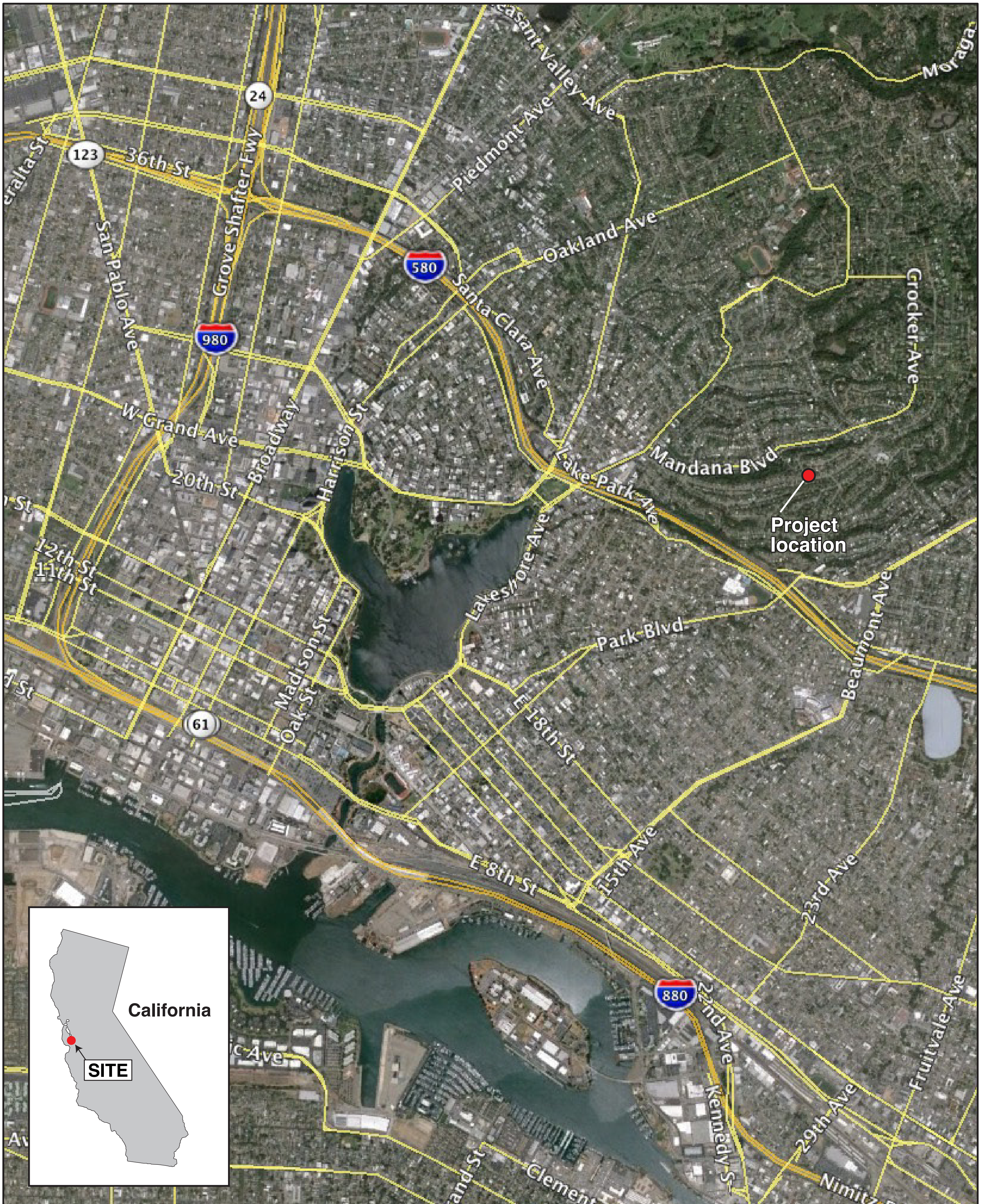
Richard S. Makdisi, P.G.
Principal Geochemist and President

Attachments: Figures showing site location and former UST layout, historical sampling locations
Helium Shroud Standard Operating Procedure - Laboratory Guidance

REGISTERED GEOLOGIST
RICHARD S. MAKDISI
No. 4652
Exp. 4/2016
STATE OF CALIFORNIA

cc: Mr. Amitai Schwartz – property owner counsel

# FIGURES




| N | SITE LOCATION MAP | | |
|---|---|---|---|
| | 811 Paramount Avenue<br>Oakland, CA | By: MJC | FEBRUARY 2015 |
| | | Figure 1 | |

STELLAR Environmental Solutions, Inc
Geoscience & Engineering Consulting

2015-16-01


# DISTRIBUTION OF ANALYTICAL RESULTS OF SOIL AND SOIL GAS SAMPLING

811 Paramount Road
Oakland, CA

By: MJC | JULY 2015

**Figure 2**

STELLAR Environmental Solutions, Inc
Geoscience & Engineering Consulting

2015-16-09

# ATTACHMENT A

# McCampbell Analytical Laboratory Standard Operating Procedure Guidance Document for Helium-Shroud Apparatus

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Telephone : 925-252-9262 Fax : 925-252-9269
www.mccampbell.com : main@mccampbell.com



## McCampbell Analytical Inc.

# MAI Helium Shroud during Soil Gas Sampling for Quantitative Leak Detection

**Number: MAI shroud Rev. No.: 01** **DATE: 04-26-13**

**Reviewed and Approved By:** ______________________ ______________

**Reviewed and Approved By:** ______________________ ______________

**Reviewed and Approved By:** ______________________ ______________

**Reviewed and Approved By:** ______________________ ______________

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Telephone : 925-252-9262 Fax : 925-252-9269
www.mccampbell.com : main@mccampbell.com

# Standard Operating Procedure:

## MAI Helium Shroud during Soil Gas Sampling for Quantitative Leak Detection

### 1. Scope and Application

1.1 The purpose of the Helium shroud technique is to detect leaks during the soil gas sampling procedure.

### 2. Summary

2.1 The shroud is placed over the borehole to be tested & infused with helium at low pressure. The shroud does NOT need to be gas tight, just rich with Helium vapor. Compared to other liquid leak check compounds such as propanol(s) or Freons, Helium does not interfere with the target compound measurements and hence eliminates the need for sample dilutions, which results in better reporting limits. If there is a leak that comprises less than 5% of the sample, Helium content can be quantitatively analyzed, and the leak dilution factor can be determined during the laboratory analysis after soil gas sampling. A leak of less than 5% is considered an acceptable leak as specified in March 2010 DTSC soil gas sampling guidelines.

2.2 Use of the Helium shroud with an MAI designed soil gas manifold has the following capabilities.

2.2.1 Borehole seal integrity. Surface air intrusion can be checked in real-time, so that sampling can be aborted as wanted.

2.2.2 The Helium shroud can be used with MAI supplied purge can, user-supplied vacuum pump, or a manual syringe.

2.2.3 Allows shut-in-test for verification of leak free manifold.

2.2.4 Quantitative measurement of Helium content within shroud, which combined with lab analysis of Helium content in sample can, allows quantitative evaluation of leak and assessment of < 5% DTSC criteria.

2.2.5 Rotameter and vacuum gauges allow assessment of DTSC defined low permeability soils and provide the needed flow/ vacuum measurements required for compliant sampling.

2.2.6 MAI's specially designed sampling manifolds offer the option for split sampling upon request. Simultaneous duplicate TO15 and sequential TO15 followed by TO17 sorbent tube (ST).

2.2.7 MAI's special design optionally allows for simultaneous sampling of a borehole at 2 different depths.

2.2.8 Allows visual monitoring of shroud helium content via helium meter.

2.2.9 Sample technician friendly: allows flood or trickle/maintenance helium input.

2.3 MAI's helium shroud is covered with a secured flexible plastic sheet that functions as the lid. Handling of the equipment inside the shroud is done through the sheet. Practice before field sampling is encouraged for a successful sampling experience.

**3. Equipment and Supplies**

3.1 All the necessary devices needed for a complete soil gas sampling process with Helium as leak check compound are provided by MAI. Complete basic kit includes: Helium tank, Helium meter, small pump, purge can with Rota meter attached, cork borehole barriers, sample cans and manifolds. (See figure 1.)

3.2 The following equipment listed below is provided by MAI.

3.2.1 A plastic shroud box with lid made of plastic sheeting. There are five connection ports located on the sidewalls of the shroud. They are labeled respectively as Port #1, Port #2, Port #3, Port #4 and Port #5 (See figure 1).

3.2.1.1 Port #1 is for attaching the Purge can/ a vacuum pump to the sample train.

3.2.1.2 Port #2 is the connection of the air pump to the shroud. The air pump facilitates the stabilization of the Helium concentration at 20%.

3.2.1.3 Port #3 connects the Helium meter to the shroud for monitoring Helium content in the shroud.

3.2.1.4 Port #4 allows a reading of Helium in the borehole, when borehole integrity test is needed, as well as a purged volume determination with a syringe

3.2.1.5 Port #5 connects the Helium shroud to the Helium supply tank.

3.2.1.6 Two inch diameter opening for borehole access.

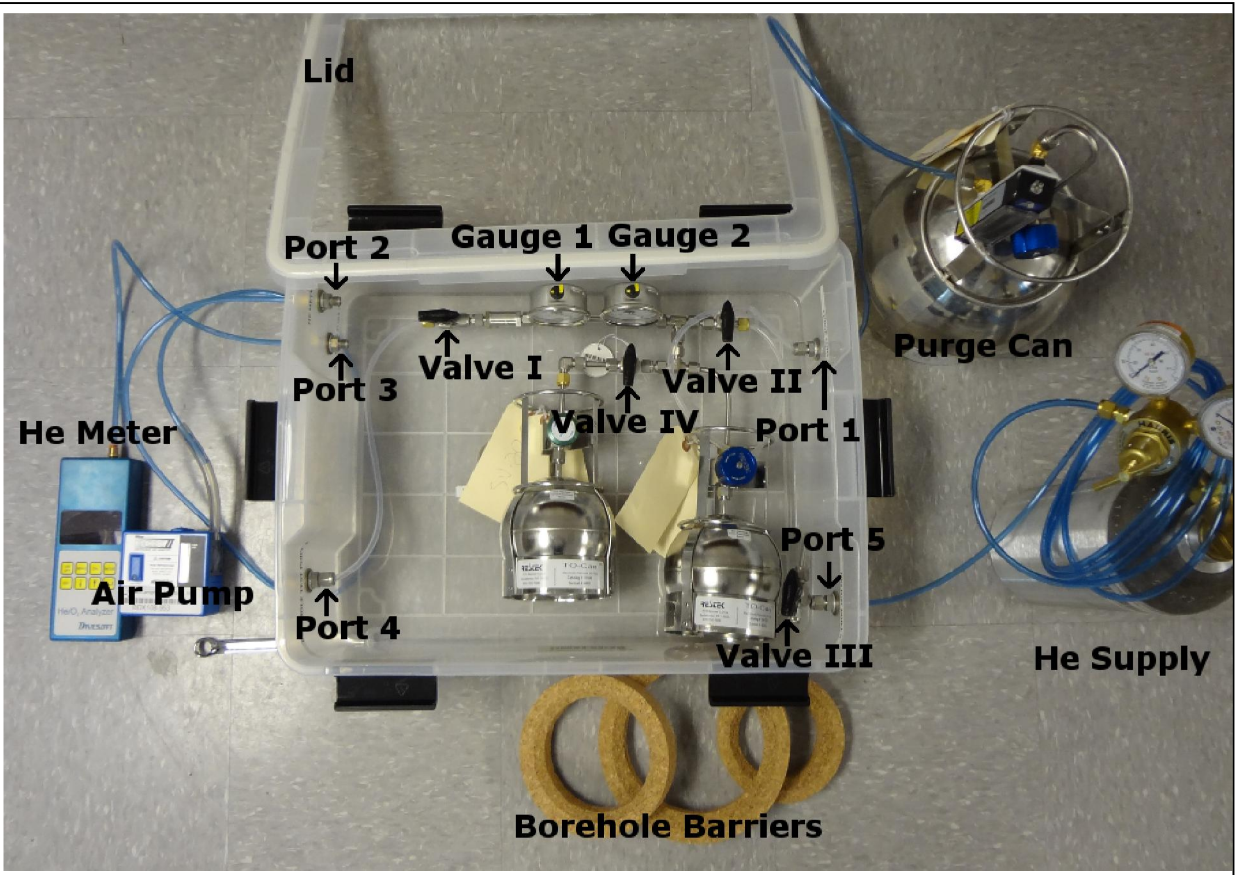



Figure 1. MAI designed Helium Shroud

3.2.2 A 2.24-liter Helium (99.995%) cylinder with a regulator set at 10 psi. Check the pressure gauge on Helium tank prior to sampling. If the pressure gauge reads less than 100 psi, then the Helium tank must be replaced.

3.2.3 A superior Helium meter, which measures Helium/Oxygen concentrations from 0% to 100% with ± 0.1% accuracy. The connection ports on the helium meter have been labeled for your convenience. A fully charged Helium meter should last up to 10 hours. *Note: To obtain an accurate reading on the Helium meter, the sampler must use the 60 mL syringe and give a quick pull on the plunger. (Pulling 60 mL of air through within a second is sufficient.)

3.2.4 The 60mL syringe is used to provide suction and force the airflow through the Helium meter or to quantify the "purged volume"

3.2.5 One Sensidyne pump set at 1250mL/min for maintaining a stable 20 %( ±2%) Helium concentration in the shroud.

3.2.6 One 6-liter purge canister with Rota meter attached as suction/evacuation source for leak testing, well purging and a check for low permeability soils.

3.2.7 Cork shroud stabilizers of various sizes are included to level/stabilize the helium shroud.

3.2.8 An additional 1-liter sample canister can be provided for the optional TO17 sampling in order to:

3.2.8.1 To provide vacuum to pull sample through.

3.2.8.2 To allow calculation of the volume pulled through.

3.2.8.3 Analyze for Helium as a leak check compound

*Note: The helium shroud may be reused for multiple borehole sites. However, due to potential cross contamination between borehole sampling, each borehole tested requires a separate certified 1-liter sample canister and certified sampling manifold. As there is no helium shroud tubing that contacts the sample upstream of the manifold; all Teflon tubing is reused.*

## 4. Sampling Media

4.1 MAI's sampling manifold, which includes the following:

4.1.1 3-way valveI on the borehole side of the manifold. The tapered end of the valve points to its connection direction.

4.1.2 A stainless steel 7-micron particle filter.

4.1.3 Vacuum gauge #1 reads the borehole side pressure.

4.1.4 A stainless steel flow restrictor.

4.1.5 Vacuum gauge #2 reads the sampling canister pressure and indicates when to stop sampling

4.1.6 Optional split sample attachment.

4.1.7 2-way valve turns on/off the access to the purge can.

4.2 A 1-liter certified sample canister

4.3 An optional thermal desorption tube (sorbent tube) for TO-17 (MAI routinely includes naphthalene in TO15).

4.4 An optional split sample manifold attachment

4.4.1 For simultaneous TO15 duplicate

4.4.2 For serial TO15 and TO17 sorbent tube

4.4.3 Optional second manifold for dual depth simultaneous sampling.

4.5 The soil gas manifold is leak checked in the lab prior to preparation for distribution. DO NOT DISASSEMBLE SOIL GAS MANIFOLD IN ANYWAY. Any damage to the equipment during sampling will incur repair fees.

## 5. Procedure

5.1 Assemble the shroud

5.1.1 Place cork shroud stabilizer over wellhead (various sizes provided for convenience and shroud stabilization)

5.1.2 Position shroud box so 'borehole access' is over borehole/borehole barrier, ensure well sampling tube rises up through wellhead and gasket into helium shroud box.

5.1.3 Position sampling manifold and sample canister(s) in shroud and make necessary connections.

*Note: Optimally, to reduce contamination, cut surface section of well tubing before connecting to Valve I.*

5.1.4 Connect the well tubing to 3-way valve I (the port that is perpendicular to the manifold) Tighten the nut over the tubing to make a good seal but do not over tighten as brass ferrules can easily shear Teflon tubing.

5.1.5 Connect the port 4 tubing to the remaining end of Valve I on the manifold. (the port in line with the manifold)

5.1.6 Connect Valve II to the tubing of port1

5.1.7 Connect purge can to Port #1 on the outside of the shroud box

5.1.8 Helium supply line is connected to Port #5.

5.1.9 Helium meter is initially connected to Port #3 for testing Helium concentration in the shroud. Prior to sampling, to conduct well integrity test for helium content, connect helium meter to Port 4.

5.1.10 Connect air pump to Port #2.

5.2 Charge the shroud with Helium

5.2.1 Initial Charge

5.2.1.1 Place plastic sheet loosely over box and secure with lid and lid clamps. Ensure a loose fit for valve manipulation. Ensure there are no gaps between the plastic sheet and lid. It is NOT necessary to adjust regulator pressure for helium supply bottle; it is preset at 10 Psi by MAI to sustain a constant 250mL/min helium flow to shroud and optimized for maintaining a 20% helium concentration. Turn 3-way valve III to 'flood' position (tapered end of the valve points to the nearest shroud wall) for initial Helium charge, which takes less than 5 seconds to is needed to reach a 20% Helium concentration. Briefly kneading the plastic cover post helium "flood" will expedite a 20% Helium equilibrium within the shroud.

5.3 Sampling train volume estimation.

5.3.1 MAI has estimated sampling train volumes for multiple sampling configurations. Volume estimates are calculated from manifold's Valve I to the source of suction. They are listed here for sample convenience:

5.3.2 Single sample configuration: 18.8 mL

5.3.3 Duplicate sample configuration: 20.6 mL

5.3.4 Serial TO15 and TO17 with Helium sample canister: 20 mL

5.3.5 Serial TO15 and TO17 without Helium canister: 18.8 mL

5.4 Maintaining Helium Concentration in Shroud

5.4.1 After initial "flood" of helium (about 5 sec), turn Valve III to 'low purge' position (tapered end of valve –with arrow– will point toward far shroud wall/Port 1). The helium tank is set at 250 mL/min helium flow, used in conjunction with an air pump at the opposing side of the shroud; pulling 1.25 mL/min out of the shroud will roughly maintain a 20% helium concentration within the shroud.

*Note: Initial helium concentration will be much higher than 20%, however it will stabilize in roughly 5 min.*

5.4.2 Monitor helium concentration within shroud regularly throughout sampling process to assure it is maintained at 20% helium (±2%). To do this, simply attach the 60mL syringe to the outlet on the meter and quickly pull 60mL, repeat two times (total of three pulls). It is recommended to record the helium concentration within the shroud once every minute (April 2012 DTSC Advisory).

5.4.3 Maintain helium at 20% concentration for five minutes before beginning sampling process.

5.5 Shut In test

5.5.1 The purpose of this test is to detect leaks in the above-ground sampling apparatus.

5.5.2 A six liter evacuated canister is employed as the vacuum source for the Shut-In test and the Leak test. A Rota meter attached to the purge can monitors flow rate, Gauge 1 (left side) on the manifold indicates vacuum level of well in negative inches of mercury (- inHg).

5.5.3 Ensure sampling container(s) and Valve I are closed (Valve I is closed when perpendicular to manifold); open Purge Can valve, then open 2-way Valve II (Valve II open when in line with manifold).

5.5.4 Once vacuum gauges read -30 inHg (or 100 inH20) close Purge Can valve. Verify absence of a significant leak by monitoring vacuum gauges on sampling manifold for a loss of vacuum for AT LEAST ONE MINUTE.

*Note: No movement on either gauge for ONE MINUTE is sufficient to proceed (during this time, see "6. Leak Test" below, and perform the Leak test before proceeding here). If there is a noticeable* *leak of the sampling train during the Shut-In test, REPLACE the manifold and REPEAT the Shut-In test of the new manifold.*

5.5.5 If no significant leak is detected; Valve I and purge can valve are reopened and soil permeability is noted.

*Note: Two criteria MUST be met; sample flow of at least 100mL/min AND borehole vacuum of -7.35 inHg are required to proceed. If these conditions are not met, damage to MAI equipment may occur at the expense of the sampler. Please see the "Sampling" section of this document for sampling procedure when the aforementioned criteria are not met.*

5.6 Leak Test

5.6.1 The purpose of this test is to determine if ambient air is introduced into the sample during collection

5.6.2 The MAI Helium Shroud design allows for the Leak test to be performed while the Shut-In test is in progress. The Leak test is performed to verify a gas-tight connection between the borehole tubing andthe manifold as well as confirm a good grout "seal" prior to sample collection.

5.6.3 It is used for shallow wells to determine if there is high permeability between the sub-surface sample tubing and the ground surface. This test is useful only if sampling will be aborted if a borehole leak is detected.

5.6.4 While waiting the "one minute" time requirement of the Shut-In test, attach helium meter to end of blue tubing on Port 4.

5.6.5 Using 60mL syringe take a helium reading of the borehole; attach syringe to outlet of meter and give a quick pull on the plunger. (Pulling 60 mL of air through within a second is sufficient.) Repeat 2 times to get an accurate reading.

5.6.6 If shroud is charged to 20% (±2%) helium and meter reads < 1% helium in well, borehole seals pass DTSC< 5% leak criteria.

5.7 Purge Volume Test

5.7.1 *Note: There are several procedures for determining well volume and purging well volume. Please refer to the* April 2012 DTSC Advisory section 4.2.3 – 4.3 *for more information. An accepted method is listed below; however, this method may not be appropriate for all wells and may not always apply.*

5.7.2 Turn 3-way Valve I so it is perpendicular to the manifold (pointing towards Port 4). Attach 60 mL syringe to end of blue tubing attached to outside of shroud box at Port 4.

5.7.3 Using the supplied 60mL syringe, pull suction on borehole sampling tube until plunger resistance is felt, noting final volume evacuated. The default purge volume is three times that of the well tubing volume (April 2012 DTSC Advisory

5.8 Sampling

5.8.1 After Shut-In test, Leak test, and purge volume procedures have been completed and helium concentration is maintained at 20% (±2%); ensure 3-way Valve I is perpendicular to manifold (pointing towards Port 4) and therefore allowing sampling from well.

5.8.2 Conventional TO15 summa sample collection procedures are now used. Generally, sample collection ceases when Gauge 2 (located on the sample canister side) reads approximately -5 inHg. **At 150ml/min a 1L summa will fill in approximately six minutes**. During sampling monitor helium concentration regularly.

5.8.3 DTSC recommends samples not be collected if down hole vacuum (Gauge 1) registers < -7.35 inHg (-100 inches of water), or flow falls below 100ml/min, indicating soil permeability is too low.

5.8.4 If low permeability is observed, close sampling can from sampling train IMMEDIATELY to prevent excessive moisture from entering into sampling canister, as this will invalidate the sample.

5.8.5 If soil is observed as low permeability soil, special sampling procedures are required as outlined in April 2012 DTSC Advisory App D.

5.8.6 If borehole vacuum reaches < -7.35 inHg, sampling should be suspended by closing valve on sampling can. After a few minutes, soil gas will replenish borehole and vacuum will gradually dissipate (refer to Gauge 1 located on borehole side of manifold for vacuum reading during this time). Sampling may resume after soil gas replenishes.

5.8.7 Once vacuum decreases, and sampling resumes, it is imperative that the sampler closely monitors borehole pressure as it may drop below -7.35 inHg again. If this occurs, repeat the 'shut' to 'replenish', then 'sample' cycle until sampling is completed. Length of replenish time depends on permeability of soil.

5.9 Optional Sampling Step

5.9.1 Sequential TO15 and TO17 sampling:

5.9.1.1 Naphthalene may be required to be sampled using TO17 sorbent tubes and a helium shroud. A modified set up for split sampling can be used, which consists of one TO15 sample can, a sorbent tube (ST), a TO17 purge/sample can, an additional 2-way valve IV and a 75ml/min flow restrictor, the latter two items are both located on the 'split sample attachment'. The TO17 ST is located between the 2-way valve IV/flow restrictor and the purge/sample can. This configuration is ideal for the following:

5.9.1.1.1 Restricts flow to the prescribed 50-100ml/minute (DTSC stipulation)

5.9.1.1.2 Allows naphthalene to be collected on the ST

5.9.1.1.3 Helps determine collected air STP volume that has passed thru the ST by lab measurement of the sample can initial and final pressure

5.9.1.1.4 Collects sample for helium leak check analysis in that branch's sample can

5.9.2 Installation of TO17 sorbent tube also requires the sampling flow direction is the same as indicated on the tube body. Naphthalene cannot be desorbed from the tube if collected at the wrong end of the tube. Teflon (TFE) ferrules are used for connections on the ST. Use of metal ferrules are strictly prohibited for connecting TO17 ST as they permanently damage the tube, Such damage will be billed to sampler.

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Telephone : 925-252-9262 Fax : 925-252-9269
www.mccampbell.com : main@mccampbell.com

5.9.3 An alternative TO-17 sampling technique, using the above set up but without the helium shroud & without the second pristine purge can, can be performed by using IPA wetted rags as the leak check and a vacuum pump or 'used' purge can suction. IPA needs to be added to analytical the target list.

5.9.4 Duplicate TO15 sampling. Simultaneous duplicate sampling can be achieved by connecting an additional 1-liter canister to the manifold. The designated 'split sample attachment' must be used. *Note: When TO17 ST sampling is needed, 2-way valve IV is in 'off' position during the shut in test. The valve is only turned on for sampling TO17 ST. On the contrary, 2-way valve IV is 'on' for the shut in test during simultaneous TO15 sampling.*

**6.0 Disconnect and Move to the Next Site**

6.1 After sample collection; close valve to sample canister, close valve on helium Supply, remove shroud lid, and detach borehole tubing from sample manifold.

6.2 Carefully label and remove sample manifold(s), canister(s) or sorbent tube(s) from shroud and ready the sampling apparatuses for shipment to McCampbell Analytical Inc.

6.3 Place the attached purge can, helium tank, 60 mL syringe, helium meter, air pump and tools into the shroud body, carefully remove the shroud and its contents from the borehole and collect the borehole seals/stabilizers and place them into the shroud box.

6.4 The shroud is now ready for transport to next borehole: the helium shroud, helium supply tank, helium meter, air pump, syringes and purge can are reusable. However, a clean certified manifold and sampling canister are needed for sampling the next well site.

6.5 When the sampling apparatuses are shipped to McCampbell Analytical Inc., TO-15 (or client specific target list) helium should be requested for analysis. Be sure to fill out Chain of Custody (COC) as completely as possible. All serial numbers of the equipment used for the sampling event need to be recorded on the COC.

**7.0 References**

7.1 Cal/EPA March 2010, Theo Johnson: Department of Toxic Substance Control, Advisory-Active Soil Gas Investigation DRAFT Advisory – Active Soil Gas Investigation CA EPA, March 2010