R02611

Environmental Management Company
6001 Bollinger Canyon Rd, K2256
P.O. Box 6012
San Ramon, CA 94583-2324
Tel 925-842-1589
Fax 925-842-8370

J. Mark Inglis
Project Manager

August 5, 2005
(date)

ChevronTexaco

Alameda County
AUG 09 2005
Environmental Health

Alameda County Health Care Services
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Re: Chevron Service Station # 9-0261 (Site #304291)
Address: 3884 First St., Livermore, CA

I have reviewed the attached report titled Additional Investigation Workplan and dated August 5, 2005

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 Cambria Environmental Technology, Inc., upon whose assistance and advice I have relied.

This letter is submitted pursuant to the requirements of California Water Code Section 13267(b)(1) and the regulating implementation entitled Appendix A pertaining thereto.

I declare under penalty of perjury that the foregoing is true and correct.

Sincerely,

J. Mark Inglis

J. Mark Inglis
Project Manager

Enclosure: Report

RO 2611

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August 5, 2005

Mr. Jerry Wickham
Alameda County Environmental Health (ACEH)
1131 Harbor Bay Parkway
Alameda, CA 94502

Re: **Additional Investigation Workplan**
Former Chevron SS #9-0261 (Site #304291)
3884 First Street
Livermore, California
Cambria Project No. 31H-2036

Dear Mr. Wickham:

Cambria Environmental Technology, Inc. (Cambria) has prepared this additional investigation workplan for the site referenced above on behalf of Chevron Environmental Management Company (Chevron). This workplan is written in response to your letter, dated June 23, 2005. A copy of this letter is included as Attachment A. The site background and our proposed investigation scope of work are described below. In addition, your letter contains several technical comments that will be addressed below.

SITE BACKGROUND

Site Description: The site is a former gasoline service station, occupying a triangular-shaped lot at the intersection of Portola Avenue and First Street in Livermore, California. Chevron, doing business as Standard Oil Company, leased the property from approximately 1936 through 1973, and possibly through 1975. Although no definite construction date is available, aerial photo evidence indicates that service station facilities were present on the site from as early as 1939 through, at least, August 1973 in two separate configurations. The original facilities were located at the eastern end of the lot, with another structure, possibly a residence, on the western portion of the site. This configuration is seen on a May 1969 aerial photo and the reconstructed service station is seen on an August 1973. It is unknown when during that four year period the station was reconstructed in the second configuration. The redeveloped facilities incorporated the area previously occupied by the possible residential structure mentioned above. A May 1978 aerial photo indicates a vacant lot with all facilities removed. The site appears to have continuously operated as an auto dealership from 1979 through the present. Local topography is relatively flat, gradually sloping toward the southeast, and at an approximate elevation of 520 ft above mean sea

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level (Figure 1). The surrounding area is primarily commercial with residential to the north and, beyond the auto dealership, to the west. Current usage of the site is as Livermore Honda's used car lot.

December 1999 Soil Boring Investigation: A series of six soil borings were advanced at locations across the site to investigate the extent of hydrocarbons in soils beneath the site. It was reported that boring locations were based on surface geophysical surveys. Soil samples were collected and analyzed for total petroleum hydrocarbons as gasoline (TPHg), total petroleum hydrocarbons as diesel (TPHd), total petroleum hydrocarbons as motor oil (TPHmo) and total recoverable petroleum hydrocarbons (TRPH). Additionally, three soil samples from one boring were selected for analysis of benzene, toluene, ethylbenzene and total xylenes (BTEX). Analytic results of soil samples indicated low concentrations of TPHg and TPHd in boring B-2, located near the eastern end of the triangular lot, within the area labeled as "SS BLDG" of the original station facilities. Maximum concentrations of 630 and 280 milligrams per kilogram (mg/kg) TPHg and TPHd, respectively, were detected in samples from 10 fbg. Maximum concentrations of TRPH and TPHmo were detected in shallow samples collected at 5 fbg at 40,000 and 39,000 mg/kg, respectively. These concentrations decreased to 10,000 and 14,000 mg/kg, respectively at 10 fbg and were, essentially, below detection limits at 15 fbg. BTEX constituents were detected in the 5-foot sample from this boring at concentrations of 0.03, 0.62, 1.2 and 6.8 mg/kg, respectively. Low concentrations of only ethylbenzene and xylenes were detected in the 10-foot sample from boring B-2 and no BTEX constituents were detected in the 15-foot sample from this boring.

April 2005 Soil Boring Investigation: A total of 24 soil borings were advanced across the site to investigate conditions resulting from facility operation in the two service station configurations, as well as previously identified "heavy end" hydrocarbons observed during the 1999 investigation described below. Analytic results indicated the presence of residual petroleum hydrocarbons in soil and groundwater, primarily associated with the second generation dispenser island and USTs. Results of this investigation indicated an apparent perched water bearing zone occurring at approximately 23 feet below grade (fbg). Residual hydrocarbons in soil associated with the second generation facilities decrease with depth to low to nearly non-detected levels, as seen in the deeper sampling depths of 23.5 and 27.5 fbg. Samples beneath the first generation facilities indicated residual hydrocarbons increasing with depth to a maximum of 94 ppm gasoline range hydrocarbons at 15.5 fbg and 69 ppm diesel range hydrocarbons at 19 fbg.

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TECHNICAL COMMENTS IN ACEH LETTER, DATED JUNE 23, 2005

1. In your letter, you requested a method of borehole clearance to insure that volatile components will not be stripped off prior to sampling. During our initial phase of work conducted in April, the borings were cleared to a depth of five fbg. Undisturbed material was available for sampling from 5-5.5 fbg. Due to Chevron's borehole clearance safety protocol, the sample was collected by hand augering and, thus, was considered a disturbed sample when reported. The only 5 fbg samples containing volatile components were collected in borings B-8, B-12, B-13 and B-14. None of these samples contained detectable levels of benzene and the greatest concentration of any other volatile constituent was 0.004 ppm xylenes in B-8 and B-14. Since retail gasoline service station operations ceased at the site a minimum of 30 years ago, it is not at all surprising that near surface residual volatile hydrocarbons have degraded to extremely low concentrations, if present at all. Due to Chevron's safety protocols regarding borehole clearance we will not be able to collect undisturbed samples within 8 feet of the surface and, based on the data from the April 2005 investigation that does not appear necessary.

2. Chevron records indicate that service station operations ceased by 1975 or earlier. At the termination of a ground lease Chevron is obligated to remove its facilities. That means that all aboveground structures, hoists and tanks would have been removed at that time. However, though no product piping was observed during the April 2005 investigation, the status of it is unknown. Regulations of sampling and reporting of conditions during UST removals did not come into effect until approximately 1985. Therefore, it is likely that no records were kept of the removal of facilities occurring prior to that time. Chevron has researched the possibility of information regarding conditions at this site and has not found any records at all.

3. It is the preference of the developer, the City of Livermore and of Chevron that redevelopment of the site occur rapidly. With the data acquired from the scope of work outlined in the investigation workplan, an evaluation of potential human health risks will be conducted and appropriate measure to mitigate any identified risks will be undertaken concurrent with development.

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4. From the redevelopment plans shared with Chevron to date, it appears minimal excavation will occur to facilitate construction. However, a soil management plan will be developed

5. to effectively manage issues arising from potentially impacted soil generated by facility construction excavation, or any additional remedial excavation should that be deemed necessary.

6. The scope of work defined by this workplan, when implemented, should sufficiently define the lateral and vertical extent of hydrocarbons in both soil and groundwater. The use of CPT technology will allow for discrete sampling of specific water bearing zones.

7. With this vertical profile of both soil and groundwater conditions, permanent monitoring 0wells can be designed if, upon evaluation of the data, they are deemed necessary.

8. The section describing soil borings, in the proposed scope of work below, states that soil and groundwater samples will be collected based on data from the previous investigation and from the detailed CPT boring logs. We will, therefore, be sampling to confirm and define the "discontinous perched" zone at depths of 23.5 to 28 fbg. We anticipate finding that hydrocarbon impacts to soil and groundwater decrease to non-detectable levels below the perched zone and that permanent wells may not be necessary. However, the detailed logs and discrete soil and groundwater samples will provide information to design an effective array of monitoring well, if they are deemed necessary.

9. The boring planned for the former fuel dispenser island in First Street will be advanced and sampled during this next phase of work.

10. You have requested a well survey and preferential pathway evaluation. A well survey was previously requested and submitted on October 7, 2004. At the request of ACEH an addendum was submitted on March 1, 2005. Regional groundwater in this area of Livermore has been estimated to be very deep, perhaps 60-100 fbg, and the zone previously identified as perched resides at approximately 23.5 fbg. Therefore, the depth of groundwater beneath this site, whether perched or regional, is too deep to be affected by preferential pathways which could possibly facilitate lateral or vertical migration.

11. A description of the regional geologic and hydrogeologic setting will be developed and submitted under separate cover for your review.

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PROPOSED SCOPE OF WORK

The objective of the proposed scope of work is to fulfill the requests for information presented in the ACEH letter of June 23, 2005. In order to accomplish these goals, Chevron and Cambria intend to conduct the following activities.

Underground Utility Location: Cambria will contact Underground Services Alert (USA) and, if necessary, a private underground utility locating service, to identify utility locations on and near the site.

Site Health and Safety Plan: Cambria will prepare a site safety plan to protect site workers. The plan will be kept on site at all times, reviewed and signed by all site workers. Since several CPT borings will be advanced offsite in the public right-of-way, a traffic plan will be developed to address safety issues to both workers and the general public.

Permits: Cambria will obtain soil boring permits from the Alameda County Zone 7 Water District prior to beginning field operations. An encroachment permit from the City of Livermore was acquired to conduct the planned boring in First Street. This permit will be renewed and expanded to include the two additional borings near the intersection of First Street and Portola Avenue.

Soil Borings: Cambria intends to advance up to 12 soil borings using Cone Penetration Testing (CPT) technology to complete both horizontal and vertical definition of hydrocarbon impacts beneath the site. Per Chevron safety protocol, the first 8 feet of each boring will be cleared by a combination of air-knife and hand auger. The locations of these borings are illustrated on Figure 2 and were selected based on data from the initial investigation conducted in April 2005. CPT borings will be advanced to obtain a detailed profile of the soil column. A review of this profile will provide data from which to select zones, in an adjacent boring, to collect soil samples and discrete zone grab groundwater samples. Soil samples will be collected at specific depths based on data obtained from the April 2005 investigation, interpretation of litholgic data from CPT and specific requests from ACEH. Cambria's Standard Field Procedures for Cone Penetrometer Testing and Sampling is presented as Attachment B.

Sampling Protocol: As stated above, soil samples will be collected from borings at determined depths based on an evaluation of the soil profile generated by the CPT tool. These samples will be collected by driving the sampling tool into undisturbed material at the prescribed depth. The sample tube will be sealed, logged onto a chain-of-custody form, placed on ice and delivered to a

state-certified laboratory. Selected soil samples will be analyzed for TPHg, TPHd, TPHmo, benzene, toluene, ethylbenzene, xylenes and lead scavengers 1,2-DCA and EDB.

Chemical Analysis: Selected soil and water samples will be analyzed for all or some of the following:

- TPHg, TPHd and TPHmo by EPA Method 8015,
- Benzene, toluene, ethylbenzene, xylenes, MTBE, 1.2-DCA and EBD by EPA Method 8260.

Soil and Water Disposal: Any soil cuttings generated during this investigation will be placed on and covered with plastic. All generated rinseate water will be stored in drums pending proper disposal. These wastes will be transported to the appropriate Chevron-approved disposal facility following receipt of profiling analytic results.

Reporting: Upon completion of field activities and review of the analytical results, we will prepare an investigation report that, at a minimum, will contain:

- Descriptions of the drilling and sampling methods;
- Boring logs;
- Tabulated soil analytic results;
- Analytic reports and chain-of-custody forms;
- Soil and water disposal methods;
- Conclusions and recommendations.

SCHEDULE

Cambria will proceed with the proposed scope of work upon receiving written approval from the ADEH. We will submit a report documenting our results approximately six weeks after receipt of sampling results.

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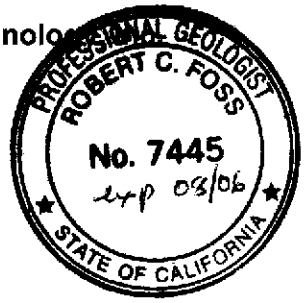
CLOSING

We appreciate your review and comments regarding this workplan. We, along with representatives of Livermore Honda and their perspective buyers, are available to meet with you to discuss any components of this Workplan. Please contact Robert Foss at (510) 420-3348 if you have any questions or comments.

Sincerely,
Cambria Environmental Technology

Robert Foss

Robert Foss, P.G.
Associate Geologist



Figures: 1 – Vicinity Map
2 – Site Plan with Proposed CPT Boring Locations

Attachments: A – ACEHS letter of June 23, 2005
B – Standard Field Procedures for Cone Penetrometer Testing and Sampling

cc: Mr. J. Mark Inglis, Chevron, P.O. Box 6012, San Ramon, CA 94583
Mr. Steven Clowdsley, Real Estate Consulting, 1561 Ramona Way, Alamo, CA 94507
Mr. Jon Robbins, Chevron, P.O. Box 6012, San Ramon, CA 94583
Ms. Susan Gallardo, GeoMatrix Consultants, Inc., 2101 Webster Street, 12th Floor, Oakland, CA 94612

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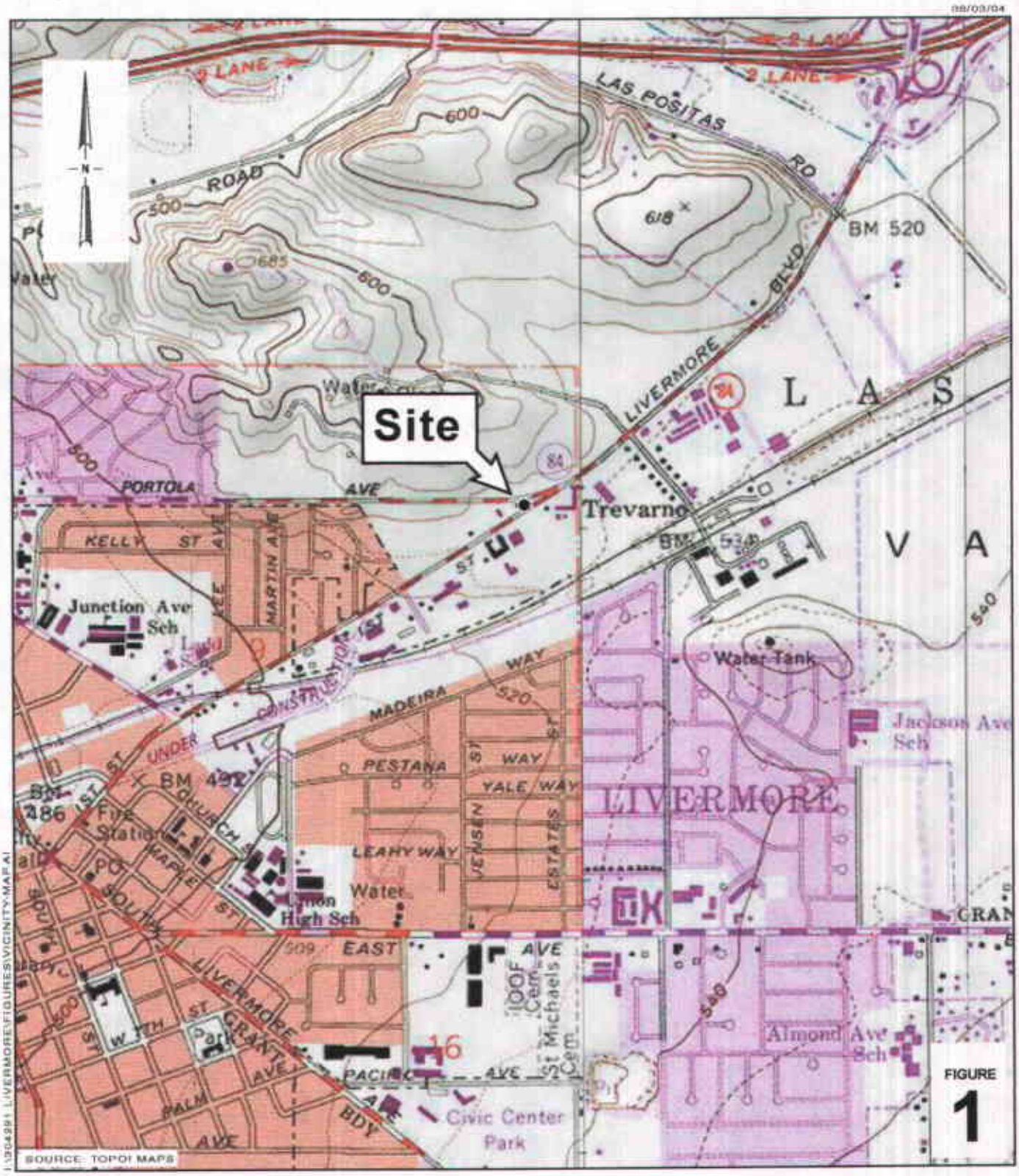

FIGURE 1

Former Standard Oil Service Station 9-0261 (Site No. 304291)

3884 First Street

Livermore, California

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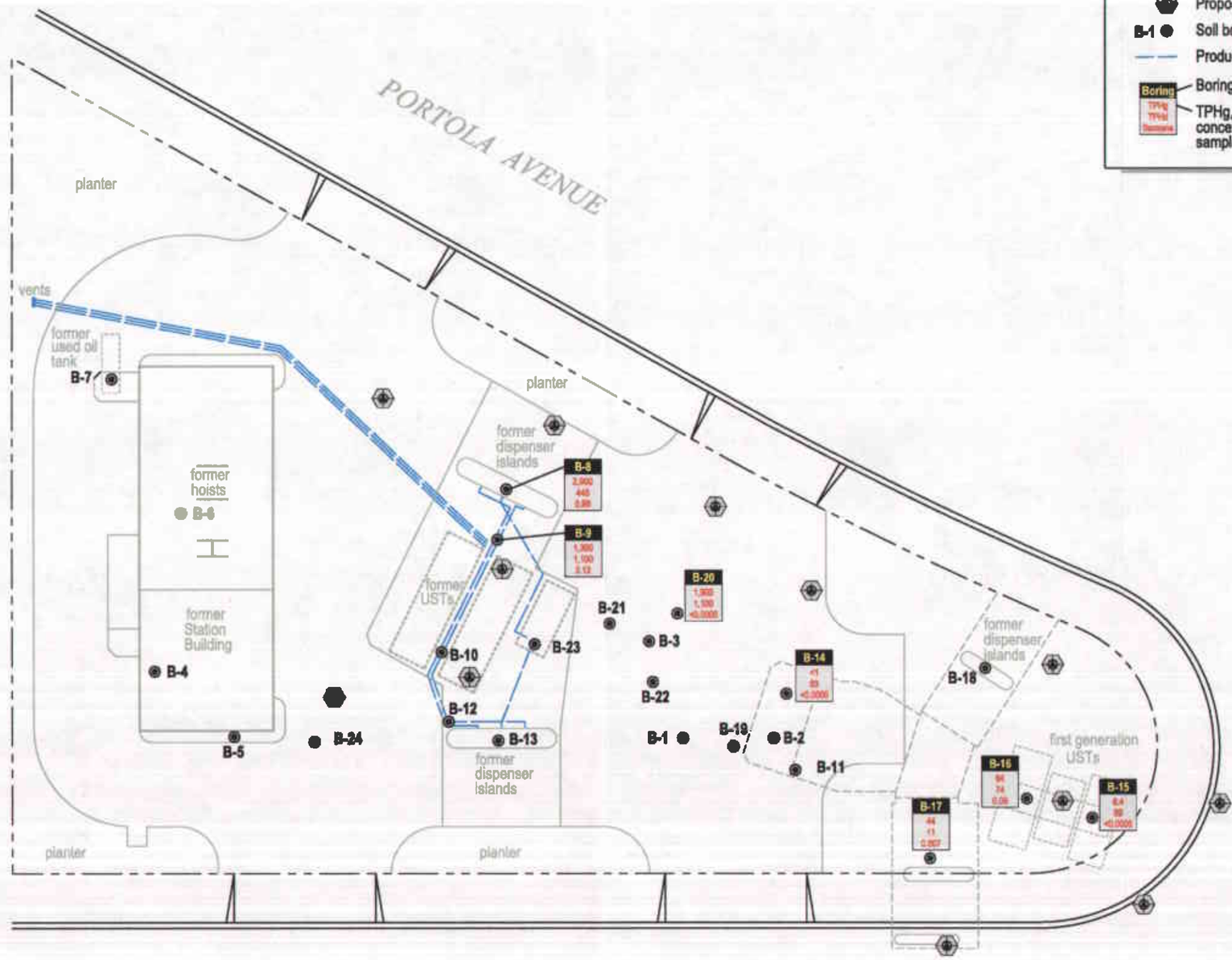
Vicinity Map

Site Plan



FIGURE

2

Former Standard Oil Service Station 9-0261
(Site No. 304291)
3884 First Street
Livermore, California

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1304291 | ARGIMG/REFIGURES/SITEPLAN.DWG

ATTACHMENT A

ACEH letter of June 23, 2005

ALAMEDA COUNTY
HEALTH CARE SERVICES
AGENCY
DAVID J. KEARS, Agency Director

ENVIRONMENTAL HEALTH SERVICES
ENVIRONMENTAL PROTECTION
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577
(510) 567-6700
FAX (510) 337-9335

June 23, 2005

J. Mark Inglis
ChevronTexaco
6001 Bollinger Canyon Rd., K2256
P.O. Box 6012
San Ramon, CA 94583-2324

Subject: Fuel Leak Case No. RO0002611, Livermore Honda, 3884 First Street, Livermore, CA – Request for Work Plan

Dear Mr. Inglis:

Alameda County Environmental Health (ACEH) staff has reviewed the fuel leak case file for the subject site and the report entitled, "Subsurface Investigation Report," received May 23, 2005, prepared on behalf of Chevron Environmental Management Company by Cambria Environmental Technology, Inc. The objective of the subsurface investigation was to define the horizontal and vertical extent and characteristics of hydrocarbons in soil and groundwater beneath the site as requested by ACEH in correspondence to Mr. Bruce Qvale of First Street LLC dated June 10, 2004.

According to records presented to ACEH, the site was formerly used as a gasoline service station. Chevron, doing business as Standard Oil Company, leased the property from approximately 1936 up through 1973 or as late as 1975. The site has apparently functioned as part of a car dealership since 1979 and is currently a used car lot.

Petroleum hydrocarbons have been detected in soil and groundwater beneath the locations of former Standard Oil (Chevron) service station USTs and dispensers, which is consistent with releases from the former service station operations. As former tank owner and operator for the site, Chevron Products Company has been designated the primary or active Responsible Party. A Notice of Responsibility dated June 24, 2005 has been sent by certified mail under separate cover. Coast Manufacturing & Supply, Inc. was a property owner and leased the site to Chevron during operation of the service station. Therefore, Hexcel Corporation, which is the corporate successor to Coast Manufacturing & Supply, Inc., has also been designated a Responsible Party. The current land owner, First Street LLC, is the third Responsible Party for the site.

Based on the soil and groundwater contamination detected at the site, further investigation is required. **We request that you prepare and submit a work plan for the soil and groundwater investigation by August 24, 2005.** Based on ACEH staff review of the document referenced above, we request that you address the following technical comments, perform the proposed work, and send us the reports described below.

TECHNICAL COMMENTS

1. **Shallow Soil Samples.** ACEH is concerned that the analytical results for soil samples collected at depths less than 8 feet in air knife excavations may be biased due to stripping of volatile components during advancement of the air knife boreholes. Please describe in the Work Plan requested below, the methods that will be used for future soil sampling in boreholes to assure that volatile components in the soil are not stripped off prior to sample collection by the high pressure air and vacuum generated by the air knife.

2. **Shallow Soil Characterization and Potential Site Redevelopment.** At most UST sites, observations are available on the conditions of the tanks and piping at the time of removal. In addition, observations and analytical data are typically available regarding the extent of contamination within the tank and piping excavations. These observations and sampling results provide valuable information to direct subsequent soil and groundwater investigations. Please research and confirm that no information is available regarding removal of the USTs and piping.

   To date, soil samples have been collected from 24 soil borings at this site. Additional investigation of the shallow soils will be required based on the sampling results collected to date, the concerns outlined in comment 1 above, and the absence of any information on the USTs, piping, and shallow soil conditions at the time of UST and piping removal.

   The report recommends limited excavation in the area of boring B-20 prior to or during redevelopment of the site. The report also suggests working with the developers of the site to mitigate any impacts to the development and final land use. ACEH encourages Chevron to work with the developer of the property to address shallow soil contamination. If the site is to be developed prior to site closure, the Responsible Parties must provide a plan to complete site characterization and to identify potential human health risks posed by soil and groundwater contamination at the site prior to or during development. Excavation within the site prior to site closure will require a plan for soil management and confirmation sampling during excavation. Please incorporate any plans for excavation during development in the Work Plan as appropriate. Plans for shallow soil characterization are to be included in the Work Plan requested below.

3. **Site Characterization.** The lateral and vertical extent of soil and groundwater contamination at the site is undefined. Detailed lithologic information is to be collected using soil borings, direct push sampling, and/or cone penetrometer. Groundwater monitoring wells will be required in the zone where groundwater was first encountered and in the deeper regional groundwater zone. Please consider the use of depth discrete groundwater samples collected along transects to characterize the site prior to installation of monitoring wells. We request that you use detailed hydrogeologic cross sections to determine the appropriate locations and designs for monitoring wells/well clusters and piezometers that are needed to appropriately characterize the three-dimensional extent of soil and groundwater contamination at the site. The zone where groundwater was first encountered in soil borings, typically at depths of 23.5 to 28 feet bgs, is described as a discontinuous perched zone. The Work Plan is to include plans to characterize chemical concentrations in groundwater within the perched zone and to assess the continuity of the perched zone and across the site. To appropriately evaluate your site, your monitoring wells/well clusters will need to be screened in the permeable zones with

screen lengths that match the stratigraphic sequence. Please include the above information in the Work Plan requested below.

4. **Additional Boring in First Street.** The planned boring to investigate the location of a former fuel dispenser in First Street was not completed due to permitting issues. This boring is to be completed during the next phase of field investigation.

5. **Preferential Pathways and Well Survey.** Please evaluate whether any potential preferential pathways may exist at the site. The preferential pathway study shall include a well survey of all wells (monitoring and production wells: active, inactive, standby, decommissioned (sealed with concrete), abandoned (improperly decommissioned or lost); and dewatering, drainage, and cathodic protection wells) within a 1/2-mile radius of the subject site. Please review historical maps such as Sanborn maps, aerial photos, etc., when performing the background study. Submittal of map(s) showing the location of all wells identified in your study, and the use of tables to report the data collected as part of your survey are required. Include appropriate prints of historic aerial photos used as part of your study. We also request that you list by date all aerial photographs available for the site from the aerial survey company or library you use during your study. Refer to the Regional Board's guidance for identification, location, and evaluation of potential deep well conduits when conducting your preferential pathway study. Please identify any sensitive receptors near the site. The evaluation of preferential pathways and well survey are to be included in the Work Plan requested below.

6. **Regional Geologic and Hydrogeologic Setting.** We request that you provide information on the regional geologic and hydrogeologic setting of your site by reviewing the available technical literature for the area. Background information for your review includes but is not limited to regional geologic maps, United States Geological Survey (USGS) technical reports and documents, Department of Water Resources (DWR) Bulletins, Regional Water Quality Control Board reports on the groundwater basin, data from contaminant investigations in the area, etc.

   Provide a narrative discussion of the regional geologic and hydrogeologic setting obtained from your background study. Use photocopies of regional geologic maps, groundwater contours, cross-sections, etc., to illustrate your results and include a list of technical references you reviewed. Report your results in the Work Plan requested below

TECHNICAL REPORT REQUEST

Please submit technical reports to Alameda County Environmental Health (Attention: Mr. Jerry Wickham), according to the following schedule:

- **August 24, 2005** - Work Plan for Soil and Groundwater Investigation
- **90 days after ACEH approval of Work Plan** – Soil and Groundwater Investigation Report

These reports are being requested pursuant to California Health and Safety Code Section 25296.10. 23 CCR Sections 2652 through 2654, and 2721 through 2728 outline the

responsibilities of a responsible party in response to an unauthorized release from a petroleum UST system, and require your compliance with this request.

PERJURY STATEMENT

All work plans, technical reports, or technical documents submitted to ACEH must be accompanied by a cover letter from the responsible party that states, at a minimum, the following: "I declare, under penalty of perjury, that the information and/or recommendations contained in the attached document or report is true and correct to the best of my knowledge." This letter must be signed by an officer or legally authorized representative of your company. Please include a cover letter satisfying these requirements with all future reports and technical documents submitted for this fuel leak case.

PROFESSIONAL CERTIFICATION & CONCLUSIONS/RECOMMENDATIONS

The California Business and Professions Code (Sections 6735, 6835, and 7835.1) requires that work plans and technical or implementation reports containing geologic or engineering evaluations and/or judgments be performed under the direction of an appropriately registered or certified professional. For your submittal to be considered a valid technical report, you are to present site specific data, data interpretations, and recommendations prepared by an appropriately licensed professional and include the professional registration stamp, signature, and statement of professional certification. Please ensure all that all technical reports submitted for this fuel leak case meet this requirement.

UNDERGROUND STORAGE TANK CLEANUP FUND

Please note that delays in investigation, later reports, or enforcement actions may result in your becoming ineligible to receive grant money from the state's Underground Storage Tank Cleanup Fund (Senate Bill 2004) to reimburse you for the cost of cleanup.

AGENCY OVERSIGHT

If it appears as though significant delays are occurring or reports are not submitted as requested, we will consider referring your case to the Regional Board or other appropriate agency, including the County District Attorney, for possible enforcement actions. California Health and Safety Code, Section 25299.76 authorizes enforcement including administrative action or monetary penalties of up to $10,000 per day for each day of violation.

If you have any questions, please call me at (510) 567-6791.

Sincerely,

Jerry Wickham, P.G.
Hazardous Materials Specialist

cc: Bruce Qvale
First Street LLC
3800 First Street
Livermore, CA 94550

Mary Harvey
Hexcel Corporation
75 N. Mines Road
Livermore, CA 94550

Donna Drogos, ACEH
Jerry Wickham, ACEH
File

ATTACHMENT B

Standard Field Procedures for

Cone Penetrometer Testing and Sampling

STANDARD FIELD PROCEDURES FOR CONE PENETROMETER TESTING AND SAMPLING

This document describes Cambria Environmental Technology ' s standard field methods for Cone Penetrometer Testing (CPT) and direct-push soil and groundwater sampling. These procedures are designed to comply with Federal, State and local regulatory guidelines.

Use of CPT for logging and soil and groundwater sampling requires separate borings. Typically an initial boring is advanced to estimate soil and groundwater characteristics as described below. To collect soil samples a separate boring must be advanced using a soil sampling device. If groundwater samples are collected, another separate boring must be advanced using a groundwater sampling device. Specific field procedures are summarized below.

Cone Penetrometer Testing (CPT)

Cone Penetrometer Testing is performed by a trained geologist or engineer working under the supervision of a California Professional Geologist (PG) or a Certified Engineering Geologist (CEG). Cone Penetrometer Tests (CPT) are carried out by pushing an integrated electronic piezocone into the subsurface. The piezocone is pushed using a specially designed CPT rig with a force capacity of 20 to 25 tons. The piezocones are capable of recording the following parameters:

Tip Resistance (Qc)
Sleeve Friction (Fs)
Pore Water Pressure (U)
Bulk Soil Resistivity (rho) - with an added module

A compression cone is used for each CPT sounding. Piezocones with rated load capacities of 5, 10 or 20 tons are used depending on soil conditions. The 5 and 10 ton cones have a tip area of 10 sq. cm. and a friction sleeve area of 150 sq. cm. The 20 ton cones have a tip area of 15 sq. cm. and a friction sleeve area of 250 sq. cm. A pore water pressure filter is located directly behind the cone tip. Each of the filters is saturated in glycerin under vacuum pressure prior to penetration. Pore Pressure Dissipation Tests (PPDT) are recorded at 5 second intervals during pauses in penetration. The equilibrium pore water pressure from the dissipation test can be used to identify the depth to groundwater.

The measured parameters are printed simultaneously on a printer and stored on a computer disk for future analysis. All CPTs are carried out in accordance with ASTM D-3441. A complete set of baseline readings is taken prior to each sounding to determine any zero load offsets.

The inferred stratigraphic profile at each CPT location is included on the plotted CPT logs. The stratigraphic interpretations are based on relationships between cone bearing (Qc) and friction ratio (Rf). The friction ratio is a calculated parameter (Fs/Qc) used in conjunction with the cone bearing to identify the soil type. Generally, soft cohesive soils have low cone bearing pressures and high friction ratios. Cohesionless soils (sands) have high cone bearing pressures and low friction ratios. The classification of soils is based on correlations developed by Robertson et al (1986). It is not always possible to clearly identify a soil type based on Qc and Rf alone. Correlation with existing soils information and analysis of pore water pressure measurements should also be used in determining soil type.

CPT and sampling equipment are steam-cleaned or washed prior to work and between borings to prevent cross-contamination. Sampling equipment is washed between samples with trisodium phosphate or an equivalent EPA-approved detergent. Groundwater samples are decanted into appropriate containers supplied by the analytic laboratory. Samples are labeled, placed in protective foam sleeves, stored on crushed ice at or below 4° C, and transported under chain-of-custody to the laboratory.

After the CPT probes are removed, the borings are filled to the ground surface with cement grout poured or pumped through a tremie pipe.

Objectives

Soil samples are collected to characterize subsurface lithology, assess whether the soils exhibit obvious hydrocarbon or other compound vapor odor or staining, estimate groundwater depth and quality and to submit samples for chemical analysis.

Soil Classification/Logging

All soil samples are classified according to the Unified Soil Classification System by a trained geologist or engineer working under the supervision of a California Professional Geologist (PG) or a Certified Engineering Geologist (CEG). The following soil properties are noted for each soil sample:

- Principal and secondary grain size category (i.e., sand, silt, clay or gravel)
- Approximate percentage of each grain size category,
- Color,
- Approximate water or separate-phase hydrocarbon saturation percentage,
- Observed odor and/or discoloration,
- Other significant observations (i.e., cementation, presence of marker horizons, mineralogy), and
- Estimated permeability.

Soil Sampling

Prior to drilling, the first 5 to 8 ft of the boring are cleared using an air or water knife and vacuum extraction. This minimizes the potential for impacting utilities. Soil samples are collected from borings driven using hydraulic push technologies. A minimum of one and one half ft of the soil column is collected for every five ft of drilled depth. Additional soil samples can be collected near the water table and at lithologic changes. Samples are collected using samplers lined with polyethylene or brass tubes driven into undisturbed sediments at the bottom of the borehole. The ground surface immediately adjacent to the boring is used as a datum to measure sample depth. The horizontal location of each boring is measured in the field relative to a permanent on-site reference using a measuring wheel or tape measure.

Drilling and sampling equipment is steam-cleaned or washed prior to drilling and between borings to prevent cross-contamination. Sampling equipment is washed between samples with trisodium phosphate or an equivalent EPA-approved detergent.

Sample Storage, Handling and Transport

Sampling tubes chosen for analysis are trimmed of excess soil and capped with Teflon[7] tape and plastic end caps. Soil samples are labeled and stored at or below 4°C on either crushed or dry ice, depending upon local regulations. Samples are transported under chain-of-custody to a State-certified analytic laboratory.

Field Screening

After a soil sample has been collected, soil from the remaining tubing is placed inside a sealed plastic bag and set aside to allow hydrocarbons to volatilize from the soil. After ten to fifteen minutes, a portable photoionization detector measures volatile hydrocarbon vapor concentrations in the bag=s headspace, extracting the vapor through a slit in the plastic bag. The measurements are used along with the field observations, odors, stratigraphy, and groundwater depth to select soil samples for analysis.

Grab Groundwater Sampling

Groundwater samples are collected from the open borehole using bailers, advancing disposable Tygon[7] tubing into the borehole and extracting groundwater using a diaphragm pump, or using a hydro-punch style sampler with a bailer or tubing. The groundwater samples are decanted into the appropriate containers supplied by the analytic laboratory. Samples are labeled, placed in protective foam sleeves, stored on crushed ice at or below 4° C, and transported under chain-of-custody to the laboratory.

Duplicates and Blanks

Blind duplicate water samples are usually collected only for monitoring well sampling programs, at a rate of one blind sample for every 10 wells sampled. Laboratory-supplied trip blanks accompany samples collected for all sampling programs to check for cross-contamination caused by sample handling and transport. These trip blanks are analyzed if the internal laboratory quality assurance/quality control (QA/QC) blanks contain the suspected field contaminants. An equipment blank may also be analyzed if non-dedicated sampling equipment is used.

Grouting

If the borings are not completed as wells, the borings are filled to the ground surface with cement grout poured or pumped through a tremie pipe.