RECEIVED
By Alameda County Environmental Health at 4:46 pm, Dec 19, 2012

Mr. Keith Nowell
Alameda County Environmental Health
Department of Environmental Health
1131 Harbor Bay Parkway, 2nd Floor
Alameda, CA 94502-6577

Re: Former Exxon Station
5175 Broadway
Oakland, California
ACEH File No. 139
SFRWQCB Site No. 01-0958
UST Fund Claim No. 3406

Dear Mr. Nowell:

I, Mr. Ernie Nadel, have retained Pangea Environmental Services, Inc. (Pangea) as the environmental consultant for the project referenced above. Pangea is submitting the attached report on my behalf.

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

Sincerely,

Ernie Nadel
Rockridge Heights, LLC

September 28, 2012

VIA ALAMEDA COUNTY FTP SITE

Mr. Keith Nowell
Alameda County Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Re: **Post Remediation Soil Gas Sampling Report**
Former Exxon Station
5175 Broadway Street
Oakland, California
ACEH Fuel Leak Case No. RO0000139

Dear Mr. Nowell:

On behalf of Rockridge Heights, LLC, Pangea Environmental Services, Inc. has prepared this *Post Remediation Soil Gas Sampling Report* for the subject site. This report describes onsite soil gas and subslab gas sampling, and offsite subslab gas sampling performed in response to ACEH correspondence, including ACEH letter dated September 21, 2012.

If you have any questions or comments, please call me at (510) 435-8664 or email briddell@pangeaenv.com.

Sincerely,
Pangea Environmental Services, Inc.

Bob Clark-Riddell, P.E.
Principal Engineer

Attachment: *Post Remediation Soil Gas Sampling Report*

cc: Rockridge Heights, LLC, C/O Ernie Nadel, 6100 Pinewood Road, Oakland, California 94611
Vera Stanovich, 1956 Stratton Circle, Walnut Creek, California 94598
SWRCB Geotracker (Electronic copy)

POST REMEDIATION SOIL GAS SAMPLING REPORT

Former Exxon Station
5175 Broadway
Oakland, California

September 28, 2012

Prepared for:

Rockridge Heights, LLC
C/O Ernie Nadel
6100 Pinewood Road
Oakland, California 94611

Prepared by:

Pangea Environmental Services, Inc.
1710 Franklin Street, Suite 200
Oakland, California 94612

Written by:

REGISTERED PROFESSIONAL ENGINEER
ROBERT G. CLARK-RIDDELL
No. C 049629
Exp. SEPT 2014
CIVIL
STATE OF CALIFORNIA

Morgan Gillies
Project Scientist

Bob Clark-Riddell, P.E.
Principal Engineer

INTRODUCTION

On behalf of Rockridge Heights, LLC, Pangea Environmental Services, Inc. (Pangea) prepared this *Post Remediation Soil Gas Sampling Report* (report) for the subject site. The work was recommended in Pangea's *Revised Soil Gas Sampling Workplan* (workplan) dated July 16, 2012 and Pangea's *Revised Soil Gas Sampling Workplan - Addendum* (addendum) dated August 6, 2012. The soil gas and subslab gas sampling was performed in response to ACEH correspondence, including ACEH letter dated September 21, 2012. The site background, soil/subslab gas sampling, and our conclusions and recommendations are described below.

SITE BACKGROUND

Site Location and Description

The subject property is located at 5175 Broadway Street, at the southwest corner of the intersection of Broadway and Coronado Avenue in Oakland, California in Alameda County (Figure 1). The site is approximately 0.6 miles south-southeast of Highway 24 and approximately 2.3 miles east of Interstate 80 and the San Francisco Bay. The property is relatively flat lying, with a slight slope to the south-southwest, and lies at an elevation of approximately 160 feet above mean sea level. Topographic relief in the area surrounding the site also slopes generally towards the south-southwest. The western site boundary is the top of an approximately 10 foot high retaining wall that separates the site from an adjacent apartment complex.

The property has been vacant since 1979 and was formerly occupied by an Exxon Service Station used for fuel sales and automobile repair. The site is approximately 13,200 square feet in area with about 10% of the area occupied by a vacant station/garage structure. The majority of the ground surface is paved with concrete and/or asphalt. Land use to the west and northwest is residential, including apartment buildings and single family homes. Properties to the northeast, east and south of the site are commercial. The site and adjacent properties are shown on Figure 2.

Summary of Previous Environmental Investigations

Environmental compliance work commenced when the site USTs were removed in January 1990. Three 8,000-gallon steel single-walled USTs, associated piping, and a 500-gallon steel single-walled waste oil tank were removed. Tank Project Engineering, Inc. (TPE) conducted the tank removal and observed holes in all four tanks. Approximately 700 tons of contaminated soil was excavated during tank removal and was subsequently remediated and reused for onsite backfill by TPE. In April 1990, TPE installed and sampled monitoring wells MW-1, MW-2 and MW-3. In June 1991, Soil Tech Engineering (STE), subsequently renamed Environmental Soil Tech Consultants (ESTC), installed monitoring wells STMW-4 and STMW-5. Groundwater monitoring was conducted on the site intermittently until October 2002. Golden Gate Tank Removal (GGTR) performed additional assessment in January and February 2006. In June 2006, the property was purchased by Rockridge Heights, LLC. Pangea commenced quarterly groundwater monitoring at the site in July 2006. MTBE is not

considered to be a contaminant of concern because use of the site for fuel sales predates widespread use of MTBE in gasoline and because analytical results have not shown significant detections of MTBE.

In January and March 2007, Pangea installed twelve wells (MW-2C, MW-3A, MW-3C, MW-4A, MW-5A, MW-5B, MW-5C, MW-6A, MW-7B, MW-7C, MW-8A and MW-8C) and three offsite soil borings to help define the vertical and lateral extent of groundwater contamination. Pangea also abandoned four monitoring wells (MW-2, MW-3, STMW-4 and STMW-5) to reduce the risk of vertical contaminant migration and improve the quality of monitoring data. New wells installed at the site were categorized according to the depths of their screen intervals. Shallow (A-zone) wells have screen intervals of approximately 10 to 15 feet bgs, which generally straddle the top of the water table and are generally screened in surficial fill and alluvium. Intermediate-depth (B-zone) wells are screened at approximately 15 to 20 feet bgs, either in surficial strata or underlying fractured bedrock, while deep (C-zone) wells are generally screened at approximately 20 to 25 feet bgs and into fractured bedrock. Well MW-1 is screened across both the A-zone and B-zone.

In April 2007, Pangea performed a dual-phase extraction (DPE) pilot test to evaluate whether DPE is an appropriate remedial technology to remove residual hydrocarbons from beneath the site. In July 2007, Pangea submitted an Interim Remedial Action Plan for site corrective action.

In August 2007, Pangea installed three offsite monitoring wells (MW-9A, MW-9C and MW-10A) and conducted subslab vapor sampling in the commercial building located immediately south of the site. The purpose of the offsite well installation was to determine the downgradient extent of contaminant migration, and to help evaluate downgradient effects of any future onsite remediation. The purpose of the subslab vapor sampling was to determine whether vapor migrating from underlying groundwater had impacted soil vapor. Soil gas sampling was also conducted near the southern and western edge of the property. Soil gas sampling and offsite monitoring well installation is described in Pangea's *Soil Gas Sampling and Well Installation Report* dated October 23, 2007. Further subslab/soil gas sampling was conducted at the two adjacent properties in June 2008 and reported in Pangea's *Additional Soil Gas Sampling Report* dated July 14, 2008.

In a June 2009 letter, ACEH approved insitu site remediation using dual-phase extraction (DPE) and air sparging (AS) techniques. Operation of the DPE system began on December 8, 2010 and operation of the AS system began on March 16, 2011. The DPE/AS system has been very effective for site remediation. The DPE/AS system was shutdown for rebound testing and post-remediation monitoring on January 31, 2012.

Post-remediation soil gas sampling was proposed in Pangea's *Revised Soil Gas Sampling Workplan* dated July 16, 2012 and *Addendum* dated August 6, 2012. As required, the Revised Workplan included an evaluation of potential vapor migration pathways between 5175 Broadway and the adjacent residential building at 5230 Coronado Avenue. Results of the soil gas sampling are summarized below.

SOIL/SUBSLAB GAS SAMPLING

Overview and Sampling Protocol

To evaluate shallow subsurface gas conditions beneath the site and beneath offsite buildings, Pangea conducted subslab gas and soil gas sampling from seven subslab gas probes (SS-1 through SS-7) and four shallow soil gas wells (SG-8 through SG-11) between September 6 and September 12, 2012. The probe locations are shown on Figure 2. Sample depth intervals and soil gas analytical results are summarized on Table 1. The sampling procedures are described below. Subslab gas and soil gas sampling was conducted in general accordance with procedures described in the following documents:

- Pangea's Standard Operating Procedures (SOPs) for Subslab and Soil Gas Sampling (Appendix A),
- *FINAL Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (Vapor Intrusion Guidance)* prepared by California Environmental Protection Agency, Department of Toxic Substance Control (Cal/EPA) dated October 2011, and
- *Advisory-Active Soil Gas Investigations* prepared by Cal/EPA, LARWQCB, and San Francisco RWQCB dated April 2012.

Deviations from these procedures are described in the following subsections.

Pangea retained Vapor Tech Services (VTS) of Berkeley, California to install all *onsite* soil gas wells and two of the seven subslab probes (the two onsite probes). VTS specializes in soil gas sampling in the San Francisco Bay Area, performing sampling for a range of customers from individual property owners to major oil companies. Prior to the start of sampling activities, access agreements were obtained from the owners of the offsite private properties to allow site assessment activity, and a site safety plan (SSP) was prepared to protect site workers. Fieldwork was performed by VTS, Pangea project manager Morgan Gillies, and staff scientist Tina de la Fuente under the supervision of Bob Clark-Riddell, a California Registered Professional Civil Engineer.

Subslab Gas Probe Installation

On July 17, 2012, Pangea project manager Morgan Gillies installed subslab probes SS-3 through SS-5 at the adjacent *offsite* residential location of 5230 Coronado Avenue. Subslab probe SS-3 was installed in the ground floor laundry room at 5230 Coronado (to evaluate potential hydrocarbon along identified subsurface conduits), and SS-4 and SS-5 were installed in the ground floor crawl space/storage room at 5230 Coronado. On August 31, 2012, VTS installed SS-6 and SS-7 within the existing concrete building slab onsite. Pre-existing subslab gas probe (SS) sampling locations SS-1 and SS-2 are located inside the commercial building at 5151 Broadway, on the northern side of this offsite building near impacted onsite wells MW-7B and MW-7C.

The subslab gas probe installation procedures for SS-3 through SS-5 involved using a rotohammer to drill a 1 ½-inch diameter hole part way through the approximately 2.5-inch to 3-inch thick concrete slab of the building, drilling a ½-inch diameter hole through the remaining concrete, installing a rubber stopper with stainless steel tubing (capped on one end with a Swagelok fitting), and placing a bentonite/cement seal from the top of the stopper to the surface. The probes were allowed to equilibrate for two weeks prior to sampling.

Probes SS-6 and SS-7 were installed by VTS using a rotohammer to drill a ½-inch diameter hole through the 4-inch concrete slab onsite and a 1 ½-inch diameter rotohammer bit was used to widen the top of the hole to facilitate probe sampling. Stainless steel tubing with a screened tip on one end was placed in the hole surrounded by filter pack sand to the bottom of the slab, and bentonite and anchoring cement were added to seal the probe. The probes were allowed to equilibrate for at least one week prior to sampling.

Soil Gas Well Installation

On August 31, 2012, VTS installed onsite soil gas wells SG-8 through SG-11. SG-8 is located in the western central portion of the site, near formerly impacted wells MW-8A/8C. SG-9 is located in the central southern portion of the site, between wells MW-3A and DPE-3. SG-10 is located in the eastern portion of the site, where groundwater concentrations rebounded during the most recent groundwater monitoring of well DPE-2. SG-11 is located in the northeastern corner of the site, near formerly impacted well MW-4A.

The overall soil gas well installation procedure involved jack hammering the asphalt surface and hand augering a 3.25-inch diameter hole to approximately 5 ft depth. A six-inch stainless-steel vapor implant with Teflon tubing was installed and surrounded by filter pack sand to a depth of approximately 4 to 5 ft, with the six-inch vapor implant screening a depth of approximately 4.25 to 4.75 ft. The probes were completed by adding dry bentonite from approximately 3 to 4 ft depth, hydrated bentonite from 3 ft depth to a few inches from the surface, and a concrete seal to the surface. The depth of the soil gas wells is slightly shallower than the 5 foot well depth recommended in the current DTSC *Advisory-Active Soil Gas Investigations* (Cal/EPA 2012). This slight deviation is considered unlikely to significantly affect the representativeness of samples. A traffic-rated well box (six-inch diameter) was then installed over each probe with an approximate 18-inch diameter concrete apron (which likely provides additional surface sealing), and the Teflon tubing was capped with a stainless steel Swagelok fitting.

Subslab Gas and Soil Gas Sample Collection and Analysis

Pangea sampled three offsite subslab gas probes (at 5230 Coronado) on September 6 and sampled the other soil gas probes/wells on September 12, 2012. McCampbell Analytical provided sampling manifolds and certified Summa canisters for purging and sampling. A fresh manifold was used for each sample probe. A schematic diagram of the sampling manifold is shown in Appendix A. The Summa canisters were supplied with an initial vacuum of approximately 30 inches of mercury. Prior to sample collection from each probe, a

shut-in test was conducted on the sampling manifold. All shut-in tests confirmed no leakage of the sampling manifolds.

After each shut-in test, a 6-liter Summa canister was used to purge the manifold/probe assembly. The subslab probes were calculated to have a single purge volume of approximately 30 ml. Each subslab probe was purged of approximately 5 purge volumes (150 ml) prior to collecting a sample in a 1L Summa canister. The soil gas wells were calculated to have a single purge volume of approximately 1,550 ml, which includes a tubing + sampling manifold volume of approximately 100 ml. For large-volume relatively shallow wells such as these there is a concern that overpurging can result in ambient air breakthrough. Therefore, only approximately 530 ml was purged from each well prior to sampling. This is approximately 5.5 tubing volumes but less than the 3 full purge volumes recommended for shallow wells in Cal/EPA 2012. However, sampling was conducted following two weeks of equilibration time following well installation, and Cal/EPA 2012 indicates that sampling of as little as 1 tubing volume is adequate following two weeks of equilibration time for soil gas wells that are subject to frequent sampling. Sampling of these soil gas wells was conducted after two weeks of equilibration and the total purge/sample volume (1,530 ml) of the SG wells represents 1 full purge volume (or about 15 tubing volumes).

A pre-set flow regulator regulated the vapor flow during purging and sampling to approximately 150 milliliters of air per minute. After approximately 5 or more minutes of sample collection, the vacuum within each Summa canister decreased to between 3 and 5 inches of mercury and the canister valve was closed.

To evaluate potential leakage within the sampling system or ambient air breakthrough from the surface, an air tight leak-check enclosure was placed over each sampling point and sampling assembly (Summa canisters and manifold). Isopropyl alcohol was applied to gauze placed inside the leak-check. The enclosure was monitored for isopropyl alcohol concentrations with a photo ionization detector (PID) to ensure that there was a sufficient concentration of isopropyl alcohol(>1 ppmv) in the air inside the enclosure. In addition, a second Summa canister and sampling manifold was used to collect air from within the leak-check enclosure at the same time that the soil gas sample was collected, in order to facilitate comparison to any isopropyl alcohol concentrations that might be detected in the sampling Summa canister. The air flow regulators for the sample and leak check summa canisters were calibrated identically. These leak-check Summa canisters were designated for analysis only if a significant concentration of isopropyl alcohol was detected in the soil gas samples with which they were associated.

After sample collection, SGP locations SG-8 through SG-11 and subslab probes SS-1 through SS-7 were capped and left for future sampling, if merited.

Soil/Subslab Gas Analytical Results

The Summa canisters containing the soil gas, subslab gas, and leak-check enclosure samples were submitted for analysis to McCampbell Analytical, Inc., of Pittsburg, California, a State-certified laboratory. Soil gas and subslab samples were analyzed by Total Organics Method 15 (TO-15) for total petroleum hydrocarbons as gasoline (TPHg) benzene, toluene, ethylbenzene, xylenes (BTEX), naphthalene, and isopropyl alcohol; and by ASTM D-1946 for total percent oxygen. Soil gas samples SG-8 through SG-11 were collected from approximately 4 to 5 ft bgs, and subslab samples SS-1 through SS-7 were collected from approximately 0.5 - 0.7 ft bgs. Soil gas and subslab analytical results and sample depth intervals are summarized on Table 1 and Figure 2. The laboratory analytical report is included in Appendix B.

The maximum detected soil gas concentrations were 7,200 $\mu g/m^3$ TPHg and 18 $\mu g/m^3$ benzene, in shallow onsite soil gas probe SG-8 (adjacent well MW-8A). Trace hydrocarbons were detected in two other onsite soil gas probes as follows: 4,000 $\mu g/m^3$ TPHg and 8.9 $\mu g/m^3$ benzene in SG-11 (adjacent well MW-4A), and 8.9 $\mu g/m^3$ benzene in SG-10. No hydrocarbons (including TPHg, benzene, ethylbenzene, and naphthalene) were detected in any of the seven subslab soil gas samples (SS-1 through SS-7) or in onsite shallow soil gas probe SG-9.

Isopropanol was only detected in SG-10 at a concentration of 54 $\mu g/m^3$, which is a very low detection for leak check compound and likely represents a negligible amount of the sample.

The percentage of oxygen in soil gas ranged from 17 to 20% for all subslab probes and soil gas probes SG-10 and SG-11. The percentage of oxygen was 4.5% in probe SG-9 and 5.1% oxygen in probe SG-8.

Comparison to RWQCB Environmental Screening Levels

Contaminant concentrations detected in the *soil gas* probes were compared to the shallow soil gas Environmental Screening Levels (ESLs) established by the San Francisco Regional Water Quality Control Board (RWQCB). According to the RWQCB ESL guidance, residential ESLs are protective of land use for residences, hospitals, day care centers and other sensitive uses. As shown on Table 1, the maximum detected soil gas concentrations were 7,200 $\mu g/m^3$ TPHg and 18 $\mu g/m^3$ benzene (SG-8), while lower hydrocarbons were detected in SG-11 (4,000 $\mu g/m^3$ TPHg and 8.9 $\mu g/m^3$ benzene) and in SG-10 (8.9 $\mu g/m^3$ benzene). <u>All detected concentrations are below residential ESLs established by the RWQCB of 10,000 $\mu g/m^3$ TPHg and 84 $\mu g/m^3$ benzene.</u>

Comparison to Vapor Intrusion Criteria of New Low Threat Closure Policy

The SWRCB's Low Threat Closure Policy, adopted in August 2012, describes conditions, including bioattenuation zone, which if met will assure that exposure to petroleum vapors in indoor air will not pose unacceptable health risks. In many petroleum release cases, potential human exposures to vapors are mitigated by bioattenuation processes as vapors migrate toward the ground surface. The policy introduces the term 'bioattenuation zone' that refers to an area of soil with conditions that support biodegradation of petroleum hydrocarbon vapors.

The policy presents four scenarios involving existing or planned buildings to apply low-threat vapor intrusion criteria. Sites shall be considered a low threat for vapor intrusion into indoor air if site-specific conditions satisfy all of the characteristics and criteria of applicable Scenarios 1 through 3 (which do not require direct hydrocarbon soil gas data) or Scenario 4 (which does require direct soil gas data). Note that oxygen data is beneficial for application of Scenarios 3 and 4. In addition, a site shall also be considered a low threat for vapor intrusion into indoor air if (1) a site-specific risk assessment demonstrates that human health is protected to the satisfaction of the regulatory agency, or (2) as a result of controlling exposure through the use of mitigation measures or through the used of institutional or engineering controls, the regulatory agency determines that petroleum vapor migrating from soil or groundwater will have no significant risk of adversely affecting human health.

Scenarios 1 through 4 of the SWRCB's Low Threat Closure Policy pertaining to vapor intrusion into indoor air are included within Appendix C of this report. The characteristics and applicability of each scenario is summarized below in Table A. As shown below, Scenarios 1 and 2 pertain to sites with 'free product', Scenario 3 pertains to sites with benzene dissolved in groundwater, and Scenario 4 addresses sites with actual direct measurement (e.g., laboratory analytical results) of soil gas hydrocarbon concentrations. As shown below on Table A, site data suggests that the subject site satisfies low-threat criteria of each potentially applicable scenario.

Table A – Evaluation of Vapor Intrusion Scenarios in Low Threat Closure Policy

Scenario	Characteristics of Bioattenuation Zone	Applicability to Subject Site
Scenario 1 Free Product in Groundwater	1. 30 ft from building foundation to free product on groundwater. 2. TPH <100 mg/kg in zone.	Not applicable. No free product at site.
Scenario 2 Free Product in Soil	1. 30 ft from building foundation to free product in soil. 2. TPH <100 mg/kg in zone.	Not applicable. No free product at site.
Scenario 3 Benzene in Groundwater (**1 of 2:** *No Oxygen data or Oxygen <4%)*	1. No oxygen data or oxygen <4%. 2. TPH <100 mg/kg in zone. 3. If benzene in groundwater <100 ug/L, minimum 5 ft clearance from building foundation to groundwater. 4. If benzene in groundwater >100 ug/L but <1,000 ug/L, minimum 10 ft clearance from building foundation to groundwater.	Not applicable since oxygen data is ≥4%. **Even if this Scenario 3 (1 of 2) were deemed applicable, there is approximately 10 ft clearance from surface to groundwater where maximum dissolved benzene has been well below 1,000 ug/L and was only 100 ug/L in Sept 2012.**
Scenario 3 Benzene in Groundwater (**2 of 2:** *Oxygen >4%)*	1. Oxygen ≥4%. 2. TPH <100 mg/kg in zone. 3. Benzene in groundwater <1,000 ug/L, minimum 5 ft clearance from building foundation to groundwater.	**Applicable. Site data satisfies criteria.** Oxygen ≥4% per below. Max benzene in water was 100 ug/L in Sept 2012. Water depth in key wells is 9 to 14 ft. TPH impact was <100 mg/kg to <9 ft depth.
Scenario 4 Direct Measurement of Soil Gas Concentrations (**1 of 2:** *No Bioattenuation Zone)*	*No* bioattenuation zone. 1. Soil gas sampling from at least 5 ft below surface (future construction) or 5 ft below bottom of building foundation. 2. Soil gas criteria **for benzene <85 ug/m^3 (residential) or <280 ug/m^3 (commercial).** Ethylbenzene and naphthalene criteria also, but not TPHg.	Not applicable: site data suggests bioattenuation zone is present. **Even if this Scenario 4 (1 of 2) were deemed applicable, the maximum benzene concentration of 18 ug/m^3 is *below* the 85 ug/m^3 criteria. Also, no benzene or TPH impact was detected in all subslab gas samples.**
Scenario 4 Direct Measurement of Soil Gas Concentrations (**2 of 2:** *Bioattenuation Zone)*	1. Soil gas sampling from at least 5 ft below surface (future construction) or 5 ft below bottom of building foundation. 2. TPH <100 mg/kg in zone, measured at two depths. 3. **Oxygen ≥4%** at lower end of 5 ft zone. 4. Soil gas criteria for **benzene <85,000 ug/m^3 (residential) or <280,000 ug/m^3 (commercial).** Ethylbenzene and naphthalene criteria also, but not TPHg.	**Applicable. Direct soil gas data satisfies criteria. Maximum benzene in soil gas of 18 ug/m^3 is several orders of magnitude below 85,000 ug/m^3. Oxygen is ≥4% for all four soil gas probes screened at 4.25 to 4.75 ft depth, and oxygen is between 17 and 20% for all subslab probes. Also, no benzene or TPH impact was detected in all subslab gas samples.** TPH soil impact previously detected slightly above 100 mg/kg at 9 ft and deeper has likely been remediated to below 100 mg/kg.

CONCLUSIONS

Based on the results of our post-remediation soil/subslab gas sampling, Pangea offers the following conclusions:

- No petroleum hydrocarbons were detected in *subslab* gas probes from onsite *or* offsite sampling locations for this post-remediation sampling event. The lack of hydrocarbons in these probes suggests that residual impact to soil and groundwater does not pose a threat to human health via vapor intrusion into indoor air for (1) planned future development at the 5175 Broadway property, (2) residents at the adjacent 5230 Coronado Avenue building, or (3) future occupants at adjacent 5151 Broadway.

- Hydrocarbon concentrations in shallow soil gas (about 5 ft depth) this sampling event were well below applicable RWQCB ESLs (both residential and commercial) for the site proper (5175 Broadway). This shallow soil gas data (and the subslab soil gas data) indicates that the completed DPE/AS remediation significantly improved site conditions, and that no additional remediation is merited to address potential vapor intrusion concerns. According to the RWQCB ESL guidance, residential ESLs are protective of land use for residences, hospitals, day care centers and other sensitive uses.

- Our comparison of site data to SWRCB's Low Threat Closure Policy (LTCP) suggests that the subject site satisfies low-threat criteria of each potentially applicable scenario regarding vapor intrusion (Table A). The following information suggests a significant bioattenuation zone is present at the site: (1) the presence of oxygen in shallow soil and subslab gas exceeding >4% in all samples, (2) the limited TPH impact down to <9 ft depth, (3) deeper soil TPH impact has been remediated by DPE/AS, (4) the depth to groundwater has ranged from approximately 9 to 14 ft bgs, and (5) benzene concentrations in groundwater were a maximum of 100 ug/L during the most recent September 2012 monitoring event (and given extensive site remediation benzene concentrations are not expected to rebound above the 1,000 ug/L criteria of LTCP Scenario 3). Direct soil gas measurement data indicates that site data satisfies LTCP Scenario 4. Even absent direct soil gas data, other site data (including the recent oxygen data in soil gas) indicates that site data satisfies LTCP Scenario 3. Having satisfied all of the characteristics and criteria of Scenario 3 and 4, this site should be considered a low threat for vapor intrusion into indoor air in accordance with the Low Threat Closure Policy.

- Institutional controls (e.g., deed restrictions) or engineering controls (e.g., vapor barrier/passive vapor collection) can be used at the subject site to control potential exposure to petroleum vapor migrating from soil or groundwater.

RECOMMENDATIONS

Based on the above conclusions and recent groundwater monitoring data, Pangea offers the following recommendations:

- Pangea recommends that the ACEH evaluate this case for No Further Action (NFA). With the current property transaction contingent upon case closure issues, Pangea respectfully requests discontinuance of post-remediation groundwater monitoring and issuance of an NFA letter. Case closure at this time will help facilitate the pending property transaction and planned site redevelopment.

- Pangea has separately requested a meeting very soon with the ACEH to discuss requirements for case closure, and to address the prospective site development. The Baseline Environmental Project Schedule document requested by ACEH to facilitate a meeting has been provided to ACEH. If the ACEH feels additional groundwater and/or soil gas monitoring would be beneficial to further characterize site conditions, Pangea respectfully requests discussing the need for such monitoring during a meeting of stakeholders with your agency. We could also discuss the use of institutional and/or engineering controls to help facilitate case closure and safeguard human health.

ATTACHMENTS

Figure 1 – Site Location Map
Figure 2 – Soil Gas and Subslab Gas Concentration Map

Table 1 – Soil Gas Analytical Results

Appendix A – Standard Operating Procedures
Appendix B – Vapor Intrusion Scenarios of the Low Threat Closure Policy
Appendix C – Laboratory Analytical Reports

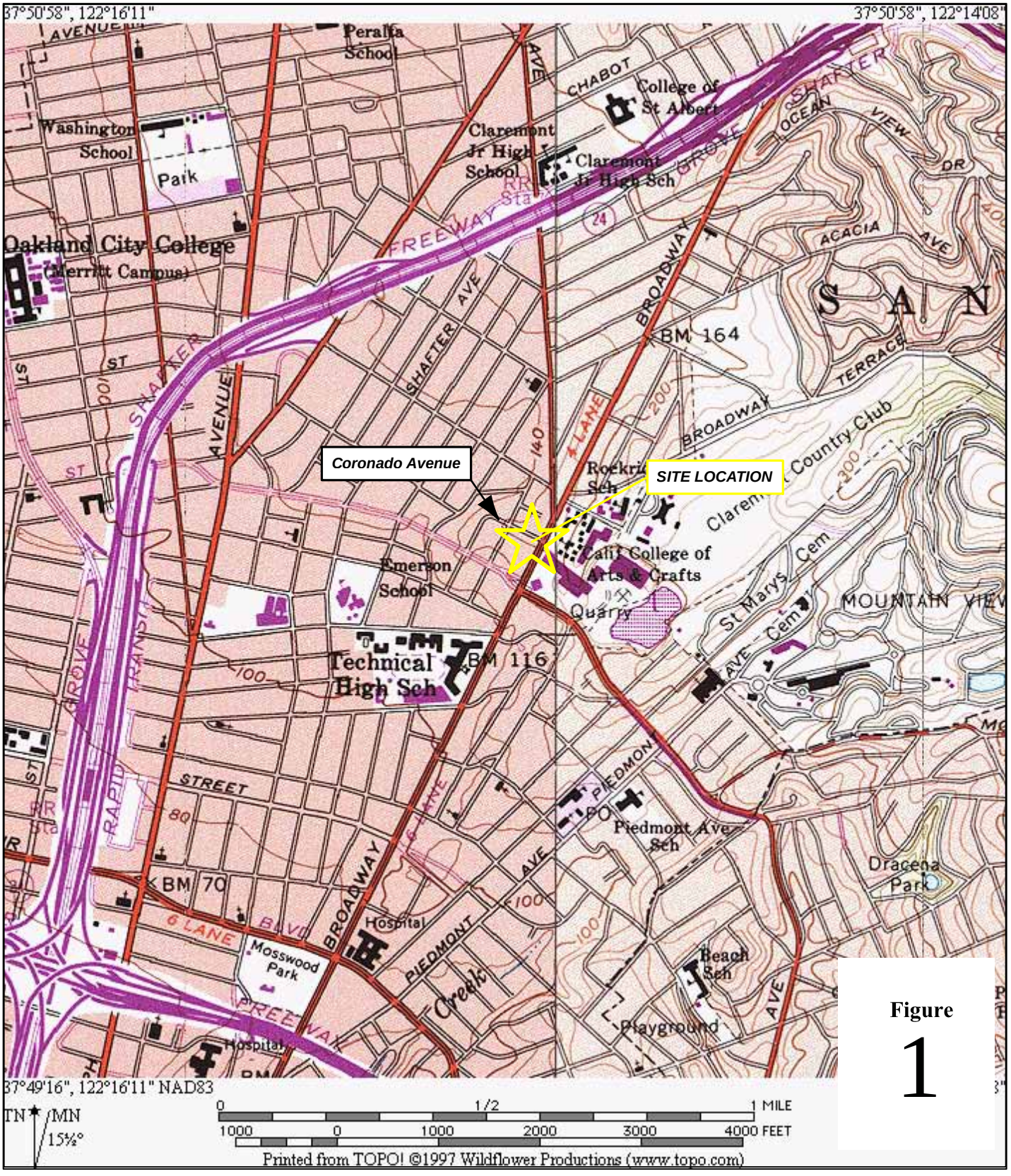


Figure 1

FeinerBroadway site loc.ai 8/30/06

Former Exxon Station
5175 Broadway
Oakland, California

PANGEA

Site Location Map

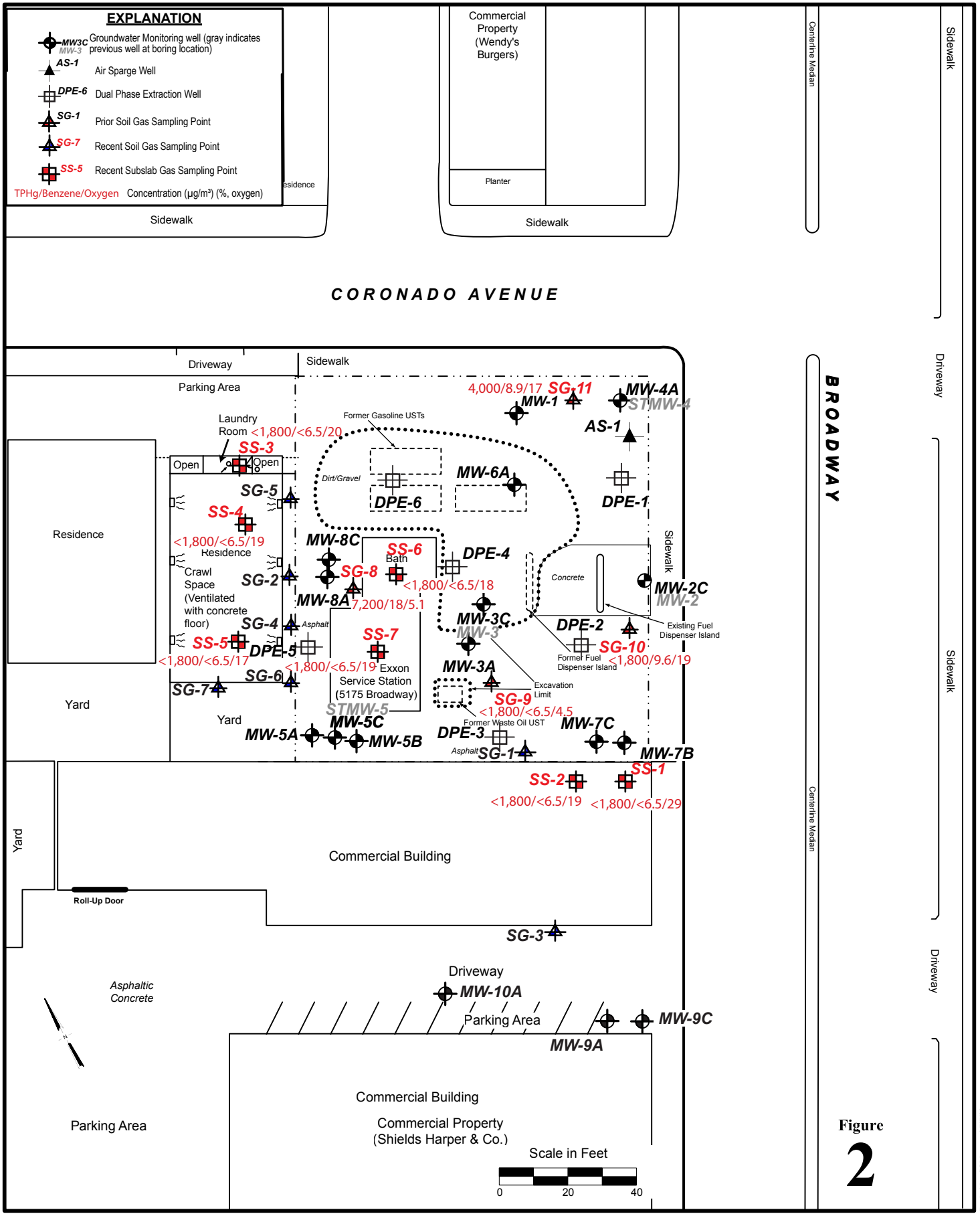


Figure 2

Rockridge SCM map.ai 7/7/08

Former Exxon Station
5175 Broadway
Oakland, California

Soil Gas Sampling
September 2012

PANGEA

Pangea

Table 1. Soil Gas Analytical Data - Rockridge Heights, 5175 Broadway, Oakland, California

Boring/ Sample ID	Date Sampled	Sample Depth (ft - ft bgs)	Benzene	Toluene	Ethylbenzene	Xylene (M+P)	Xylene (O)	TPH Gasoline (C4-C10)	Naphthalene	Isopropanol	Oxygen	Notes
			ug/m³								%	
Residential ESL for shallow **soil gas**:			**84**	**63,000**	**980**	**21,000**	**21,000**	**10,000**	**72**	--	--	
Commercial ESL for shallow **soil gas**:			280	180,000	3,300	58,000	58,000	29,000	240	--	--	
No Bio-Attenuation Zone, **Residential** (Low Threat)			85	--	1,100	--	--	--	93	--	--	
No Bio-Attenuation Zone, **Commercial** (Low Threat)			280	--	3,600	--	--	--	310	--	--	
With Bio-Attenuation Zone, **Residential** (Low Threat)			85,000	--	1,100,000	--	--	--	93,000	--	--	
With Bio-Attenuation Zone, **Commercial** (Low Threat)			280,000	--	3,600,000	--	--	--	310,000	--	--	
Soil Gas Probe Samples												
SG-1	9/12/2007	3.8-4.0	16.0	294	6.21	19.6	5.91	<2,000	--	85.4	--	
SG-2	9/12/2007	3.8-4.0	**174**	200	93.6	77.2	<21.7	**14,000**	--	70.1	--	
SG-3	9/12/2007	2.5-2.7	<128	151	<174	<174	<174	<2,000	--	21,300	--	Isoproponal = 0.7% of sample volume*
SG-4	6/17/2008	4.0-4.5	**5,930**	<754	**17,200**	15,600	<868	**830,000**	--	<983	--	
SG-5	6/17/2008	4.5-5.0	12.9	7.08	61.4	57.2	<4.34	<10,000	--	<492	--	
SG-6	6/17/2008	3.5-4.0	<63.9	<75.4	97.9	<86.8	<86.8	**13,000**	--	<490	--	
SG-7	6/17/2008	3.5-4.0	25.6	10.8	<4.34	4.78	<4.34	<10,000	--	<492	--	
SG-8	**9/12/2012**	4.0-5.0	18	<7.7	<8.8	<27	<27	7,200	<11	<50	5.1	
SG-9	**9/12/2012**	4.0-5.0	<6.5	<7.7	<8.8	<27	<27	<1,800	<11	<50	4.5	
SG-10	**9/12/2012**	4.0-5.0	9.6	<7.7	<8.8	<27	<27	<1,800	<11	54	19	
SG-11	**9/12/2012**	4.0-5.0	8.9	<7.7	<8.8	<27	<27	4,000	<11	<50	17	
Subslab Gas Samples												
SS-1	9/12/2007	0.5-0.7	24.1	187	5.38	16.8	5.91	<2,000	--	11.2	--	
SS-2	9/12/2007	0.5-0.7	<3.19	5.24	<4.34	<4.34	<4.34	<2,000	--	<4.92	--	
SS-1	6/17/2008	0.5-0.7	<3.19	<3.77	<4.34	<4.34	<4.34	<700	--	<492	--	
SS-2	6/17/2008	0.5-0.7	<3.19	<3.77	<4.34	<4.34	<4.34	<700	--	<492	--	
SS-1	**9/12/2012**	0.5-0.7	<6.5	<7.7	<8.8	<27	<27	<1,800	<11	<50	20	
SS-2	**9/12/2012**	0.5-0.7	<6.5	<7.7	<8.8	<27	<27	<1,800	<11	<50	19	
SS-3	**9/6/2012**	0.5-0.7	<6.5	<7.7	<8.8	<27	<27	<1,800	<11	<50	20	
SS-4	**9/6/2012**	0.5-0.7	<6.5	<7.7	<8.8	<27	<27	<1,800	<11	<50	19	
SS-5	**9/6/2012**	0.5-0.7	<6.5	<7.7	<8.8	<27	<27	<1,800	<11	<50	17	
SS-6	**9/12/2012**	0.5-0.7	<6.5	<7.7	<8.8	<27	<27	<1,800	<11	<50	18	
SS-7	**9/12/2012**	0.5-0.7	<6.5	<7.7	<8.8	<27	<27	<1,800	<11	<50	19	
Leak Check Samples												
SS-1 Check	9/12/2007	--	--	--	--	--	--	--	--	622,000	--	
SG-1 Check	9/12/2007	--	--	--	--	--	--	--	--	5,900,000	--	
SG-2 Check	9/12/2007	--	--	--	--	--	--	--	--	1,070,000	--	
SG-3 Check	9/12/2007	--	--	--	--	--	--	--	--	3,020,000	--	

Abbreviations:

SG-1 = Soil Gas Sample

SS-1 = Subslab Sample

ug/m3 = Micrograms per cubic meter of air results calculated by laboratory from parts per billion results using normal temperature and pressure (NPT).

ft - ft bgs = Depth interval below ground surface (bgs) in feet.

Volatile organic compounds by EPA Method TO-15 (partial list), uses GC/MS scan.

< n = Chemical not present at a concentration in excess of detection limit shown.

MRL = Method reporting limit. Laboratory reporting limit based on parts per billion on volume to volume basis (ppbv/v) and converted to ug/m3.

ESL = Environmental Screening Level for Shallow Soil Gas with Residential and Commercial/Industrial Land Use, for samples less than five feet below a building foundation or ground surface (Table E-2).

ESL established by the SFBRWQCB, Interim Final - February 2005, and amended in May 2008.

Low Threat = Low Threat Closure Policy, Adopted by State Water Resources Control Board, August 2012, Appendix 3 and 4.

DPE = Dual phase extraction.

Bold = Concentrations above ESLs for Residential Land Use for shallow soil gas (SS and SG samples) BEFORE remediation are shown in bold.

* = Since the air flow regulators on the sampling and leak check summa canisters were setup identically, the percentage of sample that leaked from ambient air within the leak-check enclosure into the sample probe can be determined by dividing the concentration of isopropanol in the sample canister by the concentration of isopropanol in the leak-check canister.

APPENDIX A

Standard Operating Procedures

APPENDIX A

STANDARD OPERATING PROCEDURE FOR SOIL VAPOR SAMPLING

1.0 PURPOSE

This standard operating procedure (SOP) describes the procedures for collecting soil vapor samples using temporary and semi-permanent soil gas probes/wells and evacuated, stainless-steel Summa canisters. The SOP is modified from procedures and information presented in Cal/EPA 2011; Cal/EPA 2012; DiGiulio and others, 2006; DiGiulio, 2003; and discussions with laboratory director with K-Prime of Santa Rosa, California (September 2006). For any conflicts between procedures described in the SOP and guidance documents, the *Advisory-Active Soil Investigations* (Cal/EPA 2012) supercedes the SOP.

2.0 REQUIRED EQUIPMENT

- Hammer drill with fittings for installing and removing vapor probes (for direct push vapor probes)
- Vapor probes with retractable or dedicated drop-off tips (e.g. AMS SGVP) (for direct push vapor probes).
- Hand auger (for soil vapor wells)
- Tubing with Swagelok or similar threaded compression-fittings and vapor-tight caps
- Screens (for soil vapor wells)
- Filter-pack sand (for dedicated tips and soil vapor wells)
- Powdered or granular bentonite
- VOA vials
- 6-Liter Summa canister (evacuated with approximately 30” Hg vacuum) with vacuum gauge for purging and leak testing
- 1-Liter Summa canister with vacuum gauge for each sample
- Stainless-steel sampling manifold with vacuum gauges and critical orifice flow restrictor (Figure 1)
- Leak-check compound (e.g. isopropyl alcohol)
- Sampling jar and absorbent material (e.g. gauze) for leak-check compound
- Calibrated photoionization detector (PID)
- Leak-check enclosure(s) (large plastic tub with flexible weather stripping and openings for sampling enclosure atmosphere).
- Record-keeping materials
- Latex or nitrile gloves

3.0 PROCEDURES

3.1 Boring Clearance

Prior to installing soil vapor probes, ensure that a utility clearance has been conducted.

3.2 Semi-permanent Direct-Push Vapor Probe Installation

1. Use a rotary hammer drill or concrete-coring equipment to core any paved surfaces.
2. The drive rod is driven to a predetermined depth and then removed, leaving a disposable drop-off tip in the hole. The hole should be sufficiently deep that there is a minimum of 5 feet between the surface and the top of the dry bentonite overlying the sand pack (see below for details). If possible, remove the drive rod and place 3” of sand in the hole before placing the drop-off tip.
3. The inner soil gas pathway from probe tip to the surface should be continuously sealed (e.g., a sampling tube attached to the probe tip with a barbed fitting or a screw adapter with an o-ring) to prevent leakage. If a screw adapter with o-ring is used, inspect the o-ring to ensure that it is not flawed and use rigid tubing that can be tightened from the surface. The volume of the sampling

apparatus should be minimized. DTSC guidance requires that tubing should be no greater than ¼" nominal diameter.

4. Cover the probe tip with at least 3"of sand (resulting in a minimum 6" sand pack), followed by at least 6" of dry granular bentonite. Fill the remainder of the boring with hydrated bentonite. VOA vials are useful for measuring and placing these materials because they have approximately the same inside diameter as the drive rod outer diameter.
5. Equilibration Time: After probe installation, tightly cap the tubing, record probe installation time/date, and wait at least **2 hours** before conducting purge volume tests, leak tests, or soil gas sampling -- if the there is a minimum of 5 feet between the surface and the top of the dry bentonite overlying the sand pack. If there is less than 5 feet between the surface and the top of the dry bentonite overlying the sand pack, wait at least **48 hours** after probe installation and capping before conducting purge volume tests, leak tests, or soil gas sampling. If hand augering was performed to clear the probe location and there is less than 5 feet between the bottom of the auger depth and the top of the dry bentonite overlying the sand pack, wait at least **48 hours** after probe installation and capping before conducting purge volume tests, leak tests, or soil gas sampling.
6. Decontamination: Decontaminate drive rods and other reusable components between sample locations by washing equipment with a non-phosphate detergent and rinsing with tap water and/or by steam-cleaning. Use new flexible tubing for each sample point (do not reuse).

3.3 Semi-permanent Augered Vapor Well Installation

1. Use a rotary hammer drill or concrete-coring equipment to core any paved surfaces.
2. Auger to a depth sufficient to allow a minimum of 5 feet between the surface and the top of the dry bentonite overlying the sand pack (see below for details). It is recommended to use the smallest diameter auger feasible to minimize future purging volumes and optimize representativeness of soil gas data.
3. Install small diameter tubing with a short (<6" long) screened section close to the bottom of the hole. The soil gas pathway from screen to the surface should be continuously sealed (e.g., a sampling tube attached to the probe tip with a barbed fitting or a screw adapter with an o-ring) to prevent leakage. If a screw adapter with o-ring is used, inspect the o-ring to ensure that it is now flawed and use rigid tubing that can be tightened from the surface. The volume of the sampling apparatus should be minimized. DTSC guidance requires that tubing should be no greater than ¼" nominal diameter.
4. For deep wells (>10 feet) install a down-hole rod or other support to ensure that the screened section remains at the proper depth.
5. Cover the screened section with at least 6" of sand, followed by at least 6" of dry granular bentonite. Ensure that the screened section is near the center of the sand pack. Fill the remainder of the boring with hydrated bentonite. The bentonite should be hydrated at the surface and poured into the borehole.
6. Equilibration Time: After probe installation, tightly cap the tubing, record probe installation time/date, and wait at least **48 hours** before conducting purge volume tests, leak tests, or soil gas sampling:
7. Decontamination: Decontaminate drive rods and other reusable components between sample locations by washing equipment with a non-phosphate detergent and rinsing with tap water and/or by steam-cleaning. Use new flexible tubing for each sample point (do not reuse).

3.4 Temporary Vapor Probe Installation Using Post Run Tubing Method

1. This method should only be used for qualitative assessments due to the possibility of vapor leaks along the drive rods. This method should not be used when sampling in coarse granular materials due to potential leakage along the probe.
2. Use a rotary hammer drill or concrete-coring equipment to core any paved surfaces.
3. The drive rod is driven to a predetermined depth (generally 5.5 feet minimum) and then pulled back to expose the inlets of the soil gas probe by exposing a short screened section.
4. The inner soil gas pathway from probe tip to the surface should be continuously sealed (e.g., a sampling tube attached to the probe tip with either a barbed fitting or a screw adapter with an o-ring) to prevent leakage. If a screw adapter with o-ring is used, replace o-rings daily and inspect them for flaws before installing each probe. Use rigid tubing that can be tightened from the surface to ensure that the o-ring is properly sealed. The volume of the sampling apparatus should be minimized. DTSC guidance requires that tubing should be no greater than ¼" nominal diameter.
5. Hydrated bentonite should be used to seal around the drive rod at the ground surface to prevent ambient air intrusion
6. Equilibration Time: After probe installation, tightly cap the tubing, record probe installation time/date, wait at least **2 hours** before conducting purge volume tests, leak tests, or soil gas sampling.

3.5 Vapor Sample Collection

During vapor sampling, record all valve open/close times and canister/manifold vacuum readings at each step. Do not conduct sampling within **5 days following a significant rain event** (0.5 inches of rainfall during any 24-hour period).

<u>Setup</u>

1. **Calculate volume of probe and sampling setup.** Calculate and record the volume of the sampling assembly, tubing, vapor probe, and any permeable air-, sand-, or dry bentonite-filled annular space around the vapor probe tip.

   One Purge Volume = $\prod * r^2 * L$ = 3.14 x (1/2*ID) x (1/2*ID) * L,

   where ID = tubing or manifold inside diameter and L = length of tubing/manifold/borehole segment.

   - 1/8" ID tubing volume = 2.4 ml/ft,
   - 1/4" ID tubing volume = 9.7 ml/ft,
   - 1/4" OD (0.17" ID) tubing volume = 4.5 ml/ft
   - 2-1/8" auger boring volume = 697 ml/ft * 0.4 = 278 ml/ft (sand) minus tubing volume
   - 2-1/8" auger boring volume = 697 ml/ft * 0.5 = 349 ml/ft (dry bentonite) minus tubing volume
   - 3-1/4" auger boring volume = 1631 ml/ft * 0.4 = 652 ml/ft (sand) minus tubing volume
   - 3-1/4" auger boring volume = 1631 ml/ft * 0.5 = 816 ml/ft (dry bentonite) minus tubing volume

Sample Purge Volumes

Item	One Purge Volume (approx)	Three Purge Volumes	Ten Purge Volumes
¼" ID tubing (10 ft)	100 ml	300 ml	1,000 ml
¼" ID tubing (10 ft) with 6" dry bentonite and 6" sand, inside 3-1/4" diameter auger boring	830 ml	2,500 ml	8,300 ml
¼" ID tubing (10 ft) with 1 ft dry bentonite and 1 ft sand, inside 3-1/4" diameter auger boring	1,550 ml	4,650 ml	15,550 ml

2. Wear latex or nitrile gloves while handling sampling equipment. Change gloves whenever a new sample is collected and after handling leak-check compound.
3. Replace the vapor probe cap with a closed Swagelok valve. Connect the sampling manifold to the vapor probe, *sample* Summa canister *and purge* Summa canister using Swagelok fittings and stainless-steel, nylon, or Teflon tubing. Check all fittings for tightness (do not over-tighten).
4. Close all valves. Record pre-test vacuum readings on both canisters.

Manifold Shut-In Leak Check

1. Open both manifold valves and valve on purge Summa canister. Do *not* open valve on sample port. Allow manifold/tubing vacuum to stabilize at approximately 30" Hg.
2. Close purge canister valve and conduct a shut-in test by waiting at least 5 minutes. Monitor manifold vacuum gauge to test for leaks. If the vacuum decreases, rectify the leak before proceeding.

Purge, Sample and Leak Check

1. **Calculate purge volume and duration**. Determine the desired total purge volume and purging duration for the equipment setup. As shown on Figure 1, a critical orifice flow restrictor is intended to limit the maximum purge and sampling flow rate (approximately 120 ml/min). Purge volumes should be determined in one of the following ways:

   a) For vapor sampling in support of risk-assessments for regulatory review, a step-purge test should be conducted at a "worst case" sampling point, using 1, 3 and 10 purge volumes (including tubing, sampling assembly and annular space) to determine the appropriate volume that yields the highest target compound concentration.

   b) For collecting samples from depths of 5 feet or less, or if step purge tests yield no detectable target compounds, use a default purge of approximately 3 purge volumes (including tubing, sampling assembly and annular space).

   c) For semi-permanent wells subject to frequent sampling, purge 1 volume only of the tubing and manifold volume (not including the dry bentonite or sand pack section) after waiting at least 2 weeks following the previous sampling event.

   Example purge time calculation: Assume 1 purge volume of 831 ml (¼" ID tubing (10 ft) with 6" dry bentonite and 6" sand, inside 3-1/4" diameter auger boring). To purge 3 purge volumes of initial 831 ml purge volume, total purge volume is 3 x 831 ml = approx. 2,500 ml. 2,500 ml divided by 120 ml/min = 21 minutes.

2. **Conduct purging.** Open purge-canister valve and vapor probe valve. Do *not* over-purge. Monitor the vacuum on the probe-side and purge canister-side vacuum gauges. If the probe-side vacuum remains below approximately 7" Hg, then sufficient flow is present to collect a representative sample (Cal/EPA 2012) and continue purging for the planned purge duration.
3. If the probe-side vacuum exceeds approximately 7" Hg, then insufficient flow is present to collect a representative sample and this condition should be noted (Cal/EPA 2012). Refer to Cal/EPA 2012 for guidance regarding collecting samples under low flow conditions. A sample may be collected for qualitative screening purposes only. For more representative sampling, conduct additional purging and allow two weeks of re-equilibration before then purging 1 tubing volume and collecting a soil gas sample.
4. Optional flow check. If the probe-side vacuum exceeds approximately 7" Hg, temporarily close the canister valve and record the elapsed time after valve closure for the manifold vacuum to drop to 5" Hg vacuum. This information can be used to estimate the probe vacuum and flow rate. Also, if no significant flow is attained, either the sampling line is plugged or the vapor probe is positioned in an impermeable or saturated layer. If the probe cap is opened for probe inspection, record the inspection procedures and duration. If purging and sampling is resumed after opening the probe cap this information will help determine the representativeness of the sample. This flow check can be performed at the beginning, middle and/or end of the purging process.
5. When purge duration complete and ready to discontinue purging, close purge canister valve.
6. **Leak-check enclosure.** Place absorbent materials (e.g., gauze) moistened with leak-check compound (isopropyl alcohol) in an open container (i.e.uncapped sampling jar) adjacent to the vapor probe. Do not allow liquid to come in direct contact with tubing or sampling assembly.
7. Place leak-check enclosure over vapor probe, floor/ground penetration, Summa canister/manifold assembly, and leak check container, and seal to floor using weatherstripping or duct tape or weight so that perimeter is sealed to ground surface.
8. Measure and record the observed PID reading for the leak-check vapor through a small hole in the leak-check enclosure. If the PID reading is below 2 ppm, reapply leak-check compound. Note that the isopropyl alcohol response factor is approximately 5.6 (i.e. a reading of 2 ppm on a PID calibrated with isobutylene indicates 5.6 x 2 = 11.2 ppm of isopropyl alcohol in the sample).
9. **Sample collection.** Once at least a 2 ppm PID reading has been reached, open sample canister valve. Sampling should take approximately 5 minutes for a 1-liter Summa canister and 30 minutes for a 6-liter canister.
10. Record PID reading for leak-check enclosure approximately every 5 minutes during purging and sampling. Slowly reapply leak-check compound if PID reading drops more than 20% below initial readings.
11. Close sampling canister valve when vacuum decreases to between 3" and 5" mercury. Do *not* allow vacuum to fall below this range.
12. If quantitative leak information is desired, use a 1-liter Summa canister and sampling manifold to collect a sample from the leak-check enclosure during the same period that sampling is conducted. Submit canister for analysis of leak-check compound only.
13. Disassemble sampling assembly, and cap (or remove and restore) vapor sampling point.
14. Fill out chain-of-custody form, including analysis for chemicals of concern and leak-check compound. Also analyze for oxygen. Include final vacuum reading and serial numbers of canister and flow restrictor.

15. For vapor sampling in support of risk-assessments for regulatory review, collect at least one duplicate sample per site per sampling event from the sampling point with the anticipated highest vapor concentrations. The duplicate sample should be collected by attaching a fresh sample canister following collection of the initial sample. If a new manifold is used, follow the same purging and sampling procedures used for the original sample. If the same manifold is used, collect a sample without further purging, using the same sampling procedures used for the original sample.

Decontamination and Decommissioning

16. Use a decontaminated sampling manifold and new tubing for each sample location. Return equipment to laboratory for decontamination.
17. Backfill any open soil vapor probe holes with bentonite slurry.

REFERENCES

Cal/EPA, 2011, Guidance for the evaluation and mitigation of subsurface vapor intrusion to indoor air (vapor intrusion guidance), California Environmental Protection Agency, Department of Toxic Substances Control, October).

Cal/EPA, 2012, Advisory-Active Soil Gas Investigation, California Environmental Protection Agency, Department of Toxic Substances Control, Los Angeles Regional Water Quality Control Board, San Francisco Regional Water Quality Control Board, April.

Dominic DiGiulio, 2003, Standard Operating Procedure (SOP) for installation of sub-slab vapor probes and sampling using EPA Method TO-15 to support vapor intrusion investigations, U.S. Environmental Protection Agency, Office of Research and Development, National Risk Management Research Laboratory, Ground-Water and Ecosystem Restoration Division, Ada, Oklahoma (included as Appendix C of Colorado Department of Public Health and Environment, 2004, Draft Indoor Air Guidance, Hazardous Materials and Waste Division), September

DiGiulio, D.C., and Cynthia J. Pau, C., Cody, R., Willey, R., Clifford, S., Kahn, P., Mosley R., Lee, A., and Christensen, K., 2006, Assessment of vapor intrusion in homes near the Raymark Superfund Site using basement and sub-slab air samples, U.S. Environmental Protection Agency, Office Of Research and Development, National Risk Management Research Laboratory, Cincinnati, OH 45268, March.

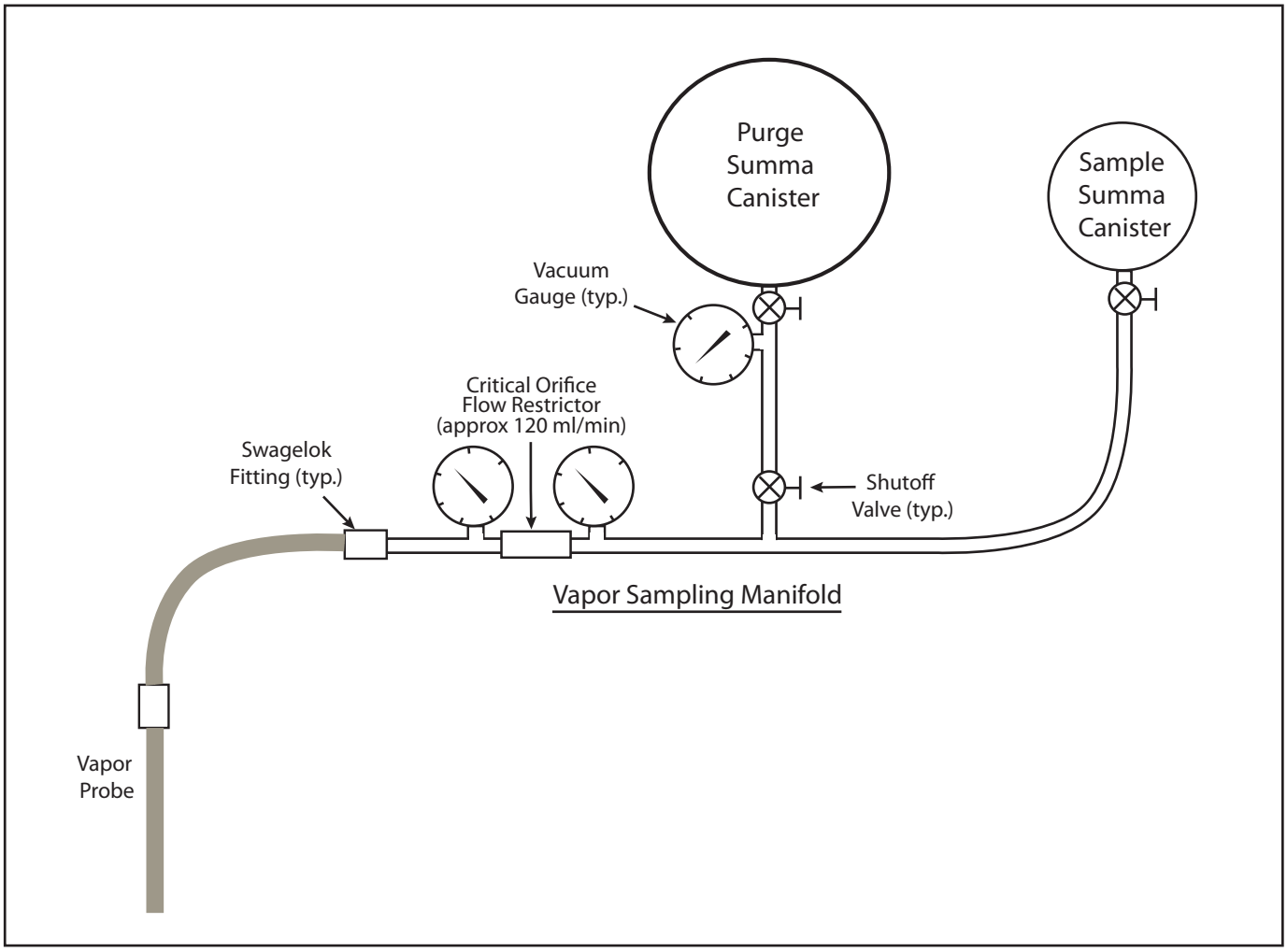


Figure 1. Soil Vapor Sampling Manifold Schematic

STANDARD OPERATING PROCEDURE FOR SUBSLAB VAPOR SAMPLING

1.0 PURPOSE

This standard operating procedure (SOP) describes the procedures for collecting subslab vapor samples using evacuated, stainless-steel Summa canisters for the purpose of assessing risk to building occupants. The SOP is modified from procedures and information presented in Cal/EPA 2011; Cal/EPA 2012; DiGiulio and others, 2006; DiGiulio, 2003; and discussions with laboratory director with K-Prime of Santa Rosa, California (September 2006).

2.0 REQUIRED EQUIPMENT

- Hammer drill with 1" bit and smaller bits (slightly larger than vapor probe tubing)
- Tubing for cleaning boring
- Stainless-steel or Teflon vapor probe tubing with Swagelok threaded compression fitting and vapor-tight cap.
- Rubber stopper or Teflon disk
- Granulated bentonite and cement
- 6-Liter Summa canister (evacuated with approximately 30" Hg vacuum) with vacuum gauge for purging and leak testing
- 1-Liter Summa canister for each sample
- 1-Liter Summa canister for leak-check compound for each sample
- Stainless-steel sampling manifold with vacuum gauges and critical orifice flow restrictor (Figure 1)(request that laboratory leak-check sampling manifold prior to mobilization)
- Leak-check compound (e.g. isopropyl alcohol) and absorbent material (e.g. gauze)
- Photoionization detector (PID)
- Isobutylene for PID calibration
- Tedlar bags for sampling leak-check compound
- Leak-check enclosure (plastic container with flexible weatherstripping and openings for vapor probe tubing and for sampling enclosure atmosphere)
- Record-keeping materials
- Latex or nitrile gloves

3.0 PROCEDURES

3.1 Boring Clearance

Prior to installing subslab vapor probes, ensure that a utility clearance has been conducted to ensure that potential subsurface utility and rebar locations have been identified and marked.

3.2 Vapor Probe Construction

1. To protect interior surfaces, lay plastic sheeting around the probe location.
2. Use a rotary hammer drill to create an approximately 2-inch deep, 1 1/2 -inch diameter hole that *partially* penetrates the slab. Use a piece of flexible tubing to blow or vacuum concrete debris and dust from the hole. Do not blow or vacuum after the slab has been completely penetrated.

3. Drill a smaller diameter *inner hole* in the center of the outer hole, periodically blowing dust and debris from the hole until the slab is penetrated. The diameter of the inner hole should exceed the diameter of the vapor probe tubing by the minimum amount practicable. The inner hole should be drilled completely through the slab and 3 to 4 inches into the subslab material (baserock or soil) to form a cavity (see Figure 1).
4. Insert the capped vapor probe tubing through a tightly fitting rubber stopper or a Teflon disk and insert the stopper or disk into the bottom of the outer hole. The purpose of the stopper is to stop moisture from the annular seal from leaking into subslab materials. The fitting may either be constructed flush, or may protrude above the slab, depending on location and susceptibility to damage. If a lubricant is needed, use only high-vacuum silicone grease.
5. Clean the concrete surfaces in the borehole with a dampened towel to increase the potential of a good seal. Fill the remainder of the hole with hydrated bentonite (temporary probe) or hydrated bentonite topped with expanding cement (semi-permanent probe). Place a tightly fitting rubber stopper over the probe to protect it from damage.

3.3 Vapor Sampling

During vapor sampling, record all valve open/close times and canister/manifold vacuum readings at each step.

Setup

1. Ensure that at least two hours have elapsed since installation of the subslab vapor probe(s) and that at least 5 days have elapsed since significant (1/2-inch or more in 24 hours) precipitation or irrigation of areas adjacent to the building.
2. Calculate and record the volume of the sampling assembly, tubing and vapor probe.

   Volume = $\prod * r^2 * L = 3.14 \times (1/2*ID) \times (1/2*ID) * L$,

   where ID = tubing or manifold inside diameter and L = length of tubing/manifold segment.
3. Wear latex or nitrile gloves while handling sampling equipment. Change gloves whenever a new sample is collected and after handling leak-check compound.
4. Replace the vapor probe cap with a closed Swagelok valve. Connect the sampling manifold to the vapor probe, sample Summa canister and purge Summa canister using Swagelok fittings and stainless-steel, Teflon or Tygon tubing. Check all fittings for tightness (do not overtighten).
5. Close all valves. Record pre-test vacuum readings on both canisters.

Manifold Shut-In Check

1. Open both manifold valves and valve on purge Summa canister. Do *not* open valve on sample port. Allow manifold/tubing vacuum to stabilize at approximately 30” Hg.
2. Close purge canister valve and conduct a shut-in test by waiting at least 5 minutes. Monitor manifold vacuum gauge to test for leaks. If the vacuum decreases, rectify the leak before proceeding.

Purge and Leak Check

1. **Calculate purge volume and duration**. Determine the desired total purge volume and purging duration for the equipment setup. As shown on Figure 1, a critical orifice flow restrictor is intended to limit the maximum purge and sampling flow rate (approximately 120 ml/min). If step testing is not required to better determine optimal purge volume, purge approximately 3 times the volume of the sampling assembly, tubing and vapor probe.
2. **Conduct purging.** Open purge-canister valve and vapor probe valve. Do *not* over-purge. Monitor the vacuum on the probe-side and purge canister-side vacuum gauges. If the probe-side vacuum remains below approximately 7" Hg, then sufficient flow is present to collect a representative sample (Cal/EPA 2012) and continue purging for the planned purge duration.
3. If the probe-side vacuum exceeds approximately 7" Hg, then insufficient flow is present to collect a representative sample and this condition should be noted (Cal/EPA 2012). Refer to Cal/EPA 2012 for guidance regarding collecting samples under low flow conditions. A sample may be collected for qualitative screening purposes only. For more representative sampling, conduct additional purging and allow two weeks of re-equilibration before then purging 1 tubing volume and collecting a soil gas sample.
4. Optional flow check. If the probe-side vacuum exceeds approximately 7" Hg, temporarily close the canister valve and record the elapsed time after valve closure for the manifold vacuum to drop to 5" Hg vacuum. This information can be used to estimate the probe vacuum and flow rate. Also, if no significant flow is attained, either the sampling line is plugged or the vapor probe is positioned in an impermeable or saturated layer. If the probe cap is opened for probe inspection, record the inspection procedures and duration. If purging and sampling is resumed after opening the probe cap this information will help determine the representativeness of the sample. This flow check can be performed at the beginning, middle and/or end of the purging process.
5. When purge duration complete and ready to discontinue purging, close purge canister valve.
6. **Leak-check enclosure.** Place absorbent materials (e.g., gauze) moistened with leak-check compound (isopropyl alcohol) in an open container (i.e.uncapped sampling jar) adjacent to the vapor probe. Do not allow liquid to come in direct contact with tubing or sampling assembly.
7. Place leak-check enclosure over vapor probe, Summa canister/manifold assembly and leak-check Summa canister and seal to floor using weatherstripping or duct tape. Ensure that PID has been calibrated with isobutylene gas. Note that the isopropyl alcohol response factor is approximately 5.6 (i.e. a reading of 2 ppm on the PID indicates 5.6 x 2 = 11.2 ppm of isopropyl alcohol in the sample).
8. Record PID reading for leak-check enclosure at least once every 2 minutes during purging and sampling.

Sample Collection

1. Once a PID reading of at least 2 ppm has been reached, open sample canister valve. **Sampling should take approximately 6 minutes for a 1-liter Summa canister.**
2. Close sampling canister valve when vacuum decreases to between 3" and 5" mercury. Do *not* allow vacuum to fall below this range.
3. If quantitative leak information is desired, use a 1-liter Summa canister and sampling manifold to collect a sample from the leak-check enclosure during the same period that

sampling is conducted. Submit this canister to laboratory 'on hold'. If significant leak check compound detected by laboratory in the sampling canister, request laboratory analysis for leak-check compound only within this leak-check canister.

4. Disassemble sampling assembly, and cap (or remove and restore) vapor sampling point.
5. Fill out chain-of-custody form, including analysis for chemicals of concern and leak-check compound. Also analyze for percent oxygen. Include final vacuum reading and serial numbers of canister and flow restrictor.
6. For vapor sampling in support of risk-assessments for regulatory review, collect at least one duplicate sample per site per sampling event from the sampling point with the anticipated highest vapor concentrations. The duplicate sample should be attached to the manifold prior to equipment vacuum testing so its connections can be tested. Collect a sample without further purging, using the same sampling procedures used for the original sample.

Decontamination and Decommissioning

1. Use a decontaminated sampling manifold and new tubing for each sample location. Return equipment to laboratory for decontamination.
2. Backfill any open soil vapor probe holes with bentonite slurry.
3. To retain the subslab probe for future sampling, cap the Swagelock fitting and cover the probe with a small vault or other protective device.

REFERENCES

Cal/EPA, 2011, Guidance for the evaluation and mitigation of subsurface vapor intrusion to indoor air (vapor intrusion guidance), California Environmental Protection Agency, Department of Toxic Substances Control, October).

Cal/EPA, 2012, Advisory-Active Soil Gas Investigation, California Environmental Protection Agency, Department of Toxic Substances Control, Los Angeles Regional Water Quality Control Board, San Francisco Regional Water Quality Control Board, April.

Cal/EPA, 2004, Interim final guidance for the evaluation and mitigation of subsurface vapor intrusion to indoor air, California Environmental Protection Agency, Department of Toxic Substances Control,December 15 (revised February 7, 2005).

Dominic DiGiulio, 2003, Standard Operating Procedure (SOP) for installation of sub-slab vapor probes and sampling using EPA Method TO-15 to support vapor intrusion investigations, U.S. Environmental Protection Agency, Office of Research and Development, National Risk Management Research Laboratory, Ground-Water and Ecosystem Restoration Division, Ada, Oklahoma (included as Appendix C of Colorado Department of Public Health and Environment, 2004, Draft Indoor Air Guidance, Hazardous Materials and Waste Division), September

DiGiulio, D.C., and Cynthia J. Pau, C., Cody, R., Willey, R., Clifford, S., Kahn, P., Mosley R., Lee, A., and Christensen, K., 2006, Assessment of vapor intrusion in homes near the Raymark Superfund Site using basement and sub-slab air samples, U.S. Environmental Protection Agency, Office Of Research and Development, National Risk Management Research Laboratory, Cincinnati, OH 45268, March.

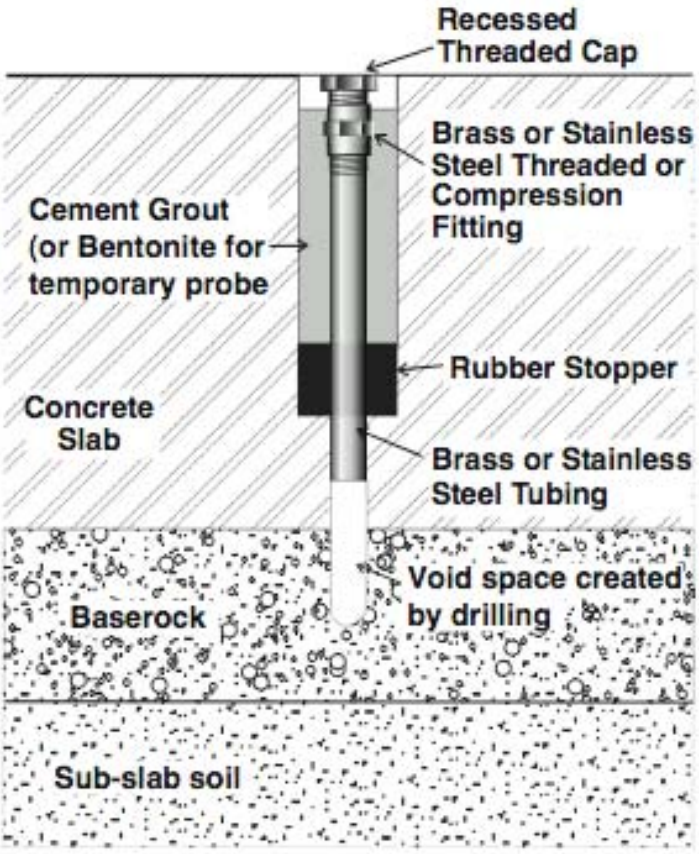


Figure
1

Subslab Vapor Probe Schematic

PANGEA

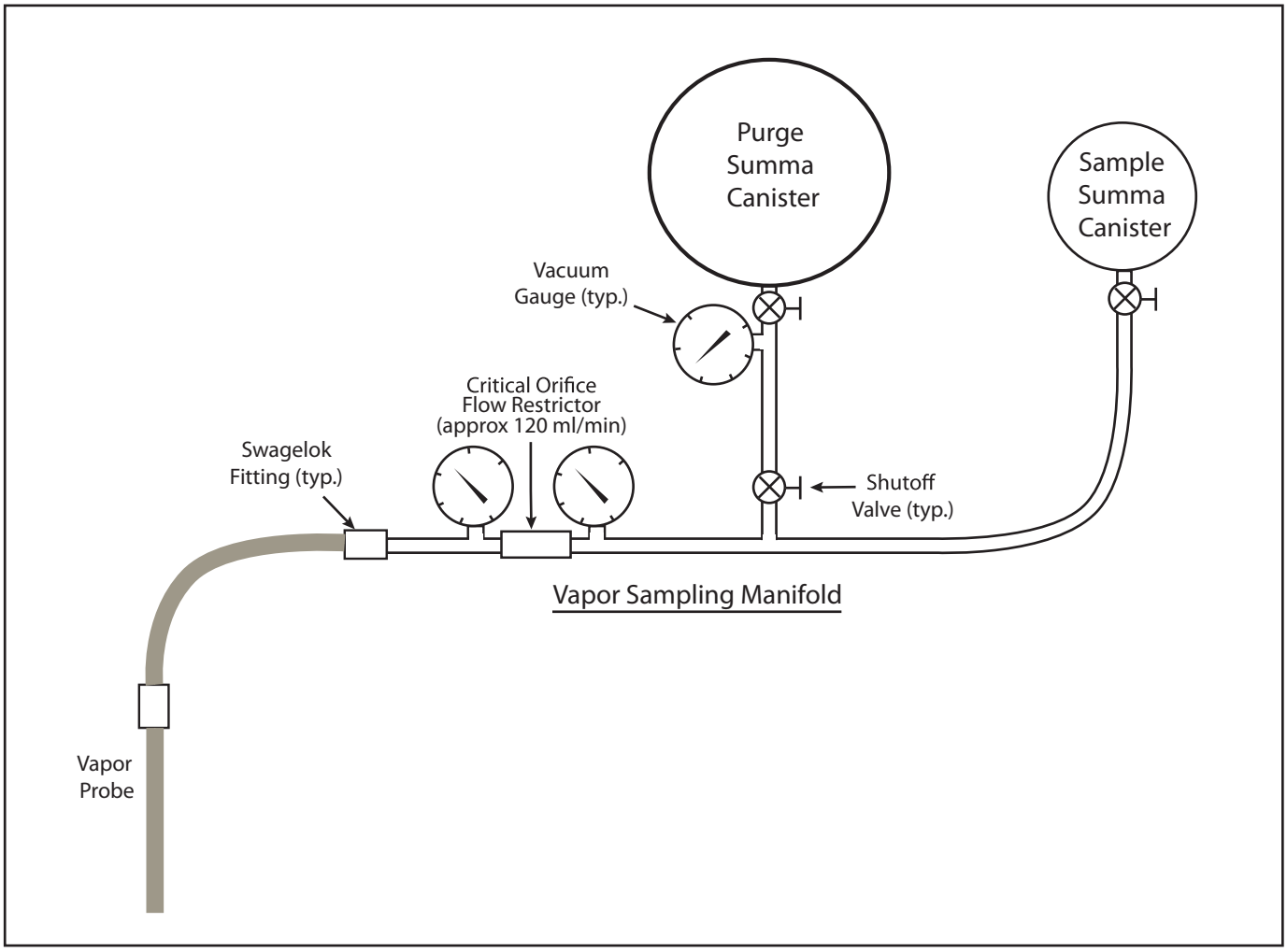


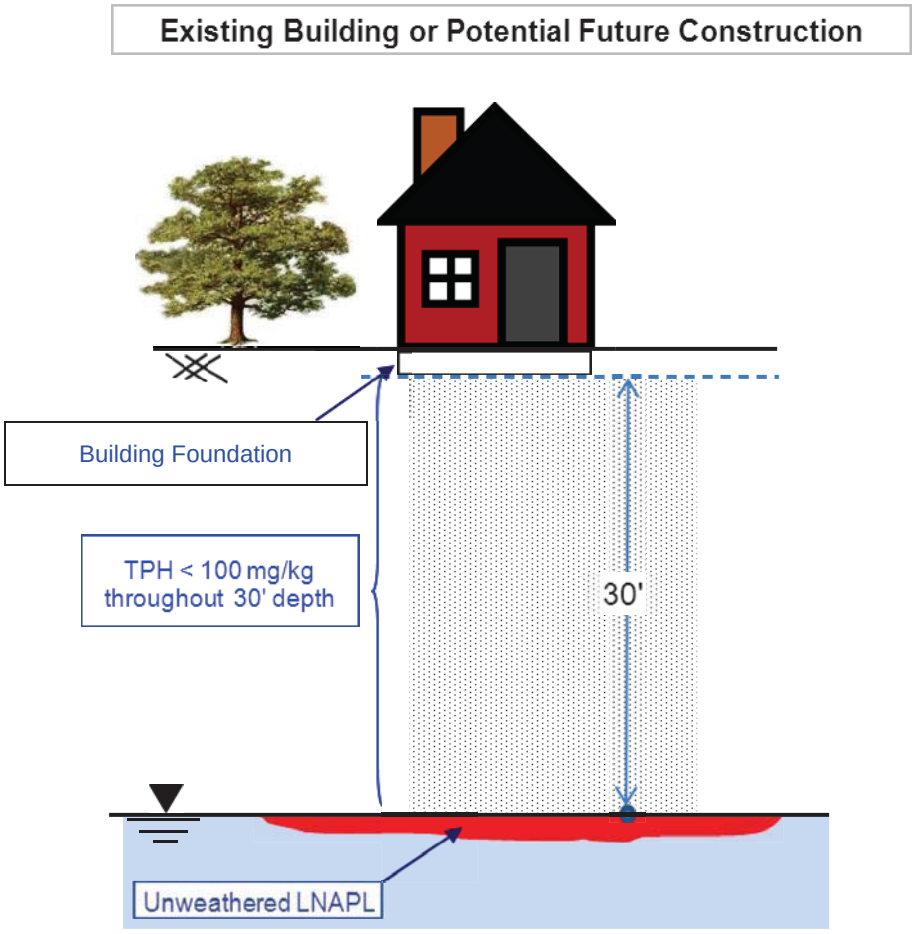
Figure 2. Soil Vapor Sampling Manifold Schematic

APPENDIX B

Vapor Intrusion Scenarios of the Low Threat Closure Policy

Appendix 1
Scenario 1: Unweathered* LNAPL in Groundwater

Required Characteristics of the Bioattenuation Zone



Required Characteristics of the Bioattenuation Zone:

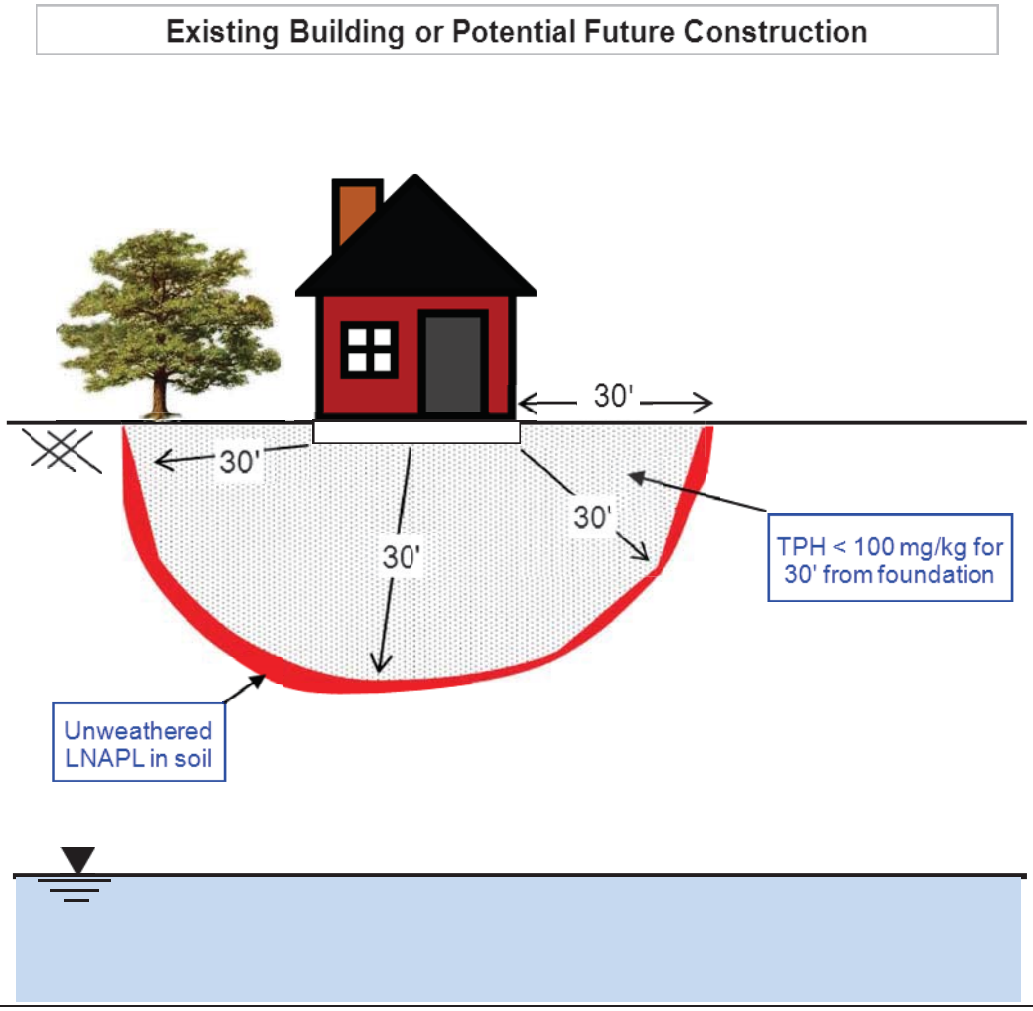
1. The bioattenuation zone shall be a continuous zone that provides a separation of at least 30 feet vertically between the LNAPL in groundwater and the foundation of existing or potential buildings; and
2. Total TPH (TPH-g and TPH-d combined) are less than 100 mg/kg throughout the entire depth of the bioattenuation zone.

TPH = total petroleum hydrocarbons
TPH-g = total petroleum hydrocarbons as gasoline
TPH-d = total petroleum hydrocarbons as diesel

*As used in this context, unweathered LNAPL is generally understood to mean petroleum product that has not been subjected to significant volatilization or solubilization, and therefore has not lost a significant portion of its volatile or soluble constituents (e.g., comparable to recently dispensed fuel).

Appendix 2
Scenario 2: Unweathered* LNAPL in Soil

Required Characteristics of the Bioattenuation Zone



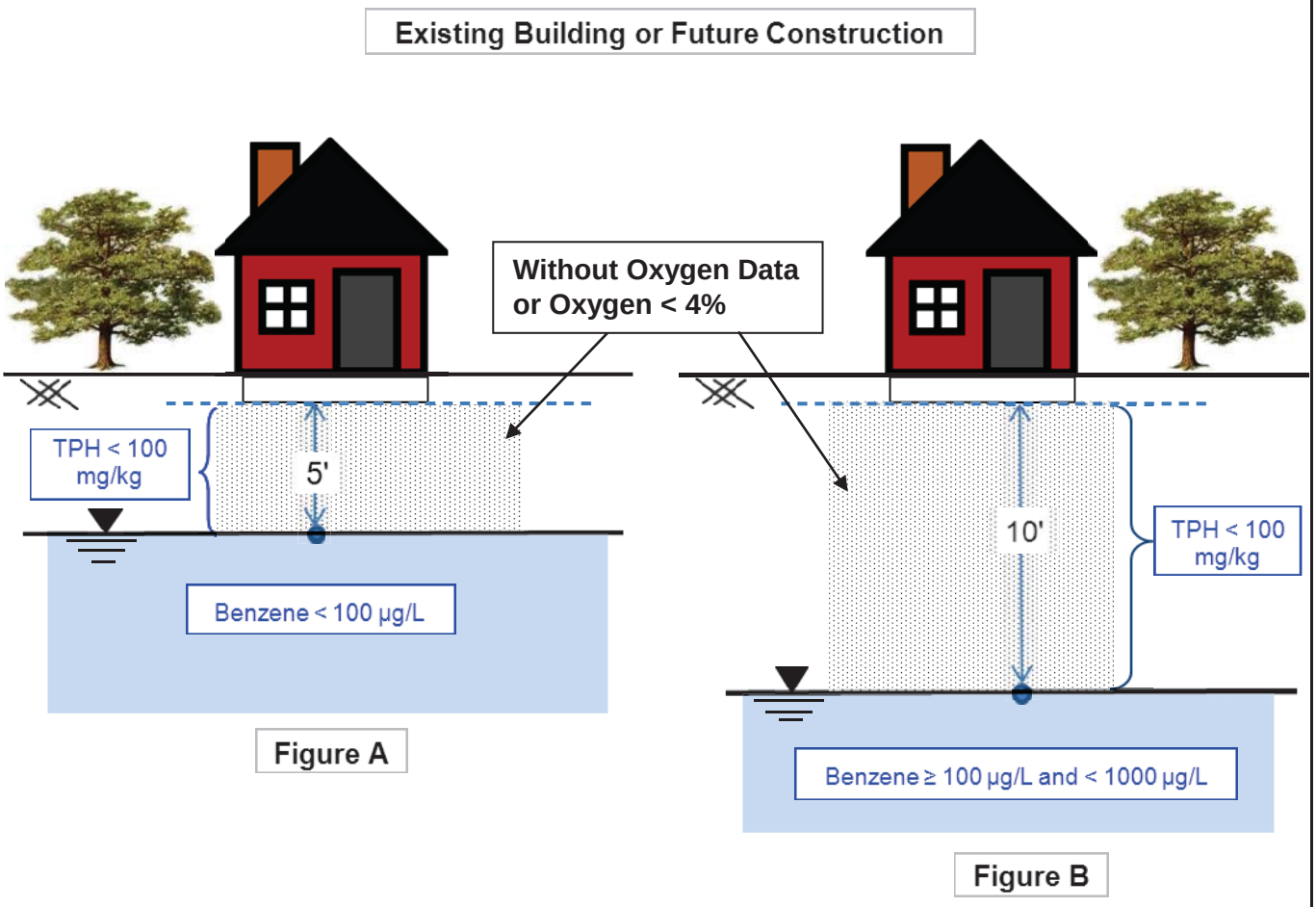
Required Characteristics of the Bioattenuation Zone:

1. The bioattenuation zone shall be a continuous zone that provides a separation of at least 30 feet both laterally and vertically between the LNAPL in soil and the foundation of existing or potential buildings, and
2. Total TPH (TPH-g and TPH-d combined) are less than 100 mg/kg throughout the entire lateral and vertical extent of the bioattenuation zone.

*As used in this context, unweathered LNAPL is generally understood to mean petroleum product that has not been subjected to significant volatilization or solubilization, and therefore has not lost a significant portion of its volatile or soluble constituents (e.g., comparable to recently dispensed fuel).

Appendix 3
Scenario 3 - Dissolved Phase Benzene Concentrations in Groundwater
(Low concentration groundwater scenarios with or without oxygen data)
(1 of 2)

Defining the Bioattenuation Zone Without Oxygen Data or Oxygen < 4%



Required Characteristics of Bioattenuation Zone for Sites Without Oxygen Data or Where Oxygen is < 4%

Figure A: 1) Where benzene concentrations are less than 100 µg/L, the bioattenuation zone:

a) Shall be a continuous zone that provides a separation of at least 5 feet vertically between the dissolved phase Benzene and the foundation of existing or potential buildings; and
b) Contain Total TPH (TPH-g and TPH-d combined) less than 100 mg/kg throughout the entire depth of the bioattenuation zone.

Figure B: 1) Where benzene concentrations are equal to or greater than 100 µg/L but less than 1000 µg/L, the bioattenuation zone:

a) Shall be a continuous zone that provides a separation of at least 10 feet vertically between the dissolved phase Benzene and the foundation of existing or potential buildings; and b) Contain Total TPH (TPH-g and TPH-d combined) less than 100 mg/kg throughout the entire depth of the bioattenuation zone.

Appendix 3
Scenario 3 - Dissolved Phase Benzene Concentrations in Groundwater
(Low concentration groundwater scenarios with or without oxygen data)
(2 of 2)

Defining the Bioattenuation Zone With Oxygen ≥ 4%

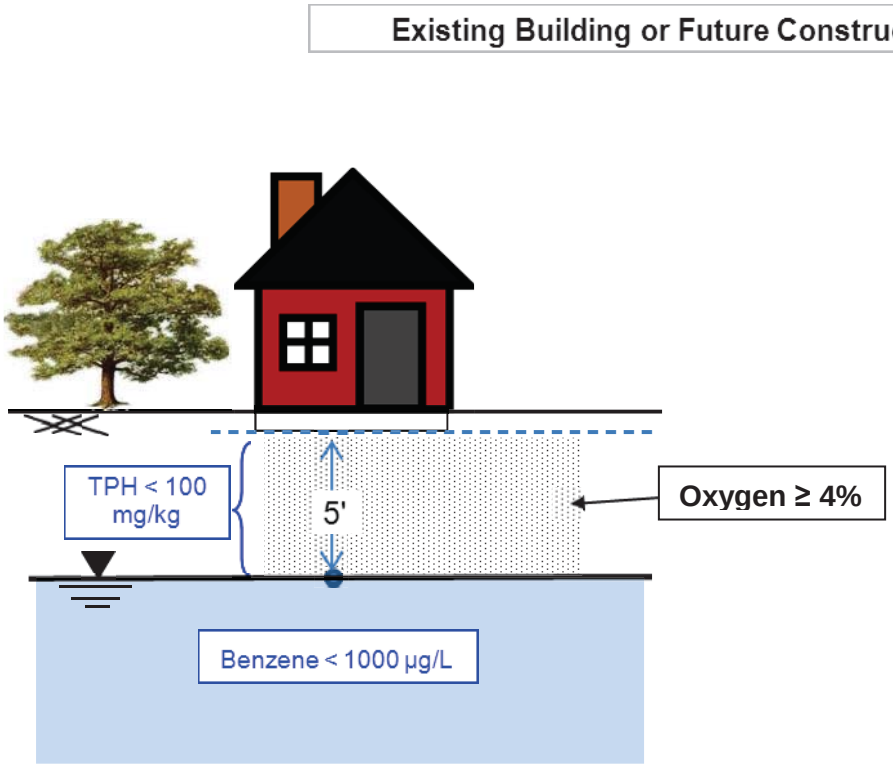


Figure C

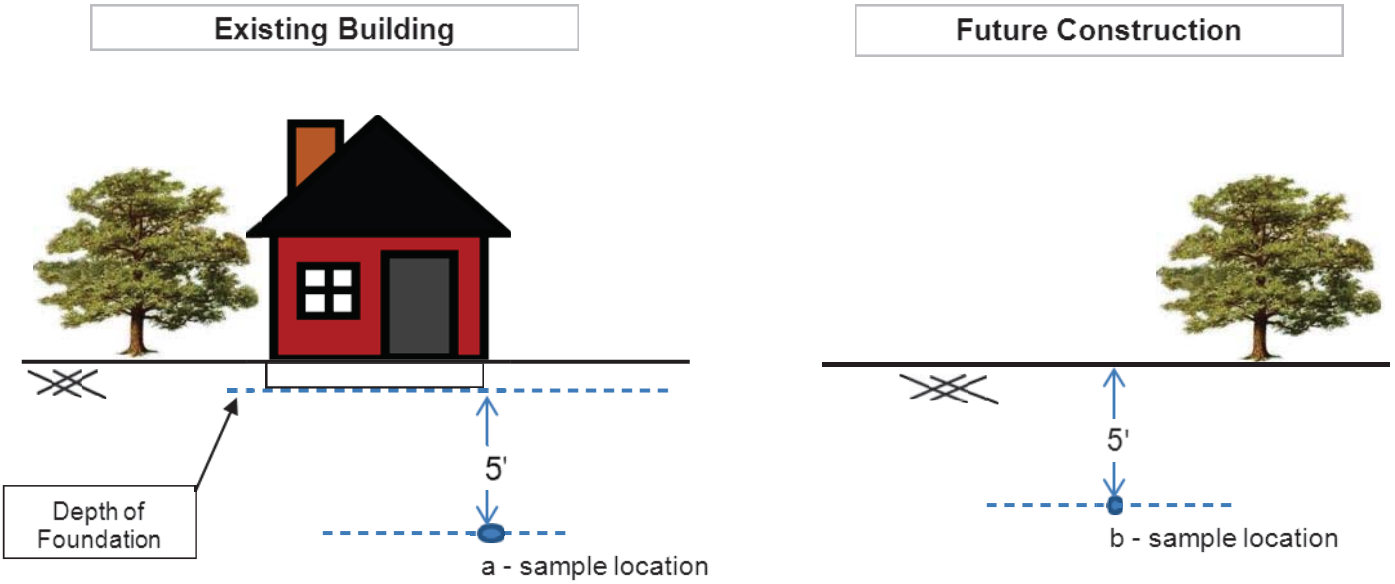
Required Characteristics of Bioattenuation Zone for Sites With Oxygen ≥ 4%

Where benzene concentrations are less than 1000 µg/L, the bioattenuation zone:

1. Shall be a continuous zone that provides a separation of least 5 feet vertically between the dissolved phase Benzene and the foundation of existing or potential buildings; and
2. Contain Total TPH (TPH-g and TPH-d combined) less than 100 mg/kg throughout the entire depth of the bioattenuation zone.

Appendix 4
Scenario 4 - Direct Measurement of Soil Gas Concentrations
(1 of 2)

Soil Gas Sampling – No Bioattenuation Zone



The criteria in the table below apply unless the requirements for a bioattenuation zone, established below, are satisfied.

When applying the criteria below, the soil gas sample must be obtained from the following locations:

a. Beneath or adjacent to an existing building: The soil gas sample shall be collected at least five feet below the bottom of the building foundation.
b. Future construction: The soil gas sample shall be collected from at least five feet below ground surface.

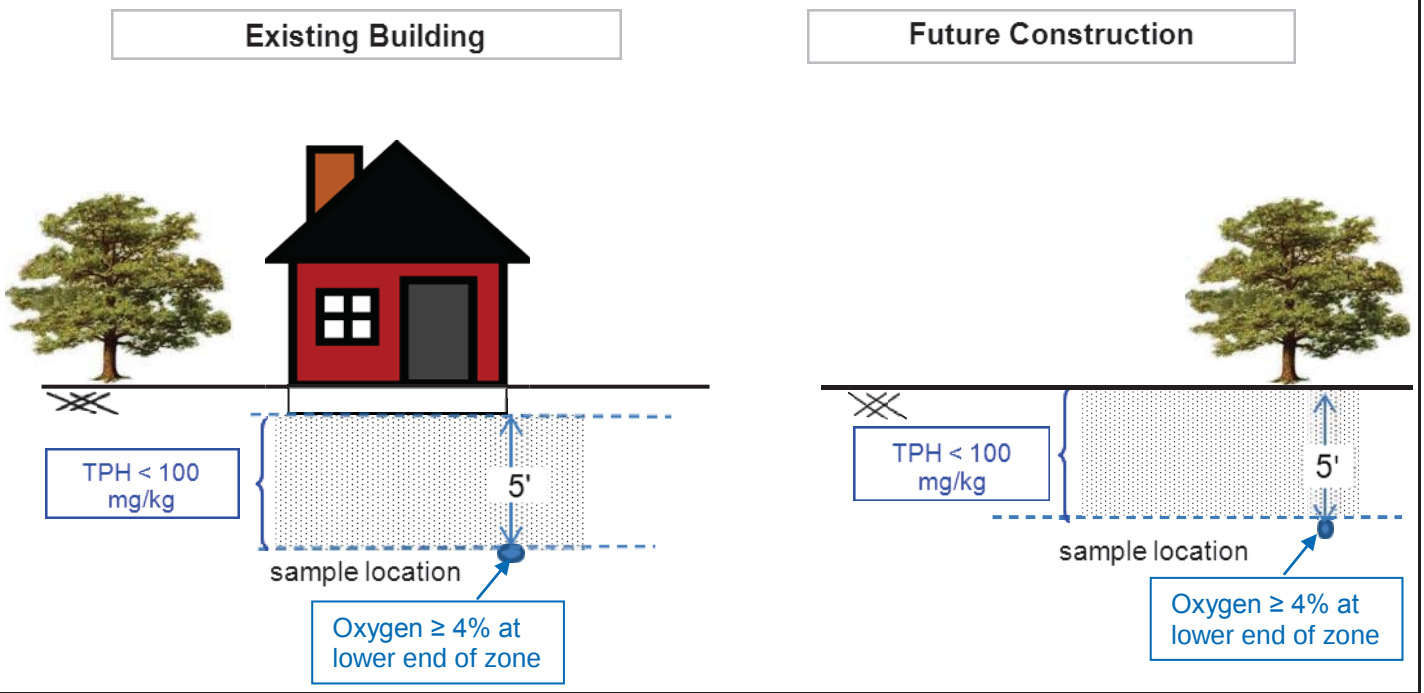
Soil Gas Criteria (µg/m^3)

	No Bioattenuation Zone*	
	Residential	**Commercial**
Constituent	Soil Gas Concentration (µg/m^3)	
Benzene	< 85	< 280
Ethylbenzene	<1,100	<3,600
Naphthalene	< 93	< 310

*For the no bioattenuation zone, the screening criteria are same as the California Human Health Screening Levels (CHHSLs) with engineered fill below sub-slab.

Appendix 4
Scenario 4 - Direct Measurement of Soil Gas Concentrations
(2 of 2)

Soil Gas Sampling – With Bioattenuation Zone



The criteria in the table below apply if the following requirements for a biattenuation zone are satisfied:

1. There is a minimum of five vertical feet of soil between the soil vapor measurement and the foundation of an existing building or ground surface of future construction.
2. TPH (TPHg + TPHd) is less than 100 mg/kg (measured in at least two depths within the five-foot zone.)
3. Oxygen is greater than or equal to four percent measured at the bottom of the five-foot zone.

Soil Gas Criteria (µg/m^3)

	With Bioattenuation Zone**	
	Residential	Commercial
Constituent	Soil Gas Concentration (µg/m^3)	
Benzene	< 85,000	< 280,000
Ethylbenzene	<1,100,000	<3,600,000
Naphthalene	< 93,000	< 310,000

**A 1000-fold bioattenuation of petroleum vapors is assumed for the bioattenuation zone.

APPENDIX C

Laboratory Analytical Reports

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

Analytical Report

Pangea Environmental Svcs., Inc. 1710 Franklin Street, Ste. 200 Oakland, CA 94612	Client Project ID: 5175 Broadway, Rockridge Heights	Date Sampled: 09/12/12
		Date Received: 09/13/12
	Client Contact: Tina De La Fuente	Date Reported: 09/18/12
	Client P.O.:	Date Completed: 09/18/12

WorkOrder: 1209315

September 18, 2012

Dear Tina:

Enclosed within are:

1) The results of the **7** analyzed samples from your project: **5175 Broadway, Rockridge Heights,**
2) QC data for the above samples, and
3) A copy of the chain of custody.

All analyses were completed satisfactorily and all QC samples were found to be within our control limits.

If you have any questions or concerns, please feel free to give me a call. Thank you for choosing McCampbell Analytical Laboratories for your analytical needs.

Best regards,

Angela Rydelius
Laboratory Manager
McCampbell Analytical, Inc.

The analytical results relate only to the items tested.

120 9315

McCAMPBELL ANALYTICAL, INC.

1534 Willow Pass Rd.
Pittsburg, CA 94565
Website: www.mccampbell.com Email: main@mccampbell.com
Telephone: (925) 252-9262 Fax: (925) 252-9269

CHAIN OF CUSTODY RECORD

TURN AROUND TIME ☐ RUSH ☐ 24 HR ☐ 48 HR ☐ 72 HR ☒ 5 DAY
EDF Required? Coelt (Normal) No Write On (DW) No

Report To: Tina de la Fuente Bill To: Pangea
Company: Pangea Environmental Services, Inc.
1710 Franklin Street, Suite 200, Oakland, CA 94612
E-Mail: tdelafuente@pangeaenv.com
Tele: (510) 836-3702 Fax: (510) 836-3709
Project #: 5175 Broadway Project Name: Rockridge Heights
Project Location: 5175 Broadway, Oakland, CA
Sampler Signature:

SAMPLE ID (Field Point Name)	LOCATION	SAMPLING Date	SAMPLING Time	# Containers	Type Containers	MATRIX Water	Soil	Air	Sludge	Other	METHOD PRESERVED ICE	HCL	HNO_3	Other	Analysis Request: BTEX & TPH as Gas (602/8020 + 8015)/MTBE	TPHd (8015) w/silica gel clean up	TPHg, BTEX, Naphthalene by TO-15	Percent Oxygen	Isopropyl Alcohol	Other	Comments
SS-7	SS-7	9/12	1042	1	Su			X									X	X	X		
SS-7 Leak Check	SS-7	9/12	1042	1	Su			X													HOLD
SG-8	SG-8	9/12	1141	1	Su			X									X	X	X		
SG-8 Leak Check	SG-8	9/12	1143	1	Su			X													HOLD
SG-11	SG-11	9/12	1226	1	Su			X									X	X	X		
SG-11 Leak Check	SG-11	9/12	1228	1	Su			X													HOLD
SG-10	SG-10	9/12	1311	1	Su			X									X	X	X		
SG-10 Leak Check	SG-10	9/12	1311	1	Su			X													HOLD
SG-9	SG-9	9/12	1351	1	Su			X									X	X	X		
SG-9 Leak Check	SG-9	9/12	1349	1	Su			X													HOLD
SS-2	SS-2	9/12	1608	1	Su			X									X	X	X		
SS-2 Leak Check	SS-2	9/12	1601	1	Su			X													HOLD
SS-1	SS-1	9/12	1627	1	Su			X									X	X	X		
SS-1 Leak Check	SS-1	9/12	1626	1	Su			X													HOLD

Relinquished By:	Date:	Time:	Received By:
	9/13/12	1500	
Relinquished By:	Date:	Time:	Received By:
	9/13/12	1630	
Relinquished By:	Date:	Time:	Received By:

ICE/t° N/A
GOOD CONDITION ✓
HEAD SPACE ABSENT
DECHLORINATED IN LAB
APPROPRIATE CONTAINERS ✓
PRESERVED IN LAB

COMMENTS: * Samples Labeled "SG-7"

	VOAS	O&G	METALS	OTHER
PRESERVATION			pH<2	

McCampbell Analytical, Inc.
1534 Willow Pass Rd
Pittsburg, CA 94565-1701
(925) 252-9262

CHAIN-OF-CUSTODY RECORD

WorkOrder: 1209315 **ClientCode: PEO**

☐ WaterTrax ☐ WriteOn ☑ EDF ☐ Excel ☐ EQuIS ☑ Email ☐ HardCopy ☐ ThirdParty ☐ J-flag

Report to:
Tina De La Fuente
Pangea Environmental Svcs., Inc.
1710 Franklin Street, Ste. 200
Oakland, CA 94612
(415) 218-7247 FAX: (510) 836-3709

Email: tdelafuente@pangeaenv.com
cc:
PO:
ProjectNo: 5175 Broadway, Rockridge Heights

Bill to:
Bob Clark-Riddell
Pangea Environmental Svcs., Inc.
1710 Franklin Street, Ste. 200
Oakland, CA 94612

Requested TAT: 5 days

Date Received: **09/13/2012**
Date Printed: **09/13/2012**

Lab ID	Client ID	Matrix	Collection Date	Hold	Requested Tests (See legend below)											
					1	2	3	4	5	6	7	8	9	10	11	12
1209315-001	SS-7	Soil Gas	9/12/2012 10:42	☐	A	A	A									
1209315-003	SG-8	Soil Gas	9/12/2012 11:41	☐	A		A									
1209315-005	SG-11	Soil Gas	9/12/2012 12:26	☐	A		A									
1209315-007	SG-10	Soil Gas	9/12/2012 13:11	☐	A		A									
1209315-009	SG-9	Soil Gas	9/12/2012 13:51	☐	A		A									
1209315-011	SS-2	Soil Gas	9/12/2012 16:08	☐	A		A									
1209315-013	SS-1	Soil Gas	9/12/2012 16:27	☐	A		A									

Test Legend:

1	LG_SUMMA_SOILGAS(%)	2	PREDF REPORT	3	TO15+GAS_SOIL(UG/M3)	4		5	
6		7		8		9		10	
11		12							

The following SampIDs: 001A, 003A, 005A, 007A, 009A, 011A, 013A contain testgroup.

Prepared by: Maria Venegas

Comments:

NOTE: Soil samples are discarded 60 days after results are reported unless other arrangements are made (Water samples are 30 days).
Hazardous samples will be returned to client or disposed of at client expense.

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

Sample Receipt Checklist

Client Name: **Pangea Environmental Svcs., Inc.**
Date and Time Received: **9/13/2012 5:13:23 PM**

Project Name: **5175 Broadway, Rockridge Heights**
LogIn Reviewed by: Maria Venegas

WorkOrder N°: **1209315** Matrix: Soil Gas
Carrier: Rob Pringle (MAI Courier)

Chain of Custody (COC) Information

Chain of custody present?	Yes ☑	No ☐
Chain of custody signed when relinquished and received?	Yes ☑	No ☐
Chain of custody agrees with sample labels?	Yes ☑	No ☐
Sample IDs noted by Client on COC?	Yes ☑	No ☐
Date and Time of collection noted by Client on COC?	Yes ☑	No ☐
Sampler's name noted on COC?	Yes ☑	No ☐

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Yes ☐	No ☐	NA ☑
Shipping container/cooler in good condition?	Yes ☑	No ☐	
Samples in proper containers/bottles?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature	Cooler Temp:		NA ☑
Water - VOA vials have zero headspace / no bubbles?	Yes ☐	No ☐	No VOA vials submitted ☑
Sample labels checked for correct preservation?	Yes ☑	No ☐	
Metal - pH acceptable upon receipt (pH<2)?	Yes ☐	No ☐	NA ☑
Samples Received on Ice?	Yes ☐	No ☑	

** NOTE: If the "No" box is checked, see comments below.*

Comments:

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

Pangea Environmental Svcs., Inc.	Client Project ID: 5175 Broadway, Rockridge Heights	Date Sampled: 09/12/12
		Date Received: 09/13/12
1710 Franklin Street, Ste. 200	Client Contact: Tina De La Fuente	Date Extracted: 09/14/12
Oakland, CA 94612	Client P.O.:	Date Analyzed: 09/14/12

Light Gases*

Extraction method: ASTM D 1946-90 Analytical methods: ASTM D 1946-90 Work Order: 1209315

Lab ID	Client ID	Matrix	Initial Pressure	Final Pressure	Oxygen	DF	% SS	Comments
001A	SS-7	Soil Gas	13.26	26.44	19	1	N/A	
003A	SG-8	Soil Gas	12.46	24.82	5.1	1	N/A	
005A	SG-11	Soil Gas	11.88	23.67	17	1	N/A	
007A	SG-10	Soil Gas	12.29	24.48	19	1	N/A	
009A	SG-9	Soil Gas	11.75	23.41	4.5	1	N/A	
011A	SS-2	Soil Gas	12.36	24.62	19	1	N/A	
013A	SS-1	Soil Gas	12.67	25.24	20	1	N/A	

Reporting Limit for DF =1; ND means not detected at or above the reporting limit	W	psia	psia	NA	NA
	SoilGas	psia	psia	0.4	%

* soil vapor samples are reported in %.

%SS = Percent Recovery of Surrogate Standard
DF = Dilution Factor

DHS ELAP Certification 1644

Angela Rydelius, Lab Manager

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

Pangea Environmental Svcs., Inc.	Client Project ID: 5175 Broadway, Rockridge Heights	Date Sampled: 09/12/12
		Date Received: 09/13/12
1710 Franklin Street, Ste. 200	Client Contact: Tina De La Fuente	Date Extracted: 09/14/12-09/17/12
Oakland, CA 94612	Client P.O.:	Date Analyzed: 09/14/12-09/17/12

Leak Check Compound*

Extraction method: TO15 Analytical methods: TO15 Work Order: 1209315

Lab ID	Client ID	Matrix	Initial Pressure	Final Pressure	Isopropyl Alcohol	DF	% SS	Comments
001A	SS-7	Soil Gas	13.26	26.44	ND	1	N/A	
003A	SG-8	Soil Gas	12.46	24.82	ND	1	N/A	
005A	SG-11	Soil Gas	11.88	23.67	ND	1	N/A	
007A	SG-10	Soil Gas	12.29	24.48	54	1	N/A	
009A	SG-9	Soil Gas	11.75	23.41	ND	1	N/A	
011A	SS-2	Soil Gas	12.36	24.62	ND	1	N/A	
013A	SS-1	Soil Gas	12.67	25.24	ND	1	N/A	

Reporting Limit for DF =1; ND means not detected at or above the reporting limit	W	psia	psia	NA	NA
	SoilGas	psia	psia	50	µg/m³

* leak check compound is reported in µg/m³.

ND means not detected above the reporting limit/method detection limit; N/A means analyte not applicable to this analysis.

The (liquid) Leak Check reference is:

DTSC, Advisory-Active Soil Gas Investigations, April 2012, page 17, section 4.2.2.1:

"The laboratory reports should quantify and annotate all detections of the leak check compound at the reporting limit of the target analytes."

%SS = Percent Recovery of Surrogate Standard
DF = Dilution Factor

DHS ELAP Certification 1644

Angela Rydelius, Lab Manager

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

Pangea Environmental Svcs., Inc. 1710 Franklin Street, Ste. 200 Oakland, CA 94612	Client Project ID: 5175 Broadway, Rockridge Heights	Date Sampled: 09/12/12
		Date Received: 09/13/12
	Client Contact: Tina De La Fuente	Date Extracted: 09/14/12-09/17/12
	Client P.O.:	Date Analyzed: 09/14/12-09/17/12

TPH gas + Volatile Organic Compounds in µg/m³*

Extraction Method: TO15 Analytical Method: TO15 Work Order: 1209315

Lab ID	1209315-001A	1209315-003A	1209315-005A	1209315-007A	Reporting Limit for DF =1 and Pressure Ratio (Final/Initial) = 2	
Client ID	SS-7	SG-8	SG-11	SG-10		
Matrix	Soil Gas	Soil Gas	Soil Gas	Soil Gas		
Initial Pressure (psia)	13.26	12.46	11.88	12.29		
Final Pressure (psia)	26.44	24.82	23.67	24.48		
DF	1	1	1	1	Soil Gas	W
Compound	**Concentration**				µg/m³	ug/L
Benzene	ND	18	8.9	9.6	6.5	NA
Ethylbenzene	ND	ND	ND	ND	8.8	NA
Naphthalene	ND	ND	ND	ND	11	NA
Toluene	ND	ND	ND	ND	7.7	NA
TPH(g)	ND	7200	4000	ND	1800	NA
Xylenes, Total	ND	ND	ND	ND	27	NA
Surrogate Recoveries (%)						
%SS1:	93	96	94	91		
%SS2:	113	83	93	85		
%SS3:	112	102	90	87		
Comments						

*vapor samples are reported in µg/m³.

ND means not detected above the reporting limit/method detection limit; N/A means analyte not applicable to this analysis.

surrogate diluted out of range or surrogate coelutes with another peak.

%SS = Percent Recovery of Surrogate Standard
DF = Dilution Factor

DHS ELAP Certification 1644

Angela Rydelius, Lab Manager

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

Pangea Environmental Svcs., Inc. 1710 Franklin Street, Ste. 200 Oakland, CA 94612	Client Project ID: 5175 Broadway, Rockridge Heights	Date Sampled: 09/12/12
		Date Received: 09/13/12
	Client Contact: Tina De La Fuente	Date Extracted: 09/14/12-09/17/12
	Client P.O.:	Date Analyzed: 09/14/12-09/17/12

TPH gas + Volatile Organic Compounds in µg/m³*

Extraction Method: TO15 Analytical Method: TO15 Work Order: 1209315

Lab ID	1209315-009A	1209315-011A	1209315-013A		Reporting Limit for DF =1 and Pressure Ratio (Final/Initial) = 2	
Client ID	SG-9	SS-2	SS-1			
Matrix	Soil Gas	Soil Gas	Soil Gas			
Initial Pressure (psia)	11.75	12.36	12.67			
Final Pressure (psia)	23.41	24.62	25.24			
DF	1	1	1		Soil Gas	W
Compound	**Concentration**				µg/m³	ug/L
Benzene	ND	ND	ND		6.5	NA
Ethylbenzene	ND	ND	ND		8.8	NA
Naphthalene	ND	ND	ND		11	NA
Toluene	ND	ND	ND		7.7	NA
TPH(g)	ND	ND	ND		1800	NA
Xylenes, Total	ND	ND	ND		27	NA
Surrogate Recoveries (%)						
%SS1:	92	93	89			
%SS2:	102	73	120			
%SS3:	85	89	97			
Comments						

*vapor samples are reported in µg/m³.

ND means not detected above the reporting limit/method detection limit; N/A means analyte not applicable to this analysis.

surrogate diluted out of range or surrogate coelutes with another peak.

%SS = Percent Recovery of Surrogate Standard
DF = Dilution Factor

DHS ELAP Certification 1644

Angela Rydelius, Lab Manager

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

QC SUMMARY REPORT FOR ASTM D 1946-90

W.O. Sample Matrix: SoilGas | QC Matrix: SoilGas | BatchID: 70796 | WorkOrder: 1209315

EPA Method: ASTM D 1946-90 **Extraction: ASTM D 1946-90** **Spiked Sample ID: N/A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	Acceptance Criteria (%)		
	µL/L	µL/L	% Rec.	% Rec.	% RPD	% Rec.	MS / MSD	RPD	LCS
Oxygen	N/A	7000	N/A	N/A	N/A	92.9	N/A	N/A	70 - 130

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:
NONE

BATCH 70796 SUMMARY

Lab ID	Date Sampled	Date Extracted	Date Analyzed	Lab ID	Date Sampled	Date Extracted	Date Analyzed
1209315-001A	09/12/12 10:42 AM	09/14/12	09/14/12 1:47 PM	1209315-003A	09/12/12 11:41 AM	09/14/12	09/14/12 1:58 PM
1209315-005A	09/12/12 12:26 PM	09/14/12	09/14/12 2:08 PM	1209315-007A	09/12/12 1:11 PM	09/14/12	09/14/12 2:19 PM
1209315-009A	09/12/12 1:51 PM	09/14/12	09/14/12 2:30 PM	1209315-011A	09/12/12 4:08 PM	09/14/12	09/14/12 2:40 PM
1209315-013A	09/12/12 4:27 PM	09/14/12	09/14/12 2:51 PM				

LCS = Laboratory Control Sample

DHS ELAP Certification 1644

QA/QC Officer

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

QC SUMMARY REPORT FOR TO15

W.O. Sample Matrix: Soilgas | QC Matrix: Soilgas | BatchID: 70768 | WorkOrder: 1209315

EPA Method: TO15 | **Extraction: TO15** | **Spiked Sample ID: N/A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	Acceptance Criteria (%)		
	nL/L	nL/L	% Rec.	% Rec.	% RPD	% Rec.	MS / MSD	RPD	LCS
Acrylonitrile	N/A	25	N/A	N/A	N/A	115	N/A	N/A	60 - 140
tert-Amyl methyl ether (TAME)	N/A	25	N/A	N/A	N/A	133	N/A	N/A	60 - 140
Benzene	N/A	25	N/A	N/A	N/A	116	N/A	N/A	60 - 140
Benzyl chloride	N/A	25	N/A	N/A	N/A	89.2	N/A	N/A	60 - 140
Bromodichloromethane	N/A	25	N/A	N/A	N/A	116	N/A	N/A	60 - 140
Bromoform	N/A	25	N/A	N/A	N/A	88.4	N/A	N/A	60 - 140
t-Butyl alcohol (TBA)	N/A	25	N/A	N/A	N/A	89.4	N/A	N/A	60 - 140
Carbon Disulfide	N/A	25	N/A	N/A	N/A	97.8	N/A	N/A	60 - 140
Carbon Tetrachloride	N/A	25	N/A	N/A	N/A	94.8	N/A	N/A	60 - 140
Chlorobenzene	N/A	25	N/A	N/A	N/A	100	N/A	N/A	60 - 140
Chloroethane	N/A	25	N/A	N/A	N/A	93.9	N/A	N/A	60 - 140
Chloroform	N/A	25	N/A	N/A	N/A	94.4	N/A	N/A	60 - 140
Chloromethane	N/A	25	N/A	N/A	N/A	107	N/A	N/A	60 - 140
Dibromochloromethane	N/A	25	N/A	N/A	N/A	113	N/A	N/A	60 - 140
1,2-Dibromo-3-chloropropane	N/A	25	N/A	N/A	N/A	92.2	N/A	N/A	60 - 140
1,2-Dibromoethane (EDB)	N/A	25	N/A	N/A	N/A	106	N/A	N/A	60 - 140
1,3-Dichlorobenzene	N/A	25	N/A	N/A	N/A	81.1	N/A	N/A	60 - 140
1,4-Dichlorobenzene	N/A	25	N/A	N/A	N/A	78.5	N/A	N/A	60 - 140
Dichlorodifluoromethane	N/A	25	N/A	N/A	N/A	80.3	N/A	N/A	60 - 140
1,1-Dichloroethane	N/A	25	N/A	N/A	N/A	95.7	N/A	N/A	60 - 140
1,2-Dichloroethane (1,2-DCA)	N/A	25	N/A	N/A	N/A	96.3	N/A	N/A	60 - 140
cis-1,2-Dichloroethene	N/A	25	N/A	N/A	N/A	98.8	N/A	N/A	60 - 140
trans-1,2-Dichloroethene	N/A	25	N/A	N/A	N/A	95.9	N/A	N/A	60 - 140
1,2-Dichloropropane	N/A	25	N/A	N/A	N/A	127	N/A	N/A	60 - 140
cis-1,3-Dichloropropene	N/A	25	N/A	N/A	N/A	119	N/A	N/A	60 - 140
trans-1,3-Dichloropropene	N/A	25	N/A	N/A	N/A	120	N/A	N/A	60 - 140
1,2-Dichloro-1,1,2,2-tetrafluoroethane	N/A	25	N/A	N/A	N/A	94.1	N/A	N/A	60 - 140
Diisopropyl ether (DIPE)	N/A	25	N/A	N/A	N/A	128	N/A	N/A	60 - 140
1,4-Dioxane	N/A	25	N/A	N/A	N/A	129	N/A	N/A	60 - 140
Ethyl acetate	N/A	25	N/A	N/A	N/A	132	N/A	N/A	60 - 140
Ethyl tert-butyl ether (ETBE)	N/A	25	N/A	N/A	N/A	134	N/A	N/A	60 - 140

LCS = Laboratory Control Sample

Laboratory extraction solvents such as methylene chloride and acetone may occasionally appear in the method blank at low levels.

DHS ELAP Certification 1644

QA/QC Officer

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

QC SUMMARY REPORT FOR TO15

W.O. Sample Matrix: Soilgas | QC Matrix: Soilgas | BatchID: 70768 | WorkOrder: 1209315

EPA Method: TO15 **Extraction: TO15** **Spiked Sample ID: N/A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	Acceptance Criteria (%)		
	nL/L	nL/L	% Rec.	% Rec.	% RPD	% Rec.	MS / MSD	RPD	LCS
Ethylbenzene	N/A	25	N/A	N/A	N/A	93.6	N/A	N/A	60 - 140
Freon 113	N/A	25	N/A	N/A	N/A	87.5	N/A	N/A	60 - 140
Hexachlorobutadiene	N/A	25	N/A	N/A	N/A	78.6	N/A	N/A	60 - 140
4-Methyl-2-pentanone (MIBK)	N/A	25	N/A	N/A	N/A	106	N/A	N/A	60 - 140
Methyl-t-butyl ether (MTBE)	N/A	25	N/A	N/A	N/A	113	N/A	N/A	60 - 140
Methylene chloride	N/A	25	N/A	N/A	N/A	85.2	N/A	N/A	60 - 140
Naphthalene	N/A	25	N/A	N/A	N/A	81.9	N/A	N/A	60 - 140
Styrene	N/A	25	N/A	N/A	N/A	93.3	N/A	N/A	60 - 140
1,1,1,2-Tetrachloroethane	N/A	25	N/A	N/A	N/A	89	N/A	N/A	60 - 140
1,1,2,2-Tetrachloroethane	N/A	25	N/A	N/A	N/A	93.8	N/A	N/A	60 - 140
Tetrachloroethene	N/A	25	N/A	N/A	N/A	99.5	N/A	N/A	60 - 140
Tetrahydrofuran	N/A	25	N/A	N/A	N/A	131	N/A	N/A	60 - 140
Toluene	N/A	25	N/A	N/A	N/A	116	N/A	N/A	60 - 140
1,2,4-Trichlorobenzene	N/A	25	N/A	N/A	N/A	89.7	N/A	N/A	60 - 140
1,1,1-Trichloroethane	N/A	25	N/A	N/A	N/A	97.5	N/A	N/A	60 - 140
1,1,2-Trichloroethane	N/A	25	N/A	N/A	N/A	115	N/A	N/A	60 - 140
Trichloroethene	N/A	25	N/A	N/A	N/A	107	N/A	N/A	60 - 140
1,2,4-Trimethylbenzene	N/A	25	N/A	N/A	N/A	86	N/A	N/A	60 - 140
1,3,5-Trimethylbenzene	N/A	25	N/A	N/A	N/A	80.4	N/A	N/A	60 - 140
Vinyl Chloride	N/A	25	N/A	N/A	N/A	108	N/A	N/A	60 - 140
%SS1:	N/A	500	N/A	N/A	N/A	95	N/A	N/A	60 - 140
%SS2:	N/A	500	N/A	N/A	N/A	107	N/A	N/A	60 - 140
%SS3:	N/A	500	N/A	N/A	N/A	82	N/A	N/A	60 - 140

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:
NONE

LCS = Laboratory Control Sample

Laboratory extraction solvents such as methylene chloride and acetone may occasionally appear in the method blank at low levels.

DHS ELAP Certification 1644

QA/QC Officer

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

QC SUMMARY REPORT FOR TO15

W.O. Sample Matrix: Soilgas | QC Matrix: Soilgas | BatchID: 70768 | WorkOrder: 1209315

EPA Method: TO15 | **Extraction: TO15** | **Spiked Sample ID: N/A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	Acceptance Criteria (%)		
	nL/L	nL/L	% Rec.	% Rec.	% RPD	% Rec.	MS / MSD	RPD	LCS

BATCH 70768 SUMMARY

Lab ID	Date Sampled	Date Extracted	Date Analyzed	Lab ID	Date Sampled	Date Extracted	Date Analyzed
1209315-001A	09/12/12 10:42 AM	09/14/12	09/14/12 9:37 PM	1209315-003A	09/12/12 11:41 AM	09/14/12	09/14/12 10:18 PM
1209315-005A	09/12/12 12:26 PM	09/14/12	09/14/12 10:59 PM	1209315-007A	09/12/12 1:11 PM	09/14/12	09/14/12 11:39 PM
1209315-009A	09/12/12 1:51 PM	09/15/12	09/15/12 12:20 AM	1209315-011A	09/12/12 4:08 PM	09/15/12	09/15/12 1:01 AM
1209315-013A	09/12/12 4:27 PM	09/17/12	09/17/12 7:23 PM				

LCS = Laboratory Control Sample

Laboratory extraction solvents such as methylene chloride and acetone may occasionally appear in the method blank at low levels.

DHS ELAP Certification 1644

QA/QC Officer

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

Analytical Report

Pangea Environmental Svcs., Inc. 1710 Franklin Street, Ste. 200 Oakland, CA 94612	Client Project ID: 5175 Broadway, Rockridge Heights	Date Sampled: 09/06/12
		Date Received: 09/10/12
	Client Contact: Tina De La Fuente	Date Reported: 09/14/12
	Client P.O.:	Date Completed: 09/14/12

WorkOrder: 1209184

September 14, 2012

Dear Tina:

Enclosed within are:

1) The results of the **4** analyzed samples from your project: **5175 Broadway, Rockridge Heights,**
2) QC data for the above samples, and
3) A copy of the chain of custody.

All analyses were completed satisfactorily and all QC samples were found to be within our control limits.

If you have any questions or concerns, please feel free to give me a call. Thank you for choosing McCampbell Analytical Laboratories for your analytical needs.

Best regards,

Angela Rydelius
Laboratory Manager
McCampbell Analytical, Inc.

The analytical results relate only to the items tested.

1209184

McCAMPBELL ANALYTICAL, INC.

1534 Willow Pass Rd.
Pittsburg, CA 94565
Website: www.mccampbell.com Email: main@mccampbell.com
Telephone: (925) 252-9262 Fax: (925) 252-9269

CHAIN OF CUSTODY RECORD

TURN AROUND TIME ☐ RUSH ☐ 24 HR ☐ 48 HR ☐ 72 HR ☒ 5 DAY

EDF Required? Coelt (Normal) No Write On (DW) No

Report To: Tina de la Fuente Bill To: Pangea
Company: Pangea Environmental Services, Inc.
1710 Franklin Street, Suite 200, Oakland, CA 94612
E-Mail: tdelafuente@pangeaenv.com
Tele: (510) 836-3702 Fax: (510) 836-3709
Project #: 5175 Broadway Project Name: Rockridge Heights
Project Location: 5175 Broadway, Oakland, CA
Sampler Signature:

SAMPLE ID (Field Point Name)	LOCATION	SAMPLING Date	SAMPLING Time	# Containers	Type Containers	MATRIX Water	MATRIX Soil	MATRIX Air	MATRIX Sludge	MATRIX Other	METHOD PRESERVED ICE	METHOD PRESERVED HCL	METHOD PRESERVED HNO_3	METHOD PRESERVED Other	Analysis Request: BTEX & TPH as Gas (602/8020 + 8015)/MTBE	Analysis Request: TPHd (8015) w/silica gel clean up	Analysis Request: TO-15 for TPHg, BTEX, Naphthalene	Analysis Request: Percent Oxygen	Analysis Request: Isopropyl Alcohol	Other	Comments
SS-3	SS-3	9/6	1146	1	Su			X									X	X	X		
SS-3 Leak Check	SS-3	9/6	1147	1	Su			X													HOLD
SS-4	SS-4	9/6	1239	1	Su			X									X	X	X		
SS-4 Leak Check	SS-4	9/6	1238	1	Su			X													HOLD
SS-5 *	SS-5	9/6	1336	1	Su			X									X	X	X		
SS-5 Leak Check	SS-5	9/6	1338	1	Su			X													HOLD
SS-6	SS-6	9/6	1453	1	Su			X									X	X	X		
SS-6 Leak Check *	SS-6	9/6	1454	1	Su			X													HOLD

Relinquished By:	Date:	Time:	Received By:
	9/7/12	1240	
Relinquished By:	Date:	Time:	Received By:
	9/7/12	1400	
Relinquished By:	Date:	Time:	Received By:

ICE/t° _____ COMMENTS:
GOOD CONDITION _____ * Samples received 9/11/12
HEAD SPACE ABSENT _____
DECHLORINATED IN LAB _____
APPROPRIATE CONTAINERS _____
PRESERVED IN LAB _____

PRESERVATION VOAS O&G METALS OTHER pH<2

McCampbell Analytical, Inc.
1534 Willow Pass Rd
Pittsburg, CA 94565-1701
(925) 252-9262

CHAIN-OF-CUSTODY RECORD

WorkOrder: 1209184 **ClientCode: PEO**

☐ WaterTrax ☐ WriteOn ☑ EDF ☐ Excel ☑ EQuIS ☑ Email ☑ HardCopy ☐ ThirdParty ☐ J-flag

Report to:
Tina De La Fuente
Pangea Environmental Svcs., Inc.
1710 Franklin Street, Ste. 200
Oakland, CA 94612
(415) 218-7247 FAX: (510) 836-3709

Email: tdelafuente@pangeaenv.com
cc:
PO:
ProjectNo: 5175 Broadway, Rockridge Heights

Bill to:
Bob Clark-Riddell
Pangea Environmental Svcs., Inc.
1710 Franklin Street, Ste. 200
Oakland, CA 94612

Requested TAT: 5 days

Date Received: **09/10/2012**
Date Printed: **09/12/2012**

Lab ID	Client ID	Matrix	Collection Date	Hold	Requested Tests (See legend below)											
					1	2	3	4	5	6	7	8	9	10	11	12
1209184-001	SS-3	Soil Gas	9/6/2012 11:46	☐	A	A	A									
1209184-003	SS-4	Soil Gas	9/6/2012 12:39	☐	A		A									
1209184-005	SS-5	Soil Gas	9/6/2012 13:36	☐	A		A									
1209184-007	SS-6	Soil Gas	9/6/2012 14:53	☐	A		A									

Test Legend:

1	LG_SUMMA_SOILGAS(%)	2	PREDF REPORT	3	TO15+GAS_SOIL(UG/M3)	4		5	
6		7		8		9		10	
11		12							

The following SampIDs: 001A, 003A, 005A, 007A contain testgroup.

Prepared by: Maria Venegas

Comments:

NOTE: Soil samples are discarded 60 days after results are reported unless other arrangements are made (Water samples are 30 days).
Hazardous samples will be returned to client or disposed of at client expense.

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

Sample Receipt Checklist

Client Name: **Pangea Environmental Svcs., Inc.**
Date and Time Received: **9/10/2012 9:27:52 AM**

Project Name: **5175 Broadway, Rockridge Heights**
LogIn Reviewed by: Maria Venegas

WorkOrder N°: **1209184** Matrix: Soil Gas
Carrier: Rob Pringle (MAI Courier)

Chain of Custody (COC) Information

Chain of custody present?	Yes ☑	No ☐
Chain of custody signed when relinquished and received?	Yes ☑	No ☐
Chain of custody agrees with sample labels?	Yes ☑	No ☐
Sample IDs noted by Client on COC?	Yes ☑	No ☐
Date and Time of collection noted by Client on COC?	Yes ☑	No ☐
Sampler's name noted on COC?	Yes ☑	No ☐

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Yes ☐	No ☐	NA ☑
Shipping container/cooler in good condition?	Yes ☑	No ☐	
Samples in proper containers/bottles?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature	Cooler Temp:		NA ☑
Water - VOA vials have zero headspace / no bubbles?	Yes ☐	No ☐	No VOA vials submitted ☑
Sample labels checked for correct preservation?	Yes ☑	No ☐	
Metal - pH acceptable upon receipt (pH<2)?	Yes ☐	No ☐	NA ☑
Samples Received on Ice?	Yes ☐	No ☑	

** NOTE: If the "No" box is checked, see comments below.*

Comments:

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

Pangea Environmental Svcs., Inc. 1710 Franklin Street, Ste. 200 Oakland, CA 94612	Client Project ID: 5175 Broadway, Rockridge Heights	Date Sampled: 09/06/12
		Date Received: 09/10/12
	Client Contact: Tina De La Fuente	Date Reported: 09/14/12
	Client P.O.:	Date Completed: 09/14/12

Work Order: 1209184

September 14, 2012

CASE NARRATIVE REGARDING TO-15 ANALYSIS

All summa canisters are EVACUATED 5 days after the reporting of the results. Please call or email if a longer retention time is required.

In an effort to attain the lowest reporting limits possible for the majority of the TO-15 target list, high level compounds may be analyzed using EPA Method 8260B.

Polymer (Tedlar) bags are not recommended for TO15 samples. The dissadvantages are listed in Appendix B of the DTSC Advisory of April 2012.

DHS ELAP Certification 1644

Angela Rydelius, Lab Manager

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

Pangea Environmental Svcs., Inc.	Client Project ID: 5175 Broadway, Rockridge Heights	Date Sampled: 09/06/12
		Date Received: 09/10/12
1710 Franklin Street, Ste. 200	Client Contact: Tina De La Fuente	Date Extracted: 09/10/12-09/12/12
Oakland, CA 94612	Client P.O.:	Date Analyzed: 09/10/12-09/12/12

Light Gases*

Extraction method: ASTM D 1946-90 Analytical methods: ASTM D 1946-90 Work Order: 1209184

Lab ID	Client ID	Matrix	Initial Pressure	Final Pressure	Oxygen	DF	% SS	Comments
001A	SS-3	Soil Gas	13.06	26.06	20	1	N/A	
003A	SS-4	Soil Gas	12.68	25.26	19	1	N/A	
005A	SS-5	Soil Gas	12.81	25.52	17	1	N/A	
007A	SS-6	Soil Gas	12.80	25.50	18	1	N/A	

Reporting Limit for DF =1; ND means not detected at or above the reporting limit	W	psia	psia	NA	NA
	SoilGas	psia	psia	0.4	%

* soil vapor samples are reported in %.

%SS = Percent Recovery of Surrogate Standard
DF = Dilution Factor

DHS ELAP Certification 1644

Angela Rydelius, Lab Manager

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

Pangea Environmental Svcs., Inc.	Client Project ID: 5175 Broadway, Rockridge Heights	Date Sampled: 09/06/12
		Date Received: 09/10/12
1710 Franklin Street, Ste. 200	Client Contact: Tina De La Fuente	Date Extracted: 09/12/12-09/14/12
Oakland, CA 94612	Client P.O.:	Date Analyzed: 09/12/12-09/14/12

Leak Check Compound*

Extraction method: TO15 Analytical methods: TO15 Work Order: 1209184

Lab ID	Client ID	Matrix	Initial Pressure	Final Pressure	Isopropyl Alcohol	DF	% SS	Comments
001A	SS-3	Soil Gas	13.06	26.06	ND	1	N/A	
003A	SS-4	Soil Gas	12.68	25.26	ND	1	N/A	
005A	SS-5	Soil Gas	12.81	25.52	ND	1	N/A	
007A	SS-6	Soil Gas	12.80	25.50	ND	1	N/A	

Reporting Limit for DF =1; ND means not detected at or above the reporting limit	W	psia	psia	NA	NA
	SoilGas	psia	psia	50	µg/m³

* leak check compound is reported in µg/m³.

ND means not detected above the reporting limit/method detection limit; N/A means analyte not applicable to this analysis.

The (liquid) Leak Check reference is:

DTSC, Advisory-Active Soil Gas Investigations, April 2012, page 17, section 4.2.2.1:

"The laboratory reports should quantify and annotate all detections of the leak check compound at the reporting limit of the target analytes."

%SS = Percent Recovery of Surrogate Standard
DF = Dilution Factor

DHS ELAP Certification 1644

Angela Rydelius, Lab Manager

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

Pangea Environmental Svcs., Inc. 1710 Franklin Street, Ste. 200 Oakland, CA 94612	Client Project ID: 5175 Broadway, Rockridge Heights	Date Sampled: 09/06/12
		Date Received: 09/10/12
	Client Contact: Tina De La Fuente	Date Extracted: 09/12/12-09/14/12
	Client P.O.:	Date Analyzed: 09/12/12-09/14/12

TPH gas + Volatile Organic Compounds in µg/m³*

Extraction Method: TO15 Analytical Method: TO15 Work Order: 1209184

Lab ID	1209184-001A	1209184-003A	1209184-005A	1209184-007A	Reporting Limit for DF =1 and Pressure Ratio (Final/Initial) = 2	
Client ID	SS-3	SS-4	SS-5	SS-6		
Matrix	Soil Gas	Soil Gas	Soil Gas	Soil Gas		
Initial Pressure (psia)	13.06	12.68	12.81	12.80		
Final Pressure (psia)	26.06	25.26	25.52	25.50		
DF	1	1	1	1	Soil Gas	W
Compound	**Concentration**				µg/m³	ug/L
Benzene	ND	ND	ND	ND	6.5	NA
Ethylbenzene	ND	ND	ND	ND	8.8	NA
Naphthalene	ND	ND	ND	ND	11	NA
Toluene	ND	ND	ND	ND	7.7	NA
TPH(g)	ND	ND	ND	ND	1800	NA
Xylenes, Total	ND	ND	ND	ND	27	NA
Surrogate Recoveries (%)						
%SS1:	107	97	86	96		
%SS2:	139	79	83	118		
%SS3:	117	112	80	121		
Comments	c1					

*vapor samples are reported in µg/m³.

ND means not detected above the reporting limit/method detection limit; N/A means analyte not applicable to this analysis.

surrogate diluted out of range or surrogate coelutes with another peak.

%SS = Percent Recovery of Surrogate Standard
DF = Dilution Factor

c1) surrogate recovery outside of the control limits due to dilution / matrix interference / coelution / presence of surrogate compound in the sample

DHS ELAP Certification 1644

Angela Rydelius, Lab Manager

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

QC SUMMARY REPORT FOR ASTM D 1946-90

W.O. Sample Matrix: SoilGas | QC Matrix: SoilGas | BatchID: 70712 | WorkOrder: 1209184

EPA Method: ASTM D 1946-90 **Extraction: ASTM D 1946-90** **Spiked Sample ID: N/A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	Acceptance Criteria (%)		
	µL/L	µL/L	% Rec.	% Rec.	% RPD	% Rec.	MS / MSD	RPD	LCS
Oxygen	N/A	7000	N/A	N/A	N/A	91.9	N/A	N/A	70 - 130

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:
NONE

BATCH 70712 SUMMARY

Lab ID	Date Sampled	Date Extracted	Date Analyzed	Lab ID	Date Sampled	Date Extracted	Date Analyzed
1209184-001A	09/06/12 11:46 AM	09/10/12	09/10/12 1:48 PM	1209184-003A	09/06/12 12:39 PM	09/10/12	09/10/12 1:58 PM
1209184-005A	09/06/12 1:36 PM	09/12/12	09/12/12 2:00 PM	1209184-007A	09/06/12 2:53 PM	09/10/12	09/10/12 2:09 PM

LCS = Laboratory Control Sample

DHS ELAP Certification 1644

QA/QC Officer

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

QC SUMMARY REPORT FOR TO15

W.O. Sample Matrix: Soilgas | QC Matrix: Soilgas | BatchID: 70684 | WorkOrder: 1209184

EPA Method: TO15 | **Extraction: TO15** | **Spiked Sample ID: N/A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	Acceptance Criteria (%)		
	nL/L	nL/L	% Rec.	% Rec.	% RPD	% Rec.	MS / MSD	RPD	LCS
Acrylonitrile	N/A	25	N/A	N/A	N/A	129	N/A	N/A	60 - 140
tert-Amyl methyl ether (TAME)	N/A	25	N/A	N/A	N/A	91.6	N/A	N/A	60 - 140
Benzene	N/A	25	N/A	N/A	N/A	111	N/A	N/A	60 - 140
Benzyl chloride	N/A	25	N/A	N/A	N/A	103	N/A	N/A	60 - 140
Bromodichloromethane	N/A	25	N/A	N/A	N/A	89.7	N/A	N/A	60 - 140
Bromoform	N/A	25	N/A	N/A	N/A	112	N/A	N/A	60 - 140
t-Butyl alcohol (TBA)	N/A	25	N/A	N/A	N/A	71.1	N/A	N/A	60 - 140
Carbon Disulfide	N/A	25	N/A	N/A	N/A	69.8	N/A	N/A	60 - 140
Carbon Tetrachloride	N/A	25	N/A	N/A	N/A	91.7	N/A	N/A	60 - 140
Chlorobenzene	N/A	25	N/A	N/A	N/A	106	N/A	N/A	60 - 140
Chloroethane	N/A	25	N/A	N/A	N/A	82.4	N/A	N/A	60 - 140
Chloroform	N/A	25	N/A	N/A	N/A	94.9	N/A	N/A	60 - 140
Chloromethane	N/A	25	N/A	N/A	N/A	89.3	N/A	N/A	60 - 140
Dibromochloromethane	N/A	25	N/A	N/A	N/A	111	N/A	N/A	60 - 140
1,2-Dibromo-3-chloropropane	N/A	25	N/A	N/A	N/A	88.2	N/A	N/A	60 - 140
1,2-Dibromoethane (EDB)	N/A	25	N/A	N/A	N/A	110	N/A	N/A	60 - 140
1,3-Dichlorobenzene	N/A	25	N/A	N/A	N/A	103	N/A	N/A	60 - 140
1,4-Dichlorobenzene	N/A	25	N/A	N/A	N/A	100	N/A	N/A	60 - 140
Dichlorodifluoromethane	N/A	25	N/A	N/A	N/A	77.7	N/A	N/A	60 - 140
1,1-Dichloroethane	N/A	25	N/A	N/A	N/A	92.4	N/A	N/A	60 - 140
1,2-Dichloroethane (1,2-DCA)	N/A	25	N/A	N/A	N/A	90.3	N/A	N/A	60 - 140
cis-1,2-Dichloroethene	N/A	25	N/A	N/A	N/A	101	N/A	N/A	60 - 140
trans-1,2-Dichloroethene	N/A	25	N/A	N/A	N/A	96.1	N/A	N/A	60 - 140
1,2-Dichloropropane	N/A	25	N/A	N/A	N/A	107	N/A	N/A	60 - 140
cis-1,3-Dichloropropene	N/A	25	N/A	N/A	N/A	101	N/A	N/A	60 - 140
trans-1,3-Dichloropropene	N/A	25	N/A	N/A	N/A	97.3	N/A	N/A	60 - 140
1,2-Dichloro-1,1,2,2-tetrafluoroethane	N/A	25	N/A	N/A	N/A	92.7	N/A	N/A	60 - 140
Diisopropyl ether (DIPE)	N/A	25	N/A	N/A	N/A	131	N/A	N/A	60 - 140
1,4-Dioxane	N/A	25	N/A	N/A	N/A	133	N/A	N/A	60 - 140
Ethyl acetate	N/A	25	N/A	N/A	N/A	76.6	N/A	N/A	60 - 140
Ethyl tert-butyl ether (ETBE)	N/A	25	N/A	N/A	N/A	124	N/A	N/A	60 - 140

LCS = Laboratory Control Sample

Laboratory extraction solvents such as methylene chloride and acetone may occasionally appear in the method blank at low levels.

DHS ELAP Certification 1644

QA/QC Officer

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

QC SUMMARY REPORT FOR TO15

W.O. Sample Matrix: Soilgas | QC Matrix: Soilgas | BatchID: 70684 | WorkOrder: 1209184

EPA Method: TO15 **Extraction: TO15** **Spiked Sample ID: N/A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	Acceptance Criteria (%)		
	nL/L	nL/L	% Rec.	% Rec.	% RPD	% Rec.	MS / MSD	RPD	LCS
Ethylbenzene	N/A	25	N/A	N/A	N/A	98.4	N/A	N/A	60 - 140
Freon 113	N/A	25	N/A	N/A	N/A	86.1	N/A	N/A	60 - 140
Hexachlorobutadiene	N/A	25	N/A	N/A	N/A	106	N/A	N/A	60 - 140
4-Methyl-2-pentanone (MIBK)	N/A	25	N/A	N/A	N/A	110	N/A	N/A	60 - 140
Methyl-t-butyl ether (MTBE)	N/A	25	N/A	N/A	N/A	108	N/A	N/A	60 - 140
Methylene chloride	N/A	25	N/A	N/A	N/A	77.5	N/A	N/A	60 - 140
Naphthalene	N/A	25	N/A	N/A	N/A	96.1	N/A	N/A	60 - 140
Styrene	N/A	25	N/A	N/A	N/A	109	N/A	N/A	60 - 140
1,1,1,2-Tetrachloroethane	N/A	25	N/A	N/A	N/A	89.1	N/A	N/A	60 - 140
1,1,2,2-Tetrachloroethane	N/A	25	N/A	N/A	N/A	115	N/A	N/A	60 - 140
Tetrachloroethene	N/A	25	N/A	N/A	N/A	93.4	N/A	N/A	60 - 140
Tetrahydrofuran	N/A	25	N/A	N/A	N/A	91.4	N/A	N/A	60 - 140
Toluene	N/A	25	N/A	N/A	N/A	97.6	N/A	N/A	60 - 140
1,2,4-Trichlorobenzene	N/A	25	N/A	N/A	N/A	127	N/A	N/A	60 - 140
1,1,1-Trichloroethane	N/A	25	N/A	N/A	N/A	92.7	N/A	N/A	60 - 140
1,1,2-Trichloroethane	N/A	25	N/A	N/A	N/A	107	N/A	N/A	60 - 140
Trichloroethene	N/A	25	N/A	N/A	N/A	104	N/A	N/A	60 - 140
1,2,4-Trimethylbenzene	N/A	25	N/A	N/A	N/A	99.9	N/A	N/A	60 - 140
1,3,5-Trimethylbenzene	N/A	25	N/A	N/A	N/A	91.4	N/A	N/A	60 - 140
Vinyl Chloride	N/A	25	N/A	N/A	N/A	91	N/A	N/A	60 - 140
%SS1:	N/A	500	N/A	N/A	N/A	103	N/A	N/A	60 - 140
%SS2:	N/A	500	N/A	N/A	N/A	86	N/A	N/A	60 - 140
%SS3:	N/A	500	N/A	N/A	N/A	103	N/A	N/A	60 - 140

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:
NONE

LCS = Laboratory Control Sample

Laboratory extraction solvents such as methylene chloride and acetone may occasionally appear in the method blank at low levels.

DHS ELAP Certification 1644

QA/QC Officer

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

QC SUMMARY REPORT FOR TO15

W.O. Sample Matrix: Soilgas | QC Matrix: Soilgas | BatchID: 70684 | WorkOrder: 1209184

EPA Method: TO15 | **Extraction: TO15** | **Spiked Sample ID: N/A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	Acceptance Criteria (%)		
	nL/L	nL/L	% Rec.	% Rec.	% RPD	% Rec.	MS / MSD	RPD	LCS

BATCH 70684 SUMMARY

Lab ID	Date Sampled	Date Extracted	Date Analyzed	Lab ID	Date Sampled	Date Extracted	Date Analyzed
1209184-001A	09/06/12 11:46 AM	09/12/12	09/12/12 5:18 AM	1209184-001A	09/06/12 11:46 AM	09/12/12	09/12/12 5:18 AM
1209184-003A	09/06/12 12:39 PM	09/12/12	09/12/12 6:00 AM	1209184-003A	09/06/12 12:39 PM	09/12/12	09/12/12 6:00 AM
1209184-005A	09/06/12 1:36 PM	09/14/12	09/14/12 1:09 PM	1209184-005A	09/06/12 1:36 PM	09/14/12	09/14/12 1:09 PM
1209184-007A	09/06/12 2:53 PM	09/12/12	09/12/12 6:41 AM	1209184-007A	09/06/12 2:53 PM	09/12/12	09/12/12 6:41 AM

LCS = Laboratory Control Sample

Laboratory extraction solvents such as methylene chloride and acetone may occasionally appear in the method blank at low levels.

DHS ELAP Certification 1644

QA/QC Officer