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May 15, 2012

Alameda County Health Care Services Agency
Environmental Health Services
Environmental Protection
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502-6577

Re: **Chevron Facility No. 351645 (Former Unocal Service Station No. 1156)**
4276 MacArthur Boulevard, Oakland, California

ACEH Fuel Leak Case No. RO0000409
RWQCB Case No. 01-2474
GeoTracker Global ID T0600102279

I have reviewed the attached report dated May 9, 2012.

I agree with the conclusions and recommendations presented in the referenced report. The information in this report is accurate to the best of my knowledge and all local Agency/Regional Board guidelines have been followed. This report was prepared by AECOM, upon whose assistance and advice I have relied.

This letter is submitted pursuant to the requirements of California Water Code Section 13257(b)(1) and the regulating implementation entitled Appendix A pertaining thereto.

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

Sincerely,

Roya Kambin
Project Manager

Attachment: *Work Plan for Vapor Intrusion Investigation and Risk Assessment*

AECOM Environment

Prepared for:
Chevron, Inc.
San Ramon, California

Prepared by:
AECOM
Camarillo, California
May 9, 2012

Work Plan for Vapor Intrusion Investigation and Risk Assessment

Former Unocal Station No. 1156
(Chevron Facility 351645)
4276 MacArthur Boulevard
Oakland, California

ACEH Case No. RO409
RWQCB Case No. 01-2474

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Work Plan for Vapor Intrusion Investigation and Risk Assessment

Former Unocal Station No. 1156
(Chevron Facility 351645)
4276 MacArthur Boulevard
Oakland, California

ACEH Case No. RO409
RWQCB Case No. 01-2474

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1.0 Introduction

On behalf of Chevron Environmental Management Company, for itself and as Attorney-in-Fact for Union Oil Company of California (hereinafter "EMC"), AECOM is pleased to submit this Work Plan for Vapor Intrusion Investigation and Risk Assessment. AECOM has prepared this work plan in association with Alameda County Environmental Health (ACEH) Case No. RO409, for Unocal Service Station No. 1156 (Chevron Site 351645), located at 4276 MacArthur Boulevard, Oakland, California (see Figure 1, Site Location Map).

1.1 Background

Elevated concentrations of petroleum hydrocarbons were previously detected in soil vapor at the station site (Delta, 2009). AECOM has prepared this work plan to assess the potential for vapor intrusion to indoor air at the Oakland Veterinary Hospital (4258 MacArthur Boulevard), located adjacent to the northwest of the station site (see Figure 1 and Figure 2, Site Plan). This work plan was prepared in accordance with the *Soil Vapor and Indoor Air Sampling Technical Toolkit*, Version 1.7 (Chevron Energy Technology Company [CETC], 2009) and guidance provided in the California Department of Toxic Substances Control (DTSC) *Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air* (DTSC, 2011a).

A work plan for additional site assessment activities, including investigation of the unknown vault located on the northwest side of the station building, will be submitted under separate cover.

1.2 Site Location and Description

The site is located in a highly urbanized area of Oakland at the base of the San Leandro Hills. The station site is located at the north corner of the intersection between MacArthur Boulevard and High Street in Oakland, and the Oakland Veterinary Hospital abuts the station site to the northwest. AECOM conducted an area reconnaissance and visited the Oakland Veterinary Hospital facility on March 15, 2012. A specific inspection of the station site was not conducted.

The site area consists of mixed commercial and residential development. A drug store is located beyond the veterinary facility to the northwest. Single-family dwellings border the station site to the northeast. An apartment building and commercial businesses (cleaners, tax service, pizza place, and sandwich shop) are present across High Street to the southeast. [Based on a review of the State Water Resources Control Board GeoTracker database, Chevron gasoline service station #93676 (4300 MacArthur Boulevard) was formerly located at this corner; case closed in 1999.] A vacant lot is located south of the station site at the south corner of the MacArthur Boulevard and High Street intersection. [The GeoTracker database indicates that an open leaking underground storage tank (LUST) case is located in the vicinity of this site – the former Roberts Tires facility, 4311-4333 MacArthur Boulevard.] A vacant lot is also located across MacArthur Boulevard to the southwest of the station site. [The GeoTracker database indicates Shell gasoline service station #13-5701 (4255 MacArthur Boulevard) was formerly located at this corner; case open.]

Based on site survey data (Morrow Surveying, 2008 and 2010), surface elevations at the site range from 179.42 feet above mean sea level (amsl) at MW-4B to 173.99 feet amsl at MW-2B. Observations during the area reconnaissance on March 15, 2012, further revealed that the elevation at the northeast site boundary is noticeably higher than at MW-4B. Additionally, the elevation at MW-5 is 169.67 feet amsl. MW-5 is located in the street in front of the Oakland Veterinary Hospital (adjacent to the northwest of the station site). To summarize, the southwest portion of the station site is at least 8 feet lower in elevation than the northeast portion; and the west corner is approximately 4 feet lower in elevation than the south corner.

1.3 History

A review of historical aerial photographs, city directories, and Sanborn fire insurance maps indicate that the site has been in use as a gasoline service station since at least 1950. The 1950 Sanborn map indicates that MacArthur Boulevard was formerly known as Hopkins. Earlier Sanborn maps indicate that a dwelling was present at the northwest corner of the site.

Historical information provided in previously prepared reports (Miller Brooks Environmental [MBE], 2005; ATC, 2005; Delta, 2007, 2008a, 2009, 2010) indicates investigative activities have been conducted at the site from 1997 through 2010. The investigations have included the drilling of numerous soil borings, installation of 12 groundwater monitoring wells [four of which (MW-1 through MW-4) have been abandoned], and several soil vapor assessments.

The most recent investigative activities were conducted by Delta Consultants in 2010 and included soil vapor point sampling, soil vapor well installation and sampling, monitoring well abandonment and reinstallation, soil and groundwater borings, and assessment of a previously unidentified underground vault/utility. The investigations were conducted to determine if a pathway existed between the former gasoline UST pit and MW-1, to adjust the effective screen interval of four on-site monitoring wells, and to assess the soil vapor intrusion risk to the Oakland Veterinary Hospital, located adjacent to the northwest of the station.

A total of eight sonic borings (SB-12 through SB-19) were sited along the northwest, northeast, and southeast portions of the station building; six soil vapor wells were installed along the northwest portion of the station; and the four on-site monitoring wells (MW-1 through MW-4) were abandoned and reinstalled with different screen intervals (MW-1B through MW-4B).

Groundwater samples were collected from SB-15, SB-16, SB-17, SB-18, and SB-19. SB-18, located between the unknown vault location and the former waste oil UST on the northwest side of the station building had the highest concentrations of petroleum hydrocarbons. SB-15, located near the current waste oil AST, on the northeast side of the station building, had the lowest concentrations.

Of the six vapor wells installed, extractable soil vapor samples were collected from only five – SVW-1, SVW-2, SVW-3, SVW-5, and SVW-6. [A soil vapor sample was not collected from SVW-4 due to water in the well.] The soil vapor wells that were sampled contained very high concentrations of petroleum hydrocarbons as gasoline (TPHg) up to 420,000,000 µg/m^3 at SVW-6, benzene up to 1,100,000 µg/m^3 at SVW-3, toluene up to 19,000 µg/m^3 at SVW-2, ethylbenzene up to 610,000 µg/m^3 at SVW-3, and total xylenes up to 820,000 µg/m^3 at SVW-3. MTBE was not detected in the soil vapor analyses, though reporting limits were higher than Environmental Screening Level (ESL) values in many cases.

1.4 Geology/Hydrogeology

AECOM reviewed boring logs prepared by other consultants during previously completed subsurface investigations (Delta, 2007; Delta, 2008a; Delta, 2009; Delta, 2010). The boring logs indicate that soil types encountered beneath the site consist of unconsolidated deposits of sand and silt in a clay matrix, with some intermixed fine-to-medium-grained gravel. Clay is predominant in the upper lithology with sandy/silty clay and clayey sand units, between approximately 1 to 15 feet below grade surface (bgs). The clay unit is underlain by clay interbedded with sandy clay, clayey sand, silty sands, and some gravelly sandy clay units, observed to the maximum depth explored (50.5 feet bgs).

Based on a review of boring logs and groundwater monitoring data tables prepared by previous consultants (Delta, 2007b, 2008a, 2009, 2010; CRA, 2011), discontinuous confined and/or unconfined water bearing zones may exist within the stratified clay matrices. Soil boring logs depict groundwater being encountered first between 4 (SB-1) and 42 (SB-11) feet bgs. During monitoring well installations in 1999, groundwater was typically encountered at a depth of approximately 23.5 feet bgs (MW-1, MW-2, MW-3, MW-4). During well installations in 2001, groundwater was encountered at 6 and 5.5 feet bgs in MW-5 and MW-6, respectively. Groundwater was encountered at 15 feet bgs in MW-7 during installation in 2001.

During the most recent groundwater monitoring event, conducted on January 23, 2012 (first quarter), the static groundwater elevation ranged from 165.19 feet (MW-7) to 172.49 feet (MW-4B) amsl. The depth to water measurements during the first quarter 2012 ranged from 6.96 feet below ground surface (bgs) (MW-1B/MW-2B) to 1.98 feet bgs (MW-5). To note, the southwest portion of the station site is at least 8 feet lower in elevation than the northeast portion; and the west corner is approximately 4 feet lower in elevation than the south corner. The groundwater flow direction and gradient was interpreted to be to the southwest at 0.06 foot per foot (ft/ft). The predominant historical groundwater flow at the 76 service station has been to the west (with variations to the southwest) at an average gradient of approximately 0.05 ft/ft.

Varying groundwater-encounter depths are indicative of multiple water-bearing zones due to semi-impermeable, discontinuous clay layers identified in the soil boring logs. In addition, shallow static groundwater levels indicate a confined groundwater aquifer below 20 feet bgs under hydrostatic pressure. Previous well installations (MW-1 through MW-4) were screened across multiple confining layers, thus providing a conduit for deeper groundwater to saturate upper layers.

2.0 Proposed Scope of Work

AECOM proposes to conduct a soil vapor and indoor/outdoor air investigation at the Oakland Veterinary Hospital. The investigation will consist of installing and sampling one sub-slab vapor probe (SS-1), collecting one crawl space air sample (CS-1), collecting two indoor air samples (IA-1 and IA-2), and collecting one ambient outdoor air sample (OA-1). The locations of the proposed sample locations are shown on Figure 2. No sub-slab vapor or indoor air samples will be collected at the station site as it is an active gasoline fueling facility.

AECOM will commence work upon receipt of regulatory acceptance of this work plan, and contingent upon successful completion of an access agreement with the Oakland Veterinary Hospital, the availability of subcontractors, and securing appropriate permits. A report will be submitted upon completion of the investigation.

2.1 Pre-Field Activities

Prior to installing and sampling the sub-slab vapor probe, AECOM will perform an inspection of the veterinary facility to determine the approximate locations of sewers, floor drains, joints in the floor slab, and utility lines beneath the concrete slab. This inspection will also help to identify potential sources of cross-contamination, to mitigate health and safety risks, and to screen the facility for any indoor sources of volatile organic compounds (VOCs). AECOM will review any utility and as-built drawings made available by the property owner and/or occupant. AECOM will mark and identify the proposed probe locations and request an underground utility line clearance at least 48 hours in advance of any subsurface activities. In addition, AECOM will contract with a private utility line locating service to establish that there are no obstructions near the proposed probe area.

Common household products can contain VOCs and could cause false positives in the indoor air samples (Chevron Energy Technology Company, 2009). Therefore, AECOM will request the property owner and building occupants to ask that smoking, cleaning, painting, solvent use, cosmetic application, or hydrocarbon storage be eliminated inside the building for at least 24 hours preceding the sampling event. AECOM will inventory, and review with the current occupant, any identified potential indoor air sources of VOCs. VOC screening will be performed before the start of vapor probe installation, and during sample collection, using a photo-ionization detector (PID) calibrated to a factory-supplied isobutylene gas standard and appropriate detection limit.

2.2 Field Activities

Field activities will be performed under the supervision of a State of California Professional Engineer. At the commencement of field activities, AECOM will perform the following tasks:

- Conduct a tailgate safety meeting at the site.
- Review the contents of the Health and Safety Plan (HASP) and Job Loss Analysis (JLA) with all AECOM and subcontracted workers and review the requirements mandated by the Chevron Operational Excellence and Safety Program.
- Set up and demarcate an Exclusion Zone around the work area for each sample location to preclude access by anyone whose entry is unauthorized.
- AECOM will keep written documentation of field conditions during sampling and drilling. This will include, but not be limited to, weather conditions (e.g., temperature, wind direction, degree of cloud

cover, etc.); and surface soil conditions (e.g., presence of standing water, wet soil in the crawl space). AECOM will maintain detailed field records of all activities, conditions, and sampling processes, including names of field personnel, dates and times, etc.

AECOM field activities will be conducted in accordance with the DTSC's vapor intrusion guidance (DTSC, 2011a). Leak detection procedures during sub-slab vapor well sampling will be conducted following the New York State Department of Health (NYSDOH) guidance document (NYSDOH, 2005), in conjunction with Chevron's *Soil Vapor and Indoor Air Sampling Technical Toolkit*, Version 1.7 (CETC, 2009).

To produce comparable results, sampling of the sub-slab vapor, crawl space air, indoor air, and outdoor air samples will be completed contemporaneously.

2.2.1 Sub-Slab Vapor Probe Installation

The sub-slab vapor probe is intended for semi-permanent to permanent use, but can be abandoned by sealing the installed point with cement. A shallow 1-inch deep, 7/8-inch-diameter outer hole is drilled into the concrete slab. A smaller, 5/16-inch-diameter inner hole is then drilled through the concrete slab and 3 inches into the sub-slab material to prevent obstruction of the probe by gravelly material. Figure 3 provides an illustration of the sub-slab vapor probe construction detail. Cuttings will be vacuumed from the sample probe hole before installation of the probe. Once the concrete slab thickness is established, stainless steel tubing will be cut to ensure that probe tubing does not reach the bottom of the hole. The surface end of a ¼-inch outside diameter and 1/8-inch inside diameter new stainless steel tube is attached to a stainless steel Swagelok® fitting with Teflon® tape. The assembly is set in the hole, flush with the surface, and has a recessed stainless steel plug screwed into the Swagelok® fitting so as not to interfere with the day-to-day use of the building. Quick-drying Portland cement will be used to seal the tubing into the drill hole and annular space (keeping it flush with the ground surface) and allowed to cure for 24 hours before the start of sampling. The 24-hour period will allow for equilibration and the probe to set and seal before sampling.

2.2.2 Sub-slab Probe Sampling Procedures

AECOM will collect one soil vapor sample from the sub-slab vapor probe (SS-1). The soil vapor sample collection procedure is described below.

2.2.2.1 Sampling Equipment

The samples will be collected in a stainless steel, gas-tight, opaque Summa™ canister with a passivated, glass-lined internal surface, provided by the analytical laboratory. The canister will be certified clean by the laboratory. The canister will be field verified to have a vacuum of at least minus 25, and up to 29.9 inches mercury (Hg) before sampling. A 1-liter Summa™ canister will be used for collecting the sub-slab vapor sample.

All gauges and flow control manifolds will be connected by laboratory-supplied chromatography-grade, stainless steel tubing, and dedicated, flexible-nylon or Teflon®, airtight tubing that has a low capacity for adsorbing VOCs. A sample train will be assembled using 0.25-inch outer diameter (OD) nylon tubing for all vapor sampling at this Site. Swagelok® type connectors will be used for all connections between tubing and other sampling components.

A vacuum will be created in order to draw the soil vapor to the surface. The vacuum will be created by a battery-powered pump vacuum, with the sample collection point on the intake side of the pump to prevent any contaminants present in the pump from being drawn into the sample. A two-way valve and "T" fitting will be used to isolate the pump from a separate tube that is connected to the vapor sample canister. Figure 4 shows a typical equipment sample train for sub-slab vapor sampling.

2.2.2.2 Leak Testing

Leakage of atmospheric air into the sampling equipment during sampling can compromise sample integrity and dilute measured soil vapor hydrocarbon concentrations. Sampling equipment will be thoroughly inspected to ensure tight fittings between all components and checked for leaks prior to sampling. Sample equipment consists of a sample train which is comprised of a purge pump, Summa™ canister with flow restrictor, and vacuum gage. To minimize the potential for leakage, the soil vapor sampling rate will be kept at <200 milliliters per minute (mL/min) using a laboratory-supplied flow regulator. The vacuum pump will be turned on and the second Swagelock® valve that is placed after the flow regulator (Figure 4) will be opened while the first Swagelock® valve is closed to the sample probe, and the valve on the sample Summa™ canister also will remain closed.

Laboratory grade helium is the tracer gas that will be used to test for air leakage into the sampling system for the purpose of sample integrity verification. The leak testing will be conducted in general accordance with NYSDOH guidance (NYSDOH, 2005) on the use of a tracer gas. A clear plastic container will be used as the chamber or helium shroud and will have three ports of entry/exit. The chamber will then be placed over the well head or sub-slab sample point and sealed to ground surface by use of weather seal stripping or like material. Helium from a cylinder will be applied as necessary to the helium shroud (to maintain approximately 10% by volume) from one port and monitored from a helium detector that will be inserted at a second port. The final port will have nylon or Teflon® tubing exiting and will be connected to the vacuum pump for purging and leak testing. The portable helium detector will be used to measure the helium tracer gas concentration in the discharge containment bag (Tedlar bag) placed at the discharge end of the purge pump. Leakage in the sample train is indicated by the presence of helium in the discharge containment bag. When helium is detected, the sample train fittings will be tightened. This procedure will be repeated until no leaks are detected in the sample train. Helium will be applied as necessary to the shroud during both the purging and sampling procedures in order to maintain a relatively uniform, known concentration of gas for leak-testing.

Helium concentrations measured from the helium detector during the sampling will be used to assess the amount of leakage, if any, during sampling. Lab analysis and field measurements will be used to estimate a leakage percentage. A sample will be considered valid and acceptable for risk evaluation if the concentrations of the tracer gas (helium) are 10% or less (CalEPA, 2005).

2.2.2.3 Purging

Prior to collecting a soil vapor sample, the sampling tubes will be purged using a battery-powered, flow-calibrated purge pump to ensure that the soil vapor samples collected will be representative of actual soil vapor concentrations. Field notes containing dimensions and specifications on the below-ground tubing length, inner diameter, and above ground sampling equipment will be used to calculate the purge volume. The volumes of the probe/screen and the sand pack will not be included in the purge volume calculation as they are assumed to be in equilibration with soil vapor concentrations in the subsurface. The flow rate for purging will be the same as the flow rate used for subsequent sampling (less than <200 mL/min). For this soil vapor sampling event, three tubing volumes will be purged before sampling. The purge test data (calculated purge volume, purging rate, and duration of purging) will be recorded on field data sheets for each soil vapor sampling point and the same purge rate will be used at a given probe/well for each sampling event.

2.2.2.4 Sample Collection

Immediately following purging and leak-testing, the sample will be collected by opening the Summa™ canister valve to draw the soil vapor sample into the canister. The vacuum and flow rates will be kept at a minimum to limit enhanced volatilization of VOCs. Consistency will be maintained as best as possible for all samples taken between samples and sampling events. Vacuum and flow rate readings will be obtained periodically to evaluate the fill rate of the Summa™ canisters. The laboratory will be instructed to set the flow controller to a rate greater than 10 mL/min and less than 200 mL/min.

The sample time interval for soil vapor samples will be approximately 30 minutes per sample and flow rates cannot exceed 200 mL/min. For the sub-slab soil vapor sampling a 1-Liter Summa™ canister will be kept at approximately 26.6 mL/min for 30 minutes to complete the sample. The vacuum gauge on the flow controller will be constantly monitored to ensure the vacuum in the Summa™ canister is decreasing with time. The valve will be closed when the Summa™ canister gauge measures approximately 5 inches of Hg vacuum. The final Summa™ canister vacuum will be measured in the field for each sample and upon receipt at the laboratory to evaluate sample integrity following shipment.

Helium will continue to be added as needed and monitored during sampling to minimize outside ambient air influences. New, unused disposable nitrile gloves will be used prior to the collection of each soil vapor sample.

2.2.3 Crawl Space Air, Indoor Air, and Ambient Outdoor Air Sample Collection

One air sample will be collected from the crawl space (CS-1) beneath the office in the veterinary hospital building, using the same procedure as that for the indoor air sample. Two indoor air samples (IA-1 and IA-2) will be collected – one co-located with the sub-slab sample, and one co-located with the crawl space sample. One ambient outdoor air sample (OA-1) will be collected for laboratory analysis from outside the veterinary hospital. The proposed sample location is indicated on Figure 2. The indoor air samples will be collected to determine the concentration of VOCs in the subject building at the time of the sub-slab vapor and crawl space air sample collection. The outdoor air sample will be collected to characterize the contribution from ambient outdoor air to indoor air. The outdoor air sampling at the veterinary hospital will begin one hour prior to indoor air sampling and will continue to at least 30 minutes prior to the end of the indoor air sampling period.

2.2.3.1 Indoor Air and Crawl Space Air Sample Procedure

Each time-integrated indoor/crawl space air sample will be collected using a 6-liter Summa® canister obtained from a California certified laboratory. All Summa™ canisters will be certified-clean at the 100% quality control (QC) level, fitted with a vacuum gauge, and under a vacuum of greater than 25 inches of Hg. The canisters will be fitted with a laboratory-calibrated flow controller (11.5 mL/min) to collect an air sample at a constant flow rate over an approximate 8-hour period. The canister vacuum shall be recorded prior to sampling, periodically during the filling period, and at the conclusion of the sampling interval. The canister used to collect the indoor air samples shall be placed at 3 to 5 feet above the floor to provide a sample representative of the breathing zone. The crawl space air sample will rest on the ground surface and the sample will come from the area near the framing for the building floor.

2.2.3.2 Outdoor Air Sample

The time-integrated ambient outdoor air sample will be collected using a 6-liter Summa™ canister obtained from a California certified laboratory. The Summa™ canister will be certified-clean at the 100% QC level, fitted with a vacuum gauge, and under a vacuum of greater than 25 inches of Hg. The canister will be fitted with a laboratory-calibrated flow controller (11.5 mL/min) to collect an ambient outdoor air sample at a constant flow rate over an approximate 8-hour period. The canister vacuum shall be recorded prior to sampling, periodically during the filling period, and at the conclusion of the sampling interval. The proposed sample location is indicated on Figure 2. The exact sample location will be determined during the pre-field work site visit and using data from National Weather Service, as the outdoor air sample should be collected on the upwind side of the veterinary hospital building, from 5 to 15 feet from an exterior wall, and protected from the elements. The canister will be placed 3 to 5 feet above ground level.

2.3 Quality Control Samples

2.3.1 Duplicate Samples

One duplicate sample will be obtained for each day of sub-slab vapor sampling, or for 10% of the samples collected, whichever is greater. AECOM anticipates that one duplicate sample will be required. AECOM proposes collecting the duplicate sample from SS-1. The duplicate sample will be obtained by using a splitter (such as a T-fitting) located between the flow controller and sample canisters with separate sample tubes connecting the splitter to two Summa™ canisters. The flow controller must be set such that the flow rate from the sampling probe is less than 200 mL/min, doubling the sample time required since two canisters are filled simultaneously.

2.3.2 Equipment Blanks

One equipment blank will be collected for each day of sampling just prior to sampling activities by collecting a sample of clean air or nitrogen through the probe materials before installation in the ground. Clean stainless steel, Nylon or Teflon tubing and a certified regulator will be used, in conjunction with a 100% QC level Summa canister. No Trip Blanks are necessary with the use of 100% certified Summa™ canisters.

2.4 Investigation-Derived Waste

No investigation-derived waste (IDW) is expected to be generated during execution of the scope of work presented herein. No soil cuttings will be generated during probe installation.

3.0 **Laboratory Analysis**

Samples will be labeled following standard chain of custody (COC) protocols, including noting the final canister vacuums and the serial numbers of canisters and flow controllers. AECOM will document sampling activities, including sampling times, conditions, and any deviations in procedure on field sheets. Samples will be transported under COC protocols within 24 hours using ground transport to a State of California certified laboratory. Samples will NOT be chilled since contaminants may condense at low temperatures.

Sub-slab vapor, crawlspace air, indoor air, and outdoor air samples will be analyzed for TPHg, BTEX, MTBE, and naphthalene using USEPA Method (Modified) TO-15 APH (air-phase petroleum hydrocarbon) Fractions (Sp)-Full list + Naph + APH. Sub-slab vapor samples will also be analyzed for oxygen, carbon dioxide, helium, nitrogen and methane by ASTM Method D1946 modified. All analytical results for this investigation will be reported in micrograms per cubic meter.

4.0 Vapor Intrusion Pathway Evaluation and Risk Analysis

4.1 Objective

AECOM proposes to evaluate the potential vapor intrusion pathway at the Oakland Veterinary Hospital building located adjacent and to the northwest of the service station site following Chevron's Best Practices approach (Chevron, 2006) and in accordance with California EPA and DTSC guidance (CalEPA, 2005 , 2009 and DTSC, 2011a). As discussed in Section 2.0, sub-slab vapor, crawl space air, and indoor air will be sampled within the veterinary hospital building, in addition to ambient outdoor air outside of the veterinary hospital, to evaluate whether there is a potentially complete vapor intrusion pathway at this building. These data will be evaluated as discussed in this section.

As discussed in Section 1.3, measurable concentrations of petroleum hydrocarbons were detected in soil vapor samples collected on September 8 and 9, 2010 (Delta, 2010) on the northwest side of the service station. The Oakland Veterinary Hospital is located on the property adjacent to, and down-gradient of, the service station site on the northwest side. Therefore, the vapor intrusion evaluation is being performed to determine whether a complete vapor intrusion pathway exists for volatile petroleum hydrocarbons originating from soil vapor on the service station site.

There are existing single-family residences located to the east of the service station site. However, these are up-gradient and uphill from the service station. Existing soil vapor data on the service station site indicates diminishing soil vapor concentrations in this direction. Therefore, investigation of these residences is not warranted.

4.2 Evaluation of Sub-Slab Vapor, Crawl Space Air, Indoor Air, and Ambient Outdoor Air

There are many sources for non-petroleum related background VOCs inside buildings. Materials and substances commonly found in commercial and residential settings contain VOCs that may be detected by indoor air testing. Some examples of these substances include, but are not limited to, paints, paint thinners, dry-erase markers, gasoline-powered machinery, building materials, cleaning products, dry cleaned clothing, and cigarette smoke. In particular, this location is a veterinary hospital and may use gaseous substances as anesthetics in animal care (e.g., isofluorane). Therefore, indoor air samples may measure BTEX and other petroleum hydrocarbon compounds related to indoor air (i.e., background) sources and unrelated to a subsurface petroleum hydrocarbon source. Comparing measured indoor air concentrations against the most conservative screening values [i.e., California Human Health Screening Levels (CHHSLs)] does not provide enough information to interpret whether the source of the indoor air VOC concentrations are due to vapor intrusion or an indoor air source. Instead, indoor air concentrations must be compared to both ambient outdoor air and sub-slab vapor concentrations to determine whether external sources are contributing to the presence of VOCs in indoor air.

Indoor air VOC concentrations will be compared to sub-slab vapor, crawl space air, and ambient outdoor air concentrations to determine whether there is sufficient evidence of a complete vapor intrusion pathway. Sufficient evidence of a complete vapor intrusion pathway will be obtained if indoor air samples contain significantly greater concentrations of petroleum hydrocarbon VOCs (e.g., BTEX) than ambient outdoor air and the normal range of typical indoor air (i.e., background) concentrations, and also contain significantly lower concentrations of petroleum hydrocarbon VOCs than sub-slab soil vapor. Indoor air concentrations will be considered significantly lower than sub-slab soil vapor concentrations if they are at least approximately 10 times lower than sub-slab vapor concentrations, consistent with an attenuation factor of 0.1 for a building with

a slab-on-grade foundation in a commercial setting. The use of an attenuation factor of 0.1 is 2 times more conservative than DTSC's default attenuation factor of 0.05 for the same building/exposure scenario (DTSC 2011a).

5.0 Data Reporting

AECOM will submit a report to Chevron and the ACEH documenting the results of the investigation and risk evaluation, and will include conclusions and recommendations. The report will be prepared under the supervision of, and signed by, a State of California Professional Geologist or Engineer. AECOM will submit electronic files necessary to comply with ACEH and State of California GeoTracker requirements.

6.0 References

Aerial photographs dated 1939, 1946, 1958, 1965, 1974, 1982, 1993, and 1998. Provided by Environmental Data Resources, 440 Wheelers Farms Road, Milford, Connecticut 06461, 800-352-0050, www.edrnet.com.

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Delta, 2007b. Site Investigation Report, 76 Service Station No. 1156, 4276 MacArthur Boulevard, Oakland, California, dated December 28. Prepared for ConocoPhillips Company, 76 Broadway, Sacramento, California. Prepared by Delta Consultants, 3164 Gold Camp Drive, Suite 200, Rancho Cordova, California 95670.

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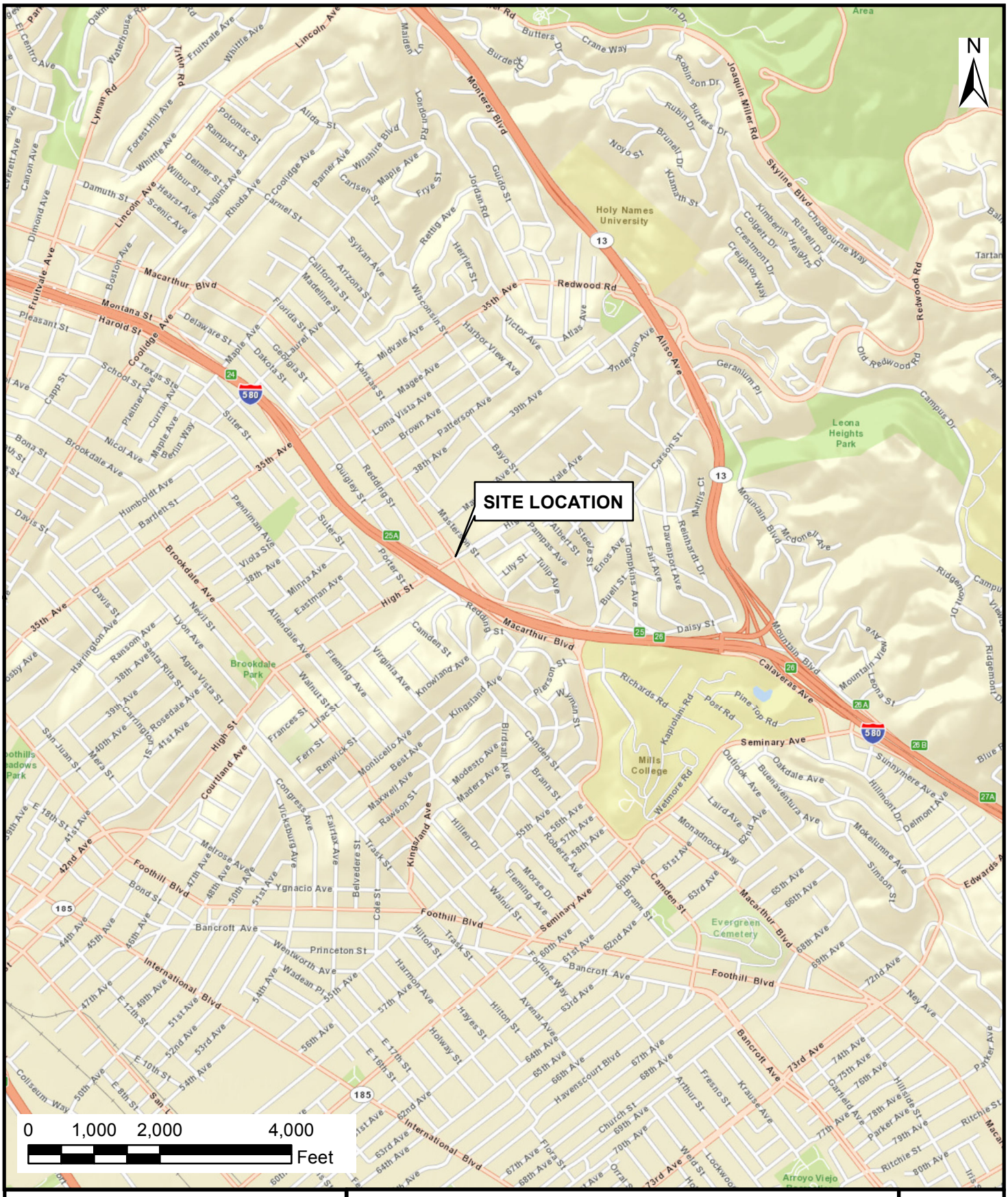

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SITE LOCATION MAP

Chevron Site #351645 (76 Service Station #1156)
4276 MacArthur Boulevard
Oakland, California

FIGURE NUMBER:
1

DRAWN BY:	DATE:	PROJECT NUMBER:	SHEET NUMBER:
M. Scop	5/2/2012	60264254	1 of 1

Source:
Delta Consultants, Site Map with Historical Sampling Locations, Dated 06/26/2010
MW and SVW well locations from Morrow Surveying Land Surveyors, 8/24/2010

REVISIONS			
NO.:	DESCRIPTION:	DATE:	BY:

DESIGNED BY:	DRAWN BY:	CHECKED BY:	APPROVED BY:
X	M. Scop	X	B. Evans

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SITE PLAN WITH PROPOSED SAMPLE LOCATIONS

Chevron Site #351645 (76 Service Station #1156)
4276 MacArthur Boulevard
Oakland, California

SCALE:	DATE:	PROJECT NUMBER:
1" = 30'	5/8/2012	60264254 - A10

FIGURE NUMBER:
2

SHEET NUMBER:
X

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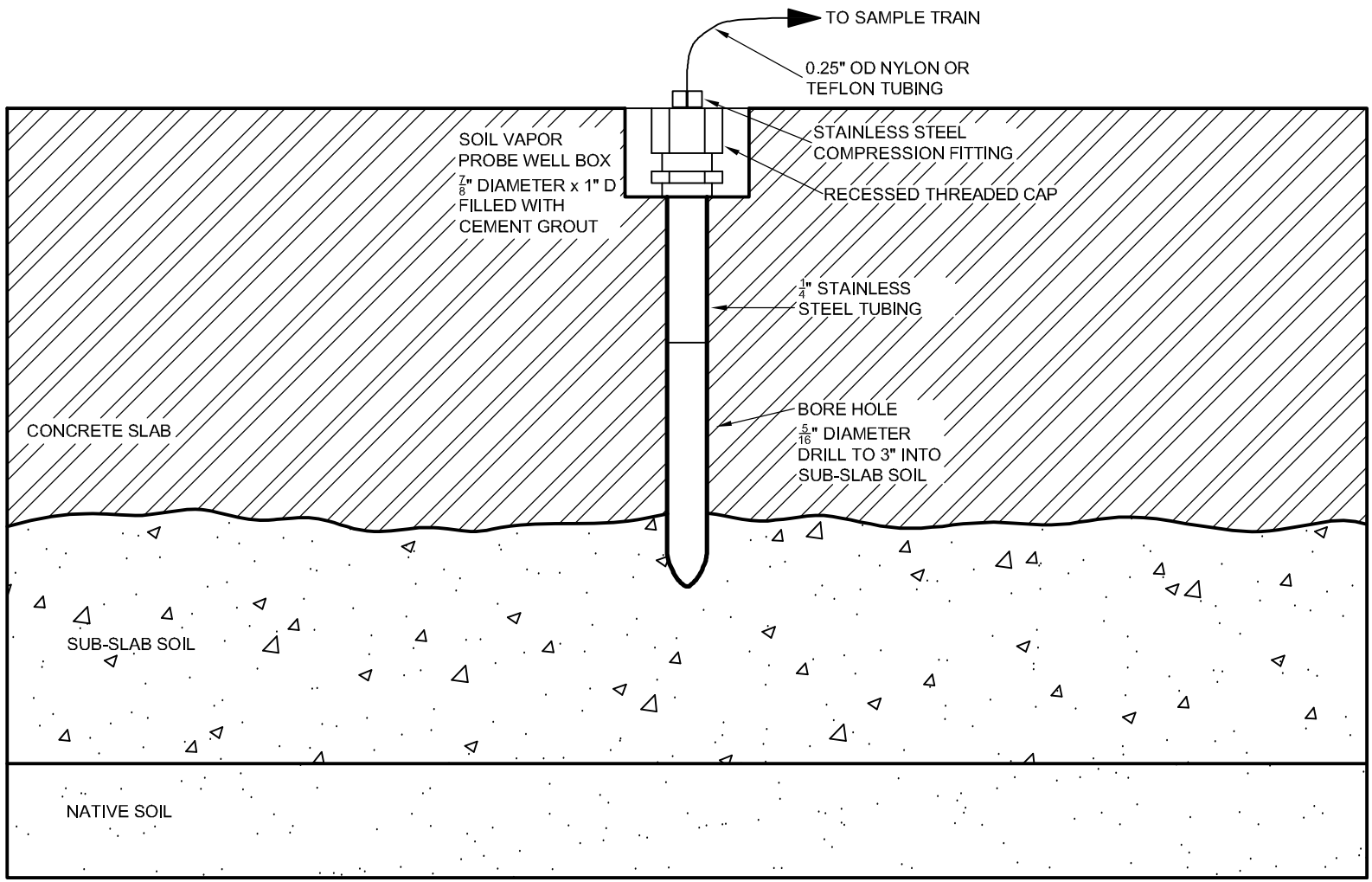

SUB-SLAB VAPOR PROBE DETAIL

Chevron Site #351645 (76 Service Station #1156)
4276 MacArthur Boulevard
Oakland, California

FIGURE NUMBER: 3

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M. Scop	5/3/2012	60264254 - A10	X

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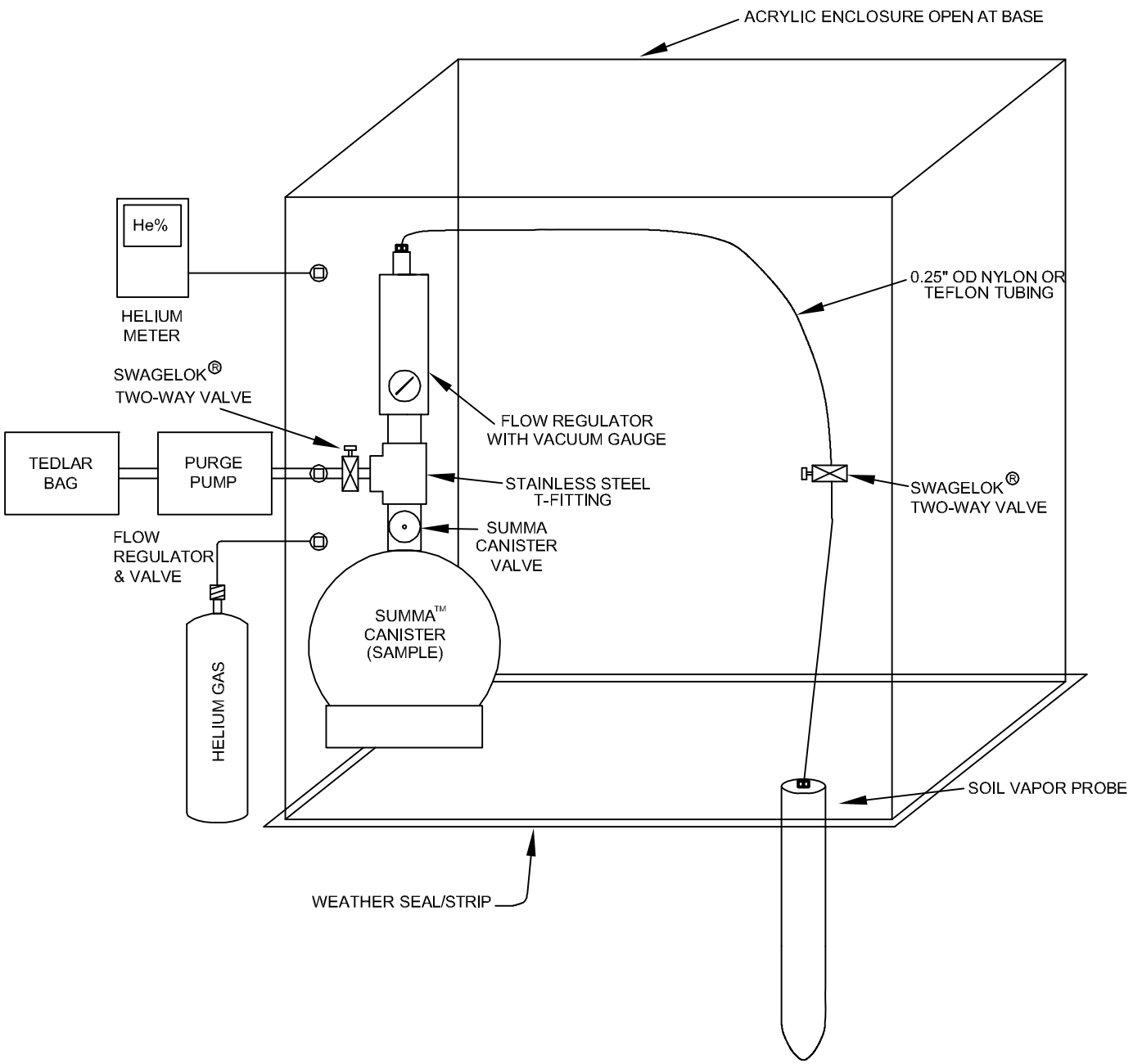

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SUB-SLAB VAPOR SAMPLING APPARATUS

Chevron Site #351645 (76 Service Station #1156)
4276 MacArthur Boulevard
Oakland, California

FIGURE NUMBER:
4

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M. Scop	5/9/2012	60264254 - A10	1