City of Carson
Report to Mayor and City Council

June 18, 2013
New Business Discussion

SUBJECT: CONSIDER SENDING A LETTER FOR THE CARSON CITY COUNCIL TO THE LOS ANGELES REGIONAL WATER QUALITY CONTROL BOARD PROVIDING WRITTEN COMMENTS ON, TO THE SITE-SPECIFIC CLEANUP GOAL REPORT FOR THE CAROUSEL TRACT AND MAKING A SPECIFIC DEMAND TO ISSUE APPROPRIATE CLEANUP ORDERS (FORMER KAST PROPERTY)

Submitted by Clifford W. Graves
Director of Community Development

Approved by David C. Biggs
City Manager

I. SUMMARY

The Los Angeles Regional Water Quality Control Board (Regional Board) oversees the environmental investigation and cleanup activities at the Carousel Tract. The Regional Board has released the Site-Specific Cleanup Goal Report (Exhibit No. 1) for public review and receipt of comments on or before June 24, 2013.

Tonight the City Council is asked to authorize the submittal of a comment letter demanding that the Regional Board take all appropriate measures to ensure that the Carousel Tract is properly and expeditiously remediated (Exhibit No. 2).

II. RECOMMENDATION

TAKE the following actions:

1. APPROVE the comment letter on the Site-Specific Cleanup Goal Report for the Carousel Tract (Former Kast Property) and AUTHORIZE the Mayor and all Councilmembers to be signatory to the letter.
2. DIRECT staff to transmit the letter and attachments to the Los Angeles Regional Water Quality Control Board.

III. ALTERNATIVES

TAKE another action the City Council deems appropriate.

IV. BACKGROUND

A Site-Specific Cleanup Goal Report was prepared in response to the Cleanup and Abatement Order issued to Shell Oil Products US (Shell) by the Regional Board. The objectives of the report are to propose the remedial action objectives and site-specific cleanup goals for soil, soil vapor, indoor air, and groundwater that will be used in preparation of a Remedial Action Plan (RAP). By the end of 2013, Shell will be required to submit a RAP incorporating a cleanup strategy

that details how Shell will go about cleaning residual oil and other wastes in soil and groundwater in the community that was caused by activities at the former Kast Tank Farm property. In addition, a full Human Health Risk Assessment (HHRA) incorporating the site-specific cleanup goals will be conducted to further evaluate potential health risks once the site characterization work is complete. The HHRA will be used to guide final response action and will likely be included in the RAP. Cleanup of the Carousel Tract community will begin once the Regional Board issues an approved RAP and completes an environmental impact report or other California Environmental Quality Act document.

The City Council retained the law firm of Girardi & Keese as special counsel to represent the City in an action against Shell and other defendants to obtain appropriate remedy to a public nuisance existing at the Carousel Tract to remove any chemicals that pose a potential threat to human health and the environment. Girardi & Keese has retained environmental consultants to review the Site-Specific Cleanup Goal Report and prepare reports to assist the City in submitting comments by the June 24, 2013 deadline. A comment letter has been prepared with the assistance of Girardi & Keese which includes technical reports by L. Everett & Associates and Soil/Water/Air Protection Enterprise.

V. FISCAL IMPACT

None.

VI. EXHIBITS

1. Site-Specific Cleanup Goal Report dated February 22, 2013 (without list of references, tables, figures and appendices). (pgs. 4-66)
2. Draft Letter to Regional Board. (pgs. 67-101)

Prepared by: Sheri Repp Loadsman, Planning Officer

TO:Rev09-04-2012

Reviewed by:

City Clerk	City Treasurer
Administrative Services	Public Works
Community Development	Community Services

Action taken by City Council

Date______________ Action____

____

Prepared for:

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Site-Specific Cleanup Goal Report

Former Kast Property
Carson, California

Prepared by:

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Project Number: SB0484-04-2

February 22, 2013

EXHIBIT NO 01

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Geosyntec
consultants

SITE-SPECIFIC CLEANUP GOAL REPORT

Former Kast Property
Carson, California

Prepared for:

Shell Oil Products US

Prepared by:

Geosyntec Consultants, Inc.

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CERTIFICATION

SITE-SPECIFIC CLEANUP GOAL REPORT

FORMER KAST PROPERTY

CARSON, CALIFORNIA

I am the Project Manager for Equilon Enterprises LLC doing business as Shell Oil Products US for this project. I am informed and believe that the matters stated in the Site-Specific Cleanup Goal Report dated February 22, 2013 are true, and on that ground I declare, under penalty of perjury in accordance with Water Code section 13267, that the statements contained therein are true and correct.

Gene Freed
Project Manager
Shell Oil Company
February 22, 2013

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EXECUTIVE SUMMARY

A Site-Specific Cleanup Goal Report (SSCG Report) was prepared for the Former Kast Property (Site) in Carson, California in response to the Cleanup and Abatement Order issued to Shell Oil Products US by the California Regional Water Quality Control – Los Angeles Region (Regional Board). The Site is a former petroleum storage facility from the mid-1920s to the mid-1960s that was sold by Shell to residential developers, who drained and decommissioned the reservoirs, graded the site and redeveloped it into the Carousel Community residential housing tract in the late 1960s. The objectives of the report are to propose the remedial action objectives (RAOs) and site-specific cleanup goals (SSCGs) for soil, soil vapor, indoor air, and groundwater that will be used in preparation of a Remedial Action Plan (RAP) for the Site. A full Human Health Risk Assessment (HHRA) incorporating the SSCGs proposed in this report will be conducted to further evaluate potential health risks once the site characterization work is complete. The HHRA will be used to guide final response actions for impacted media at the Site and will likely be included in the RAP.

Previous Site Evaluations

Environmental characterization of the Site is ongoing. As part of the characterization, investigations that have been conducted include Site-wide assessment of soil, soil vapor, and groundwater in roadways and an adjacent rail right-of-way. Property-specific investigations at individual residential properties have also been conducted that have included assessment of soil, sub-slab soil vapor, and indoor air and methane screening.

Through December 31, 2012, environmental data have been collected at the following numbers of properties:

- 265 properties have been screened for methane,
- 265 properties have had soil samples collected,
- 262 properties have had sub-slab soil vapor collected, and
- 190 properties have had indoor air samples collected

Results of these investigations have detected the presence of petroleum-related and some non-petroleum-related constituents. To date, over 550 Phase II Interim and

Follow-up Reports[1] have been prepared to document the results of these property-specific investigations and submitted to the Regional Board. These reports included a Human Health Screening Risk Evaluation (HHSRE) and an evaluation of interim response actions.

The HHSREs provide a preliminary evaluation of potential human health risks associated with detected chemicals at the property to assist in interim response planning. The screening level concentrations that were used in the HHSREs were developed following California Environmental Protection Agency (Cal-EPA), Office of Environmental Health Hazard Assessment (OEHHA) and United States Environmental Protection Agency (USEPA) guidance. Screening levels are based on general assumptions and are used to gain a general understanding of potential issues with the Site. However, it is important to note that the presence of a chemical at concentrations in excess of a screening level does not indicate that adverse impacts to human health are occurring or will occur, but suggests that further evaluation of potential human health concerns is warranted.

As indicated in the Phase II Interim and Follow-up Reports, soil concentrations of Site-related potential Constituents of Concern (COCs) exceeding screening levels were detected across the Site. Based on these results, interim response actions to limit exposure to impacted soils were recommended, as appropriate. The investigations conducted at the Site did not identify potentially hazardous levels of methane due to petroleum degradation in indoor air or in public areas at the Site. Additionally, COCs detected in indoor air are reflective of background levels and are not indicative of vapor intrusion. The Regional Board and OEHHA have reviewed the Phase II Interim and Follow-up Reports submitted for the properties tested and have concurred in the findings and recommended actions.

Constituents of Concern

Potential COCs were initially identified by reviewing the historical and current uses associated with the Site and were selected based on their likelihood of being associated with the petroleum storage facility present in the 1924 to 1966 time frame. Consideration was also given as to whether COCs may have been introduced from non-Site-related potential sources or residential land-use activities. Only COCs potentially related to the previous operation of the Site as a crude/bunker oil storage facility are considered as Site-related COCs. Key potential Site-related COCs are as follows: Total

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[1] Multiple reports have been submitted for many properties at the Site.

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petroleum hydrocarbons (TPH); TPH-related volatile organic compounds (VOCs); TPH-related semi-volatile organic compounds (SVOCs) including polycyclic aromatic hydrocarbons (PAHs); metals (lead and arsenic); and methane. Non-Site-related COCs are also identified and are considered as those COCs that are detected at the Site, but not related to previous petroleum hydrocarbon storage operations. Non-Site COCs include chlorinated VOCs, fuel oxygenates, trihalomethanes, and selected metals. Metals that are consistent with background concentrations or below California Human Health Screening Levels are not considered Site-related. The final list of COCs that was incorporated into the SSCG derivation was selected using a conservative screening process based on (i) detection of the constituent during the site investigation activities, (ii) the screening levels presented in the HHSRE reports, and (iii) background levels.

Remedial Action Objectives and Site-Specific Cleanup Goals

Medium-specific RAOs were developed based on the results of the Site investigation and HHSREs. The following RAOs are proposed for the Site:

- Prevent human exposures to concentrations of Site-related COCs in soil, soil vapor and indoor air such that total lifetime incremental carcinogenic risks are within the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) risk range of 10^{-6} to 10^{-4} (i.e., incremental cancer risk ranging from one in one million to one hundred in one million) and non-cancer hazard indices are less than 1 or concentrations are below background whichever is higher. Potential human exposures include on-site residents and construction and utility maintenance workers,
- Prevent fire/explosion risks in indoor air and/or enclosed spaces (e.g., utility vaults) due to the generation of methane from the anaerobic biodegradation of petroleum hydrocarbons in soils,
- Remove light non-aqueous phase liquid (LNAPL) to the extent practicable and where a significant reduction in current and future risk to groundwater will result, and
- Maintain a stable or decreasing plume of Site-related COCs in groundwater beneath the Site.

Numeric and non-numeric media-specific SSCGs are proposed for soil, soil vapor, indoor air, and groundwater. These SSCGs were developed using appropriate guidance documents and agency policies and are summarized below by medium.

SSCGs for Soil

Numerical SSCGs for soil were developed using the similar methodology and approach used to conduct the HHRSE for each property located on the Site where soil sampling was conducted (265 properties). SSCGs for a residential scenario are based on exposure assumptions for two depth profiles: surface soil (0-2 feet below ground surface (bgs)) and subsurface soil (>2-10 feet bgs). Evaluation of these depth ranges separately accounts for the more likely exposure to soil nearer the surface and infrequent exposure to subsurface soil. SSCGs for a construction worker and utility maintenance worker scenario are developed assuming exposures can occur to soil at depths from 0 10 feet bgs. The SSCGs for soil are as follows:

- The SSCGs for residential exposures are chemical-specific numerical values assuming a target incremental cancer risk of 10^{-6} and a hazard quotient of 1. These numerical SSCGs will be applied to soils not covered by hardscape and are calculated for both surface (0-2 feet bgs) and subsurface soils (>2-10 feet bgs).
- The SSCGs for construction and utility maintenance worker exposures are chemical-specific numerical values assuming a target incremental cancer risk of 10^{-5} and a hazard quotient of 1. These numerical SSCGs will be applied to soils from 0 to 10 feet bgs.

These numerical values are listed in the report.

SSCGs for Soil Vapor and Indoor Air

The soil vapor cleanup goals for the residential scenario are based on the sub-slab soil vapor sample analytical results and a multiple-lines-of-evidence vapor intrusion pathway analysis. Additionally, fire and explosion risks are considered for methane.

The multiple-lines-of-evidence evaluation considered the sub-slab soil vapor, indoor air, garage air, and outdoor air data at the 190 properties where indoor air sampling has been conducted as of December 31, 2012. In addition, the evaluation also relied on published studies of background concentrations of indoor and outdoor air quality. The conclusions of the evaluation are as follows:

- Indoor air and outdoor air concentrations of VOCs detected at the properties evaluated are indistinguishable from background and within the typical ranges of background concentrations reported in the literature.

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- The analyses show that indoor air concentrations are correlated with the garage air and outdoor air concentrations. However, indoor air concentrations of Site-related COCs are not correlated with sub-slab soil vapor concentrations (i.e., homes with higher indoor air concentrations are not the properties with higher sub-slab soil vapor concentrations), and the analyses show that vapor intrusion is not affecting indoor air quality at the Site for Site-related COCs.

- The presence of indoor sources of VOCs contributes to the variability in indoor air concentrations detected at the Site.

- An empirical vapor intrusion attenuation factor cannot be calculated for this site, because indoor air concentrations are reflective of background concentrations and there is no statistically significant relationship between the sub-slab soil vapor and indoor air concentrations.

As a result of the evaluation, numerical SSCGs for residential exposure are not proposed. Instead, a vapor intrusion assessment will be made on a property-specific basis to assess whether the sub-slab data result in indoor air concentrations above background.

Methane screening has been conducted in indoor structures on the Site and utility vaults, storm drains and sewer manholes at and surrounding the Site. The screening assessments have not identified methane concentrations in enclosed spaces that indicate a potential safety risk. Additionally, more than 1,000 sub-slab soil vapor samples have been collected at 262 properties at the Site and analyzed for methane. Methane concentrations above the interim action levels of 0.1% and 0.5% resulting from biodegradation of residual petroleum hydrocarbons have been identified at one sample location under the garage at one property; however, no methane exceedances were found during the indoor air screening and sampling conducted at this property. Engineering controls to mitigate the potential risks due to methane detected beneath the garage at this location were installed.

Proposed SSCGs for methane are the same as those presented in the Data Evaluation and Decision Matrix previously prepared for the Site. These SSCGs are consistent with DTSC guidance for addressing methane detected at school sites.

Methane Level	Response
>10%LEL (> 5,000 ppmv) Soil vapor pressure > 13.9 in H_2O	Evaluate Engineering Controls
> 2% - 10%LEL (> 1,000 - 5,000 ppmv) Soil vapor pressure > 2.8 in H_2O	Perform follow-up sampling and evaluate engineering controls

The SSCGs for construction and utility maintenance worker exposures are chemical-specific numerical values assuming a target incremental cancer risk of 10^{-5} and a hazard quotient of 1. These numerical SSCGs will be applied to soil vapor from 0-10 feet bgs. These numerical values are listed in the report.

SSCGs for Groundwater

Uppermost (or first) groundwater occurs at variable depths of approximately 52-68 feet bgs depending on well location and timing of sampling (Shallow Zone). The Gage aquifer is interpreted to underlie the Site at a depth of approximately 80-90 feet bgs. The Gage aquifer is underlain by low permeability materials which separate the Gage aquifer from the underlying Lynwood aquifer. There is no documented or expected future use of groundwater within the Shallow Zone or Gage aquifer at or near the Site. Furthermore, the agencies have stated that drinking water supplied to the Carousel Community is safe, as it is drawn from off-site wells that draw from other aquifers, and the shallow aquifer and Gage aquifer beneath the site that are impacted by COCs are not used as sources of drinking water.

Groundwater beneath the Site, including groundwater in the Shallow Zone and Gage aquifer, is impacted with various chemicals including petroleum hydrocarbons, chlorinated hydrocarbons, metals, and general minerals. Of these, potential Site-related COCs in groundwater which exceed a California drinking water Maximum Contaminant Level (MCL) or California health-based notification level (NL) include benzene, naphthalene, and arsenic.

- Benzene: The distribution of benzene in groundwater beneath the Site is generally well defined, both laterally and vertically, and the dissolved benzene plume at the Site appears to be stable or declining. The stable or declining plume is consistent with an old, weathered crude oil source and the well documented process of natural degradation of petroleum hydrocarbon compounds in the subsurface environment through microbial activity.

- Naphthalene: Concentrations of naphthalene exceed the NL in two wells on-Site both of which are also impacted by benzene.

- Arsenic: Concentrations of arsenic are above the MCL in multiple Site monitoring wells with higher concentrations detected in the west central portion of the Site. The source of arsenic is likely naturally occurring, although the concentrations may be locally enhanced due to the presence of reducing conditions due to the degradation of petroleum hydrocarbon compounds. Arsenic is recognized as a regional contaminant in southern California groundwater. Because the source of arsenic is likely naturally occurring, the compound is not considered in setting Site-specific groundwater cleanup goals.

Groundwater in both the Shallow Zone and the Gage aquifer in the Site vicinity is not used for drinking or other purposes, and future use of the groundwater is not expected to occur. In the case of groundwater, it is proposed that the following non-numerical SSCGs be established for the site (consistent with the RAOs):

- Remove LNAPL to the extent practicable and where a significant reduction in current and future risk to groundwater will result.
- Maintain a stable or decreasing plume of Site-related COCs beneath the Site.

These groundwater SSCGs are consistent with the direction set out in the CAO as follows:

- Return of the Shallow Zone and Gage aquifer to background levels for Site-related benzene (and naphthalene) impacts is expected to eventually occur through natural biodegradation. Although arsenic is not considered herein in setting a cleanup goal, reduction of petroleum hydrocarbon levels through time is also expected to lower arsenic concentrations as groundwater conditions become less reducing.

- No use of Site groundwater is reasonably anticipated in the future given the overlying land use as housing and the adjudicated nature of the groundwater basin. Thus, the people of the State are not expected to be affected by Site-related benzene concentrations persisting into the future at the Site.

- Points of compliance for monitoring benzene plume stability will be established and presented in the RAP based on review of Site data and approved by the Regional Board in order to comply with the SSCG.

1.0 INTRODUCTION

This Site-specific Cleanup Goal Report (SSCG Report) was prepared for the Former Kast Property (Site) in Carson, California on behalf of Equilon Enterprises LLC, doing business as Shell Oil Products US (SOPUS). The Former Kast Property is a former petroleum storage facility from the mid-1920s to the mid-1960s that was sold by Shell to residential developers, who drained and decommissioned the reservoirs, graded the site and redeveloped it into the Carousel Community residential housing tract in the late 1960s. The site is located in the area between Marbella Avenue on the west and Panama Avenue on the east and E. 244th Street on the north to E. 249th Street to the south (Figure 1).

1.1 Background.

This report was prepared in response to Cleanup and Abatement Order (CAO) No. R4-2011-0046 issued to SOPUS on March 11, 2011 by the California Regional Water Quality Control Board – Los Angeles Region (RWQCB or Regional Board). Section 3.c of the CAO orders SOPUS to "prepare a full-scale impacted soil Remedial Action Plan (RAP) for the Site." As a part of the RAP several requirements have been set forth that address the development of remedial action objectives (RAOs) and cleanup goals for the Site. The CAO also ordered that this SSCG report be prepared in advance of the RAP and submitted concurrently with the Pilot Test Report. Pilot tests for the following technologies have been evaluated for applicability at the Site: soil vapor extraction (SVE), in-situ chemical oxidation (ISCO), bioventing, and excavation. The results of these pilot studies have been submitted to the Regional Board (URS, 2010b; Geosyntec, 2012a; Geosyntec, 2012b; and URS, 2013a,d). It is anticipated that a final Pilot Test Report summarizing the results of all the pilot studies and an evaluation of the feasibility of removing the concrete slabs of the former reservoirs will be submitted after the pilot study work is completed.

This SSCG report was prepared to address these requirements of the CAO and provide an overview of the Site conditions, as well as the RAOs and cleanup goals to address petroleum hydrocarbon impacts at the Site.

The SSCG Report is organized into the following sections:

- 1.0 Introduction
- 2.0 Site Conceptual Model
- 3.0 Constituents of Concern and Remedial Action Objectives
- 4.0 Guidance Documents Considered

- 5.0 Soil
- 6.0 Soil Vapor
- 7.0 Indoor Air
- 8.0 Groundwater
- 9.0 Summary

1.2 Objectives

The objectives of this report are to provide the RAOs and site-specific cleanup goals (SSCGs) that will be used in the RAP for the Site. Specifically, this report will address the following requirements of the CAO:

- Evaluate impacts to shallow soils as defined in the CAO as soils from 0-10 feet below ground surface (bgs)[2] (CAO Section 3);
- Consider listed guidelines and Policies in the development of cleanup goals (CAO Section 3.c.II.i);
- Address groundwater cleanup goals considering the Basin Plan, State Board Resolution No. 68-16 and State Board Resolution No. 92-49 (CAO Sections 3.c.II.ii, iii and iv); and
- Develop site-specific cleanup levels for residential (i.e., unrestricted) land use (CAO Section 3.c.III) and for construction/utility worker exposures.

1.3 Previous Response Actions

URS Corporation (URS) and Geosyntec Consultants (Geosyntec) are conducting an environmental characterization at the Site on behalf of SOPUS, as requested in the Regional Board's Section 13267 letter dated May 8, 2008. As part of the characterization, investigations that have been conducted at the Site include (i) Site-wide assessment of soil, soil vapor, and groundwater in roadways and an adjacent rail right-of-way and (ii) property-specific investigations at individual residential properties that have included assessment of soil, sub-slab soil vapor, and indoor air and methane screening.

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[2] Impacts to shallow soils for residential properties and public rights of way will be addressed in this report.

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Results of these investigations have detected the presence of a number of petroleum-related and some non-petroleum-related constituents. Total petroleum hydrocarbons (TPH) quantified as gasoline-range organics (TPHg), diesel-range organics (TPHd), and motor oil-range organics (TPHmo) have been detected in Site soils and groundwater. A number of volatile organic compounds (VOCs), including compounds associated with petroleum hydrocarbons (e.g., benzene, toluene, ethylbenzene, xylenes [BTEX], trimethylbenzenes and other substituted aromatic compounds), and non-petroleum-related VOCs, including the chlorinated solvents trichloroethene (TCE) and tetrachloroethene (PCE) and related breakdown products, have been detected in Site soils, groundwater, soil vapor, and indoor/outdoor air. In addition, polycyclic aromatic hydrocarbons (PAHs), including naphthalene and benzo(a)pyrene, have been detected in site soils associated with hydrocarbon-impacts. Various metals including arsenic have been detected in site soils and groundwater.

For each of the property-specific evaluations, a Human Health Screening Risk Evaluation (HHSRE) was conducted to provide a preliminary evaluation of potential human health risks associated with chemicals detected at the property. These were based on the analytical results of the soil, sub-slab soil vapor and indoor air samples collected to date and conservative screening levels. The HHSREs were conducted in accordance with the approved HHSRE Work Plan (Geosyntec, 2009) and addendum (Geosyntec, 2010b). In conjunction with the HHSRE Workplan, a Data Evaluation and Decision Matrix was developed (Geosyntec, 2010a). The purpose of the matrix was to identify potential follow-up interim response actions that may be performed upon evaluation of Phase II Site Characterization of soil, sub-slab soil vapor and indoor air analytical data and HHSRE screening results. The screening level concentrations that were used in the HHSRE are consistent with the California Environmental Protection Agency (Cal-EPA), Office of Environmental Health Hazard Assessment (OEHHA) and United States Environmental Protection Agency (USEPA) screening levels. Screening levels are based on general assumptions and are useful to gain a general understanding of potential issues with the Site. The presence of a chemical at concentrations in excess of a screening level does not indicate that adverse impacts to human health are occurring or will occur but suggests that further evaluation of potential human health concerns is warranted. A full Human Health Risk Assessment (HHRA) will be conducted to further evaluate potential health risks once the site characterization work is complete.

Based on the findings of the Phase II investigations, potential follow-up interim response actions were identified. The interim response actions that could be used at the Site were documented in the Interim Remediation Action Plan (IRAP, URS, 2009a). Through December 31, 2012, the number of properties that have been evaluated for potential interim response actions based on the matrix criteria and the IRAP are:

- 265 properties for soil,
- 262 properties for sub-slab soil vapor, and
- 190 properties for indoor air.

Interim response actions are documented in the Phase II Interim and Follow-up Reports prepared for each property that has been evaluated. To date, over 550 HHSREs have been prepared and submitted to the Regional Board in the Phase II Interim and Follow-up Reports. The Regional Board has concurred with HHSRE findings presented in these reports for Site-related COCs. Interim response actions were further evaluated at 21 properties and reported in the Evaluation of Interim Institutional and/or Engineering Control Reports submitted to the Regional Board.

As stated previously, a full HHRA will be conducted once the Phase II Site Characterization work is complete. The HHRA will incorporate the SSCGs developed in this report and will be used to guide final response actions for impacted media at the Site. It is anticipated that the HHRA will be included in the RAP.

2.0 SITE CONCEPTUAL MODEL

This section summarizes and updates the Site Conceptual Model (SCM), which was included as an appendix to the Plume Delineation Report (PDR) (URS, 2010a). The objectives of the SCM were to summarize the Site understanding related to: (i) identification of potential constituents of concern (COCs); (ii) sources of COCs and potential release mechanisms; and (iii) potential fate and transport of Site COCs, including identification of exposure pathways and receptors for the COCs. The information in this section has been updated to incorporate new data and understanding of the site obtained through site investigations conducted subsequent to the September 2010 date of the PDR.

2.1 Potential Sources and Potential Constituents of Concern

Historically, petroleum-related operations were associated with the Site. Crude oil was stored in three concrete-lined earthen reservoirs from 1924 to about 1966. Bunker oil, a very viscous residuum from refining of lighter-end hydrocarbons, was apparently also stored at the Site. Some records also refer to the storage of other heavy intermediate refinery streams. Due to the nature of former crude oil storage operations at the Site, and the oil production and former industrial operations in the surrounding area, a number of sources may have contributed to the contaminants that have been detected at and around the Site. Detailed information about potential sources was included in Section 4.0 of the SCM (URS, 2010a), as summarized below.

The historic onsite petroleum storage reservoirs are considered to have been a source of petroleum releases to Site soils. The reservoirs are believed to have had reinforced concrete-lined earthen floors and slopes with wood frame roofs supported by wooden posts and/or concrete pedestals, and were surrounded by earthen levees averaging 20 feet in height. The site was sold by Shell to a developer, who drained and demolished the reservoirs in the mid-late 1960s. Where concrete from the reservoirs was not removed, records indicate that following the removal of residual hydrocarbons remaining in the reservoirs by the residential developer, the developer's contractors cut trenches into the reservoir bases so that the reservoirs would not pond water and adversely affect drainage/infiltration for the subsequent residential development on the Site. Concrete from the reservoir sides was then reportedly placed by the developer's contractors into the base of the reservoirs, and soil from the surrounding levees was subsequently graded, watered and compacted in place, spreading any existing petroleum impacts around the site.

In addition to the reservoirs, other potential sources include former pipelines, an onsite oil pump house, various offsite operations by others at surrounding facilities (including refining operations, refined hydrocarbon storage, industrial chemicals processing, and chemical milling operations), offsite oil wells owned and operated by others, dry cleaners, atmospheric depositions, and, likely to a smaller extent, various residential activities.

Compounds associated with crude or bunker oil, include TPH, and TPH-related compounds such as certain volatile organic compounds (VOCs) (primarily BTEX - benzene, toluene, ethylbenzene and xylene), polycyclic aromatic hydrocarbons (PAHs) and possibly metals. Potential COCs were identified by reviewing the historical and current uses associated with the Site and were selected based on their likelihood of being associated with the petroleum storage facility operating in the 1924 to 1966 time frame. Consideration was also given as to whether COCs may also have been introduced from non-Site-related potential sources and residential land-use activities. Section 5.0 of the SCM (URS, 2010a) contains detailed information about sources for each potential COC. Only COCs related to the previous operation of the Site as a crude/bunker oil storage facility are considered as Site-related COCs. The remaining COCs are considered non-Site-related COCs. The remainder of this section discusses key potential COCs as follows:

- TPH;
- VOCs;
- Semi-volatile organic compounds (SVOCs) including PAHs;
- Metals; and
- Methane.

In addition to the above constituents, polychlorinated biphenyls (PCBs), pesticides and fuel oxygenates were considered. PCBs and pesticides have not been detected in Site soils and are not considered COCs. The oxygenate tert-butyl alcohol (TBA) has been detected in Site groundwater; however as discussed below, TBA was not used before the 1970's and is considered a non-Site-related COC.

2.1.1 Total Petroleum Hydrocarbons

The specific source of the crude oil stored in the reservoirs is not known. Crude oil is a complex mixture of various petroleum hydrocarbon compounds. TPH concentrations are often reported in general hydrocarbon chain ranges corresponding to gasoline, diesel, and motor oil. If the TPH from crude or bunker oil is present at sufficiently high concentration it will occur as a non-aqueous phase liquid (NAPL) which typically has lower density than water and is often referred to as "light NAPL" or LNAPL. LNAPL has been detected at the Site. As an example, an LNAPL sample collected and analyzed from Site monitoring well (MW-3) characterized the LNAPL as a relatively unweathered crude oil likely produced from the Monterey Formation, a common oil-producing geologic formation found throughout southern California.

Borings completed during Site characterization found evidence of petroleum releases at the Site. Elevated TPH and other indicators of petroleum releases were found: (1) beneath the footprint of the former reservoirs (below their bases, but primarily along the perimeter), in the area near the presumed joint between the reservoir bases and the reservoir sidewalls; (2) within the fill material above the base level of the former reservoirs (the source of these impacts appears to be from the developer's reuse of petroleum-impacted fill from other portions of the Site such as berm areas), and (3) in areas outside the footprints of the former reservoirs. The source(s) of impacts outside the former reservoirs are potentially from a combination of sources, including the developer's grading activities, possible former onsite or offsite pipelines, offsite sources, and shallow soil sources associated with residential activities.

2.1.2 Volatile Organic Compounds

Volatile organic compounds (VOCs) are light molecular weight hydrocarbons which have low boiling points and therefore evaporate readily. Some VOCs occur naturally in the environment, others only as a result of manmade activities, and some have both origins. Only VOCs associated with crude oil such as aromatic and aliphatic hydrocarbons are considered Site-related COCs. In addition to a crude oil source, these compounds may also have been released to the Site though accidental releases of gasoline or other refined petroleum products following residential development.

Site-related VOCs: The most prevalent VOCs associated with crude oil include aromatic compounds such as BTEX and aliphatic compounds such as the alkanes (hexane, heptane etc.). They can impact soil or volatilize from the liquid or sorbed phase to impact soil vapor. For example, BTEX could volatilize from LNAPL and migrate through soil as a soil vapor to an enclosed space or enter a building through vapor intrusion.

Non-Site-related Chlorinated VOCs: Chlorinated VOCs include hydrocarbon compounds that contain chlorine atoms and are typically used as solvents (such as tetrachloroethene [PCE] and trichloroethene [TCE]). Although these compounds have been detected at the Site, they are not considered Site-related COCs because no evidence has been found that chlorinated solvents were used at the Site. Their presence at the Site is likely related to other sources including offsite sources such as the adjacent former Turco Products/Purex facility (Turco) where they are an identified COC (see below); the former Oil Transport Company, Inc. (OTC), which is now the location of the Monterey Pines community directly west of the Former Kast Property, dry cleaner facilities, which most commonly use PCE; or possibly residential chemical product use. USEPA is currently conducting an investigation regarding the presence of chlorinated VOCs in areas near the Site. A description of Turco and OTC is as follows:

<u>Turco</u>: Activities associated with Turco's former operations, included the processing of industrial chemicals and chemical milling operations associated with aircraft and milling production which resulted in the contamination of soil and groundwater with VOCs. Contamination is greatest in the areas formerly used for chemical and hazardous waste storage, handling and treatment. A summary of results for Turco's soil and groundwater investigations indicated that volatile compounds, including benzene, toluene and chlorinated VOCs were detected in the groundwater (ERM, 2010). Soil, soil vapor and groundwater samples were also collected in the Carousel Tract residential area east of the former Turco facility as part of Turco's investigation. Hydrocarbons, including benzene, toluene, xylenes, and ethylbenzene, and chlorinated solvents were detected (ERM, 2010 and Leymaster, 2010). In an April 2008 Fact Sheet for the former Turco facility, DTSC also associated the detected VOCs within the soil vapor with past Turco operations (Cal-EPA DTSC, 2008). The results of these investigations led to further investigations at the Former Kast Property.

Former OTC Facility: OTC operated a trucking firm from 1953 to 1996 specializing in the transportation of crude oil and asphalt (Cal-EPA DTSC, 2009a). The OTC site was used for truck parking and maintenance. The OTC site included one active oil well, above ground and underground fuel and water storage tanks, a clarifier, garage and mechanic shops and truck wash down areas (PIC Environmental Services, 1996). In 1997, Blue Jay Partners constructed a residential subdivision called Monterey Pines on the OTC site. Prior to construction operations, seven underground storage tanks (USTs) used to store gasoline, diesel and waste oil and associated piping and dispensing islands were excavated and removed from the site. A brick lined sump and concrete clarifier were also removed. Soil sampling during the UST and clarifier removal indicated TPH, BTEX, TCE and PCE impacts in soil (PIC Environmental Services, 1995). DTSC (2009a) reported that during construction of the residential subdivision

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contaminated soils were consolidated under the roads of the new subdivision. As part of the environmental investigation and plume delineation for the Former Kast Property, URS documented elevated concentrations of chlorinated VOCs beneath Monterey and Carmel Drives (URS, 2010a). At this time DTSC does not believe the chlorinated VOC plume beneath the current Monterey Pines Development is associated with the Former Kast Property (USEPA, 2012a). The EPA in cooperation with DTSC and the RWQCB is conducting an environmental investigation to further delineate chlorinated VOCs contamination beneath Monterey Pines.

Trihalomethanes (THMs) are another group of VOCs detected at the Site, which can be present from residential activities. Common THMs include bromomethane, chloroform, bromodichloromethane, dibromochloromethane, and bromoform. These have all been detected in Site soils and soil vapor. Their presence at the Site is most likely related to irrigation of yards and landscaping or leaking water lines and other household water use, as THMs are found in the domestic water supply from the California Water Service Company which provides water to the area. THMs are used for water treatment/purification (California Water, 2008/2009). Although these compounds are present at the Site, they are not considered Site-related COCs.

Additionally, some VOCs that have been detected at the Site are often found in common household products that are generally perceived as safe by the average consumer. For example, 1,4-dichlorobenzene is a compound that is commonly detected in homes due to its presence in commonly used household products, including air fresheners, mothballs and toilet deodorizer blocks (ATSDR, 2006). Other common household products that contain these VOCs include paint degreasers and removers, adhesives and adhesive removers, and auto products including brake cleaners, carburetor cleaners, degreasers, and lubricants. Although typical releases are expected to be small, some of these compounds may have been released through resident activities. A list of commonly detected chemicals present on some of the residential properties as well as some known household products that contain these chemicals was provided in the SCM (URS, 2010a).

<u>Non-Site-related Oxygenated VOCs:</u> TBA has been detected in groundwater beneath the Site. TBA is a fuel oxygenate additive and is also a breakdown product of methyl-tert butyl ether (MTBE). TBA and MTBE were both used as gasoline additives in the mid-1980s and 1990s. Although this compound has been detected in Site groundwater, it is considered a non-Site-related COC because its use post-dates the Site use as a crude oil storage facility. The presence of TBA at the Site is likely related to other sources

including offsite sources such as the adjacent former Turco site (discussed above) and the Fletcher Oil and Refining Company Site located 1,500 feet west of the Site, just east of the intersection of Main and Lomita Blvd. Leymaster Environmental Consulting (2009) indicated that the Fletcher site was used to refine and store petroleum products including crude oil, light distillates such as gasoline, naphtha, and intermediate and heavier distillates such as diesel and asphalt. The refinery was in operation from 1939 to 1992. TBA was detected in groundwater at both the Turco and Fletcher Refinery sites. Available information indicates that TBA in groundwater was detected as high as high as 850 μg/L at the Turco site (Leymaster Environmental Consulting, 2010) and 800 μg/L at the Fletcher Refinery site (Leymaster Environmental Consulting, 2012).

Residential Activities: Various activities, including lawn care, hobbies and crafts, auto repair, and home maintenance such as painting, which are not related to historical Site activities, may have resulted in release of and subsequent detections of chemicals in soil, soil vapor, or indoor air. Although it is unlikely that a large volume of a contaminant would be released to the ground surface by resident activities, localized impacts could be noticeable in surface soils or in indoor air.

In summary, with respect to VOCs, only TPH-related VOCs are considered related to historical Site activities. Chlorinated VOCs, though present at the site, are not considered Site-related, because their presence is not consistent with previous operation of the site as a crude and bunker oil storage facility. Chlorinated VOCs are believed to be present at the site as a result of either offsite sources (e.g., Turco or OTC) and/or residential activities (e.g., trihalomethanes, 1,4-dichlorobenzene).

2.1.3 Semi-volatile Organic Compounds (SVOCs)

SVOCs are organic compounds which have a boiling point higher than water, but may volatilize when exposed to temperatures above room temperature. SVOCs vary widely in their chemical structures. Forms include, but are not limited to, PAHs, phthalates, and phenols. Certain SVOCs can be associated with crude oil, petroleum, and/or produced through combustion. Because of their association with crude oil, select SVOCs are considered Site-related COCs.

PAHs are composed of two or more aromatic hydrocarbon rings bound in a lattice formation. They are commonly found in crude oil, tar, coal, and residues from former manufactured gas plant sites. PAHs are also commonly produced as a by-product of burning fossil fuels (in power plants or vehicle emissions) or biomass fuels (like wood), or as residues from brush or forest fires. While PAHs may have been introduced historically from the crude oil storage operations at the Site, there are other natural and anthropogenic sources that may also be sources of PAHs detected at the Site. In addition to their derivation from the burning of organic materials, PAHs are widely distributed throughout modern urban areas in near-surface soils as a result of atmospheric deposition. As a result, PAHs are found in almost all urban and rural surface soils. PAHs are generally found at higher ambient concentrations in urban areas, near heavily traveled roadways, areas that have been occupied/established for an extended period of time, and areas downwind of urbanized areas (Cal-EPA DTSC, 2009b; Environ, 2002). The PAHs that have been most regularly detected at the Site include pyrene, phenanthrene, chrysene, benzo(a)anthracene, fluoranthene, 2-methylnaphthalene, naphthalene, benzo(a)pyrene, benzo(b)fluorathene and benzo(g,h,i)perylene. Chrysene, benzo(a)anthracene, benzo(a)pyrene and benzo(b)fluorathene are in a group of PAHs that are associated with carcinogenic effects and are commonly evaluated together as the carcinogenic PAHs (cPAHs).

2.1.4 Metals

Metals may be found in crude oil in trace amounts, but are also naturally occurring in southern California soils or are present due to anthropogenic sources. Site investigations indicated the limited, localized presence of arsenic and lead in soils at concentrations above their respective California Human Health Screening Level (CHHSL, Cal-EPA OEHHA, 2005) or regional background values. The sources of these metals are not known. Metals that are consistent with background concentrations or below CHHSLs (Cal-EPA OEHHA, 2005) are not considered Site-related.

Lead is known to be deposited in urban areas through atmospheric deposition, which was most significant historically prior to the widespread phase out of leaded gasolines in the late 1970s. Other potential sources of lead include lead-based paint, which may have been used during the crude oil storage operation and on residences before the use of lead-based paint was restricted in 1978.

Arsenic has been used in the past as a pesticide/rodenticide agent, and as a wood preservative. It is not known to have been specifically used at the Site. However, it is possible it was used during the crude oil storage period, the residential period, or both. Arsenic is also known to occur naturally in soils and groundwater at concentrations exceeding risk-based screening levels.

Several metals exceed the California Maximum Contaminant Level (MCL) in groundwater. These metals are arsenic, thallium, mercury, and antimony. Additional discussion of these metals is presented in Section 8.

2.1.5 Methane

Methane has been detected in soil vapor samples collected at the Site. Based on the characterization work completed, methane is present primarily as the by-product of anaerobic biological degradation of crude oil compounds in the soils beneath the Site (biogenic methane), and as a result of leaking natural gas utility lines, which were found at several of the residential properties.

Although petroleum hydrocarbons in the subsurface have likely fermented to produce methane at depth, such methane is generally not present in the shallow subsurface and is generally not present in residences or enclosed areas of the Site at levels that pose a hazard. In one instance to date, methane believed to be attributable to fermentation of petroleum hydrocarbons was detected at a concentration above the interim action level in a sub-slab probe beneath a garage; however, methane was not detected above the interim action level in other sub-slab soil vapor probes located at this property and no methane exceedances were found during the indoor air screening and sampling conducted at this property. The detection at this location is anomalous in that it represents the only detection of petroleum hydrocarbon-related methane out of 812 sub-slab soil vapor locations sampled through December 31, 2012. Although methane has been detected in a few instances during indoor air screening with hand-held instruments, in each of those cases the source was determined to be leaking natural gas lines or connections to a stove, a clothes dryer, a furnace, and a fireplace. In none of these instances was the methane linked to subsurface hydrocarbon impacts.

Typically, methane generated at depth migrates very slowly through soils because it is not under significant pressure. Transport is primarily through diffusion, and methane moving upward from depth is typically biologically degraded and/or significantly attenuated in the aerobic shallow soils before it reaches the surface. This bio-attenuation in vadose zone is evident in the soil vapor data collected at the site that has been reported in the Interim and Follow-up Phase II Reports and the quarterly soil vapor monitoring reports (URS, 2013b). These natural mechanisms explain the lack of elevated methane levels in the sub-slab soil vapor samples and in indoor air within the residences that have been tested.

2.1.6 Summary of Potential COCs

The SCM identifies a range of constituents that are potential COCs. These are divided into Site-related COCs (i.e., COCs considered to be potentially related to the previous operation of a crude/bunker oil storage facility) and non-Site-related COCs (e.g., COCs related to offsite activities or site activities following Site redevelopment and COCs representative of background conditions). Potential Site-related COCs include:

- TPH;
- TPH-related VOCs;
- TPH-related SVOCs (including PAHs);
- Metals – (lead and arsenic); and
- Methane.

Non-Site-related COCs include:

- Chlorinated VOCs;
- THMs; and
- Metals present in soil or groundwater at background levels.

Further discussion of COCs is provided in Section 3.0. Additionally, the RAP will propose what corrective actions, if any, are warranted for the different COCs identified in this report.

2.2 Fate and Transport

Crude oil was released to the Site from the former crude oil storage operations. It is assumed that one release mechanism was through leakage of the crude oil storage reservoirs (primarily in the area where the side walls and floors were joined). Also, site grading for residential development appears to have redistributed impacted soils, particularly in the areas overlying the former reservoirs and outside the reservoir boundaries. There may also have been releases from former onsite pipelines, in adjacent streets and rights-of-way, and releases from adjacent oil production and industrial facilities owned and operated by others, and oil field operations (oil wells) owned and operated by others.

COCs released to soils during the crude oil storage operation presumably migrated downward through soils in the LNAPL phase. If sufficient volume existed (i.e., through significant leakage over a long period of time), crude oil containing the associated COCs would have migrated downward through the soil profile as LNAPL to the groundwater table. LNAPL has been detected at the groundwater table at MW-3 near the former location of a sidewall and floor joint of the central storage reservoir.

Petroleum VOCs, PAHs, and metals detected at the Site may be related to crude oil; however, some may be from other sources. For example, their origin at the Site may be through other mechanisms such as atmospheric deposition or a combination of Site releases and atmospheric deposition as well as occurring naturally. The presence of secondary sources may complicate the pattern of detections in environmental media and therefore interpretation of transport pathways.

Once COCs enter the soil, they may migrate or have been redistributed via one or more of the following mechanisms:

Construction Activities: The demolition, grading and home construction activities, particularly Site grading by Lomita Development Company and its contractors, appear to have redistributed some petroleum containing soils at the Site, especially in surface soils (approximately the upper 10 feet). Available historical records do not indicate the source of fill placed at the Site by the developer. Such fill may have been derived from the Site itself (e.g. the berms that formed the reservoirs). Redistribution of petroleum containing soil during grading by the developer is the most likely explanation for detections of petroleum hydrocarbons in the soils at the Site present above the elevation of the former reservoir bases.

LNAPL Migration: If sufficient driving force was present, LNAPL (crude oil) could migrate directly through the soil column. For example, the presence of LNAPL in Site monitoring well (MW-3) indicates that LNAPL migrated downward from near-surface release(s) to groundwater at this location.

Leaching: COCs may also have partitioned out of residual crude oil released to Site soils and into infiltrating water (via leaching) from rainfall or Site irrigation water that eventually came in contact with the crude oil in the subsurface. COCs most subject to leaching include VOCs, certain SVOCs, and to a much lesser degree PAHs and metals. Infiltrating water could have potentially carried these compounds downward through the soil column and eventually into groundwater.

It is expected that the VOCs and other COCs originally present in the vadose zone will be further reduced over time through degradation/leaching processes.

Groundwater Transport: COCs that reach groundwater would then be subject to transport with moving groundwater. Shallow groundwater at the Site currently flows northeastward. The vertical gradient at the Site between the shallow water table aquifer and the underlying Gage aquifer is slightly downward or slightly upward depending upon the area of the Site (URS, 2013c). COCs are expected to migrate at rates much less than the actual flow of groundwater, as concentrations will attenuate through adsorption to soil particles, dilution, biodegradation, and other mechanisms.

Volatilization: Some VOCs associated with crude oil, including BTEX and naphthalene, may have partitioned from crude oil into the vapor phase (soil vapor). These compounds have the potential to migrate through the Site soils and potentially impact residences through the vapor intrusion pathway. BTEX and naphthalene have been detected in soil and soil vapor samples collected throughout the Site, but their vapor migration is expected to be limited because they are very susceptible to aerobic degradation by bacteria. Aerobic conditions in shallow soils at the Site have been observed through the soil vapor monitoring that has been completed to date. The presence of BTEX in soil vapor at the Site is believed to be related to proximity of source soils and lower oxygen levels at depth that limit the potential for biodegradation away from the ground surface.

Degradation: As with most organic materials, crude oil is subject to biological degradation. A significant by-product of anaerobic biodegradation of crude oil is methane, which is present in the subsurface at the Site. As biological degradation proceeds, the volume of crude oil is decreased. Methane has the potential to migrate through the soil profile and impact residences through the vapor intrusion pathway. However, methane rapidly degrades biologically in the presence of sufficient bacteria and oxygen (Ririe and Sweeney, 1995; Eklund, 2010). It is likely that significant degradation of methane occurs in near-surface (several feet) soils at the Site where oxygen is more plentiful than deeper zones (URS, 2013b). It is important to note that degradation of other petroleum compounds such as benzene also likely occurs in the near-surface soils at the Site.

Plant Uptake: Plant uptake of chemicals is controlled by the physical chemical properties of the chemical, the environmental conditions, and the plant species. Lipophilicity and volatility are the two major parameters that dictate a chemical's potential for plant uptake. Hydrophilic and non-volatile organic compounds can enter plants by root uptake and be translocated to the aboveground parts of the plants through the transpiration stream; while lipophilic and volatile organic compounds enter plants mainly through air deposition.

For the COCs related to crude oil, PAHs and BTEX, evidence suggests that the soil-root-above ground plant or fruit pathway plays an insignificant role in their uptake. For PAHs, a number of studies suggest that air deposition is the major pathway for plants' uptake of PAHs (Edwards, 1983; Nakajima, et al., 1995; Kipopoulou, et al, 1999; Wilcke, 2000; Li, et al., 2010). Li, et al. (2010) investigated PAH distribution in water, sediment, soil, and plants and no correlation was found between PAH concentrations in soils and plants, suggesting that plants accumulate PAHs mainly through air deposition and not through translocation from the soil to the plant. Kaliszova et al. (2010) summarizes that "plant root PAH uptake was observed in some species, but the available data suggest that it does not represent a significant public health risk, even in heavily polluted soils". In addition, green plants may naturally produce benzo(a)pyrene (New Zealand Ministry for the Environment, 2011). Consistent with the literature, Cal-EPA OEHHA does not require evaluation of the soil to root uptake pathway for PAH compounds (Cal-EPA OEHHA, 2012). For BTEX, either rapid endophytic degradation in the rhizosphere or volatilization to the atmosphere would occur, preventing effective uptake by plant roots. Volatile contaminants have a low potential to accumulate by root uptake because they quickly escape to air (Trapp and Legind, 2011).

2.3 Potential Human Health Exposure

Potential human exposure to Site COCs is partly dependent on the type of chemicals that are present and the respective exposure media. For VOCs detected in soil, exposure may occur via direct contact to soil (dermal contact or incidental ingestion) as well as indirect exposure from vapors migrating from the subsurface into indoor or outdoor air. For non-volatile chemicals such as metals and most SVOCs and PAHs, direct human contact exposures should be considered as well as inhalation of particulates. In addition, the potential for exposure is dependent on the locations at which impacts are identified. For example, reasonable maximum exposure assumptions are considered for near-surface (0-2 feet bgs) or uncovered soils, which are more readily available for human contact. Conversely, infrequent exposures are expected for subsurface soils (greater than 2-10 feet bgs) or soils covered by impermeable media such as a building foundation, driveway, or hard-scape patio). Consequently, this report evaluates cleanup goals for more-likely contacted surface soils and infrequently contacted subsurface soils separately.

The following receptors and exposure pathways are considered relevant for the Site:

Receptor Population	Exposure Medium	Potentially Complete Exposure Pathway
Onsite Resident	Shallow Surface Soil (0-2 feet bgs)	• Incidental Ingestion • Dermal Contact • Outdoor Air Inhalation
	Shallow Subsurface Soil (>2-10 feet bgs)	• Infrequent Incidental Ingestion • Infrequent Dermal Contact • Outdoor Air Inhalation
	Soil Vapor	• Vapor Inhalation in Indoor Air via Vapor Intrusion
	Indoor Air	• Inhalation in Indoor Air
Construction and Utility Maintenance Worker	Shallow Soil (0-10 feet bgs)	• Incidental Ingestion • Dermal Contact • Outdoor Air Inhalation
	Soil Vapor	• Vapor Inhalation in Outdoor Air

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3.0 CONSTITUENTS OF CONCERN AND REMEDIAL ACTION OBJECTIVES

As a first step to developing cleanup goals for the Site, the COCs and Remedial Action Objectives (RAOs) must be established. As discussed in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR 300) (which is incorporated into the California Hazardous Substances Account Act (HSAA) by reference), RAOs describe in general terms what a remedial action should accomplish in order to be protective of human health and the environment. RAOs are narrative statements that specify the chemicals and environmental media of concern, the potential exposure pathways to be addressed by remedial actions, and the receptors to be protected. According to USEPA (USEPA, 1988), "RAOs for protecting human receptors should express both a contaminant level and an exposure route, rather than contaminant levels alone, because protectiveness may be achieved by reducing exposure (such as capping an area, limiting access, or providing an alternate water supply) as well as by reducing contaminant levels." The RAOs are used to help develop specific response actions for each media in the remedial action process.

This section presents the COCs and RAOs for the Site. In Sections 5 through 8, the RAOs are discussed in the context of each media to identify Site-specific Cleanup Goals (SSCGs) for the Site.

3.1 Constituents of Concern

HHSRE have been conducted for the majority of properties at the Site to evaluate the analytical results of soil and sub-slab soil vapor samples collected at the property. The HHSRE is a preliminary, conservative evaluation of potential human health risks associated with all detected organic chemicals (whether or not they are Site-related COCs). The results of the HHSRE have been used to evaluate whether interim action is warranted as data are being collected and processed in advance of a full HHRA that is planned when data collection is complete. The results of a full HHRA will be used to focus further evaluations in the RAP on those media and constituents that pose the majority of potential risk. The Site-specific clean-up goals presented in this report will be used in the full HHRA and have been developed for both Site-related and non-Site-related COCs. Recommendations for future corrective actions for COCs will be presented in the RAP for the site and will consider the SCM, the results of the upcoming HHRA, and the pilot test results. The evaluation in the RAP may identify COCs that do not require corrective action based on their source (e.g., natural or anthropogenic background, offsite source, or current onsite sources [such as THMs]) or other considerations such as exposure potential and feasibility.

COC screening was conducted using risk-based screening levels (RBSLs) that were calculated assuming potential residential exposures to COCs in soil and soil vapor as a part of the HHSRE process and presented in the approved HHSRE Work Plan (Geosyntec, 2009). The RBSLs address the exposure pathways presented in the SCM in Section 2 and represent the chemical concentrations in the relevant environmental media that would be consistent with a target risk level for the current land use under conservative (i.e., protective) exposure conditions. For the carcinogenic PAHs and metals, a background comparison value was used along with the calculated RBSLs for COC selection in this report.

In the first step of COC selection, a list of detected chemicals in each media was identified. Tables 1 through 4 present the prevalence and range of concentrations of all chemicals that were detected at least once in soil, soil vapor, indoor air and groundwater, respectively across the Site.

To identify COCs for the media, the maximum concentration was compared to one-tenth of its respective RBSL. If the maximum concentration was greater than one-tenth of the RBSL it was selected as a COC for the Site. One-tenth of the RBSL (i.e. 1×10^{-7} for carcinogenic effects and 0.1 for noncancer effects) was used as a conservative adjustment to screen chemicals for further analysis and to address potential cumulative effects. In addition to the RBSL screen, background concentrations for metals and carcinogenic PAHs (cPAHs as benzo(a)pyrene equivalents) were considered.

Tables 5 and 6 present the COCs that have been identified for soil and soil vapor to be carried forward into the RAP. COCs for groundwater are presented in Section 8.0.

3.2 Remedial Action Objectives

For the Kast Site, medium-specific RAOs have been developed based on Site investigations completed to date. Based on these medium-specific RAOs, numerical SSCGs for the COCs for the Site, where applicable, have been developed to achieve the RAO for a given medium. It is anticipated that the medium-specific RAOs and SSCGs along with the analysis with respect to Applicable or Relevant and Appropriate Requirements (ARARs) will be presented and used in the RAP for the Site to identify the final response actions for each media.

Various demarcations of acceptable risk have been established by regulatory agencies. The NCP (40 CFR 300) indicates that lifetime incremental cancer risks posed by a site should not exceed a range of one in one million (1×10^{-6}) to one hundred in one million (1×10^{-4}) and noncarcinogenic chemicals should not be present at levels expected to

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cause adverse health effects (i.e., a Hazard Quotient [HQ] greater than 1). In addition, other relevant guidance (*The Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*, USEPA, 1991c) states that sites posing a cumulative cancer risk of less than 10^{-4} and hazard indices less than unity (1) for noncancer endpoints are generally not considered to pose a significant risk warranting remediation. The California Hazardous Substances Account Act (HSAA) incorporates the NCP by reference, and thus also incorporates the acceptable risk range set forth in the NCP. In California, the Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) regulates chemical exposures to the general population and is based on an acceptable risk level of 1×10^{-5}. The California Department of Toxic Substances Control (DTSC) considers the 1×10^{-6} risk level as the generally accepted point of departure for risk management decisions for unrestricted land use. Cumulative cancer risks in the range of 10^{-6} to 10^{-4} may therefore be considered to be acceptable, with cancer risks less than 10^{-6} considered *de minimis*.

The following RAOs are proposed for the Site based on the above and site-specific considerations:

- Prevent human exposures to concentrations of Site-related COCs in soil, soil vapor and indoor air such that total lifetime incremental carcinogenic risks are within the NCP risk range of 10^{-6} to 10^{-4} and non-cancer hazard indices are less than 1 or concentrations are below background whichever is higher. Potential human exposures include onsite residents and construction and utility maintenance workers,
- Prevent fire/explosion risks in indoor air and/or enclosed spaces (e.g., utility vaults) due to the generation of methane from the anaerobic biodegradation of petroleum hydrocarbons in soils,
- Remove LNAPL to the extent practicable and where a significant reduction in current and future risk to groundwater will result, and
- Maintain a stable or decreasing plume of Site-related COCs in groundwater beneath the Site.

The RAOs are addressed for each specific media in Sections 5 through 8.

4.0 GUIDANCE DOCUMENTS AND POLICIES CONSIDERED

Per the CAO, the following guidance documents and Policies were considered in establishing SSCGs for the Site:

- LARWQCB Interim Site Assessment and Cleanup Guidebook, (LARWQCB, 1996)
- USEPA Regional Screening Levels (Formerly Preliminary Remediation Goals) (USEPA, 2012b)
- Use of Human Health Screening Levels (CHHSLS) in Evaluation of Contaminated Properties (Cal-EPA DTSC, 2005a)
- TPHCWG Series (TPHCWG, 1997a,b, 1998a,b, 1999)
- Characterizing Risks Posed by Petroleum Contaminated Sites: Implementation of MADEP VPH/EPH Approach (MADEP, 2002)
- Updated Petroleum Hydrocarbon Fraction Toxicity Values for the VPH/EPH/APH Methodology (MADEP, 2003)
- Air-Phase Petroleum Hydrocarbons (APH) Final (MADEP, 2009)
- Advisory-Active Soil Gas Investigations (Cal-EPA DTSC, 2012)
- Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air (Cal-EPA DTSC, 2011)
- Risk Assessment Guidance for Superfund (RAGS) Part A-F
- USEPA User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings (2004)
- USPEA Supplemental Guidance for Developing Soil Screening Levels (2002b)
- USEPA Supplemental Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites, (2002a);

- Cal-EPA Selecting Inorganic Constituents as Chemicals of Potential Concern at Risk Assessments at Hazardous Wastes Sites and Permitted Facilities (Cal-EPA DTSC, 1997)

- Cal-EPA use of the Northern and Southern California Polynuclear Aromatic Hydrocarbons (PAH) Studies in the Manufactured Gas Plant Site Cleanup Process, (Cal-EPA DTSC, 2009b)

- California's Maximum Contaminant Levels (MCLs), Notification Levels (NLs), or Archived Action Levels (AALs) for drinking water as established by the California Department of Public Health

- State Water Resources Control Board's "Antidegradation Policy" (State Board Resolution No. 68-16)

- The Regional Board's Basin Plan

- Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304 (State Board Resolution No. 92-49)

References for these guidance documents and policies are included in Section 10.

5.0 SOIL

The RAOs for soil are to prevent human exposures to Site-related COCs: (i) to concentrations that are above background levels; or (ii) to concentrations above the NCP risk management range and target hazard level (i.e., incremental lifetime cancer risk of 10^{-6} to 10^{-4} or non-cancer hazard index less than 1). For derivation of individual chemical SSCGs, a lifetime incremental cancer risk of 10^{-6} was used for residential land use and a lifetime incremental cancer risk of 10^{-5} was used for construction and utility worker exposures consistent with the NCP risk management range and common practice within the State of California. A target hazard quotient (HQ) of 1 was used for noncarcinogens.

Because background concentrations for some COCs detected in soil exceed risk-based levels, an evaluation of background concentrations is a critical factor in identifying clean up goals. Details of the background concentration evaluation are provided in Appendix A.

As of December 31, 2012, soil sampling has been conducted at 265 residential properties. In addition, soil sampling has been conducted in the streets within the Site. Soil sampling has included collection of soil samples within the 0-10 foot bgs range to assess potential exposures to shallow soils as defined in the CAO. The site investigations have detected soil impacts by primarily petroleum-related constituents. Petroleum related constituents detected in over 50% of the samples include TPHd and TPHmo, the PAHs pyrene, phenanthrene, chrysene, benzo(a)anthracene, fluoranthene, 2-methylnaphthalene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(b)fluoranthene, and the VOCs naphthalene and benzene. Of these, chrysene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, and benzo(b)fluoranthene are considered cPAHs. In addition, metals have been detected in soils with arsenic and lead detected at concentrations above background.

To evaluate potential exposures to these constituents in soil, an HHSRE was conducted for each property where soil sampling was completed and results included in the Interim and Follow-up Residential Sampling reports. Potential exposures were initially evaluated for a depth interval of 0-2 feet bgs corresponding to the depth interval where there is a higher potential for residential exposure during recreational activities, landscaping and yard maintenance. In addition, the full depth interval of 0-10 feet bgs was evaluated to address the more unlikely scenario that deep soils contact would occur during a major renovation project (e.g., pool installation or underground utility work). Because the Site is completely developed this deep soil exposure scenario is considered unlikely for residents. However, exposures to these deeper soils could occur during construction or utility maintenance work at the Site.

The soil cleanup goal approach has been developed for onsite residents and construction and utility maintenance workers considering these factors and is discussed in more detail in the following subsections.

As presented in Section 3, the Site-related COCs consist of the petroleum hydrocarbon derived constituents, and some metals. Metals that are consistent with background concentrations or below CHHSLs (Cal-EPA OEHHA, 2005) are not considered Site-related. In addition, other chemical have been detected in Site soils that are not considered Site-related COCs. Typically, soil samples were collected at a minimum of 6 locations per property in accessible areas at a four depths (0.5, 2, 5 and 10 feet bgs). Samples were collected at alternate depths if impacts were observed or if refusal was met due to subsurface obstructions preventing collection of the deeper samples. Over 10,000 soil samples have been collected as of December 31, 2012 and the results have been compared to risk based screening levels in the HHSREs submitted to the Regional Board. The Regional Board and OEHHA concurred with the HHSRE findings presented in these reports for Site-related COCs. The Site-related and non-Site-related COCs are presented below. The soil results for the primary Site-related COCs cPAHs (as defined by benzo(a)pyrene equivalents) and TPH-diesel and TPH-motor oil are summarized on Figures 2 through 4.

Site-related Soil COCs	
1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene 1-Methylnaphthalene 2-Methylnaphthalene Arsenic Benzene Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene	Chrysene Dibenz(a,h)anthracene Ethylbenzene Indeno(1,2,3-c,d)pyrene Lead Naphthalene Pyrene TPH as Diesel TPH as Gasoline TPH as Motor Oil

Non-Site-related Soil COCs	
1,1,2,2-Tetrachloroethane 1,2,3-Trichloropropane	Chromium VI Cobalt

Non-Site-related Soil COCs	
1,2-Dichloropropane 1,4-Dichlorobenzene 2,4-Dinitrotoluene Antimony Bis(2-Ethylhexyl) Phthalate Bromodichloromethane Bromomethane Cadmium	Copper Methylene Chloride Tetrachloroethene Thallium Trichloroethene Vanadium Vinyl Chloride Zinc

Once the COCs and potentially exposed populations are identified, the complete exposure pathways by which the individuals may contact chemicals must be determined. A complete exposure pathway requires a source and mechanism of chemical release, a point of potential human contact within the impacted medium, and an exposure route (e.g., ingestion) at the contact point. These source-pathway-receptor relationships provide the basis for the quantitative exposure assessment.

The following table summarizes the exposure pathways that are relevant for potential residential exposures and potential construction and utility maintenance worker exposures at the Site.

Receptor Population	Sample Medium	Potentially Complete Exposure Pathway
Onsite Resident (Child and Adult)	• Surface Soil (0-2 ft bgs)	• Incidental Ingestion • Dermal Contact • Outdoor Inhalation
	• Shallow Subsurface Soil (>2-10 feet bgs)	• Infrequent Incidental Ingestion • Infrequent Dermal Contact • Outdoor Air Inhalation
Onsite Construction/Utility Maintenance Worker	• Surface and Subsurface Soil (0-10 ft bgs)	• Incidental Ingestion • Dermal Contact • Outdoor Inhalation

5.1 Residential Receptor

The SSCGs for the residential scenario are based on surface soil (0-2 feet bgs) and subsurface soil (>2-10 feet bgs) exposure assumptions. Surface soils are considered for more typical residential exposures whereas subsurface soils are considered for infrequent contact because the likelihood of a resident contacting soils at deeper depths is extremely low given the developed nature of the Site and typical residential activities where exposure to soil could occur (i.e., recreational activities, lawn care, landscaping).

SSCGs were developed considering the exposure pathways identified above using the same methodology and approach presented in the RWQCB and OEHHA-approved HHSRE Work Plan and addenda. In addition, SSCGs were developed considering background conditions (considering both natural and non-site-related anthropogenic sources) for metals and PAHs. The consideration of background concentrations is important in risk assessment and remedial planning as it is infeasible to cleanup to lower concentrations than background.

Metals may be associated with petroleum hydrocarbons, but are also naturally occurring in the environment. According to DTSC (Cal-EPA DTSC 2009c) for naturally occurring materials such as metals, an evaluation of background concentrations is important to evaluate whether the metals concentrations at the Site are consistent with naturally occurring or ambient levels in the area, and whether they should be included in the risk assessment. If concentrations of a metal are within background, the metal is not considered a COC and is not evaluated further. For each metal, an Upper Tolerance Limit (UTL) has been developed based on local background (Appendix A). These values will be used to determine if a metal is above background and should be considered further. For arsenic, the DTSC background concentration for southern California sites of 12 mg/kg (Cal-EPA DTSC, 2007) or a more detailed statistical evaluation will be used for this Site as presented in Appendix A. For lead, the California Human Health Screening Level (CHHSL) of 80 mg/kg will be used for surface soil for residential land-use.

In addition to metals, polycyclic aromatic hydrocarbons (PAHs) can be naturally occurring or present at ambient levels not associated with former site activities. A background dataset and methodology has been developed that can be used to evaluate the presence of PAHs in soil (Cal-EPA DTSC, 2009c). Consistent with agency-approved risk assessment practice in California, the DTSC-developed background concentration of 0.9 mg/kg benzo(a)pyrene equivalents (Bap-eq) (see Appendix A) will be used to evaluate cPAHs results.

Table 7 presents the SSCGs for the Site-related COCs using the target risk levels of 10^{-6} and a target hazard quotient of 1 for residential land use. Appendix A presents the methodology that was used to derive the SSCGs.

Because of the developed nature of the Site and the lack of exposure potential to soil under hardscape and at depth, SSCGs are calculated separately for surface soil (uncovered soils from 0-2 feet bgs) and subsurface soil (>2-10 feet bgs). Residential reasonable maximum exposure (RME) assumptions that are equivalent to frequent exposure frequency (i.e., 350 days per year) are used to calculate SSCGs for surface soils (e.g., uncovered soils from 0-2 feet bgs) within the residential property areas. This is consistent with the focus on exposure potential stated in USEPA for conducting feasibility studies [USEPA, 1988] "RAOs for protecting human receptors should express both a contaminant level and an exposure route, rather than contaminant levels alone, because protectiveness may be achieved by reducing exposure (such as capping an area, limiting access, or providing an alternate water supply) as well as by reducing contaminant levels." The application of cleanup levels to surface soils (0-2 feet bgs) is considered protective and would meet the RAO for the Site. However, to address the unlikely infrequent exposure to subsurface soils (>2-10 feet bgs), SSCGs have been developed assuming a lower frequency of exposures (See Appendix A) based on an exposure frequency of 4 days per year assuming a resident may want to dig deeper than 2 feet to plant a tree as part of gardening.[3] It is anticipated that a Soil Management Plan will be prepared either as a part of, or subsequent to, the RAP that will provide the detailed approach to preventing residential exposure to subsurface soils impacted by Site COCs.

The chemical-specific SSCGs will be used with the 95 Upper Confidence Limit (95UCL) chemical concentrations calculated for each property and depth interval being evaluated to estimate chemical-specific risks and noncancer hazards. Cumulative estimates of cancer risk and noncancer hazard will be calculated by summing the chemical-specific estimates. In addition, for metals and cPAHs, a comparison to background will be conducted as discussed in Appendix A.

5.2 Construction Worker

The soil cleanup goals for the construction and utility maintenance worker scenario are based on soil data results from 0-10 feet bgs. This is considered an interval where exposure is more likely should utility maintenance work be required at the Site.

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[3] The exposure frequency of 4 days per year is based 1/10th of the USEPA recommended event frequency of 40 events per year for an adult resident gardening outdoors on a more routine basis (USEPA, 1997).

Soil cleanup goals were developed considering the exposure pathways identified above using the same methodology and approach presented in the HHSRE Work plan and addendum (Geosyntec, 2009, 2010b) modified to account for the different exposure assumptions used for construction workers in risk assessment. In addition, because utility workers may need to conduct subsurface utility repair or maintenance, the potential exists for worker exposure within a trench. So this exposure scenario was also included and the methodology is presented in Appendix A.

Soil cleanup goals were developed considering background conditions (considering both natural and non- site-related anthropogenic sources) for metals and PAHs as discussed for residential cleanup goals. As mentioned earlier, the consideration of background concentrations is important in risk assessment and remedial planning as it is infeasible to cleanup to lower concentrations than background.

Table 8 presents the cleanup goals for the Site-related COCs using the target risk levels of 10^{-5} and a target hazard quotient of 1 for construction and utility maintenance worker exposures as presented in Section 3. Appendix A presents the methodology that was used to derive the cleanup goals.

Existing utilities are present at the Site in areas that are currently both uncovered and covered. Therefore, repair or maintenance may be required in both covered and uncovered soils at the Site. While it is unlikely that utility repair will be conducted to maximum depths of 10 feet bgs, this depth interval was included to address that potential. A Soil Management Plan will be prepared either as a part of, or subsequent to, the RAP that will provide the detailed approach to preventing unacceptable construction and utility worker exposure to Site-related COCs.

The chemical-specific SSCGs will be used with the 95 Upper Confidence Limit (95UCL) chemical concentrations calculated for each property and depth interval being evaluated to estimate chemical-specific risks and noncancer hazards. Data collected in the streets will be evaluated separately in a similar manner. Cumulative estimates of cancer risk and noncancer hazard will be calculated by summing the chemical-specific estimates. In addition, for metals and cPAHs, a comparison to background will be conducted as discussed in Appendix A.

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6.0 SOIL VAPOR

The RAOs for soil vapor are to prevent human exposures to Site-related COCs: (i) to concentrations that are above background levels; or (ii) to concentrations above the NCP risk management range and target hazard level (i.e., cancer risk of 10^{-6} to 10^{-4} or non-cancer hazard index less than 1). Additionally, the RAOs for methane in soil vapor are to prevent fire/explosion risks in indoor air and/or enclosed spaces (e.g., utility vaults) due to the generation of methane from the anaerobic biodegradation of petroleum hydrocarbons in soils.

Soil vapor cleanup goals for residential and construction worker scenarios are presented in the sections below.

6.1 Residential Receptor

Soil vapor cleanup goals for VOCs and methane are presented for the residential scenario. The soil vapor cleanup goals for the residential scenario are based on the sub-slab soil vapor sample analytical results and a multiple-lines-of-evidence vapor intrusion pathway analysis (Appendix B). Soil vapor samples collected at depth are not considered in the residential receptor analysis. For VOCs, the vapor intrusion exposure pathway is evaluated. Fire and explosion risks are considered for methane.

6.1.1 VOCs

The sub-slab soil vapor data were used to evaluate the vapor intrusion pathway for potential exposure to residents at the Site. As of December 31, 2012, sub-slab soil vapor samples have been collected at 262 properties. Typically, sub-slab soil vapor samples were collected at three locations, and multiple sampling events have been conducted at many properties. Through December 31, 2012, over 1,500 sub-slab soil vapor samples have been collected, and the results have compared to risk-based screening levels in the HHSREs. The sub-slab soil vapor results for the two primary sub-slab soil vapor COCs, benzene and naphthalene, are summarized on Figures 5 and 6 and the screening results for COCs that exceed the RBSLS for properties where indoor air samples have been collected are summarized below:

COC	Number of Samples	# Above RBSL	# Properties Sampled	# Properties With A Single Exceedance	# Properties With Multiple Exceedances
1,2,4-Trichlorobenzene	1524	1	262	1	0
1,2,4-Trimethylbenzene	1524	2	262	2	0

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COC	Number of Samples	# Above RBSL	# Properties Sampled	# Properties With A Single Exceedance	# Properties With Multiple Exceedances
1,2-Dichloroethane	1524	1	262	1	0
1,3,5-Trimethylbenzene	1524	1	262	1	0
1,3-Butadiene	1524	1	262	1	0
1,4-Dichlorobenzene	1524	1	262	1	0
1,4-Dioxane	1524	10	262	10	0
Benzene	1524	78	262	42	16
Bromodichloromethane	1524	24	262	17	3
Carbon Tetrachloride	1524	6	262	6	0
Chloroform	1524	66	262	28	14
Dibromochloromethane	1524	6	262	2	2
Ethylbenzene	1524	6	262	4	1
Methylene Chloride	1524	5	262	1	1
Naphthalene	1524	56	262	36	9
Tetrachloroethene	1524	51	262	15	12
Trichloroethene	1524	3	262	1	1
Vinyl Chloride	1524	1	262	1	0

As shown above and on Figures 5 and 6, exceedances of screening levels from the HHSRE Work Plan for benzene and naphthalene are infrequent, and when an exceedance at a property is identified, this is often a result of a single soil vapor sample and is not representative of the bulk of the sub-slab data collected at a property. Note that the sub-slab soil vapor sampling has been conducted throughout the Phase II investigation; consequently, potential variability in the concentrations due to seasonal or other effects has been evaluated through this sampling program. Because the exceedances of sub-slab soil vapor screening levels at a specific property frequently are not reproducible, corrective action decisions based on the maximum concentration at that property will likely lead to implementation of mitigation or remedial measures that do not result in a reduction of risk. Consequently, an assessment of background contributions to indoor air and data consistency has been conducted to evaluate soil vapor SSCGs.

A multiple-lines-of-evidence evaluation of the vapor intrusion pathway at the Site based on sub-slab soil vapor and indoor air data has been conducted (Appendix B). This evaluation included a multiple linear regression analysis of the sub-slab soil vapor, indoor air, garage air, and outdoor air data at the 190 properties where indoor air sampling has been conducted as of December 31, 2012. Based on the multiple linear regression analysis results, it is concluded that contributions from sub-slab soil vapor concentrations to indoor air are not statistically different from zero. In other words, sub-slab soil vapor concentrations do not explain the variability in indoor air concentrations, and vapor intrusion is not affecting indoor air quality at the Site. Further, the vapor intrusion analysis shows that indoor air concentrations are representative of background conditions (see Section 7.0). Additionally, an empirical vapor intrusion attenuation factor cannot be calculated for the Site, because indoor air concentrations are reflective of background concentrations, and there is no statistically significant relationship between the sub-slab soil vapor and indoor air concentrations.

Consequently, the SSCGs for sub-slab soil vapor at the site are based on levels that will not exceed background concentrations in indoor air[4]. Because indoor air background concentrations are dependent on household activities, it is not appropriate to present numerical sub-slab soil vapor cleanup levels based on indoor air background concentrations. Instead, a vapor intrusion assessment will be made on a property-specific basis to assess whether the sub-slab data result in indoor air concentrations above background. As a result, SSCGs for VOCs in soil vapor and sub-slab soil vapor are based on meeting the RAOs (indoor air concentrations are below background) and numerical values are not proposed.

6.1.2 Methane

Methane screening has been conducted in indoor structures on the Site and utility vaults, storm drains, and sewer manholes at and surrounding the Site. The screening assessments have not identified methane concentrations in enclosed spaces that indicate a potential safety risk. Additionally, 1,182 sub-slab soil vapor samples have been collected at 262 properties at the Site and analyzed for methane. Methane concentrations above the interim action levels of 0.1% and 0.5% resulting from biodegradation of residual petroleum hydrocarbons have been identified at one location at one property[5]; however, no methane exceedances were found during the indoor air screening and sampling conducted at this property. Engineering controls to mitigate the potential risks due to methane detected at this location have been installed.

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[4] For vapor intrusion evaluations, background is defined as sources that are not due to sub-surface impacts (e.g., contributions due to outdoor air or indoor sources). More details on characterization of background in indoor air are provided in Appendix B.

[5] Sub-slab soil vapor methane concentrations exceeding interim action levels have been identified at 5 additional properties, but the source of methane at these locations was determined to be due to leaking natural gas lines and not due to the petroleum hydrocarbon impacts at the Site.

Proposed SSCGs for methane are the same as those presented in the Data Evaluation and Decision Matrix (Geosyntec, 2010a). These SSCGs are consistent with DTSC guidance for addressing methane detected at school sites (Cal-EPA DTSC, 2005b).

Methane Level	Response
>10%LEL (> 5,000 ppmv) Soil vapor pressure > 13.9 in H_2O	Evaluate Engineering Controls
> 2% - 10%LEL (> 1,000 – 5,000 ppmv) Soil vapor pressure > 2.8 in H_2O	Perform follow-up sampling and evaluate engineering controls

6.2 Construction and Utility Maintenance Worker Receptor

The conceptual exposure scenario for the construction and utility maintenance worker receptor is the same as that considered for soils – exposure to volatiles during excavation. The volatilization factor for soil vapor to a trench was calculated using the same relationships as those used for soil, with an additional factor to relate soil and soil vapor source concentrations. Worker exposure due to the dermal and ingestion pathways was not considered in the soil vapor source term (Appendix A). For derivation of individual chemical SSCGs, a lifetime incremental cancer risk of 10^{-5} was used for construction and utility worker exposures consistent with the NCP risk management range and common practice within the State of California. A target hazard quotient (HQ) of 1 was used for noncarcinogens. Table 9 presents the SSCGs for VOCs in soil vapor. Potential safety concerns associated with methane detected at the site are addressed by occupational safety and health laws.

The chemical-specific SSCGs will be used with the 95UCL chemical concentrations calculated for each property being evaluated to estimate chemical-specific risks and noncancer hazards. Data collected in the streets will be evaluated separately in a similar manner. Cumulative estimates of cancer risk and noncancer hazard will be calculated by summing the chemical-specific estimates.

7.0 INDOOR AIR

The RAOs for indoor air are to prevent human exposures to Site-related COCs: (i) to concentrations that do not exceed background levels; or, (ii) to levels within the NCP risk management range (i.e., cancer risk of 10^{-6} to 10^{-4} or non-cancer hazard index less than 1). Because background concentrations for some COCs detected in indoor air exceed risk-based levels, an evaluation of background concentrations is a critical factor in identifying clean up goals. Details of the background concentration evaluation and statistical evaluation of the vapor intrusion pathway at the Site are provided in Appendix B.

There are a variety of background sources that can contribute to concentrations of petroleum compounds in indoor air. These sources include outdoor air, indoor product use and activities, residential building materials (i.e. paint, carpet, vinyl flooring, etc.), materials brought into the home (e.g., dry cleaned clothing), and sources within attached garages. Outdoor impacts can migrate into indoor areas when doors and/or windows are open. Impacts from attached garages can migrate into indoor areas as a result of poor seals between the garage and the residential living spaces (CARB, 2005). Concentrations of VOCs in indoor air are often associated with indoor product use, occupant activities (e.g., hobbies, smoking), and building materials (Van Winkle and Scheff, 2001). Typical sources of these background impacts include environmental tobacco smoke from cigarettes and cigars, gasoline- or diesel-powered equipment, paints, glues, solvents, cleaners, and natural gas. Table 10 summarizes potential background sources and concentrations of VOCs detected in indoor air.

Consideration of household activities and indoor sources of VOCs is a critical factor in the background analysis, because indoor air background concentrations are greater than outdoor air concentrations (Van Winkle and Scheff, 2001; Hodgson and Levin, 2003; Sexton et al., 2004; CARB, 2005). On average, indoor concentrations were one (Jia and Batterman, 2010) to five (CARB, 2005) orders of magnitude higher than measured outdoor concentrations. This trend is likely due to two primary factors including indoor sources (as discussed above) and lower indoor ventilation compared to outdoor dispersion (Sexton et al., 2004). Studies have also shown that background levels in indoor air are building-specific due to household use and occupant activities (Van Winkle and Scheff, 2001; CARB, 2005).

As of December 31, 2012, air sampling has been conducted at 190 residential properties at the Site to evaluate the vapor intrusion pathway. The air sampling conducted at the residential properties consists of indoor, outdoor, and garage air sampling to evaluate indoor air quality and potential background contributions due to outdoor air and materials present in the garages which are frequently attached to the living area of the residence. Additionally, a chemical inventory is performed to assist in the assessment of the background contribution due to household product use.

As discussed in Appendix B, the outdoor air concentrations measured at the Site were compared to the literature values for studies conducted in the region (SCAQMD, 2008; DRI, 2009). A comparison of the two data sets is shown on Figure 7. The box and whisker plot for each chemical shows the outdoor air concentration distributions for eleven compounds reported in the regional studies. The box in these figures shows the interquartile range (i.e., 25th to 75th percentile) and the bar in the middle of the box is the median value. The whiskers of the plots show the 10th and 90th percentile concentrations, and outlier results are plotted to illustrate the range of detected concentrations. The colored symbols on this plot show the ranges of mean and maximum outdoor air concentrations reported in the regional studies (SCAQMD, 2008; DRI, 2009). Open and closed symbols show the lower and upper end of the ranges for these statistics, respectively. The concentrations of these constituents detected in samples collected from the Site are within the reported background ranges. The results of the comparison of Site data with literature background values indicates that VOCs detected in outdoor air are reflective of background concentrations.

Appendix B also includes a comparison of the indoor air concentrations measured at the Site to the literature values summarized by USEPA (USEPA, 2011). A comparison of the two data sets is shown on Figure 8. The box and whisker plot for each chemical shows the indoor air concentration distributions for ten compounds that were frequently detected in the indoor air samples (detection frequencies greater than 95%). The box and whisker plots show the same statistical information as described above for the outdoor air data. The colored symbols on this plot show the ranges of median, 90th percentile and maximum indoor air concentrations reported in the USEPA report (USEPA, 2011). Open and closed symbols show the lower and upper end of the ranges for these statistics, respectively.

With the exception of 1,2-dichloroethane (1,2-DCA), the concentrations of these constituents detected in samples collected from the Site are within the background range reported by USEPA. Although 1,2-DCA was outside of the background range reported in the USEPA study, more current studies (Doucette, et al., 2010 and Kurtz et al., 2010) conclude that this compound has been detected in increasing frequency and higher concentrations since 2004 (i.e., the data considered in the USEPA study [1990 - 2005] did not reflect this more recent increase in indoor air concentrations).

The results of the comparison of Site data with literature background values indicates that VOCs detected in indoor air are reflective of background concentrations. As a result, the data cannot be used to calculate an empirical vapor intrusion attenuation factor[6]. Excluding data where background concentrations have a significant effect on the indoor air concentrations has been used by USEPA in their evaluation of empirical attenuation factors for sites across the United States (USEPA, 2012c).

As of December 31, 2012, more than 600 indoor air samples have been collected at the Site and the results have compared to risk-based screening levels in the HHSREs and background concentrations. The indoor air results for benzene and naphthalene are summarized on Figures 9 and 10. As shown in these figures, indoor air concentrations detected at the Site are reflective of background levels. These findings were discussed in the Interim and Follow-up Phase II Site Characterization reports which have been reviewed by the Regional Board and OEHHA. The regulatory agency reviews of the Interim and Follow-up Phase II Site Characterization reports have concurred that the VOCs detected in indoor air appear to be due to background sources.

To investigate the relationship between indoor air and sub-slab soil vapor concentrations, multiple linear regression analysis methods (as described in Appendix B) were applied to the Site data. The statistical analysis evaluated the relationship between measured indoor air concentrations and (i) indoor sources, (ii) transport from the garage air, (iii) transport from outdoor air, and (iv) sub-slab soil vapor (i.e., vapor intrusion). Based on the multiple linear regression results, it is concluded that the correlations for garage air to indoor air and outdoor air to indoor air are statistically significant[7]. This indicates that the indoor air concentrations are related to the garage and outdoor air concentrations. However, the statistical analysis indicates that contributions from sub-slab soil vapor concentrations are not statistically different from zero. In other words, sub-slab soil vapor concentrations do not explain the variability in indoor air concentrations and the presence of indoor sources of VOCs contributes to the variability in indoor air concentrations at the Site. The results of this vapor intrusion pathway evaluation at the Former Kast Property indicate:

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[6] The vapor intrusion attenuation factor is the ratio of indoor and sub-slab soil vapor concentrations for constituents measured in both media assuming that the contributions from background sources are insignificant.

[7] Note that the outdoor air to garage air coefficient estimate for 1,2-dichloroethane is not statistically significant.

- Indoor air and outdoor air concentrations of VOCs detected at the properties evaluated are indistinguishable from background and within the typical ranges of background concentrations reported in the literature.

- The multiple linear regression analyses show that indoor air concentrations are correlated with the garage air and outdoor air concentrations. However, indoor air concentrations of Site-related COCs are not correlated with sub-slab soil vapor concentrations (i.e., homes with higher indoor air concentrations are not the properties with higher soil vapor concentrations).

- An empirical vapor intrusion attenuation factor cannot be calculated for this site, because indoor air concentrations are reflective of background concentrations and there is no statistically significant relationship between the sub-slab soil vapor and indoor air concentrations.

Consequently, the proposed SSCGs for indoor air at the site are background concentrations. Because background concentrations are dependent on household activities, as well as outdoor air, it is not appropriate to present numerical background concentrations. Instead, an assessment of background levels will be made on a property-specific basis. As indoor air data are collected as part of each Phase II investigation, the data will be reviewed to assess whether indoor air concentrations are representative of background conditions. Mitigation and/or remedial action may be required for properties where indoor air concentrations exceed background levels.

8.0 GROUNDWATER

8.1 Introduction

Cleanup goals for Site groundwater are proposed in this section.

This section contains a summary of:

- Overall occurrence of groundwater at the Site.
- Groundwater quality including identification of Site-related COCs exceeding California MCLs of other relevant action level, plume configuration, and plume stability analysis.
- Proposed cleanup goals.

8.2 Groundwater Occurrence

Groundwater beneath the Site has been extensively investigated (URS, 2010a and URS, 2011) including quarterly monitoring reports which have been prepared and submitted to the LARWQCB since well installation. Key findings of the previous investigations related to groundwater are as follows:

Shallow Zone Groundwater

- Uppermost (or first) groundwater occurs at variable depths of approximately 52-68 feet bgs depending on well location and timing of sampling. Uppermost groundwater occurs within sandy deposits of the Bellflower aquitard. This zone is referred to as the "Shallow Zone." A cross section (Figure 9) depicting the Bellflower aquitard and underlying units is presented in URS (2011).
- There are currently 17 monitoring wells associated with the Site which are used to monitor Shallow Zone groundwater on a quarterly basis (Figure 10).
- Groundwater flow direction in the Shallow Zone is to the northeast (Figure 10) with a gradient of approximately 0.002 feet/foot, which has remained generally consistent since monitoring began.
- There is no documented use of groundwater within the Shallow Zone.
- As of December 2012, LNAPL was present in one well, MW-3. Active recovery of LNAPL through pumping occurs monthly.

Gage Aquifer

- The Gage aquifer is interpreted to underlie the Site at a depth of approximately 80-90 feet bgs (Figure 9). The base of the unit is estimated to occur at a depth of approximately 163-176 feet. The Gage aquifer is underlain by low permeability materials which separate the Gage aquifer from the underlying Lynwood aquifer.
- Four monitoring wells were installed in the upper portion of the Gage aquifer which are paired spatially with four monitoring wells completed in the lower portion of the Gage (Figures 11 and 12). These well pairs are also co-located near Shallow Zone wells.
- In the shallow Gage wells, the gradient is northeast in the northeastern part of the Site to east-northeast in the central to southwestern part of the Site at a gradient of approximately 0.0016 (4^{th} Quarter 2012). The gradient has varied from east-southeast to northeast over the monitoring period.
- In the deeper Gage wells, the gradient is to the east-northeast at approximately 0.0017 feet per foot (4^{th} Quarter 2012). The gradient has varied from east-northeast to east over the monitoring period.
- The vertical gradient varies from slightly downward from the Shallow Zone to the Upper Gage to the Lower Gage, to slightly upward in the same zones.
- There is no documented use of groundwater within the Gage aquifer near the Site. The nearest production well to the Site (CWS Well 275 located 435 feet west of the western Site boundary) produces from the underlying Lynwood and Silverado aquifers. The drinking water supplied to the Carousel community by the water provider is tested according to state standards and the regulatory agencies have stated that the water is safe to drink.

8.3 Groundwater Quality

Quarterly monitoring of both Shallow Zone and Gage wells has been conducted since well installation (e.g., URS, 2013c). Wells are sampled quarterly for VOCs and TPH. Additionally, the wells have been sampled for metals, SVOCs, and general mineral parameters, although not on a quarterly basis. Table 4 summarizes the groundwater sampling data.

Several compounds have been detected above their respective MCL or Notification Level (NL). A NL is a health-based advisory level established by the California

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Department of Public Health for chemicals in drinking water that lack MCLs. Compounds detected in one or more sampling rounds which exceed their respective MCL or NL are summarized below:

	Chemical	MCL (µg/L)	NL (µg/L)	Maximum detected concentration (µg/L)*
VOCs and Hydro-carbons	1,1-Dichloroethane	5		33
	1,1-Dichloroethene	6		100
	1,2,3-Trichloropropane		0.005	27
	1,2-Dichloroethane	0.5		3.6
	Benzene	1		650
	cis-1,2-Dichloroethene	6		230
	Naphthalene		17	82
	tert-Butyl Alcohol (TBA)		12	250
	Tetrachloroethene	5		190
	trans-1,2-Dichloroethene	10		120
	Trichloroethene	5		310
	Vinyl Chloride	0.5		0.91
	1,4-Dichlorobenzene	5		11
Metals and General Minerals	Antimony	6		24.8
	Arsenic	10		900
	Thallium	2		4.24 J
	Mercury	2		2.33
	Iron	300		67,000
	Manganese	50		2550
	Chloride	500 mg/L		3200 mg/L
	Nitrate (as N)	10000		14000
	Total Dissolved Solids	1000 mg/L		5620 mg/L
	Specific Conductance	1600 µS/cm		7600 µS/cm

* Unless noted
J : Estimated
Note: MCLs for iron, manganese, chloride, Total Dissolved Solids and Specific Conductance are secondary MCLs. MCLs shown for chloride, Total Dissolved Solids and Specific Conductance are the "Upper" Secondary MCLs.

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Of the compounds listed above, only benzene, naphthalene, and arsenic are considered Site-related COCs in groundwater. Additional discussion of non-Site and Site-related COCs is presented in Sections 8.3.1 and 8.3.2 below.

8.3.1 Non Site-Related COCs

Tert-Butyl Alcohol (TBA)

TBA is an oxygenate additive to gasoline. It is also a degradation product of MTBE. Both TBA and MTBE were used in gasolines around the late 1980s. Therefore, TBA is not a Site-related COC. TBA is widely detected in groundwater at the Site, both in Shallow Zone and in the Gage wells. It has been detected in 11 of the 16 Shallow Zone wells. It has also been detected in 3 of the 4 shallow Gage wells and one of the deep Gage wells. The highest concentration is in the shallow Gage well MW-G04S located in the northwestern portion of the Site. Its presence at the Site clearly demonstrates the migration of impacted groundwater onto the Site from offsite sources. Nearby sites known to be have TBA present in groundwater include the former Fletcher Oil and Refining site located approximately 1,500 feet west of the Site just east of the intersection of Main and Lomita Blvd and the Turco site located adjacent to the northwest portion of the Site. These facilities are described in Section 2.1.2.

Chlorinated Compounds

The chlorinated compounds which exceed their respective MCLs in one or more Site monitoring wells include: 1,1-dichloroethane; 1,1-dichloroethene; cis-1,2-dichloroethene; trans-1,2-dichloroethene; 1,2-dichloroethane; 1,4 dichlorobenzene; tetrachloroethene; trichloroethene; and vinyl chloride. These compounds are not known to have been used at the Site and are not Site-related COCs. Chlorinated solvent compounds have also been detected during upgradient investigation of other sites (e.g., Turco, located adjacent to the northwest portion of the Site and OTC located adjacent to the southwest portion of the Site). The presence of these chlorinated compounds at the Site is attributed to offsite sources and also demonstrates the migration of impacted groundwater onto the Site from adjacent offsite sources. The Turco and OTC sites were previously discussed in Section 2.1.2.

1,2,3-Trichloropropane (1,2,3-TCP) has been detected in three Site monitoring wells (Shallow Zone well MW-06 located in the northeast portion of the Site and MW-7 located west and hydraulically upgradient of the Site) and shallow Gage well (MW-G02S located in the west central portion of the Site. 1,2,3-TCP is an emerging chemical of concern with no MCL, but a relatively low NL of 5 parts per trillion. 1,2,3-TCP is commonly associated with agricultural soil fumigation activities or industrial solvent use. 1,2,3-TCP is not a Site-related COC, but has been detected at the adjacent, upgradient Turco site.

General Minerals

The general mineral quality of groundwater in nearly all Shallow Zone Site wells exceeds State Secondary MCLs for total dissolved solids (TDS) and electrical conductivity (Table 4)[8]. Chloride also exceeds the Secondary MCL in the wells with the highest TDS. Iron and manganese exceed the Secondary MCL in nearly all wells.

The TDS quality of the underlying Gage aquifer is generally better than the Shallow Zone quality. Elevated concentrations of TDS (and electrical conductivity) is common in groundwater in much of the LA Basin (WRD, 2008), particularly in shallow groundwater and near the coast where aquifers have been affected by seawater intrusion. The elevated TDS/chloride/ iron/manganese concentrations at the Site are regional and not related to previous Site activities prior to the late 1960s.

Nitrate exceeds the MCL in one Shallow Zone Site well (MW-01). The source of the nitrate is not known, but is not expected to be related to previous Site activities prior to the late 1960s.

Metals

Antimony and thallium exceed the MCL in several Site wells (Table 4). In the last monitoring event (4th quarter 2012) antimony slightly exceeded the MCL in only one shallow monitoring well, and thallium slightly exceeded the MCL in three shallow monitoring wells and three Gage wells. Thallium concentrations have been reported above the MCL in only the 4th quarter 2012 event and were reported as estimates because of the low levels detected (i.e., 3-4 μg/L). Mercury also slightly exceeded the MCL in one shallow well (MW-07 at a concentration of 2.33 μg/L) in the 4th quarter 2012 monitoring event (Table 4).

Given that these metals are considered to be non-Site COCs in soil, and the very low concentration and limited distribution of these trace metals in Site groundwater, they are considered to be non-Site-related COCs in groundwater.

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[8] Electrical Conductivity or EC is a generally related and proportional to Total Dissolved Solid concentrations.

8.3.2 Site-Related COCs

Site-related COCs exceeding State MCLs or NLs are benzene, naphthalene, and arsenic. These compounds are discussed below.

8.3.2.1 Benzene

The distribution of benzene in Site groundwater is depicted on Figures 10, 11, and 12 which are based on data contained in the 4th quarter 2012 groundwater monitoring report (URS, 2013c). As shown on Figure 10, benzene is present beneath much of the Site in the Shallow Zone. The highest concentration of benzene in the Shallow Zone is in wells MW-13 and MW-14 (600 µg/L and 640 µg/L, respectively). Offsite to the northeast (downgradient), benzene concentrations were not detected in the latest monitoring event (URS, 2013c); however, in the past benzene was detected slightly above the MCL in one well (Figure 10).

Concentrations of benzene attenuate markedly in the underlying Gage aquifer. Figure 11 shows recent data for the Upper Gage (URS, 2013c). Benzene concentrations in wells MW-G01S, - G02S, - G03S and - G04S are ND, 0.57 µg/L, 0.81 µg/L and 110 µg/L, respectively. The benzene concentration of 110 µg/L in MW-G04S is anomalous because the concentration is significantly higher than the overlying Shallow Zone concentration of 0.91 µg/L in MW-17. Furthermore, the elevated benzene concentrations in this Upper Gage well MW-G04S are also associated with the highest TBA concentrations at the Site (190 µg/L in the 4th quarter 2012 and up to 250 µg/L TBA historically). As noted previously, TBA is associated with relatively recent gasoline impacts and is unrelated to the Site operation prior to the late 1960s. The association of the anomalous elevated benzene concentration in MW-G04S with the elevated TBA concentration in the same well indicates that benzene impacts in this well are attributable to refined gasoline from an offsite source and not to former Site operations.

Benzene was not detected in samples collected in the Lower Gage aquifer with the exception of a detection of 0.66 µg/L in MW-G03D located in the northeast portion of the Site (Figure 12).

As shown on Figures 10 through 12, the lateral and vertical distribution of benzene at the Site is generally well defined. Benzene concentrations in downgradient, offsite wells (MW-09, MW-10 and MW-11) are significantly lower than onsite wells and were non-detect in the 4th quarter 2012. The Gage aquifer wells define the vertical benzene distribution with the exception of the detection in shallow Gage well MW-G04S which is attributed to an offsite source.

To characterize the stability of the benzene groundwater plume at the Site, a public-domain software package Monitoring and Remediation Optimization System (MAROS was employed to analyze the temporal trends of the plume (AFCEE, 2004). Details of this analysis are presented in Appendix C. The results are summarized below.

- Based on statistical analysis of the data collected to date from the 23 onsite and offsite wells with dissolved phase data (upgradient offsite well not included), benzene concentrations in each well are non-detect or have either No Trend, or Stable or Decreasing/Probably Decreasing trends. Only two wells display statistically increasing trends.
- Overall the MAROS analysis indicates that the dissolved benzene plume located beneath the Site is Stable and that benzene concentrations in the "tail area" or downgradient (off-Site) areas are decreasing.

Given these overall trends it is likely that the benzene in Site groundwater is being attenuated through natural biodegradation processes.

8.3.2.2 Naphthalene

Naphthalene has been identified as a Site COC (Section 2.2) and is detected in the majority of Site wells. However, concentrations that exceed the NL of 17 µg/L have been detected in only two wells. Naphthalene has been detected at a maximum concentration of 82 µg/L in well MW-13 located in the northern portion of the Site (detected at 80 µg/L in the 4th Quarter 2012). MW-13 is the monitoring well with the highest detected concentration of benzene at the Site. Naphthalene is also present above the NL in well MW-14 located in the southern portion of the Site. Concentrations of naphthalene exceeding the NL are limited to these two areas and the extent is relatively well defined.

8.3.2.3 Arsenic

Arsenic has been detected in most of the Site monitoring wells. Arsenic concentrations exceeding the MCL of 10 µg/L have been detected in 14 wells (MW-2, 4, 5, 6, 8, 12, 13, 14, 15, G02S, G03S, G-04S, G01D, G03D). Dissolved arsenic is relatively elevated (above 100 µg/L) in four Shallow Zone wells located in the west central portion of the Site: MW-05, MW-08, MW-12 and MW-15. The highest arsenic

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concentration, 900 µg/L, was reported in a sample collected from MW-08. Arsenic was not detected in the three offsite Shallow Zone downgradient wells.

Dissolved arsenic concentrations in the deeper Gage wells are significantly lower and are only slightly above the MCL of 10 µg/L. The highest reported arsenic concentration in the Gage was 26.7 µg/L in MW-G04S.

Although arsenic is identified as a Site COC (Section 2.2), it is likely that at least a portion, if not a large portion, of the arsenic present in groundwater at the Site is derived from native Site soils. Arsenic is a natural trace metal that occurs in soils, and due to the high capacity of clay and organic materials to adsorb metals, arsenic concentrations tend to be higher in fine-grained organic rich soils (Alloway, 1990), such as the fine-grained portions of the Bellflower aquitard unit beneath the Site. Arsenic can be leached out of soils into groundwater under reducing conditions (i.e., low oxygen conditions). Under reducing conditions iron oxides that can bind with natural arsenic dissolve. Arsenic can then be freed and thence reduced to a more soluble and mobile phase. The relatively high dissolved iron and manganese concentrations in many of the Site wells are indicative of reducing conditions beneath the Site (the relatively low field oxidation reduction potential [ORP] measurements in the field during sampling also indicate reducing conditions). These reducing conditions in the Site subsurface may be natural, but may also be enhanced by the presence of petroleum hydrocarbon compounds that consume oxygen during biodegradation. Welch et al. (2000) indicates that arsenic in the iron oxides of natural aquifer materials may be an important source of dissolved arsenic at sites contaminated with VOCs.

Because arsenic is naturally soluble, dissolved arsenic is a common contaminant in southern California groundwater. Out of all wells sampled by WRD in the West and Central Groundwater Basins in the Los Angeles area, arsenic exceeds its MCL more than any other constituent (WRD, 2008). WRD (2008) reports that arsenic concentrations as high as 205 µg/L were detected in the wells they monitor.

It is known that arsenic is a regional contaminant in southern California. It is likely that at least a portion, if not all, of the dissolved arsenic beneath the Site is derived from natural sediments beneath the Site. Petroleum hydrocarbon impacts at the Site may enhance the solubility of arsenic by lowering oxygen levels in the subsurface. Based on monitoring well data, relatively elevated arsenic concentrations are localized in the central western portion of the Site and are attenuated in the downgradient direction.

8.4 Proposed Cleanup Goals for Groundwater

8.4.1 Site Conditions Relevant to Establishing Clean Up Goals

As described in Section 8.2, groundwater beneath the Site is impacted with various chemicals including petroleum hydrocarbons, chlorinated hydrocarbons, metals, and general minerals. Of these, COCs which exceed an MCL or NL in groundwater, and which are attributable or potentially attributable to the Site, include benzene, naphthalene, and arsenic.

Of the Site-related COCs, benzene is the most significant because it is widespread in the Shallow Zone groundwater and is not generally naturally occurring. Naphthalene exceeds the NL in only two wells onsite both of which are already impacted by benzene. As noted in Section 8.3.2.3, the source of arsenic is likely naturally occurring (although the concentrations may be locally enhanced due to the presence of reducing conditions due to the degradation of petroleum hydrocarbon compounds). Given that arsenic is recognized as a regional issue in southern California groundwater, the compound is not considered further in setting Site-specific cleanup goals.

The distribution of benzene in groundwater is generally well defined, both laterally and vertically. The downgradient limit of the benzene plume is at or near the northeastern property boundary. Benzene concentrations are low to non-detect in the Gage aquifer with the exception of one well that is likely being affected by an offsite source given the co-located elevated concentrations of TBA.

The benzene plume at the Site appears to be stable or declining. This is consistent with a weathered crude oil source that is at least 45 years old. The presence of relatively low levels of dissolved oxygen suggests the benzene plume in groundwater is degrading through microbial activity. In addition, it is expected that the benzene source has declined through time and will continue to do so in the future. Crude oil present in the vadose zone above the groundwater table has been subject to biological degradation and leaching over a minimum 45-year period, if not much longer. It is expected that benzene concentrations in soils will be further reduced through time by degradation and/or leaching. The diminishing concentrations of benzene in the vadose zone are expected to result in further declining benzene levels in groundwater in the future.

Groundwater in both the Shallow Zone and the Gage aquifer in the Site vicinity is not used for drinking or other purposes. Because groundwater extractions from the area are strictly controlled (the West Coast Basin is adjudicated), future use of water in the Shallow Zone and Gage in the area is not expected to occur.

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8.4.2 Proposed SSCG for Groundwater

As directed in the CAO # R4-2011-0046 (LAWRQCB, 2011):

> Groundwater cleanup goals shall at a minimum achieve applicable Basin Plan water quality objectives, including California's MCLs or Action Levels for drinking water as established by the California Department of Public Health, and the State Water Resources Control Board's (SWRCB) "Antidegradation Policy" (SWRCB Resolution No 68-16), at a point of compliance approved by the LARWQCB, and comply with other applicable implementation programs in the Basin Plan.
>
> The SWRCB's "Antidegradation Policy, requires attainment of background levels of water quality, or the highest level of water quality that is reasonable in the event that background levels cannot be restored. Cleanup levels other than background must be consistent with the maximum benefit to the people of the State, and not unreasonably affect present and anticipated beneficial uses of the water, and not result in exceedence of water quality objectives in the LARWCB's Basin Plan.
>
> The SWRCB's "Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304" (SWRCB Resolution No. 92-49), requires cleanup to background or the best water quality which is reasonable if background levels cannot be achieved and sets forth criteria to consider where cleanup to background water quality may not be reasonable.

The proposed RAOs listed in Section 3.0 relevant to groundwater are:

- Remove LNAPL to the extent practicable and where a significant reduction in current and future risk to groundwater will result.
- Maintain a stable or decreasing plume of Site-related COCs beneath the Site.

In the case of groundwater, it is proposed that the non-numerical SSCGs be set consistent with the above-listed proposed RAOs. These goals are consistent with the direction set out in the CAO as follows:

- Return of the Shallow Zone and to a lesser extent the Gage aquifer to background levels for Site-related benzene (and naphthalene) impacts is expected to eventually occur through natural biodegradation. Although

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arsenic is not considered herein in setting a cleanup goal, reduction of petroleum hydrocarbon levels through time is also expected to reduce arsenic concentrations as groundwater conditions become less reducing.

- The length of time over which natural remediation of Site-related benzene will occur is likely many tens of years or longer. No use of Site groundwater is reasonably anticipated in the future given the overlying land use as housing and the adjudicated nature of the groundwater basin. Thus, the people of the State are not expected to be affected by Site-related benzene concentrations persisting into the future at the Site.
- Points of compliance for monitoring benzene plume stability will be established and presented in the RAP based on review of Site data and approved by the LARWQCB in order to comply with the SSCG.

9.0 SUMMARY

This report was prepared in response to Cleanup and Abatement Order (CAO) No. R4-2011-0046 issued to SOPUS on March 11, 2011 by the Regional Board. Section 3.c of the CAO orders SOPUS to "prepare a full-scale impacted soil RAP for the Site." As a part of the RAP, several requirements have been set forth that address the development of remedial action objectives (RAOs) and cleanup goals for the Site. The CAO also ordered that this SSCG report be prepared in advance of the RAP and submitted concurrently with the Pilot Test Report.

As a part of SSCG development the following RAOs have been developed:

- Prevent human exposures to concentrations of Site-Related COCs in soil, soil vapor and indoor air such that total lifetime incremental carcinogenic risks are within the NCP risk range of 10^{-6} to 10^{-4} and non-cancer hazard indices are less than 1 or concentrations are below background whichever is higher. Potential human exposures include onsite residents and construction and utility maintenance workers;
- Prevent fire/explosion risks in indoor air and/or enclosed spaces (e.g., utility vaults) due to the generation of methane from the anaerobic biodegradation of petroleum hydrocarbons in soils;
- Remove LNAPL to the extent practicable and where a significant reduction in current and future risk to groundwater will result; and
- Maintain a stable or decreasing plume of Site-related COCs beneath the Site.

Media-specific SSCGs are proposed as follows:

Soil

- The SSCGs for residential exposures are chemical-specific numerical values assuming a target incremental cancer risk of 10^{-6} and a hazard quotient of 1. These numerical SSCGs will be applied to soils not covered by hardscape from 0-2 feet bgs.
- The SSCGs for construction and utility maintenance worker exposures are chemical-specific numerical values assuming a target incremental cancer risk of 10^{-5} and a hazard quotient of 1. These numerical SSCGs will be applied to soils from 0-10 feet bgs.

Soil Vapor

- The SSCGs for residential exposures are based on the indoor air results and the vapor intrusion evaluation. No numerical SSCGs for soil vapor are proposed.

- The SSCGs for construction and utility maintenance worker exposures are chemical-specific numerical values assuming a target incremental cancer risk of 10^{-5} and a hazard quotient of 1. These numerical SSCGs will be applied to soil vapor from 0-10 feet bgs.

Indoor Air

- The SSCGs for indoor air at the site are background concentrations.

Groundwater

- Remove LNAPL to the extent practicable and where a significant reduction in current and future risk to groundwater will result.
- Maintain a stable or decreasing plume of Site-related COCs beneath the Site.

CITY COUNCIL

CITY OF CARSON

June 18, 2013

Dr. Teklewold Ayalew
California Regional Water Quality Control Board – Los Angeles Region
320 West Fourth Street; Suite 200
Los Angeles, California 90013

Re: **COMMENT LETTER – FORMER KAST PROPERTY TANK FARM – SITE SPECIFIC CLEANUP GOAL REPORT**

Dear Teklewold Ayalew,

This comment letter is submitted on behalf of the City of Carson in response to the request for public comments on the Site-Specific Cleanup Goal Report dated February 22, 2013. It has been five long years since this tragedy first came to light and, to date, there has been no successfully executed method of remediation. Thus far, Shell has tested four different technologies and all four have either proven insufficient and/or potentially dangerous to the public. We have patiently waited for the Los Angeles Regional Water Quality Control Board (LARWQCB), acting authority over this project, to force Shell Oil to abate this nuisance and return the Carousel community to the once beautiful and peaceful neighborhood it used to be. However, this process has taken much longer than originally anticipated. With respect, this delay is unacceptable to the Carson City Council and to our entire community

We, the elected officials of the City of Carson, hereby demand that the LARWQCB take ALL appropriate measures to ensure that the Carousel tract neighborhood (formerly known as the Shell Oil, Kast Property Tank Farm) is properly and expeditiously remediated, leaving absolutely ZERO risk to public health and welfare. After careful review, it has become abundantly clear that Shell Oil's present plan, detailed in the Site Specific Cleanup Goal Report, falls far short of meeting this Council's reasonable expectations. Allowing the standards for cleanup to exceed the limit set by the LARWQCB for TPHg by over 130 times and TPHd by 110 times is completely unacceptable. Shell's proposed Site Specific Cleanup Goals are even higher than soil screening levels used by the Regional Board at industrial sites where no residential land use is proposed or even possible in the future. For example, at the Valero Refinery in Wilmington, an industrial site, the Regional Board approved a set of cleanup criteria consisting of 1,000 mg/kg TPHg and 10,000 mg/kg TPHd. When compared to Shell's proposal of 66,000

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mg/kg TPHg and 110,000 mg/kg TPHd on a site where parents plan to garden and children hope to play, the results are unacceptable. The fact that this report would even be considered for public comment is incomprehensible.

We recognize this step in the remedial process to be an extremely important one; therefore, we implore you to proceed expeditiously. The revised and final Cleanup and Abatement Order allowed Shell to submit "...site-specific cleanup goals for residential (i.e., unrestricted) land use..." Proposed Site Specific Cleanup Goals are required to "...include detailed technical rationale and assumptions underlying each goal. However, there is no rationale to allow Shell's excessive Site Specific Clean Up Goals for residential properties at the Site when the Regional Board has previously required more protective Maximum Soil Screening Levels at residential and industrial sites in the region (e.g. East Bluff Residential Community in Signal hill).

We respectfully submit three reports prepared by environmental consultants, who are internationally recognized experts, to assist the LARWQCB in considering alternative technical rationale. We believe the LARWQCB will find their scientific analysis, and further their suggestions, to be more than appropriate given the Water Board's decision making history with other projects.

The LARWQCB is at a pivotal moment in the clean up on this site. Action must be taken, and it must be taken NOW. This is the perfect opportunity for the LARWQCB to set the tone for the Remedial Action Plan to come. The City of Carson appreciates the opportunity to comment on this important document. If you have any questions concerning these comments, or if we may otherwise be of assistance in connection with this matter, please do not hesitate to contact the undersigned.

Respectfully,

Mayor Jim Dear

Mayor Pro Tempore Elito M. Santarina

Councilmember Mike A. Gipson

Councilmember Lula Davis-Holmes

Councilmember Albert Robles

Enclosures
cc: City Manager

L. EVERETT & ASSOCIATES
ENVIRONMENTAL CONSULTANTS

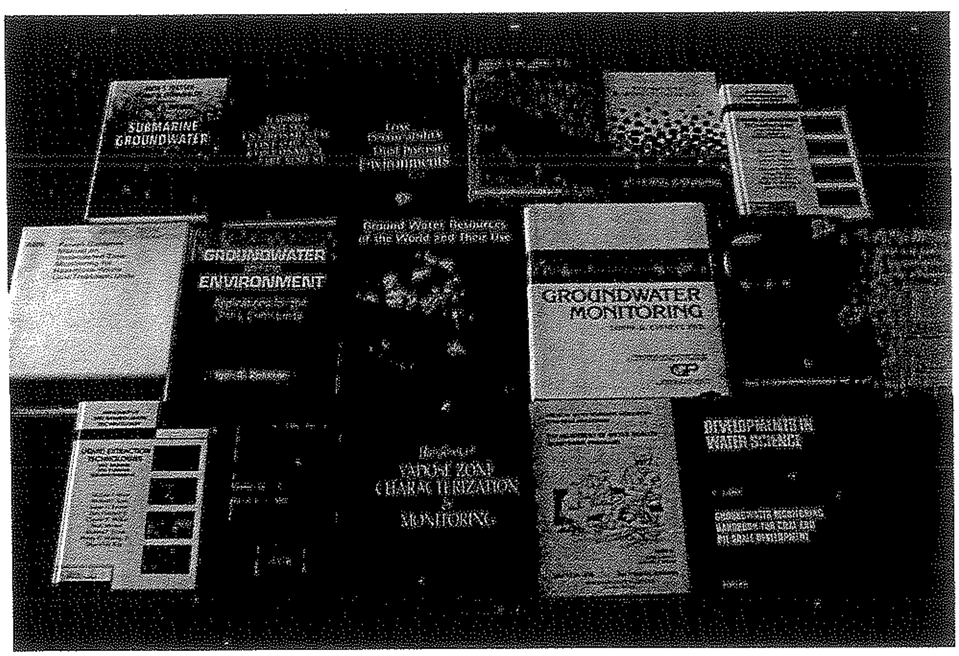
June 7, 2013

Samuel Unger, Executive Officer
California Regional Water Quality Control Board
Los Angeles Region
320 West Fourth Street, Suite 200
Los Angles, California 90013

Subject: Former Kast Tank Farm
Comments on Site-Specific Cleanup Goal Report

Dear Mr. Unger,

I have reviewed the above referenced cleanup goal report and have prepared the following comments. Further, I have extensively studied the available documentation on the former Kast Tank property site and have participated in different meetings with the Los Angeles Regional Water Quality Control Board. My comments will focus primarily on the vadose zone soil contamination and the vadose zone soil gasses and soil moisture. Further, I will comment on the almost complete lack of soil gas and indoor air data. My comments are based on over 40 years of working in the vadose zone, dealing with soil gas behavior in response to external parameters such as soil moisture. My subsurface experience is documented in my books below.



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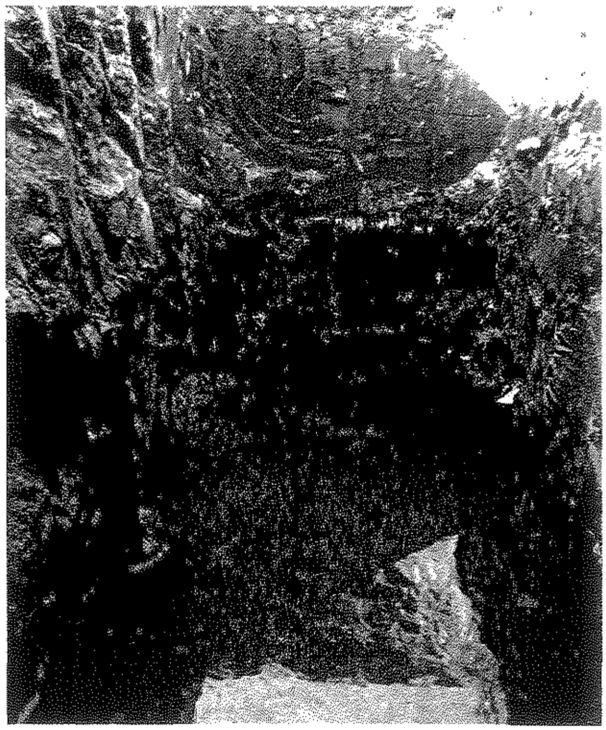
805-880-9300

In order to understand the petroleum hydrocarbon releases at the Carousel Tract, I have provided below a picture of a limited exploratory soil excavation at the Tract showing petroleum hydrocarbons at 18 inches below the land surface oozing out into the excavation. Please note that the waste oil oozes at variable rates, variable locations and variable depths all of which are completely unpredictable and which can only be remediated by complete excavation. Clearly this highly viscous, high density liquid waste will not permit gasses to migrate through this material, thereby precluding soil vapor extraction technologies.



Background and Qualifications for Lorne G. Everett Ph.D., DSc., PH, PHG, CGWP

I am a retired Research Professor/Hydrologist (Level VII) in the Donald Bren School of Environmental Science and Management at the University of California at Santa Barbara. The University of California has reserved Level VII for "scholars of great distinction."

I am a Fellow of the American Society of Civil Engineers (ASCE), a Fellow of the American Water Resources Association (AWRA), and a Fellow of the American Society for Testing and Materials (ASTM). The Title Fellow recognizes the highest earned honor bestowed by a Professional society.

I have a Ph.D. in hydrology (1972) from the University of Arizona. I am a registered hydrologist, #164, and a registered hydrogeologist #836, with the American Institute of Hydrology. I have served on the Board of Registration for the American Institute of Hydrology. I am a Certified Groundwater Professional, #293, by the American Association of Groundwater Scientists and Engineers. Lastly, I am a former Registered Environmental Assessor II, by the California Environmental Protection Agency, Department of Toxic Substances Control. DTSC declared that the REA II registration was the highest environmental registration recognized in the State of California.

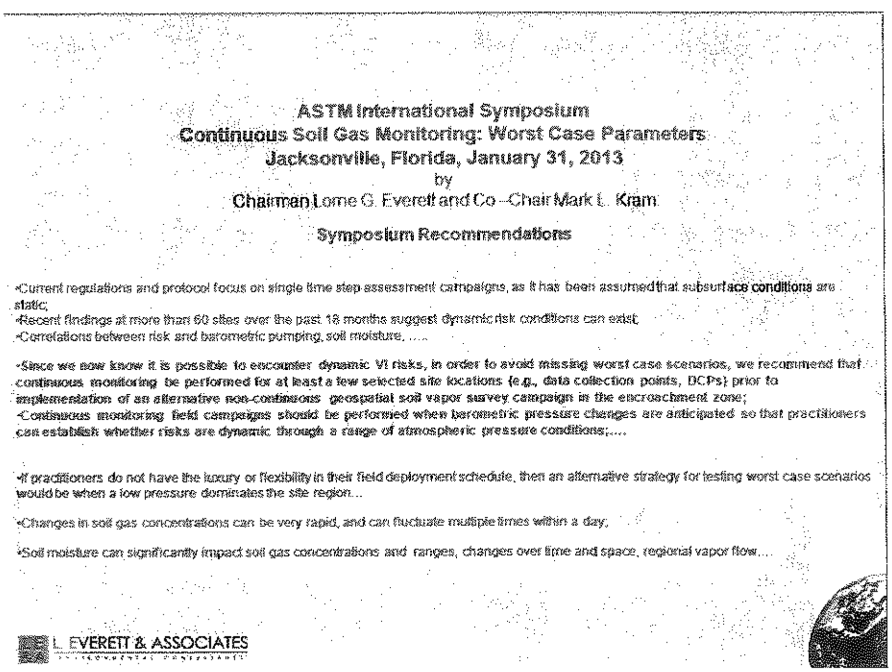
I am the Past Director of the Vadose Zone (Soils) Monitoring Laboratory at the University of California. For over 15 years I directed leading edge research on liquid and gaseous migration in both the saturated and unsaturated (vadose) zone.

For 18 years I have been the Charter D18.21.02 Chairman of the American Society for Testing and Materials (ASTM) task committee on Vadose Zone Monitoring. I was a centennial member of the ASTM Board of Directors and received the ASTM, Award of Merit, the highest honor bestowed by the society for writing National Groundwater and Vadose Zone Standards. As chairman of ASTM's Vadose Zone Task Committee, I was responsible for developing all of the current national ASTM D18.21.02 Vadose Zone standards. I have received ASTM Standards Development Awards including the award for Comparison of Field Methods for Determining Hydraulic Conductivity and the Standards Development Award for the Standard Guide for Pore-Liquid Sampling. I received the A. Ivan Johnson Outstanding Achievement Award in 1997 for "Outstanding and Significant Contributions" to the hydrogeologic understanding of soil and rock.

Of direct relevance to soil gas sampling and vapor intrusion issues in this letter, I Chair the ASTM committee (D18.21.02) which developed the following soil gas monitoring national standards:

- D5314-92 (2006) Standard Guide for Soil Gas Monitoring in the Vadose Zone
- D7758 (2011) Practice For Passive Soil Gas Sampling in the Vadose Zone for Source Identification, Spatial Variability Assessment, Monitoring, and Vapor Intrusion Evaluations
- D7648 (2012) Practice For Active Soil Gas Sampling for Direct Push or Manual-Driven Hand-Sampling Equipment
- D7663 (2012) Practice for Active Soil Gas Sampling in the Vadose Zone for Vapor Intrusion Evaluations

Further, on January 30, 2013, I chaired an international ASTM symposium (see below) entitled: Continuous Soil Gas Measurements: Worst-Case Risk Parameters. This symposium is directly related to the vapor intrusion issues in this letter.



In 1996, I received a Doctor of Science Degree (Honoris Causa) from Lakehead University in Canada for Distinguished Achievements in Hydrology. In 2002 I received the C. V. Theis Award, the highest award given by the American Institute of Hydrology (AIH) for major contributions to groundwater hydrology.

I have authored, edited, and contributed chapters to over 12 books, published over 150 professional papers and reports, hold several patents, and developed numerous standards on the subject of groundwater and vadose zone characterization and remediation. My book entitled "Groundwater Monitoring" was endorsed by the EPA as "establishing the State of the Art used by industry today" and was recommended by the World Health Organization for all developing countries. I was an invited Charter member of the Editorial Board of the journal, Environmental Forensics, a quarterly peer-reviewed scientific journal of national and international circulation. In this role, I evaluated the work of others through peer-review of manuscripts submitted for publication to the journal. I also participated in publication decisions, as well as establishing and maintaining the editorial direction of the journal.

For my contributions to the science of hydrogeology I was elected (No. 300-H3) to the Russian Academy of Natural Sciences. Based upon my original contributions to the science of hydrogeology, I received the Russian Academy's highest honor entitled the "Kapitsa Gold Medal". The Medal was presented by the Head of the Russian Academy's Water Problems Institute, on October 29, 1999 at the Beau Rivage Palace in Lausanne, Switzerland in front of an audience Chaired by Nobel Laureates.

My book entitled "Subsurface Migration of Hazardous Waste" is widely used in contamination investigations. With the Russian Academy, I was the English editor of a 2002 book entitled Groundwater and the Environment-Applications for the Global Community. My book entitled "Vadose Zone Monitoring for Hazardous Waste Sites" has been sold out. My book entitled, "Handbook of Vadose Zone Characterization and Monitoring" has been deemed a best seller by Lewis Publishers. As a tribute, the United States Department of Energy (DOE) in 1999, asked me to endorse their book entitled "Vadose Zone Science and Technology Solutions. DOE further asked me to frame the research needs of the book and to write the Foreword (I), Forward (II) was written by Dr Paul A. Witherspoon, UC Berkeley. My endorsement appears on the back cover of the 1540 page, two-volume book.

Based upon my many years of experience, I have participated on the Executive Committee of the United States Department of Energy's DOE Complex Wide Vadose Zone Science and Technology Roadmap.

As a further part of my contributions to federal agencies, I was a charter member of the Science Advisory Board of the United States Department of Defense (DOD) National Environmental Technology Test Site. For my contributions to the science advisory board on petroleum characterization and remediation, I received the United States Navy's Medal of Excellence in October, 1999.

I am a co- author of the Lawrence Livermore National Laboratory reports entitled; "California Leaking Underwater Fuel Tank (LUFT) Historical Case Analysis" and "Recommendations to Improve the Cleanup Process for California's Leaking Underground Fuel Tanks". This was the largest analysis of petroleum hydrocarbon migration characteristics that has ever been undertaken.

I was on the US Navy "Gatekeeper Review Panel" which evaluated the latest research on petroleum and chlorinated hydrocarbon characterization and remediation.

At the request of UNESCO in Paris, I was the English editor of a Monograph entitled Groundwater Resources of the World and Their Use. The Monograph published in 2004 looks at drinking water issues throughout the World and was distributed by UNESCO to every water resources research centre in the World. The US National Association of Groundwater Scientists and Engineers published a second printing of the book in 2006. The book was translated into Russian and reprinted by the Russian Academy of Sciences in 2007.

On behalf of EPA/DOE/DuPont I co edited a State of the Art book entitled: Barrier Systems for Environmental Contaminant Containment and Treatment that was released in 2006 by CRC press.

For the past 24 years I have been continuously invited by Dr Antonio Zichichi, a Science Advisor to the Pope, to participate in Planetary Emergency meetings held in southern Italy wherein I am the Chairman of the World Federation of Scientists Pollution Panel. In the fall a second meeting is often held at the Pontifical Academy of Sciences in the Vatican.

For over three decades I have been involved in consulting and advising the US Department of Energy on environmental issues. I have peer reviewed, visited, consulted, lectured, and been an advisor at the following DOE sites: Lawrence Livermore National Laboratory, Hanford Washington, Rocky Flats Colorado, Idaho National Engineering Laboratory, Fernald Ohio, Paducah Kentucky, Savannah River, Argonne National Laboratory and DOE Headquarters in Washington DC. I have been on DOE Roadmap committees as a member and Executive reviewer.

I have given mock trial training programs to environmental lawyers at the invitation of Carmen Trutanich Esq., the former Los Angeles City Attorney.

From 2000 -2009 I was the Chancellor of Lakehead University in Thunder Bay, Ontario, Canada. For my contributions to Canada, I received the Gold Medal from the Governors General of Canada in 2002.

I have given invited court room training to the Environmental Protection Agency, Criminal Investigation Division. My Criminal Investigation Division award states: "For your invaluable support and notable contribution to the mission of the Criminal Investigation Division".

Report Comments

As was pointed out at the last Regional Water Quality Control Board meeting on March 7, 2013, Shell's consultants indicated that the majority of the homes in the Carousel tract had only one indoor air sample taken and less than a dozen homes had more than one subslab soil gas samples taken. Shell has noted that their soil gas investigation follows the DTSC vapor intrusion guidance. However, the DTSC final vapor intrusion guidance recommends time series data, as follows:

Page 6 "For sites subject to vapor intrusion, permanent vadose monitoring points for sample collection should be installed to evaluate the long term behavior of contaminated soil gas. Soil gas may need to be monitored through time, in a fashion similar to groundwater, to ascertain representative subsurface conditions, to detect seasonal variations and other temporal changes, and to determine long term stability of contaminant concentrations."

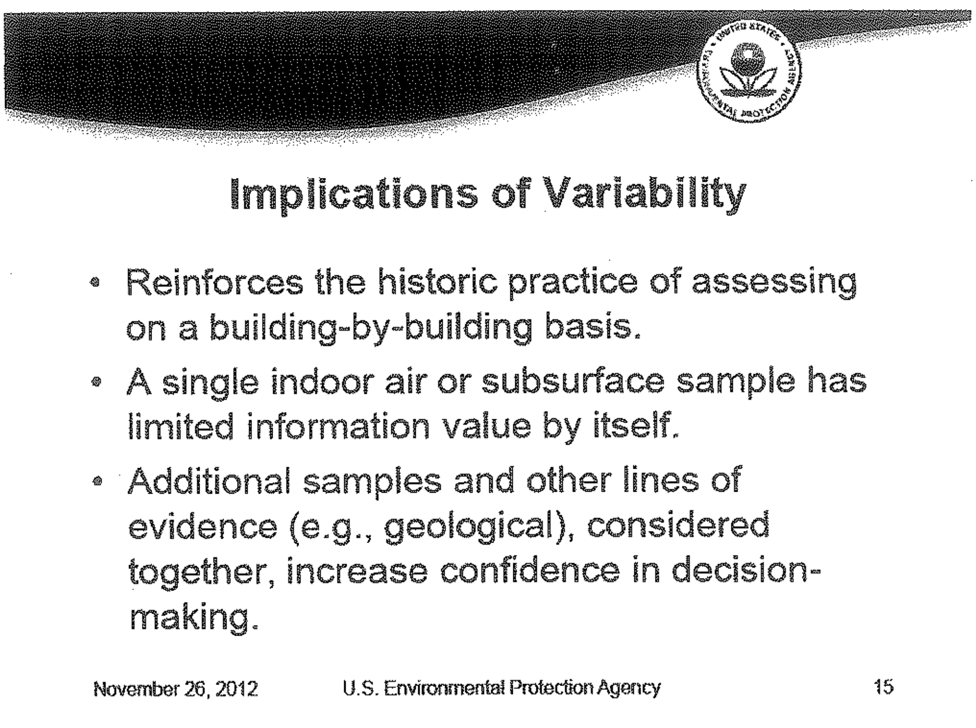
Page 8 "Soil gas may need to be monitored through time to ascertain representative subsurface conditions, to detect seasonal variations and other temporal changes, and to determine long term stability of contaminant concentrations."

Page 22: "Permanent sampling points should be installed and an appropriate number of sampling events should be conducted to characterize the temporal variability of subsurface conditions."

Page 33: "Discreet samples collected in most indoor air investigations may not adequately address temporal variations in contaminant concentrations."

Page G1: "When evaluating sub slab soil gas for a building, DTSC recommends that permanent sampling points be installed so that repeated sampling can be conducted, as necessary, to evaluate seasonal or temporal variations."

Clearly Shell is in violation of the very state guidance document that it purports to satisfy. Soil gas migration is highly variable and subject to changing soil moisture/capillary pressure conditions. The rate of soil gas migration may be highly dependent on barometric pressure changes and temperature changes. Clearly Shell's position of taking one or two samples at the homes in the Carousel Tract is not only insufficient, it shows a patent disregard for the health and safety of the families who reside on the Kast Tank Farm site. This point was clearly recently made by EPA below.

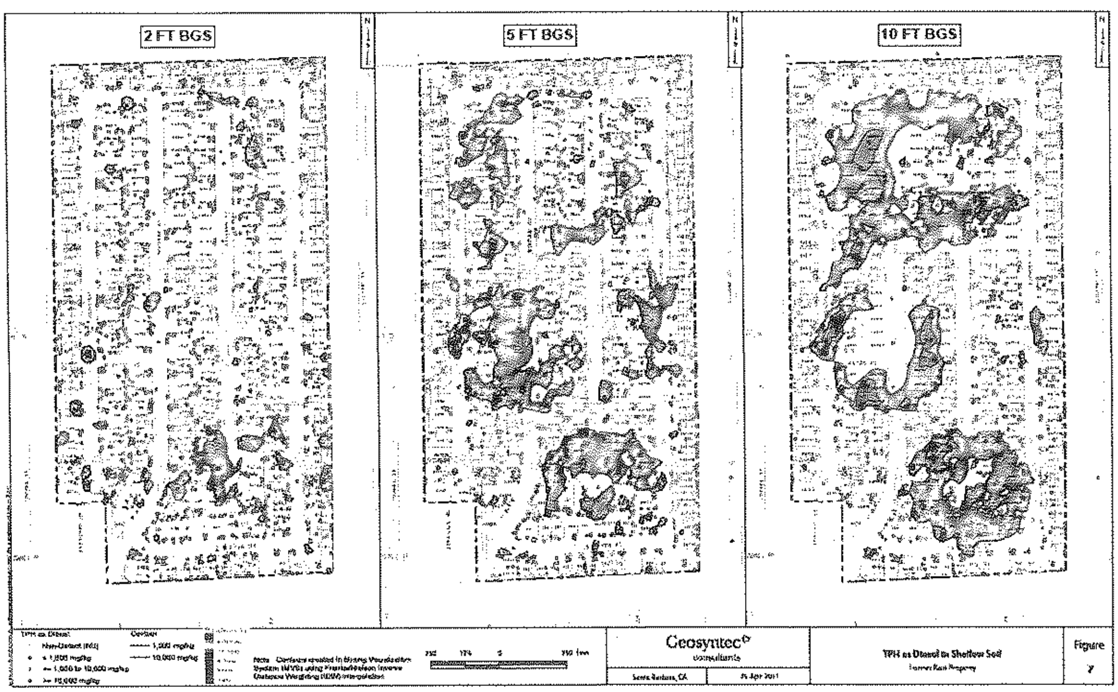


Shell's complete disregard for the current understanding of the dynamic behavior of soil gas was recently made clear in comments from Helen Dawson, Chief of the Science Policy Branch in EPA's OSWER's Superfund office after the AEHS sampling workshop in March 2013. Ms. Dawson said that "vapor intrusion guidance remains the subject of internal deliberations. And that recent studies with continuous monitoring have shown traditional sampling methods of sampling over a 24 hour period are insufficient to account for vapor variability". Dawson said, "studies have shown variability ranges from two-four orders of magnitude at any site and that discreet measurements will be below the long term average by one order of magnitude making it likely that current sampling methods will miss high concentrations". Dawson said that measures of variability depend on the monitoring approach, and she called continuous monitoring the "gold standard" of sampling. Clearly, Shell is not following the California State DTSC vapor guidance and certainly not following the spirit of EPAs position on continuous monitoring. One or two indoor air samples could hardly be expected to address any site specific cleanup goal regardless of their ultimate level.

EPA recently (September 2012) released a new research and development document entitled "Fluctuation of Indoor Radon and VOC Concentrations Due to Seasonal Variations"-EPA/600/R-12/673. EPA in its conclusion section on page 1-2 stated "Lower VOC concentrations were observed in indoor air in summer. These VOC concentrations in indoor air are controlled not only by 'building envelope-specific' factors but they are also significantly influenced by seasonal variations in subsurface concentration distributions, especially in shallow/sub slab soil gas where a weaker seasonal trend was observed." Further, on page 1-3 of the EPA report under the title "Relationship between Subsurface and Indoor Air Concentrations", EPA notes there is a strong seasonal component to PCE and chloroform indoor concentrations at the study site. The seasonal component appears to be related to the strength of the stack effect but it is not the only variable that controls indoor air concentrations. Further, EPA said that a repeatable seasonal effect of higher concentrations during winter was seen however, each winter tends to be different climatically and therefore the VOC concentrations will vary depending upon the year in question. Further, the EPA document concluded that high concentrations of VOCs were seen directly under buildings in sub slab and 6 foot soil gas depth however, these concentrations were not seen at similar depths external to the buildings; therefore soil gas samples taken outside of the foot print of the building are not representative of what is found underneath the building. Shell's characterization of the family homes in the Carousel Tract do not even begin to address the seasonal variability of subsurface gases and indoor air concentrations identified by EPAs latest research and development document. Variables such as HVAC system effects, diurnal temperature and wind effects, barometric pumping and weather fronts, water table fluctuations, soil and groundwater temperature changes, vadose zone moisture changes, and stack effects relative to heating and cooling seasons simply cannot be quantified by taking one sample in a family home and pronouncing that the family (including the kids) are at no risk now or in the future.

Methane Risk

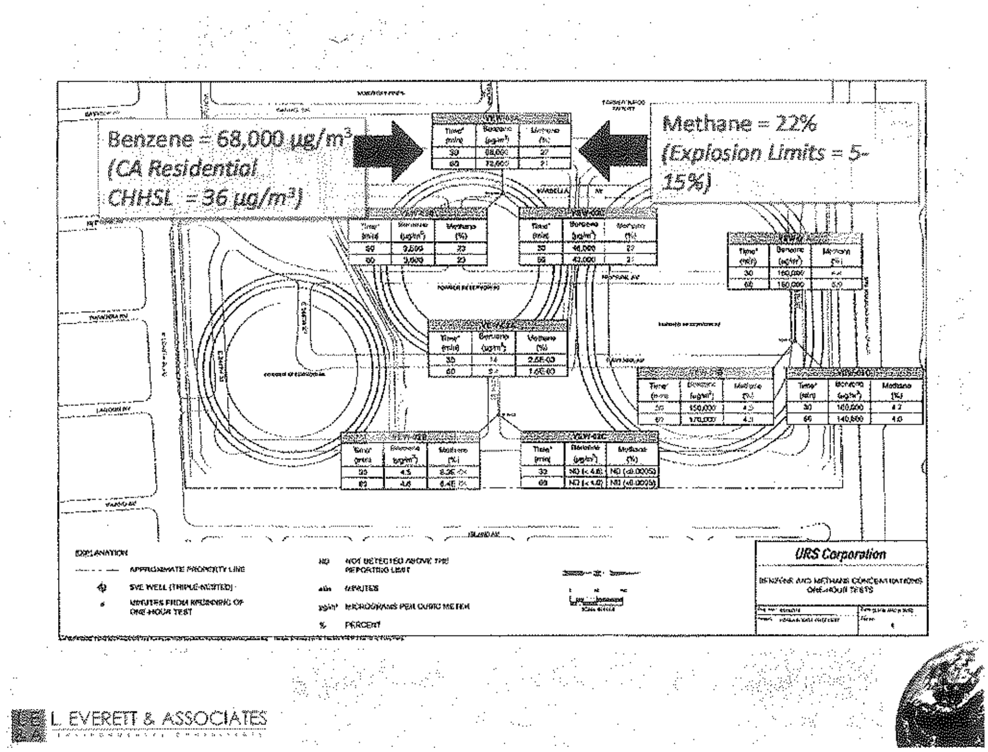
The petroleum hydrocarbons which were released from the three huge storage reservoirs on the Carousel Tract provide an abundant, well understood, source of food for bacteria to utilize. This process can



produce dangerous levels of methane in the subsurface.

I am particularly familiar with the degradation of petroleum hydrocarbons by bacteria since I was the co-author of the EPA national guidance document entitled: Permit Guidance Manual on Unsaturated Zone Monitoring for Hazardous Waste Land Treatment Units, EPA/503-SW-86-040. Throughout America, one of the main ways of treating waste petroleum hydrocarbons is through the process called land farming or land treatment. I had been selected by EPA in Washington on a sole source basis to develop this hydrocarbon guidance document since I had demonstrated a lengthy career in evaluating hydrocarbon sites.

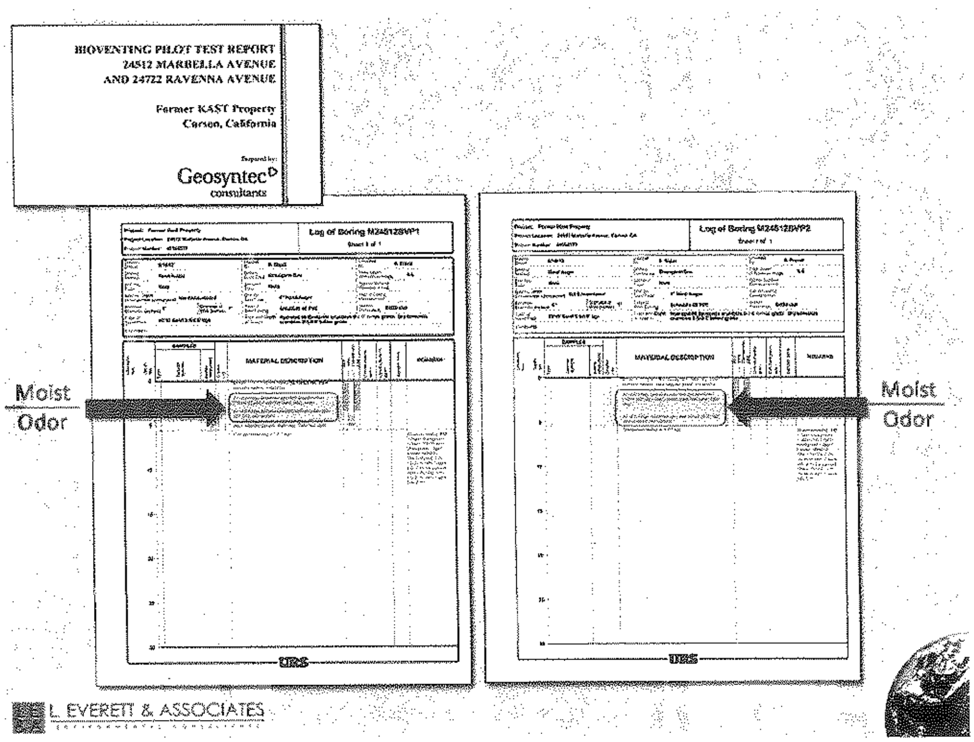
The Occupational Safety and Health Administration (OSHA) states that the lower explosion limit for methane is 5%. If methane is present below 5% and a match is lit then no explosion will occur. The upper explosion limit for methane is 15%. If methane gas exists between 5% and 15% and an ignition source is present, an explosion is expected to occur. If the methane concentrations are greater than 15% an explosion will not occur because of the lack of oxygen however, if these methane rich gasses leak into sewer lines, utility lines, gas lines, or home foundations, and the concentration dilutes to below 15% then an explosion can occur. As noted in the figure below presented by Shell's consultants, the methane concentrations below the Carousel Tract at 5 feet are as much as 22% methane. Clearly, this concentration is higher than the upper explosion limit for methane and therefore constitutes a long term source of explosive gas.



As bacteria degrade petroleum hydrocarbons they utilize all of the available oxygen thereby driving the system anaerobic. These bacteria then begin to look for other energy sources to degrade the petroleum hydrocarbon. Often the microbes will strip oxygen from nitrate groups resulting in the generation of methane gas. Methane is an explosive gas that is found in many locations across the Carousel Tract site. To put this concentration in perspective, I refer to the, OSHA-3115-06R-2003 criteria which state that a competent person must test all underground work areas for methane and other flammable gases… The OSHA document states that if 20% or more of the lower explosive limit for methane (1% methane) or other flammable gasses is detected in any underground work area or in the air return, all employees must be evacuated to a safe location above ground (except those employees required to eliminate the hazard). Electrical power, except for acceptable pumping and ventilation equipment) must be cut off to the area until concentrations reach less than 20% of the lower explosion limit. The OSHA guidance goes on to say if 10% or more of the lower explosive limit for methane gas (.5% methane) or other flammable gases is detected near any welding or other hot work, the work must be suspended until the concentration is reduced to below 10% of the lower explosion limit. Further, OSHA says when 5% or more of the lower explosive limit for methane (.25% methane) or other flammable gases is detected in an underground work area or in the air return, steps should be taken to increase ventilation air volume or otherwise control the gas concentration. Clearly methane concentrations above 5% are high risk and concentrations of 22% are completely unacceptable.

Soil Moisture

I have reviewed numerous boring logs for subsurface investigation at the Carson Tract sites. As noted in the figure below, the majority of the boring logs indicate moist conditions in the top 5 feet of lithology.



Having studied soil moisture effects on soil gas migration for decades, I am well aware that elevated soil moisture will reduce the flow of soil gas in the subsurface. It is my considered opinion that the soil moisture tied up in the fine grained silts, sands and clays located close to the surface at the Carousel Tract curtail the flow of both explosive and toxic gases into the homes in the development. Soil moisture varies relative to rainfall events, seasonal events, and long term climate behavior. Further soil moisture varies with soil type, landscape irrigation, leaking pipes, and artificial permeabilities from sewer line trenches, gas line trenches, electrical trenches etc. Since the soil moisture varies for each home based on sprinkler usage and seasonal effects, for example, it is impossible to predict future soil moisture levels across the Carousel Tract and therefore impossible to predict the soil gas concentrations or soil gas migration across the Tract.

Global climate change will dramatically change water use and costs in Southern California. Aquifer depletion, the dramatic reduction in flows in the Colorado River, reduced rainfall distribution etc. all point to a dryer soil moisture regime over time. Clearly any protection offered to these families based on the apparent low levels of explosive gases and toxic gases in these homes will be diminished in time as the soil moisture begins to be reduced and the soils dry out. We know that highly toxic chemicals at very high concentrations are found at 5 feet and we know that explosive levels of methane are found at 5 feet and as such, I believe that there is an unacceptable risk to families living over these threatening gasses. An example of a family home destroyed by methane gas is provided below.

Recent Volatile Gas Research

In the United Kingdom (UK), all Brownfield sites must be evaluated over the long term for the generation of methane. In response, British scientists have developed new sensors which measure methane on a continuous basis along with a number of other in-situ parameters. In the United Kingdom Research Bulletin RB13 dated February 2011, the opening title reads: The Utility of Continuous Monitoring in Detection and Prediction of "Worse Case" Ground Gas Concentration (see figure below).

CL:AIRE

RB 13
(February 2011)

research bulletin

CL:AIRE research bulletins describe specific, practical aspects of research which have direct application to the characterisation, monitoring or remediation of contaminated soil or groundwater. This bulletin describes how continuous monitoring, rather than a periodic measurement approach, can reduce uncertainty in ground-gas risk assessment.

The Utility of Continuous Monitoring in Detection and Prediction of "Worst Case" Ground-Gas Concentration

1. INTRODUCTION

Many environmental parameters show high temporal variability, therefore, their representative measurement requires multiple measurement. In the case of ground-gas monitoring, flaws in the existing multiple measurement approach have been identified in the literature and are subject to continuing correction (e.g. Wilson *et al.*,

Monitoring wells are the preferred method to sample sub-surface gas, therefore, the ICSM and the sensitivity of the end use will guide:

i) the number and location of monitoring wells,
ii) the position of their response zones.

Previous guidance has suggested minimum numbers of monitoring

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Based on this new methane sensing technology, it was quickly realized that worse case conditions for these explosive gases can only be determined through continuous monitoring of methane. As shown in the figure below, the methane concentrations are dramatically reduced when the barometric pressure increases and further, the methane concentration dramatically increases when the barometric pressure is reduced.

CL:AIRE (Contaminated Land: Applications in Real Environments) Feb 2011

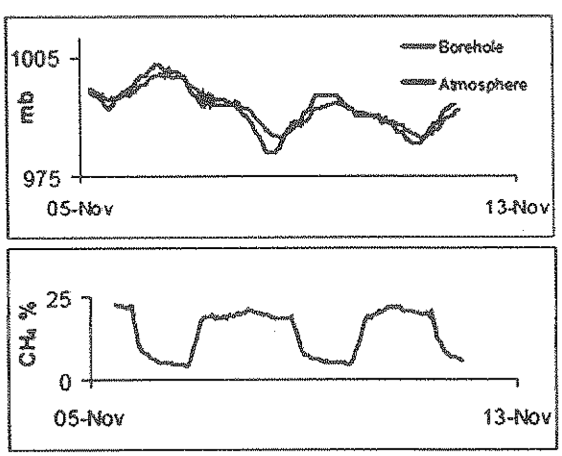

Figure 5. The delayed response of borehole pressure to atmospheric pressure and the coincidence of gas migration with the consequential differential pressure.

L. EVERETT & ASSOCIATES

This research done in the UK expressly shows that methane concentration can be very dynamic in response to barometric pressure changes. This new information will substantially change how we evaluate methane sites in particular with respect to determining those conditions under which explosive gasses could wreak havoc to a development. At the Carousel Tract, one or two methane samples have been taken at each home, which is entirely inadequate to provide any assurance to the home-owners or to provide any measure of the dynamic range of these methane gasses.

My personal experience with explosive concentrations of methane gasses at military bases resulted in the developer jacking up all of the homes, moving them off of their slabs, excavating the shallow contamination under the homes, re-pouring the slabs and relocating the homes back to their original locations. Clearly, on our military bases, the developer was not willing to take the risk of these shallow explosive gases devastating military families. We should expect no less from Shell for the Carousel Tract families. The sequence of excavating under homes on a military base is provided below.

Bandolier Circle, 1357, All Support Beams Installed, 09/12/08

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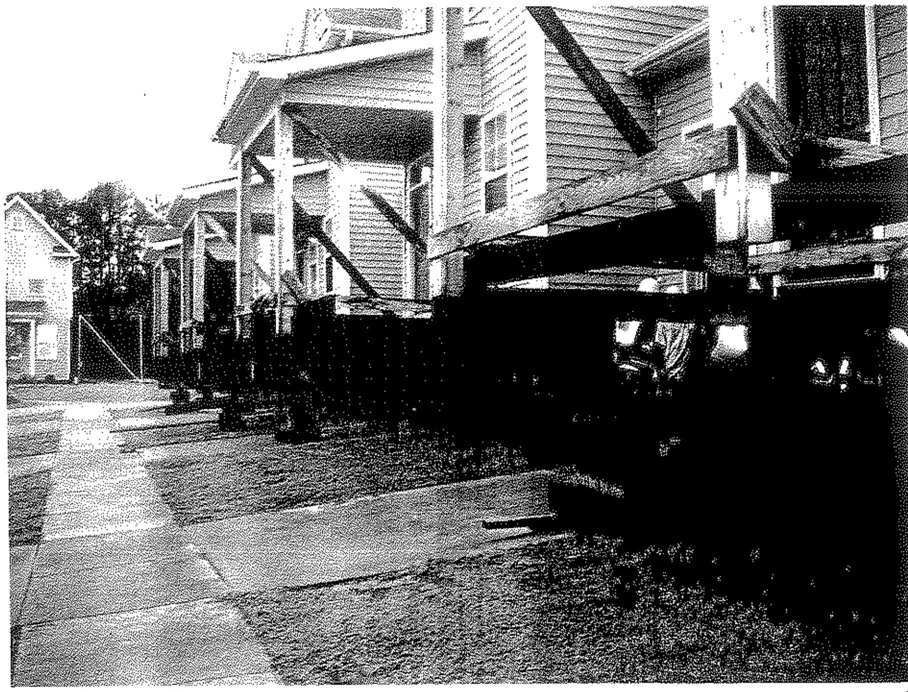

Bandolier Circle, 1357 1st Move D, 09/26/08

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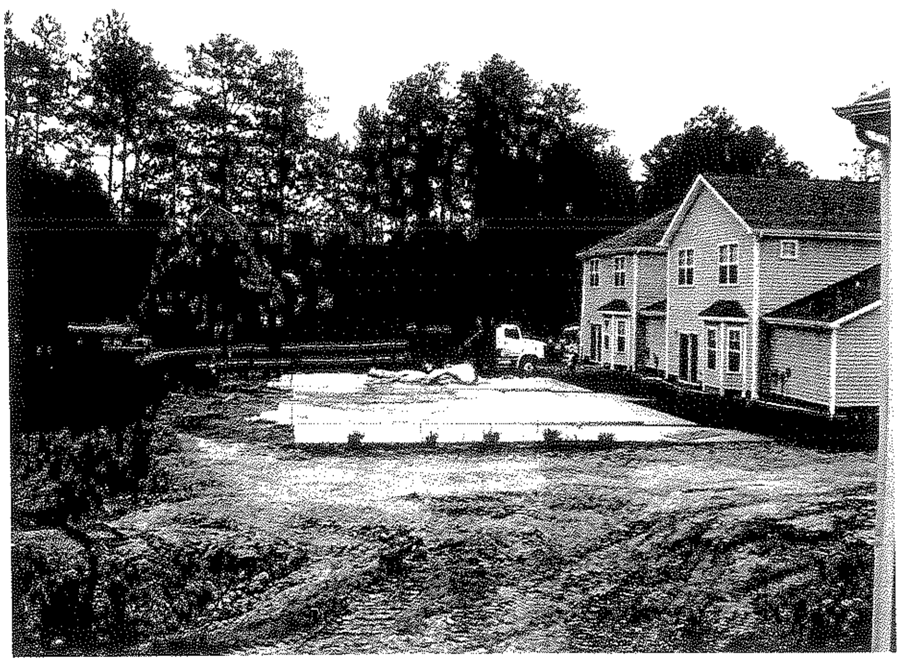

Virginia Place, HH-VP-34-36, Initial Demo Pad, Picture 1,

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Virginia Place, HH-VP-34-36, Picture 3

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Virginia Place, HH-VP-34-36, Compacted Backfill, Picture 09

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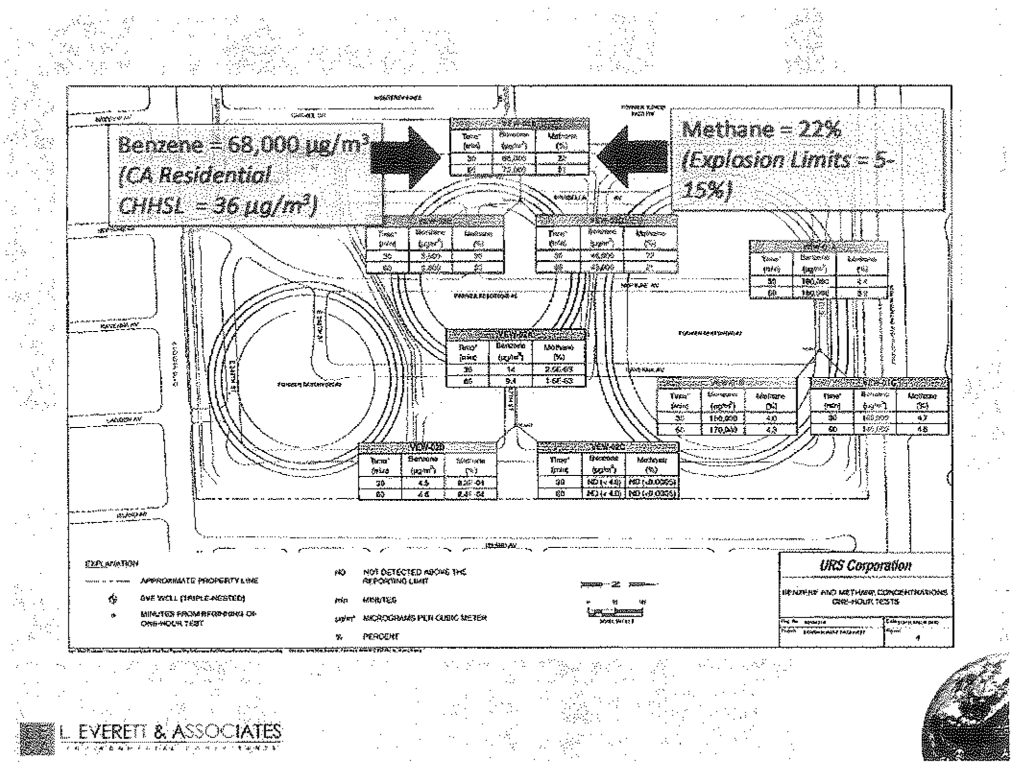
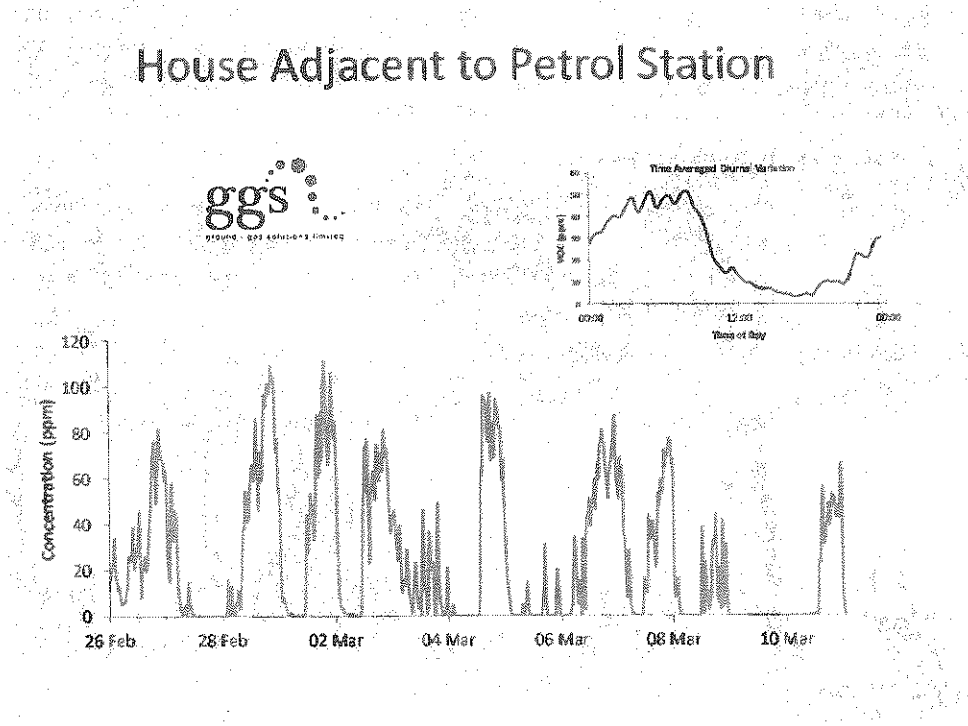
Benzene Gas

Benzene is a volatile component of petroleum hydrocarbons and is a known human carcinogen. The California Human Health screening level for benzene is 36 ug/m^3. Above this level, human health is at risk and a proactive approach is required to reduce the human health risk. As noted in the figure below, the benzene concentration in the Carousel Tract at location VEW-03A at 5 feet is 68,000 ug/m^3. At location VEW-01A the benzene concentration is 190,000 ug/m^3. It defies all reasonable expectations that these extremely high concentrations of a soil gas would be allowed to remain at a 5 foot depth below these homes. Allowing concentrations of a known human carcinogen at a 5 foot depth which is 6,000 times the level deemed to be safe in California, is unconscionable.



As noted in the figure below the concentration of VOCs in a home next to a petroleum station can show wide swings in concentration. These wide swings in concentration vary by the hour, by the day, by the season, and over the years.

Shell on the other hand would have us believe that taking one sample in the majority of the homes in the Carousel Tract is sufficient to protect these families from highly carcinogenic gases at any time during the next day, week, month, or many years into the future. Characterizing the VOCs as safe in homes immediately adjacent to extremely high concentrations of cancer causing gases is an expression of the total disregard for the health of the adults and children who live in these homes.



Shell Remediation Pilot Test Results

Shell has a long history and understanding of petroleum hydrocarbon remediation technologies. Consequently, when Shell proposed four separate remediation technologies for testing at the Carousel site, the Regional Water Quality Control Board approved the pilot test plans. The result of the four separate pilot tests however were a complete failure, as extensively documented by Shell. The in-situ chemical oxidation (ISCO) pilot test failed and the consultants to Shell stated, "Therefore, field pilot testing of ISCO using sodium persulfate does not appear effective. The field pilot testing of ISCO using ozone is not recommended." Shells own consultant's felt that in-situ chemical oxidation should not be considered and therefore recommended that testing of this technology be discontinued.

The second technology recommended by Shell was the use of bioventing. Bioventing involves the enhancement of oxygen to encourage the biological degradation of the petroleum hydrocarbons. Based on the test results, Shell concluded that it would take several decades to clean up this site assuming that the average biodegradation rates determined by Shell would hold. Clearly requiring these families to live for several decades (more than a generation) before homes would be livable is completely unacceptable and thus the bioventing remediation approach failed.

The third technology proposed by Shell was to surgically excavate in the streets, alleys, parts of yards but not under the homes. This technology also completely failed because it is unrealistic to think that contamination directly under homes somehow is reduced by excavating areas outside of the home foot print. As noted by EPAs latest research and development on soil and gas discussed earlier, soil gases measured external to a home have very little bearing on the concentrations found under a home. Clearly the partial excavation approach would fail to reduce the risk to the families in the Carousel Tract.

The fourth remediation pilot test involved soil vapor extraction to cause the volatile components to be removed from the subsurface. The extraction range for the soil vapor extraction program ranged from 5 feet to a radius of 10-15 feet in some locations. Based on my years of experience, this extraction range is very low and is understandable based on the high soil moisture content and the fine grained sediments involved. Based on a radius of 5 feet or even 10 feet, the number of extraction wells associated with any home or yard would be completely intrusive, unacceptable, and unworkable in a home environment. Thus simply based on the site conditions the soil vapor extraction program is a failure.

It is important to point out that in-situ chemical oxidation, bio venting, surgical extraction, and soil vapor extraction are applicable technologies for petroleum hydrocarbon remediation under the appropriate conditions. The conditions to support those technologies simply do not exist at the Carousel Tract. It is important to point out that Shell's Westhollow Technology Center in Houston is one of the most sophisticated hydrocarbon research facilities in the world and when they vetted the above four technologies they were clearly presenting the best suite of technologies available to them. Since all four of the technologies failed it is unreasonable to think that alternative technologies could come along to remediate this site. Rather than recognize the failure of the technologies, Shell has preferred to introduce delay after delay after delay in anticipation that at some stage a case could be made for leaving excessive levels of contamination in the subsurface.

Sincerely,

Lorne G. Everett, PhD, DSc.
F.ASCE, F.AWRA, F.ASTM
Chief Scientist & CEO
L. Everett & Associates, LLC

L. EVERETT & ASSOCIATES
ENVIRONMENTAL CONSULTANTS

June 7, 2013

Samuel Unger, Executive Officer
California Regional Water Quality Control Board
Los Angeles Region
320 West Fourth Street; Suite 200
Los Angles, California 90013

Subject: Former Kast Tank Farm
Comments on Site-Specific Cleanup Goal Report

Dear Mr. Unger,

When the owner of a property in Hawthorne discovered contamination from a former service station, (case number T0603717633) the Los Angeles Regional Water Quality Control Board ("The Board") imposed a cleanup standard of 500 mg/kg for gasoline-range total petroleum hydrocarbon (TPH_g) and 1,000 mg/kg for diesel-range (TPH_d). These are the standards called for in The Board's Interim Site Assessment and Cleanup Guidebook.[1] This standard was applied to all soil with no exception for soil under buildings or sidewalks. The story is much the same for the owner of an orchard in Monterey County (T0608797961) and a family trust in Temecula (T0606501135; TPHg and TPHd in soil remediated to levels below 100 mg/kg). Indeed, similar soil cleanup standards have been and continue to be applied at dozens if not hundreds of sites across the state under the regulatory authority of the regional water quality control boards.

Shell is demanding more lax soil cleanup standards than were applied at the sites noted above. Approving Shell's proposed cleanup standards would not only be a mistake on technical grounds, it would be a blow to the concept of fairness and consistent application of government rules and policies. Faith in government stems from citizens' belief that the rules are applied consistently: the millionaire or politician is just as likely to get a speeding ticket as the rest of us. By proposing lax cleanup standards, Shell is demanding special treatment. This has serious implications. Shell has the resources to commission its own science to allegedly back up its proposal whereas families and small businesses are stuck following the stricter rules because they don't have the money, influence or wherewithal to make the rules bend for them. What is the net result? The appearance that the State grants favorable treatment to giant corporations that allows for less costly cleanups while families and small businesses strain to follow the rules as written.

[1] Depth to groundwater at the Hawthorne site is between 20 and 50 feet below ground surface (bgs). For shallower groundwater, the standards are 100 mg/kg for TPH_g and TPH_d and 1,000 mg/kg for heavier oil.

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This letter provides comments on the February 22, 2013 Site-Specific Cleanup Goal Report for the Former Kast Property in Carson, California. The report was prepared by Geosyntec Consultants on behalf of Shell Oil Products, US. This 44-acre site was operated as a petroleum storage facility from approximately 1923 to the 1960's with three very large oil reservoirs[2] and other petroleum handling and storage appurtenances. These were huge storage reservoirs, spanning 4 to 6 acres each, allegedly with concrete-lined earthen floors and walls and wood-frame roofs. This long history of petroleum operations led to widespread subsurface contamination. The site was redeveloped as a residential neighborhood beginning in 1967. The subsurface contamination was not remediated at the time of redevelopment, nor has any meaningful remediation been performed in the intervening 46 years.

Elevated levels of soil, soil gas and groundwater contamination extend across essentially the entire Carousel neighborhood. By proposing to limit removal of contaminated soil to shallow exposed patches of ground and by proposing permissive cleanup standards, the RWQCB is being led down a path that will allow Shell to leave most of this contamination in the ground. In essence, Shell is building a case for a "low-threat" closure for this site. In this letter, I will argue that the Carousel neighborhood is not suitable for low-threat closure status and a more conventional (thus more thorough) remediation strategy is necessary.

For soil between 2 and 10 feet bgs, Shell proposes the following cleanup standards:

- 66,000 mg/kg for TPH_g
- 110,000 mg/kg for TPH_d
- 190,000 mg/kg for TPH in the range of motor oil (TPH_{mo}).

It is essentially impossible for soil to be more contaminated than these proposed standards. By approving these standards, The Board would be setting a precedent that virtually no petroleum hydrocarbon contamination deeper than 2 feet ever requires cleanup. The theoretical upper limit of soil contamination (the highest amount of contamination possible) would be if all pores spaces in the soil were filled with pure petroleum product.[3] The corresponding theoretical maximum TPH concentration varies because it depends on porosity, bulk density and other factors. However, for a heavy oil in a typical sandy soil (porosity = 25%; dry bulk density of soil = 1.5 g/cm^3; product specific gravity = 0.8) the theoretical maximum concentration is approximately 120,000 mg/kg. The proposed cleanup standard of 190,000 mg/kg is higher than what is physically possible under most (if not all) subsurface conditions; thus for heavier TPH, no physically-possible degree of soil contamination would trigger a cleanup requirement under Shell's plan as long as the soil is deeper than 2 feet.

Plan is inconsistent with SWRCB Low Threat Closure Policy

Low threat closure is a concept that generally allows higher levels of contamination to remain in the subsurface than might otherwise be allowable if it can be shown that the residual chemicals would pose a sufficiently low risk to human health and the environment. The SWRCB issued its Low Threat

[2]One reservoir has a capacity of 2,000,000 barrels and there were also two 750,000 barrel reservoirs. 2,000,000 barrels corresponds to about 84 million gallons.

[3] In the real world, contaminated soil would never reach this extreme because at least some of the pore space would be filled with water and some would be filled with air.

Closure Policy for petroleum contamination at underground storage tank (UST) sites in 2012. The plan being developed by Shell for the Carousel Tract is inconsistent with the SWRCB policy in a number of ways. First, the Board needs to determine if a large non-UST site like the Carousel Tract even qualifies for consideration for low-threat closure.

It is permissible to apply low threat closure criteria to non-UST sites:

> "This policy may still be used to evaluate whether a petroleum-only site that is not associated with USTs is low-threat as long as the exposure assumptions are equivalent to those in this policy, or are shown to be low-threat by a site-specific analysis." (SWRCB, 2012, Leaking Underground Fuel Tank Guidance Manual, p. 17-7, discussing Low Threat Closure Policy).

However, the SWRCB did not intend low-threat closure criteria to be applied to large sites with widespread contamination:

> "For example, sites with petroleum releases from natural gas/oil field operations, pipelines, or aboveground storage tanks (ASTs) may be evaluated using this policy as long as these sites meet all of the criteria ***and the impacted soil is less is than 82 feet by 82 feet in areal extent***[4] (to meet the direct contact CSM), or a site-specific risk assessment shows that the impacted soil is low-risk for the direct contact pathway." (SWRCB, 2012, Leaking Underground Fuel Tank Guidance Manual, p. 17-7; emphasis added).

Free Product

Concentrations like 66,000 mg/kg for TPHg and 110,000 mg/kg for TPHd are levels that clearly indicate the presence of free product in soil. It is inconsistent with decades of policy and practice in this state to allow LNAPL to remain in soil with no remediation. A fundamental component of any cleanup strategy for petroleum hydrocarbons is that if free product is present, it should be actively cleaned up:

- California LUFT Manual, 2012: "Federal UST Regulations (40 Code of Federal Regulations [CFR] 280.64), State Regulations (CCR, Title 23, Division 3,Chapter 16, Section 2655(a), and the Case Closure Policy state that 'free product' (light-nonaqueous-phase liquid, or LNAPL) shall be removed '**to the maximum extent practicable.**" (p. 18-4, emphasis added).
- LARWQCB Interim Site Assessment and Cleanup Guidebook: "sites are ready for closure when: The leak has been stopped and ongoing sources, **including fuel-saturated soil and soil which contains mobile fuel components** have been removed or remediated. (p. 4-9, emphasis added).

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[4] Normally a site like the Carousel Tract would be considered a single operable unit and cleanup decisions would be made holistically for the entire site. Shell's insistence that the risk assessments and cleanup decisions be made on a home-by-home basis (i.e. splitting up the site into 285 operable units) allows it to argue that each operable unit is small enough to meet the criteria low threat closure. The RWQCB should not allow Shell to slice the site into 285 pieces considering that the ultimate result of such a decision is to obscure that fact that the contamination is as widespread as it truly is, thus justifying a low threat closure strategy.

The California LUFT Manual provides guidelines for "residual saturation" or concentrations above which the product may be mobile (See California LUFT Manual Table 13-3). Under every soil type and for every hydrocarbon range tabulated by the SWRCB, the residual saturation is well below the proposed cleanup standards proposed by Shell for "deep" soil between 2-10 feet. This comparison shows that Shell is proposing to leave free product in the soil. Thus the cleanup standards proposed by Shell do not satisfy the essentially universal requirement that (if present) free product should be remediated.

Inappropriate cleanup levels and depth intervals for individual constituents in soil

In the 2012 Low Threat Closure Policy, the SWRCB published soil screening levels for individual petroleum hydrocarbon compounds for 0-5 feet below ground surface (bgs) and 5-10 feet bgs. Shell's proposed cleanup goals are inconsistent with the state's policy because they are segregated into different depth intervals (0-2 feet bgs and 2-10 feet bgs). This might seem like an innocent discrepancy, but it has huge implications for cost and for risk to human health. In a low threat closure scenario, deeper soil generally has higher (i.e., more permissive) cleanup standards. Thus, by classifying the deeper zone as 2-10 feet instead of 5-10 feet, Shell is seeking to apply more permissive cleanup standards to soil between 2-5 feet, in clear violation of the SWRCB policy, and saving Shell millions of dollars.

In addition to arbitrarily shifting the depth intervals in its favor, Shell is proposing cleanup standards for the deeper soil that significantly exceed the State's own screening levels, as shown on the table below.

Chemical	SWRCB Low Threat Closure Soil Screening Level: Residential 5-10 feet bgs (mg/kg)	Cleanup standard proposed by Shell for Carousel Tract 2-10 feet bgs (mg/kg)
Benzene	2.8	19
Ethylbenzene	32	420
Naphthalene	9.7	350

Although mostly a problem in deeper soil, the low threat closure soil screening level for PAH in shallow soil is 0.063 mg/kg but Shell's proposed shallow soil cleanup goal for just one PAH, benzo(a)pyrene is 0.16 mg/kg. Even if this site is found to qualify for a low threat closure strategy, (not an obvious call) at minimum the Shell cleanup goals should comply with the State's policy.

Not accounting for nuisance levels for TPH in soil

A nuisance is defined by the Water Code as anything that meets all of the following requirements:

- Is injurious to health, or is indecent or offensive to senses, or an obstruction to free use of property, so as to interfere with comfortable enjoyment of life or property,

- Affects at the same time an entire community or neighborhood, or any considerable number of persons, although the extent of annoyance or damage inflicted upon individuals may be unequal
- Occurs during, or as a result of, the treatment or disposal of wastes (petroleum release in this case)

This definition could almost have been written specifically for the Carousel Tract: it is clear that the petroleum saturated soil at this site meets the criteria for a nuisance condition. Shell's proposed cleanup goals are too high because they neglect this important factor. While the Water Code does not provide numerical guidelines for how much contamination constitutes a nuisance, I believe that the levels of contamination currently found at the Carousel Tract constitute a nuisance and (more importantly) the nuisance would remain even after Shell's cleanup if the proposed cleanup levels and excavation criteria are allowed. The San Francisco RWQCB[5] defines a ceiling level for nuisance and other gross contamination concerns as 100 mg/kg for TPH(gasoline and middle distillates[6]) in shallow soil in a residential land use scenario and 500 mg/kg for TPH(residual fuels).[7]

These nuisance guidelines from the San Francisco RWQCB are generally consistent with policies of other states around the country. For example, Massachusetts incorporated an analysis of nuisance in establishing a soil cleanup standard of 200 mg/kg for TPH. [8] New York defines nuisance characteristics for petroleum-contaminated soil as presence of petroleum-type odors and concentrations of individual contaminants in soil greater than 10,000 ppb (10 mg/kg). By contrast, Shell is proposing significantly higher cleanup standards for TPH in shallow soil. These proposed standards are too high because they ignore the nuisance aspect of high levels of petroleum contamination in soil. The following table provides a comparison.

Petroleum Range	RWQCB Nuisance ESL for Residential Soil (0-10 ft bgs)	Shallow Soil Cleanup Standard Proposed by Shell (0-2 ft bgs)	Deeper Soil Cleanup Standard Proposed by Shell (2-10 ft bgs)
TPH_g	100 mg/kg	760	66,000
TPH_d	100	1,300	110,000
TPH_{mo}	500	3,300	190,000

[5] San Francisco RWQCB, 2007, Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater, Interim Final, p.8-6. In this document, "shallow soil" is defined as less than or equal to 3 meters or about 10 feet bgs.

[6] This encompasses the compositional range of TPH_g and TPH_d as reported at this site.

[7] TPH(residual fuels) encompasses the compositional range of TPH_{mo} as reported at this site.

[8] Massachusetts Department of Environmental Protection, 1997, Characterizing Risks Posed by Petroleum Contaminated Sites.

The proposed cleanup standards for TPH in soil are clearly too permissive. Even if acceptable from a toxicological perspective (a dubious assumption at best, considering the data gaps in site characterization: see below), leaving these very high levels of petroleum in the soil would ignore the nuisance characteristics of this contamination and would result in an inadequate cleanup for a residential land use scenario.

Underreporting contaminant concentrations in soil

The casual reader might be led to believe that Shell is agreeing to clean up all soil that exceeds the proposed cleanup standards presented in the Site Specific Cleanup Goal Report. This is actually not true. Another trick employed by Shell is to apply the cleanup standards to a statistical construct, not to the concentrations at specific locations from specific samples:

> "The chemical-specific SSCGs will be used with the 95[%] Upper Confidence Limit (95UCL) chemical concentrations calculated for each property and depth interval being evaluated to estimate chemical-specific risks and noncancer hazards." (Geosyntec, 2013, Site Specific Cleanup Goal Report, p. 27).

Take, for example, 24612 Marbella Avenue. Between 0-2 feet, TPH_d was found in soil at this home at concentrations up to 7,200 mg/kg: well above Shell's (already high) proposed cleanup standard of 1,300 mg/kg. One might conclude that soil at this home needs to get cleaned up on the basis of TPH_d in shallow soil. But if Shell's plan is approved, this home would actually not need to be cleaned up because Shell factors in other sample locations with lower levels of TPH_d and calculates an exposure point concentration (EPC) of only 905.2 mg/kg for the 95% UCL. Even though this home has TPH_d more than five times higher than the proposed cleanup standard (and 70 times higher than the more appropriate cleanup standard of 100 mg/kg that would account for the nuisance factor), Shell uses statistical sleight-of-hand to reclassify this site as being sufficiently clean. Shell and its consultants are using the appearance of dispassionate science to methodically carve away at their cleanup obligations and minimize their cost at the expense of the residents of the Carousel Tract. This is not an isolated anomaly: under Shell's proposed protocol, 55 homes have an EPC greater than 1,300 mg/kg so they would presumably qualify for soil cleanup. However, at least 60 more homes have TPH_d concentrations at individual locations greater than the proposed cleanup standard of 1,300 mg/kg but would be considered acceptable and not in need of remediation because Shell calculates an EPC of less than 1,300 mg/kg for these homes.

Similarly, 70 homes contain TPH_{mo} in 0-2 foot soil in excess of the proposed cleanup standard of 3,300 mg/kg but Shell would decline to remediate the soil because the calculated 95% UCL for these homes is allegedly less than 3,300.[9] For example, 24728 Neptune Avenue has up to 11,000 mg/kg TPH_{mo} in shallow soil (0-2 feet bgs). However, Shell calculates an EPC for this home of only 2,893 mg/kg, (under the 3,300 mg/kg limit) thus by Shell's logic, there's no problem at this home and no remediation would be offered based on TPH_{mo} levels.

There is nothing wrong with the theory underlying upper confidence limits and other statistical methods, however, as proposed here, cleanup decisions would be based inappropriately on average

[9] This is based on the incomplete site characterization results collected thus far. The real number of homes in this category is likely much larger.

concentrations rather than maximum concentrations in soil at these homes. The opportunity for mischief with the proposed protocol should not be underestimated. Since the cleanup decisions would be based on an average concentration calculated from an arbitrary number of samples from arbitrary locations, these averages are not statistically significant. Consider a hypothetical residential property where half of the shallow soil is impacted with TPH_d of 2,000 mg/kg (above the proposed cleanup standard of 1,300) and shallow soil on the other half of the property is clean. Since the cleanup decision is based on an average of the samples I happen to collect (which is not the same as the true average concentration of all soil on the site) all I need to do is collect enough samples from the clean half to drive the overall average below 1,300 mg/kg and I can "prove" that this site doesn't need to be cleaned up. Using common sense, most reasonable people would conclude that the contaminated half of the property should be remediated, but Shell's proposed plan would not require it.

Insufficient site characterization considering heterogeneity of contaminant distribution

Much of the health risk identified thus far comes from petroleum-contaminated soil. Because of the nature of the original releases and reworking of the soil during grading for the redevelopment, the distribution of contamination in the soil is quite variable. On the scale of a single yard, the shallow contamination seems to consist of small hot spots and broader zones with lower levels of contamination. The distribution of hot spots should be considered essentially random, thus unpredictable. An intensive site characterization effort is required if all (or even most) of the hot spots are to be identified.[10] 24533 Ravenna provides a good case study of this problem. This home had a very high cancer risk index of 260[11] due largely to a hot spot in the back yard with PAHs and other contaminants in soil. In its excavation pilot test at 24533 Ravenna, Shell excavated soil from a 9-ft x 9-ft x 5-ft deep patch in the backyard, which apparently removed most of this contaminant hot spot. When the risk calculations are redone to account for this removed soil, the health risk will presumably be much lower, but this would be based on the sparse data collected at this home and is not a valid representation of the contamination that may remain in undetected hot spots.

If an unacceptable risk level can be triggered by an occurrence as small as 9 x 9-ft (or smaller) then one can never be sure you've found all these occurrences unless the sampling density is approximately 9 x 9-ft, too (or ideally less). The incomplete nature of the site characterization is illustrated in Figure 1. This map of 24529 Ravenna Avenue is directly next door to 24533 Ravenna (the home with high health risk due to a soil hot spot). As shown in Figure 1, soil samples have been collected from six locations at this home and some soil contamination has been detected. However, to insure that a small (but potent) hot spot can be found, the sampling density needs to be approximately the same size as the dimensions of the target (in this case: a 9 x 9-ft soil hot spot). For this and most of the other homes in the Carousel Tract, it would require about 60 sample locations (and samples from multiple depths at each location) to achieve the appropriate sampling density. Soil samples have been collected from only six locations at 24529 Ravenna which is about typical for homes in the Carousel Tract and is about ten

[10] The (more prudent) alternative is to acknowledge that the hot spots in soil cannot all be found and the entire soil column requires remediation. At large sites like the Carousel Tract, this alternative is often more cost-effective because the cost of intensive characterization sampling would be very high.

[11] URS, November 21, 2012, Follow-Up Phase II Indoor Air and Sub-Slab Soil Vapor Sampling Report for 24533 Ravenna Avenue Carson, California.

times too few to achieve an adequate characterization considering the heterogeneous nature of the contamination.

Slow Pace of Work

Unlike many contaminated sites that are in industrial settings, the Carousel Tract, is occupied by 285 homes, thus hundreds of families are potentially exposed to the site contaminants on a daily basis. The presence of the homes and families in such close proximity to soil, soil gas and groundwater contamination not only presents special logistical challenges for remediation, it also requires a sense of urgency to resolve this environmental problem in a manner that is timely and protective of the health of the hundreds of residents of this neighborhood. Considering that unsafe levels of contamination persist in the subsurface to this day, 46 years after homes were first built and five years after the contamination was "rediscovered," it is sadly clear that the residents of the Carousel neighborhood have not been well-served by our system of environmental protection.

The slow pace of this project has largely been justified by Shell as necessary and typical for an environmental project of this magnitude and complexity. This argument may have had some merit if hundreds of residents were not being exposed to toxic chemicals on a daily basis. The slow pace of the work may have been justified if the residents were not repeatedly inconvenienced by noise, dust and intrusive sampling on their private property. The slow pace of the work may have been justified if residents' free use of their property was not impinged by warnings against digging in their gardens or allowing children to play in their yards. There are several reasons for the slow pace of the work and none of them are technical necessities. One reason for the slow pace of the work is cash flow: it's cheaper for Shell to drag out studies and pilot tests year after year than to initiate what is destined to be a very expensive remediation project. For example, Shell took more than 20 months to evaluate the feasibility of excavation as a strategy for soil remediation at this site.[12] If we were to review LARWQCB files for other cases involving shallow soil contamination, it's doubtful we would find any other sites for which anyone felt a need to perform an excavation pilot. It is such a straightforward method that pilot testing is generally not required to evaluate the feasibility of digging dirt out of the ground and it certainly should not take 20 months to figure this out.

Another reason for the slow pace of the work is that Shell and its consultants need time to build a (faulty) technical justification for leaving most of the contamination in the ground. Finally, the slow pace of this work is a testament to limitations of our system of environmental protection. It is true that the protocol for characterizing and cleaning up contaminated sites in this country has evolved into a complex and methodical process. However, when there is an imminent and substantial endangerment to human health on the massive scale seen at this site, our system should be capable of responding promptly and with appropriate concern for the well-being of our fellow citizens.[13]

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[12] The Pilot Test Work Plan was issued in May 2011; Shell had completed some of the proposed excavation pilot testing in February 2013 and suggested that completing the rest of the proposed work was not necessary. We would assert that none of the excavation pilot testing was necessary. This is such a well-established, low-tech method for soil remediation: there's not much to be gained from digging a hole and calling it a pilot test.

[13] It is disconcerting the pace of this project has been so slow even though rapid cleanups can and do occur in California. When a contaminated commercial property is slated for major redevelopment, environmental investigation and cleanup can be accomplished relatively quickly. This shows that a financial incentive

Summary and Conclusions

The cleanup standards proposed in the February 22, 2013 Site-Specific Cleanup Goal Report are too high because they are inconsistent with the state's cleanup policies and are not protective of human health or the environment. The proposed cleanup goals for soil:

- do not insure that LNAPL is remediated, where present,
- do not account for the profound nuisance aspect of petroleum-contaminated soil;
- do not abide by State of California policy for depth intervals that may be suitable for more permissive cleanup standards;
- Seek to disqualify contaminated homes from remediation by using statistical averaging rather than maximum contaminant levels.
- Do not honor the urgency for resolving this problem considering that 285 homes overlie the contamination and 285 families live in this contaminated neighborhood every day.

The Cleanup Goal Report is a step toward Shell's ultimate goal of limiting remediation to hot spot excavations for exposed patches of shallow contaminated soil. It is not clear that this approach could ever reliably reduce the environmental risks at this site. However, in our opinion, it is certainly unacceptable considering the level of site characterization completed thus far and the uncertainty that remains regarding the small-scale distribution of soil contamination, especially under the homes. However, for the piecemeal excavation approach that Shell appears to be promoting, there would need to be significantly lower cleanup goals (applied to all occurrences in soil, including under the homes) and a much more thorough site characterization program that is capable of actually finding all the so-called soil hot spots.

Thank you for the opportunity to provide our comments on this important project.

Sincerely yours,
L. EVERETT & ASSOCIATES, LLC

James T. Wells, PhD, PG

(returning a property to economic use) is a stronger motivational factor than protecting the environment, which is perhaps understandable from the perspective of the responsible parties, but it's harder to justify regulatory agencies' acquiescence to these discrepancies in the pace of environmental cleanups.

Figure 1
Incomplete characterization: Soil Sampling Example

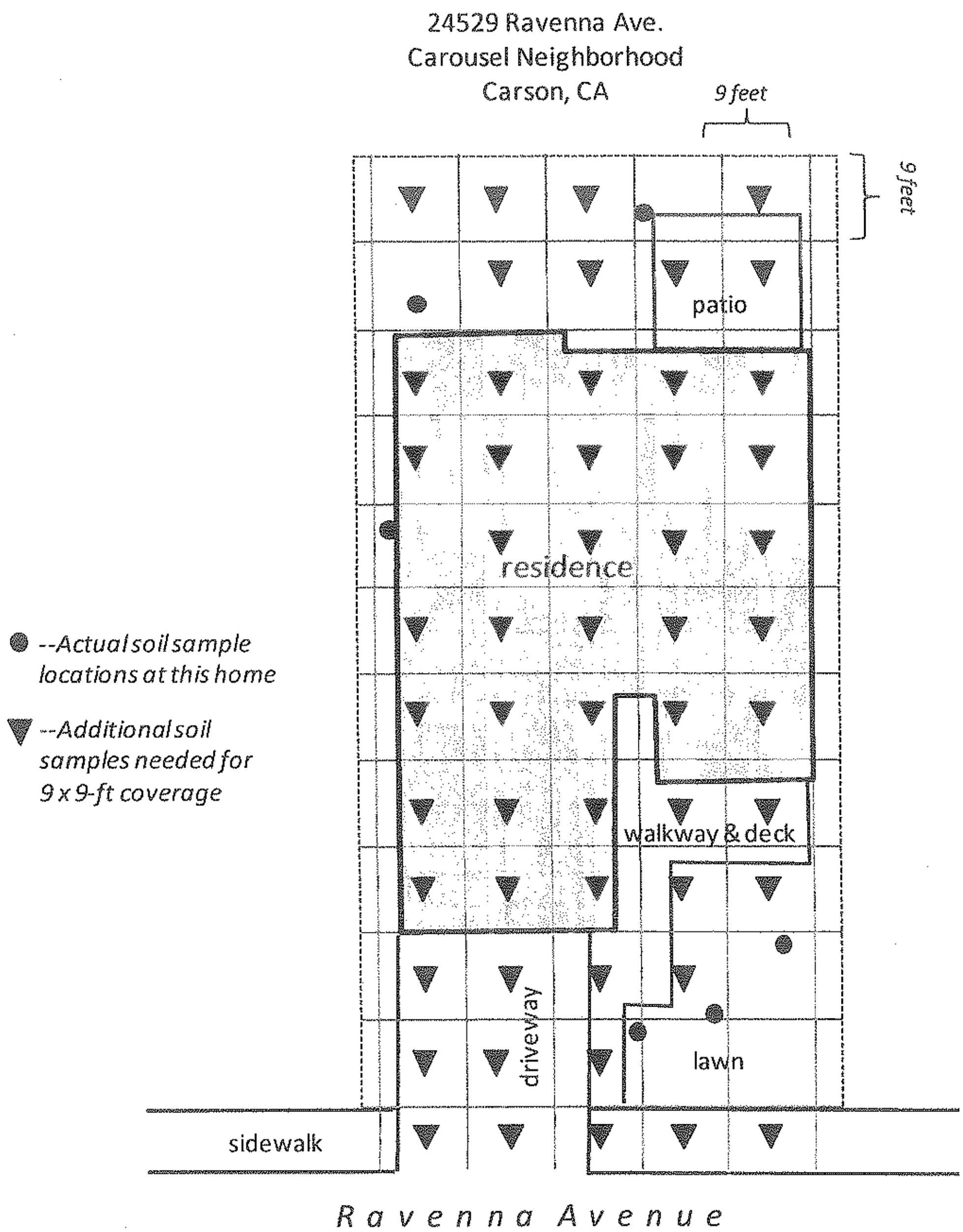

Figure 1. *Sampling on a 9 x 9 foot grid would require approximately 60 soil sampling locations at each home. With six soil sample locations, this home is typical of the level of characterization actually conducted.*

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June 7, 2013

Mr. Samuel Unger, P.E.,
Executive Officer
California Regional Water Quality Control Board
Los Angeles Region
320 West Fourth Street; Suite 200
Los Angeles, California 90013

Subject: Comments on Site-Specific Cleanup Goal Report for Residential Properties at the Former Kast Property Tank Farm Site in Carson, California

Dear Mr. Unger:

Soil / Water / Air Protection Enterprise ("SWAPE") has prepared this comment letter concerning the *Site-Specific Cleanup Goal Report* [1] for the former Shell Oil Company ("Shell") Kast Property Tank Farm Site (the "Site") in Carson, California. This letter specifically comments on the merits of Shell's site-specific cleanup goals ("SSCGs") and overall cleanup plan for the Site. The information presented herein demonstrates that Shell's SSCGs are unacceptable and should be rejected by the California Regional Water Quality Control Board, Los Angeles Region (the "Regional Board"). If the current SSCGs are approved, the Regional Board will be allowing Shell to "clean up" the Site to sub-par standards and will be breaching their own *Cleanup and Abatement Order* ("CAO").[2]

We reference our previous letter[3] to the Regional Board, which criticized Shell's overall remediation approach for assessment and cleanup of properties in the Carousel neighborhood. Our April 3, 2013 letter and the comment letters from other experts highlighted numerous, unacceptable aspects of Shell's remediation approach. The many inadequacies of the proposed cleanup plan remain unanswered by the

[1] Site-Specific Cleanup Goal Report - Former Kast Property, Carson, California. Geosyntec Consultants, Inc. February 22, 2013.
[2] Cleanup and Abatement Order No. R4-2011-0046 - Requiring Shell Oil Company - To Cleanup and Abate Waste Discharged to Waters of the State Pursuant to California Water Code Section 13304 at the Former Kast Property Tank Farm, Carson, California. Regional Water Quality Control Board, Los Angeles Region. March 11, 2011.
[3] Letter to Samuel Unger, P.E. - re: Comments on Completion of Excavation Pilot Testing Program and Proposed Site-Specific Cleanup Goals for Residential Properties at the Former Kast Property Tank Farm Site in Carson, California. Soil / Water / Air Protection Enterprise. April 3, 2013.

Regional Board today. Shell's proposed SSCGs are now at issue and in the hands of the Regional Board to approve or deny. These unacceptable SSCGs are contestable, but just one part of a flawed cleanup plan that has been designed by Shell to evade appropriate site assessment and remediation targets at the impacted residential properties.

This present letter discusses Shell's proposed SSCGs in relation to existing Regional Board policy and cleanups that have been approved at other petroleum hydrocarbons ("TPH") remediation sites across the region. The record demonstrates that Shell's proposed SSCGs are too high compared to TPH soil cleanup standards established and used by the Regional Board for other TPH-impacted sites across the region. Furthermore, the proposed SSCG's do not conform with the stated requirements of the CAO. It is also inevitable that land use restrictions will be necessary, which calls into question the entire cleanup approach. Shell's SSCGs are unacceptable and must be rejected.

SOIL CLEANUP GUIDANCE

The soil cleanup plan for the Site must be consistent with policies and past practices of the Regional Board and the State of California for site assessment and cleanup of TPH-impacted sites. Otherwise, the residents will not enjoy equal protections that the State has allowed for cleanups at other properties. Standard guidance for conducting TPH cleanups in the region was established in the Regional Board's 1996 *Interim Site Assessment & Cleanup Guidebook.*[4] The 1996 *Guidebook* is the most widely-used guidance for assessment and cleanup of TPH-impacted sites and is used by the Regional Board today. This standard, containing TPH cleanup levels, is also the first listed guidance in the CAO.[5]

The Regional Board's 1996 *Guidebook* was intended for setting common standards for protection of groundwater and "... people from exposure when they come in contact with the chemicals..."[6] The *Guidebook* indicates Maximum Soil Screening Levels ("MSSLs") for TPH-impacted sites, which are standards that have been mandated at numerous cleanup locations in the region. These MSSLs have been consistently used at both residential and industrial Sites in the region for almost two decades. The residents of the Carousel neighborhood are entitled to have their properties cleaned up to standards that have been enforced by the Regional Board elsewhere in the region. Otherwise, they are harmed.

Chapter 4.0 of the *Guidebook* states a fundamental policy of applying the cleanup standards, where "... the Regional Board should make every effort to ensure that the standards are consistent across all programs under its jurisdiction..." In order to be consistent with the Regional Board's existing policy and cleanup

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[4] Interim Site Assessment & Cleanup Guidebook. California Regional Water Quality Control Board, Los Angeles and Ventura Counties, Region 4. May 1996.
[5] See Page 11 (Section 3.c.II.i) of the Cleanup and Abatement Order No. R4-2011-0046. March 11, 2011.
[6] Ibid., p. 3-9.

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standards, the SSCGs for the Site must be as protective as the MSSLs listed in the Regional Board's 1996 *Guidebook*. However, the proposed SSCGs greatly exceed the applicable MSSLs for the Site:

TPH Range	Shell's SSCG	Regional Board MSSL (GW 20-150 feet)[7]	Regional Board MSSL (GW >150 feet)[8]
TPHg - Gasoline (C4-C12)	***66,000***	500	1,000
TPHd - Diesel (C13-C22)	***110,000***	1,000	10,000
TPHmo - Motor Oil (C23- C32)	***190,000***	10,000	50,000

As shown above, the 1996 Regional Board MSSLs are much more protective (lower standards) than the cleanup levels that Shell has proposed for TPH at the Site. For example, Shell's SSCG for gasoline range TPH in soil (TPHg) is more than ***60 times higher*** than the least protective Regional Board MSSL. Meanwhile, the above MSSL's have been used as standards for industrial sites where no residential homes will ever be built in the future. So, under what rationale can the Regional Board allow Shell to use standards that are less protective than those used for industrial properties? Clearly, Shell's proposed cleanup levels grossly exceed the existing Regional Board standards and cannot be accepted.

The Regional Board's March 2011 CAO[9] clearly indicates that the Remedial Action Plan ("RAP") for the Site shall apply "...soil cleanup goals set forth in the Regional Board's *Interim Site Assessment and Cleanup Guidebook, May 1996..*" The revised and final CAO also allowed Shell to submit "...site-specific cleanup goals for residential (i.e., unrestricted) land use..." Proposed SSCGs are required to "...include detailed technical rationale and assumptions underlying each goal. However, there is no rationale to allow Shell's excessive SSCGs for residential properties at the Site when the Regional Board has previously required more protective MSSL's at residential and industrial sites in the region.

For the proposed cleanup plan to be protective, the Regional Board must also assure residents that the Site (i.e., each residential property) has been thoroughly characterized and that the lateral and vertical extent of soil contamination has been defined. Comment letters[10,11] already submitted to the Regional Board in

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[7] The listed MSSLs (see Table 4-1 of 1996 *Guidebook*) in units of milligrams per kilogram ("mg/kg") are applicable to sites with groundwater ("GW") existing at depths between 20 and 150 feet below ground surface. The depth to groundwater at the Site is approximately 60 feet; therefore the MSSLs listed here are the most appropriate.
[8] The listed MSSLs are applicable to sites with groundwater existing at greater than 150 feet below ground surface.
[9] See Page 11 (Section 3.c.II.i) of the Cleanup and Abatement Order No. R4-2011-0046. March 11, 2011.
[10] Letter to Samuel Unger, P.E. - re: Comments on Completion of Excavation Pilot Testing Program and Proposed Site-Specific Cleanup Goals for Residential Properties at the Former Kast Property Tank Farm Site in Carson, California. Soil / Water / Air Protection Enterprise. April 3, 2013.
[11] Letter to Samuel Unger, Executive Officer - re: Former Kast Tank Farm - Comments on Completion of Excavation Pilot Testing Program and Site-Specific Cleanup Goal Report. L. Everett & Associates. April 3, 2013.

April 2013 and concurrently with this comment letter demonstrate that complete characterization has not been accomplished. Therefore, the entire cleanup plan is flawed.

There are numerous examples of TPH-impacted sites in the Los Angeles region that have been remediated using the Regional Board's 1996 standards. Two such sites, the Valero Refinery in Wilmington and East Bluff Residential Site in Signal Hill, were both described briefly in our April 3, 2013 comment letter.[12] These two examples both demonstrate that the Regional Board's 1996 *Guidebook* maximum soil screening levels (MSSLs) were used to establish cleanup goals for TPH-impacted soils at both a large industrial site (oil refinery) and a residential development.

At the Valero Refinery, the Board approved site-wide cleanup standards of: 1,000 mg/kg for TPHg, 10,000 mg/kg for TPHd, and 50,000 mg/kg for TPHmo.[13] In the instance of the East Bluff Residential Site in Signal Hill, the Regional Board approved a set of TPH cleanup criteria consisting of: 1,000 mg/kg for TPHg, 5,000 mg/kg for TPHd, and 15,000 mg/kg for TPHmo.[14] These examples, among many others, demonstrate that the Regional Board has applied consistent TPH soil cleanup standards in accordance with the 1996 *Guidebook*. Yet, the Regional Board is now considering approval of Shell's relaxed SSCGs that have no basis in existing policy and practice used elsewhere.

The Regional Board's consideration of cleanup standards that are <u>much less protective</u> than those required for other TPH-impacted residential sites in the same jurisdiction is an inequity and a insult to the residents of the Carousel neighborhood in Carson. The Board's consideration of cleanup standards that are less protective than those required for cleanup at an oil refinery is unconscionable. The State's Geotracker (www.geotracker.com) website contains the records for hundreds of TPH-impacted sites, where the 1996 *Guidebook* has been used. The Regional Board must therefore reject the proposed SSCGs.

LAND USE RESTRICTIONS

The CAO clearly implies that the proposed SSCGs submitted by Shell shall be for <u>unrestricted</u>[15] residential land use. The fact that TPH and other contaminants will be left in-place at virtually all of the residential parcels at the Site suggests that land use restrictions are <u>inevitable</u> based on the proposed cleanup plan. Under the proposed cleanup plan and SSCGs, the need for land use restrictions is a damage to the future use, enjoyment and value of the properties. The proposed cleanup plan is therefore

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[12] Letter to Samuel Unger, P.E. - re: Comments on Completion of Excavation Pilot Testing Program and Proposed Site-Specific Cleanup Goals for Residential Properties at the Former Kast Property Tank Farm Site in Carson, California. Soil / Water / Air Protection Enterprise. April 3, 2013.

[13] Conceptual Site Model for Valero Wilmington Refinery, 2402 E. Anaheim Street, Wilmington, California. Environmental Engineering & Contracting, Inc. June 29, 2011.

[14] Letter to Signal Hill Petroleum, Inc. re: No Further Requirements - Signal Hill Petroleum/Hilltop, East Bluff Residental Development Site (Q Lots), Tract 53467, Lost 1-23, Signal Hill, California. March 1, 2005.

[15] See Page 13 (Section 3.c.III) of the Cleanup and Abatement Order No. R4-2011-0046. March 11, 2011.

incompatible with unrestricted use of the properties and is unacceptable. Indeed, Shell should remediate all subsurface areas of properties or unrestricted use of the properties cannot be possible.

Recorded land use restrictions are land use covenants which will specify requirements and/or limit the use of the properties and affect the titles to the properties. Land use restrictions will be recorded at the county recorder's office so that they are found during a title search of county records. The purpose of the recorded land use restrictions is to protect the public health and safety on the contaminated Site due to residual contamination. The contamination in this case would be the toxic substances that are left in-place left in place as part of the proposed remedial action.

Shell's proposed cleanup plan limits remediation to only portions of parcels that are not covered by homes and hardscape (e.g., concrete drives and patio areas, etc.) and proposes to leave large portions of the properties uncharacterized and unremediated. Land use restrictions therefore must be recorded for the properties at the Site, which would limit current and future home owner's rights to conduct some desired improvements. Without land use restrictions, some improvements requiring subsurface excavation activities could cause exposures to contaminants that are present in areas that have not been characterized or remediated. This is an unacceptable scenario, whereby the properties are tainted by restrictions and unknown hazards for decades. Clearly, the proposed plan is not a cleanup plan at all.

Current residents and future owners of the properties at the Site may desire to perform a variety of improvements to properties. However, because unknown volumes of contaminants at potentially high concentrations are proposed to be left in-place, regulatory restrictions on the land are necessary to protect current and future residents and workers from exposures. For example, any Site resident will be restricted from installing a pool or basement at their property because they will likely uncover contamination. Land use restrictions will also likely limit residents from growing fruits and vegetables in areas that have not been remediated.

Land use restrictions "run with the land," i.e., and will be binding on current and subsequent property owners, and will remain in effect until they are formally removed or modified. Therefore, current residents will be limited concerning future property improvements and will need to disclose the contamination concerns at their properties for future buyers. The damage of land use restrictions and necessary requirements pertaining to any improvements desired in areas of uncharacterized and unremediated land is a liability to all current and future owners of properties at the Site.

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CLOSURE

The Regional Board's cleanup objectives at the Site should be consistent with past policies and cleanup standards that have been used at other TPH-impacted properties in the region. The cleanup criteria that Shell is proposing grossly exceeds existing Regional Board standards in the 1996 *Guidebook*. Shell's proposed SSCGs are even higher than soil screening levels used by the Regional Board at industrial sites (e.g., Valero Refinery in Wilmington) where no residential land use is proposed or even possible in the future. Therefore, the proposed SSCGs are entirely unreasonable and should be rejected.

The Regional Board must require a cleanup plan that provides the residents with equal protections offered to other private property owners in the region. Furthermore, the Site cleanup plan and SSCGs must be revised so that land use restrictions are not necessary. Otherwise, under the proposed plan, residents will likely be tainted by restrictions and liabilities that affect the future use, enjoyment and value of their properties. At a minimum, the Regional Board should require Shell to clean up the Site to standards that are consistent with the existing guidance. The approval of any relaxed cleanup standards for Shell to remediate the Carousel Tract neighborhood is a liability to the homeowners now and into the future.

Very truly yours,

Paul Rosenfeld

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