Office of Environmental Health Hazard Assessment

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MEMORANDUM

TO: Teklewold Ayalew, Ph.D., P.G.
Engineering Geologist
Regional Water Quality Control Board
320 West 4th Street, Suite 200
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FROM: James C. Carlisle, D.V.M., M.Sc.,
Staff Toxicologist
Air, Community, and Environmental Research Branch

DATE: April 29, 2014

SUBJECT: HUMAN HEALTH RISK ASSESSMENT REPORT, FORMER KAST PROPERTY, CARSON, CALIFORNIA
SWRCB#R4-09-17 OEHHA #880212-01

Document reviewed

- Human Health Risk Assessment Report, Former Kast Property, Carson, California, dated March 10, 2014 by Geosyntec Consultants, Inc.

Scope of review

- OEHHA's review is limited to risk assessment issues. Specifically excluded are evaluation of:
  - explosion hazards
  - leaching potential and groundwater protection
  - relationship of chemicals of concern to previous site activities.

Exclusion of analytes as chemicals of potential concern (COPCs)

1. The process of eliminating detected chemicals as COPCs should be clearly laid out. A flow chart would be helpful in this regard (see also 4 below).
2. Apparently there are three bases for eliminating detected chemicals as COPCs: a. frequency of detection; b. toxicity screen; and c. comparison with background. Table 4 should include all three criteria and would become much clearer if the reason for exclusion were provided rather than the reason for inclusion.
3. Comparison with background: Page 13 & Table 4 of the main report state that "The results of the one-sample proportion test indicated that cadmium, cobalt, copper, vanadium, and zinc concentrations at the Site are within background". This conclusion seems to contradict the last column of Appendix A Table 5-2 where, in some cases, the answer in is "yes".

a. It appears that if an element passes any one of 4 or 5 screens, it is eliminated. OEHHA believes that the results of the various analyses should be taken together using a weight-of-evidence approach, rather than a 'pass-one-test-and-you're-out' approach
b. Although the use of the one-sample proportion test was approved in a November 21, 2013 OEHHA memorandum, OEHHA is concerned that the test may have been misapplied to the UTL. Using a one-sample proportion test to compare site data to a UTL may bias the analysis in favor of accepting the null hypothesis. It controls the type I error rate at 2 levels (the UTL itself is a UCL on the 95th percentile and then the P value for exceedance of the UTL must be <0.05 to reject the null hypothesis), but does not the type II error rate at all . . DTSC (1997) guidance on the subject includes the following: "Metals eliminated as COPC are never again considered in the process of risk assessment or risk management. Thus, it is highly desirable to avoid or minimize Type II error in selection of COPC. On the other hand , if a Type I error is made, two subsequent levels of decision-making provide opportunities for correction..... Thus, acceptable Type II error should always be less than or equal to Type I error." APPENDIX 6 of Appendix A - "*ProUCL Output of One Sample Proportion Test Results*" contains no ProUCL output, only a summary thereof. Therefore, OEHHA cannot verify the One Sample Proportion Test Results.
c. Arsenic has been eliminated as a COPC at sites where the maximum arsenic concentration is more than twice the BTV and/or exceedances comprise up to 30% of the samples. The probability plot has an apparent deviation from linearity. Since the residential SSCG is 12 mg/kg(Table 11), how can concentrations over 28 mg/kg be left in place?
For thallium and antimony, the exceedances are even greater in both magnitude and frequency. This does not appear to be consistent with DTSC (1997, 2005, 2009)
d. However, the concern regarding exclusion of elements as chemicals of potential concern is mitigated by the fact that the excluded elements are not believed to be site-related.

4. <u>Toxicity screen</u>: Geosyntec compared the maximum concentration of each detected analyte in a given medium to one-tenth of its RBSL. If the maximum concentration was not greater than one-tenth of the RBSL it was eliminated as a COC for the Site. OEHHA is not aware of a prior approval of this screening procedure. This screening procedure could potentially underestimate risk and/or hazard if several chemicals were present at less than, but close to, their respective RBSLs.

Transfer factors

- OEHHA agrees with the transfer factors.

Exposure assessment

- Soil exposure assumptions are similar to those in the SSCG document except that exposure to soils up to 5 feet deep is considered on a 350 days/year basis.
- Equation 3.5.3.3 seems to have omitted a term for sub-slab concentration.
- Vapor intrusion is estimated based on a site-wide attenuation factor of 0.002.

Site-Specific Clean-up Goals (SSCGs)

- SSCGs were verified by comparison to previously approved SSCGs and/or by forward risk and hazard calculations using the SSCG as the input concentration.

Conclusions

- Geosyntec has employed additional screens to the determination of COPCs.
  - The concentration/toxicity screen could potentially underestimate combined risk and/or hazard.
  - OEHHA initially had some concerns regarding the screening process based on background comparisons, but it appears that this only affects elements that are not site-related.
- OEHHA verified the SSCGs by independent forward risk and hazard calculations and by comparison to previously approved SSCGs.

Peer reviewed by

H.H.

Hristo Hristov, MD, PhD

References

DTSC, 1997, Selecting Inorganic Constituents As Chemicals Of Potential Concern At Risk Assessments At Hazardous Waste Sites And Permitted Facilities Final Policy Prepared By: Human And Ecological Risk Division Department Of Toxic Substances Control California Environmental Protection Agency February 1997

DTSC, 2005, Final Report Background Metals at Los Angeles Unified School Sites – ARSENIC California Department of Toxic Substances Control California Environmental Protection Agency June 6, 2005

DTSC, 2009, Arsenic Strategies Determination of Arsenic Remediation Development of Arsenic Cleanup Goals January 16, 2009

TO: Los Angeles Regional Water Quality Control Board

FROM: UCLA Expert Panel: J.R. DeShazo, Arturo Keller, and Gary Krieger

PROJECT: Former Kast Property in Carson, California

SUBJECT: Review of the HHRA, FS, and RAP

DATE: April 29, 2014

1. Introduction

As requested by the Los Angeles Regional Water Quality Control Board (Regional Board), the Expert Panel provides comments based on the Panel's review of the: (1) Human Health Risk Assessment, (2) Feasibility Study, and (3) Remedial Action Plan. These documents were prepared for the former Kast Property in Carson, California by Geosyntec Consultants (for the Feasibility Study, by URS Corporation as well) for Shell Oil Products US. This memo builds upon the Panel's previous comments on the: (1) Site-specific Cleanup Goal Report (SSCG Report) and Human Health Screening Risking Evaluation that the Panel submitted to the Regional Board on July 24, 2013 and (2) the Revised Site-Specific Cleanup Goal Report that the Panel submitted to the Regional Board on December 18, 2014.

The Panel's overall charge is to provide its recommendations for the Regional Board to consider in determining whether cleanup goals and remedial actions proposed by the responsible parties named in the Cleanup Order are consistent with applicable legal authorities.

After this introduction, the memo is divided into three main sections. The first section reviews the three germane documents to assess the human health risk analysis contained in them. The next section focuses on the Feasibility Study and specifically the technical feasibility of the remedial actions alternatives evaluated. The final section addresses issues of adherence to the germane regulations, specifically State Water Resources Control Board Resolution 92-49.

2. Health Risk Analysis

The Human Health Risk Assessment (HHRA), Feasibility Study (FS), and Remedial Action Plan (RAP) for the Former Kast Property were reviewed by Gary Krieger of New Fields to assess the human health risk analysis. This review was conducted subsequent to his review of the Site-Specific Cleanup Goal (SSCG) Report and the Human Health Screening Risk Evaluations (HHSRE) conducted for the Site. The HHRA was conducted consistent with the SSCG and HHSRE but does have minor differences as identified in the Geosyntec letter to the Regional Board dated March 20, 2014.

The FS and RAP lists the remedial action objectives (RAOs) for the site:

- "Prevent human exposures to concentrations of COCs in soil, soil vapor, and indoor air such that total (i.e., cumulative) lifetime incremental carcinogenic risks are within the NCP risk range of 1×10-6 to 1×10-4 and noncancer 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. For onsite residents, the lower end of the NCP risk range (i.e., 1×10-6) and a noncancer hazard index less than 1 have been used.
- Prevent fire/explosion risks in indoor air and/or enclosed spaces (e.g., utility vaults) due to the accumulation of methane generated from the anaerobic biodegradation of petroleum hydrocarbons in soils. Eliminate methane in the subsurface to the extent technologically and economically feasible.
- Remove or treat LNAPL to the extent technologically and economically feasible, and where a significant reduction in current and future risk to groundwater will result.
- Reduce COCs in groundwater to the extent technologically and economically feasible to achieve, at a minimum, the water quality objectives in the Basin Plan to protect the designated beneficial uses, including municipal supply."

The following section focuses on how the documents (HHRA, FS, and RAP) address the first aforementioned RAO.

2.1. Human Health Risk Assessment

The first RAO states "Prevent human exposures to concentrations of COCs in soil, soil vapor, and indoor air such that **total** [emphasis added] (i.e., cumulative) lifetime incremental carcinogenic risks are within the NCP risk range of 1×10^{-6} to 1×10^{-4} and noncancer hazard indices are less than 1 or concentrations are below background, whichever is higher. ..." This word "total" or "cumulative" was discussed during the review of the SSCG Report and every comment was responded to by Shell and Geosyntec that the HHRA would address the cumulative aspect of the risk assessment. The HHRA does address the cumulative nature of multiple constituents of Concern (COCs) within each medium (e.g., soil, soil vapor, etc), but does not address the cumulative or additive effect of the receptor of concern (e.g., residents) exposure to multiple media.

Geosyntec states that the assessment of indoor air using sub-slab vapor is highly conservative, and therefore they may believe that adding this additional incremental risk is over-protective. However, standard risk assessment guidance (USEPA 1989) states, "The total exposure to various chemicals will equal the sum of the exposures by all pathways." While USEPA (1989) then cautions the reader to not "automatically sum risk from all exposure pathways evaluated for a site", it does state, "two or more pathways should be combined for a single exposed individual or group of individuals." Given the HHRA evaluated the site data on a property basis, one would expect the receptor exposed to the property soil would be the same receptor exposed to indoor air. USEPA (1989)[1] does recognize that the same individuals may not consistently face the "reasonable maximum exposure" for more than one pathway, and the HHRA does allude to this issue in the uncertainty section when it states that "HHRA assumptions entail the receptor staying outdoor[s] or indoors the entire duration of the exposure period. As a result, the estimated incremental cancer risks and noncancer hazards are over-estimated." But note the pathways risks were not combined in the HHRA.

Table 6-1 in the RAP identifies by property whether the soil excavation (exceedance of the risk criteria for soils ≤5ft), sub-slab soil vapor mitigation (exceedance of the risk criteria for sub-slab vapor SSCG) , or SVE/bioventing (exceedance of the risk or leaching criteria for soils ≤10ft) will be conducted. Upon examination of this table, six properties will require sub-slab soil vapor mitigation with no surface soil (<3ft) excavation, three of these six properties will receive no on-property soil remediation (3 properties will have SVE/bioventing).

While the risk assessment process is over-protective in many ways, until the cumulative effects of all pathways are evaluated, there may be properties un-identified that would not be meeting this objective.

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[1] USEPA 1989, *Risk Assessment Guidance for Superfund. Volume I, Human Health Evaluation Manual (Part A). Interim Final.* EPA/540/1-89/002. U.S. EPA, Office of Emergency and Remedial Response.

Recommendation: Assess cumulative impacts across mediums in the HHRA.

2.2. Feasibility Study and Remedial Action Plan with regard to Human Health Risk

The FS and RAP use the HHRA exceedance of risk/hazard in soils to identify properties for soil excavation and exceedance of risk/hazard in indoor air via soil slab vapor evaluation to identify properties for sub-slab vapor intrusion mitigation. As these two pathways are assessed in the HHRA separately, it is possible that there are some properties that may still pose an unacceptable risk based on the cumulative effects.

Recommendation: Ensure all possible "hot spots" requiring more extensive remediation have been identified, by assessing cumulative impacts across mediums.

2.3. Risk Management

The RAP (or FS) does not clearly state that all existing trees and bushes would be removed during excavations. Most homeowners are more attached to their trees than their hardscapes. The homeowner may choose to refuse the remediation if their mature and/or fruit-bearing tree, for example, has to be removed.

Recommendation: If trees can be left in place, institutional controls and surface soil capping should be considered to reduce or mitigate exposure. This will be further discussed in Section 4.

2.4. Miscellaneous Minor Edits for the HHRA

Regional Board's comment that their Tables 1-3 were the COCs for the Site: With respect to Table 9-2, the Regional Board considers the list of COCs complete with the addition of xylenes and toluene. (Page 5 of the 1/24/14 letter) and then attaches Table 1 as a revision of Table 9-2 of the SSCG Report. However the HHRA excludes additional COCs based on "additional background analysis (one-sample proportion test) [which] indicated this metal to be within background for all properties [footnote to cadmium, cobalt, copper, vanadium, zinc]." (page 2 of Table 6). It is unclear to the reviewer if the Regional Board, who considered the COC list complete with Table 1, will accept this reduction of the list.

Table 4 – footnote on toluene and xylenes #5 is incorrect as Footnote #5 discusses the additional background analysis to exclude COCs based on the one-sample proportion test.

Table 5 does not indicate toluene and xylenes are COCs for Soil Vapor, Sub-Slab (though they are marked as such in Table 6). While these analytes would not be selected as COCs using the methodology presented in the table, we recommend that Tables 4 and 5 present the COC screening process consistently. We would recommend that Table 4 be changed to be consistent with the process described and Table 6 be used to return the analytes to COC list. Using this method of displaying the screening process, the reader would then follow the reasoning of why the analytes are included in the Soil and Soil-Vapor, Sub-Slab categories due to the regulatory request when they actually pass the COC screening process.

Table 6 – Note the footnote on the toluene and xylenes analytes under the Soil Vapor, Non-Sub-Slab category is incorrect. These analytes are included on the COC list under this category because they **did** meet the criteria of the COC selection screening process.

Table 6 should acknowledge the soil vapor screening criteria the Regional Board gave for aliphatic ranges and the nuisance concentration.

Table 8 should include a definition of Soil vapor to indoor air volatilization factor (VF_{SV-IA}) for consistency.

Examining the tables, the reviewer is concerned with the handling of the xylenes. In some cases the xylenes are presented in total (Table 9a), in analytical isomers (Table 5), or in both forms (Table 4 and 6).

Table 9a missing VFs on the table for the COCs of 1,2-Dichloroethane, cis-1,2-Dichloroethene, and tert-Butyl Alcohol. Reviewer assumes that the total xylene VFsoil will be used for the xylene isomers if the EPCs are based on the isomers.

Table 9b does not need VF SV-OA for 1,2-dichloropropane or for 1,3 butadiene.

3. Remedial Alternatives and Feasibility Study Analysis

Geosyntec has adequately considered a number of alternatives for addressing the contamination at the site. The Feasability Study identified a reduced set of alternatives that are likely to meet regulatory requirements, as well as practical matters such as ease of implementation, effectiveness and cost. In addition, the most promising alternatives were evaluated with regards to: (1) overall protection of human health and the environment; (2) compliance with applicable or relevant and appropriate requirements; (3) long-term effectiveness and permanence; (4) reduction of toxicity, mobility and volume through treatment; (5) short-term effectiveness to protect human health and the environment; (6) implementability; (7) estimated cost; (8) state acceptance; (9) community acceptance; (10) consistency with Resolution 92-49; (11) social considerations; and (12) sustainability.

This narrowed down the range of alternatives to a small subset that involves excavation to different depths (2, 3, 5 and 10 feet below ground surface), combined with removal of reservoir slabs if encountered in the excavation, sub-slab vapor intrusion mitigation, soil vapor extraction (SVE), bioventing, monitored natural attenuation of contaminants in groundwater, LNAPL removal and some institutional controls to minimize exposure. The set of alternatives under #4 all involve excavation below hardscape and landscape, whereas alternative set #5 considers only landscape.

Contamination appears to be pooled in certain areas that reflect the original reservoirs. The use of auger technology to get to contamination at 10 bgs in certain "hot spots" may require considerable less disruption of the surface, less soil removed and less truckloads hauled from the site. It is important to consider that a large number of truckloads will have to be removed, which will disrupt daily life in the area, and increase exposure to air pollutants from the exposed soils as well as from truck emissions. Potential impacts are further discussed in Section 4. As indicated by Geosyntec, Alternatives 4D and 5D would provide a greater degree of reduction in impacted soil through excavation, resulting in higher short and long-term effectiveness, and more permanence, and higher reduction of toxicity, mobility and volume.

4. Legal and Policy Analysis

Through the Porter-Cologne Water Quality Control Act, the legislature gave the Board "the primary responsibility for the coordination and control of water quality." When someone discharges into the soil materials that can adversely impact water quality, water code Resolution 92-49 states that the Board shall:

> *Ensure that dischargers are required to clean up and abate the effects of discharges in a manner that promotes attainment of either background water quality, or the best water quality which is reasonable if background levels of water quality cannot be restored, considering all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible.*

This means that while the Board should also seek to restore the background water quality observed before the discharge, it has the discretion to select another water quality level objective based on several factors. The water code goes on to clarify and define some of these factors.

> *The Regional Water Board shall determine whether water quality objectives can reasonably be achieved within a reasonable period by considering what is technologically and economically feasible and shall take into account environmental characteristics of the hydrogeologic unit under consideration and the degree of impact of any remaining pollutants pursuant to Section III.H.3.*

The code defines how to assess or evaluate technological and economic feasibility of the water quality objective as follows.

> *Technological feasibility is determined by assessing available technologies, which have been shown to be effective under similar hydrogeologic conditions in reducing the concentration of the constituents of concern.*
>
> *The evaluation of economic feasibility will include consideration of current, planned, or future land use, social, and economic impacts to the surrounding community including property owners other than the discharger.*

The code provides the additional clarification on economic feasibility which will becomes relevant to our discussion:

Economic feasibility, in this Policy, does not refer to the discharger's ability to finance cleanup. Availability of financial resources should be considered in the establishment of reasonable compliance schedules;

These objectives and decision criteria will guide our discussion of the remediation alternatives.

4.1 Social and Economic Impacts of Remediation Alternatives

One of the larger challenges in interpreting 92-49 is identifying the "total values involved," specifically the tangible and intangible social and economic impacts of meeting alternative water quality objectives and their associated remediation alternatives. In this section, we identify both the benefits and the costs of the various categories of remediation alternatives. We will not consider the specific estimates of the magnitude of these costs and benefits. However, we will discuss qualitatively their relative magnitude in some cases and also factors that create uncertainty around these costs and benefits.

4.1.1 Groundwater Quality Benefits

The Statute and the water code clearly identify improvements in water quality as a critical benefit that the Board should consider. The water quality that is under threat is groundwater, which is subject to future leaching of materials from subsurface soils and materials. The ability of remediation activities to benefit current and future groundwater quality will depend on removing or remediating the TPH mass which has the greatest potential to adversely impact water quality.

The recommended options, 4B or 5B, may remove less than 10% of the TPH mass, leaving >90% of the mass in the ground. This estimate is based on the analysis by the LA RWCB of the total TPH mass present at different depths (Memorandum of March 20, 2014, on TPH Mass Calculation for Subsoil at Kast Property), indicating that the mass is approximately 295,000 lb at 0-2 ft bgs, 650,000 lb at 2-3 ft bgs, 1,740,000 lb at 3-5 ft bgs, and 6,470,000 lb at 5-10 ft bgs.

Table 1 describes how this mass is distributed as a percentage of the total at different depths bgs.

Table 1: Distribution of the TPH Mass below ground surface*

Depth	Cumulative TPH Total Mass (lbs)	Incremental Percentage**	Cumulative Percentage**
0-2 bgs	295,000	0.03	0.03
2-3 bgs	945,000	0.07	0.10
3-5 bgs	2,685,000	0.19	0.29
5-10 bgs	9,155,000	0.71	1.00

* Based on the analysis by the LA RWCB (Memorandum of March 20, 2014, on TPH Mass Calculation for Subsoil at Kast Property).
** Actual amount of mass that would be removed under remediation alternatives is less that these amounts because a) excavation would not take place beneath buildings, streets, sensitive utility infrastructure and b) shoring and setbacks may further reduce amount of material/mass that would be removed.

Two related aspects of the preferred remediation options, 4B and 5B, are important to note because of their ability to deliver water quality benefits. As noted in Table 1, while approximately 10% of the cumulative mass is located at 0-3 bgs, the amount that would be excavated in options 4B or 5B is likely to be considerably less because the material that underlies the homes or the public streets will not be removed under these alternatives. Second, the material that would be removed is from the top of the mass, being the furthest from the groundwater resource. Taken together, this suggests that excavation alternatives 4B and 5B are likely to have relatively small impacts on long-term water quality objectives.

If an excavation alternative is being seriously considered by the Board, we recommend requesting that Geosyntec evaluate an additional remediation alternative.

Recommendation: Geosyntec should evaluate an excavation alternative at fewer locations than the proposed 183 homes and at greater depths to potentially remove a larger fraction of the TPH in targeted areas.

It would make most sense to take this approach in areas heavily impacted by COCs as shown in Figure 1. The pilot study conducted by Shell demonstrated that excavation to 10 ft is feasible. Any additional excavation alternative that is developed that removes more than 10% of the mass with considerably less land surface disruption would advance water quality goals over the current alternative while imposing considerably less cost on homeowners.

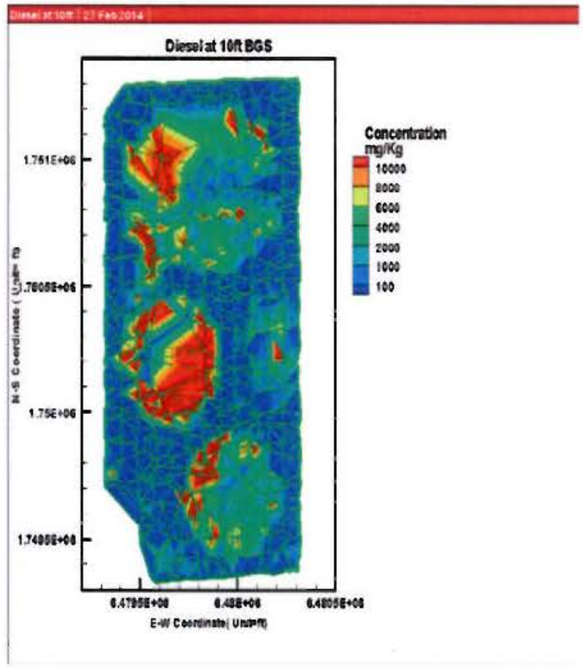
As we discuss below, 4B and 5B represents an expansive excavation effort that may affect upwards of 183 homes, which will very likely impose significant, short-term economic costs on residents, while having nominal impacts on long-term water quality levels. As such, when evaluating this alternative excavation effort, Geosyntec should consider the use of augers to reach some of the contamination at 10 ft bgs, which appears to be pooled in certain areas that reflect the original reservoirs. This technology may require considerably less disruption of the surface, less soil removed and thus less truckloads hauled from the site.

Recommendation: Geosyntec should consider the use of augers to reach contamination at 10 ft bgs.

It is important to consider that a large number of truckloads will have to be removed, which will disrupt daily life in the area, and increase exposure to air pollutants from the exposed soils as well as from truck emissions. The use of augers to reach greater depths might provide a greater degree of reduction in impacted soil through excavation, resulting in higher short and long-term effectiveness, and higher reduction of toxicity, mobility and volume.

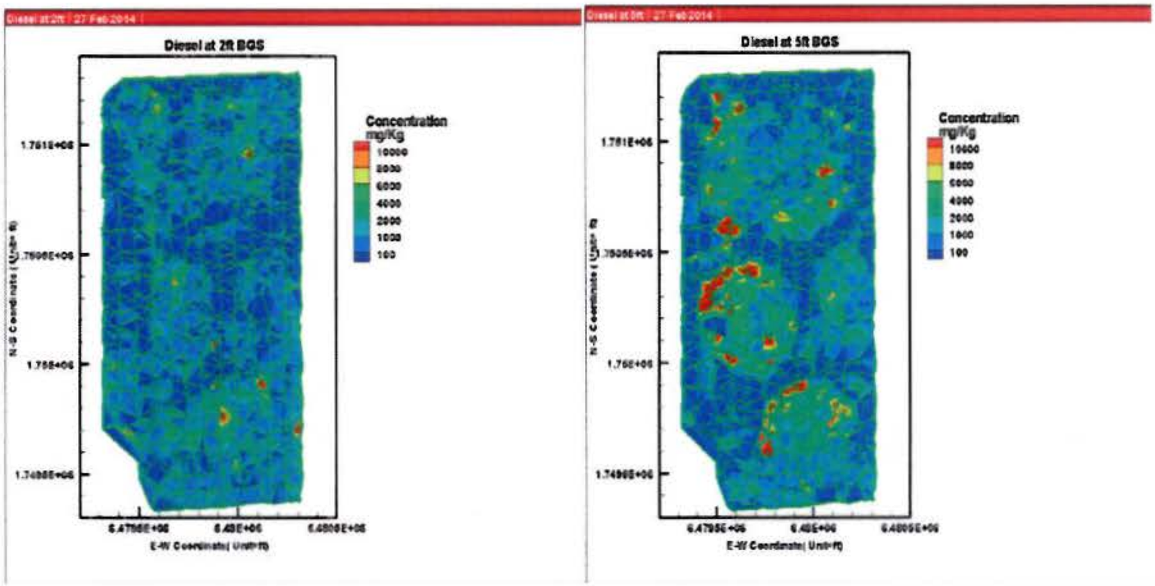
Figure 1 illustrates in red the "hot spots" areas with greater concentrations that might warrant such an approach.

Figure 1: TPH as diesel at 10 ft bgs



Based on the information in Figure 2, if the major hotspots at 10 ft bgs are removed via excavation, the residuals in the other areas are a significantly lower concern, with excavation to 5 ft bgs probably only needed in a few areas, to minimize risk and based on the economic consideration that follows from Resolution 92-49.

Figure 2: TPH as diesel at 2 and 5 ft bgs



Whether excavation is warranted depends upon whether the Board believes significant leaching from the TPH mass is likely to continue to occur. This mass may be strongly held by the soils, but we currently have only indirect evidence to support this belief. Such a determination is important since over 60% of the TPH mass is located at 5-10 ft bgs, which would require the more aggressive excavation alternatives to mitigate, and even then would be able to remove only a fraction of this mass due to the needed setbacks from buildings, roads and utilities. (As we discuss below, the excavation options will also impose significant short-term cost on residents.)

It is uncertain at this point if leaching flow from this TPH mass could be collected and evaluated by remediating groundwater. If this were possible, the magnitude and trends in flow could be evaluated by the Board over time allowing a further assessment of: (1) the basic threat this mass represents to groundwater quality and (2) the need for groundwater remediation as an on-going remedial option. The acceptability of this approach would seem to depend, in part, on whether the Board agrees as Geosyntec asserts there is "... no current or future use of the Shallow Zone and gage aquifer at or near the Site." (p. 12, Feasibility Study, 2014)

4.2 Human Health Exposure Reduction Benefits

We briefly review the impacts of the remediation alternatives as they relate to: (1) indoor air quality compliances, (2) future utility work exposure and (3) the effectiveness of a "clean soil buffer."

4.2.1 Indoor Air Quality

Based on the extensive on-site testing, no properties exhibited health exceedances for indoor air pollutants. We assume that the 27 properties with sub-slab soil vapor exceedances will be addressed and remediated regardless of the broader remediation alternative selected for the tract. As a result neither of the more preferred remediation options, 4B or 5B, will significantly contribute to compliance with air quality regulations within residences. Indeed, this is true of the other considered remediation alternatives as well.

4.2.2 Utility Workers

Other important health exposures reductions could arise from utility workers excavating in the 0-3 ft bgs area. Utility-specific institutional controls might mitigate some or all of these exposures. (Recall that this 0-3 ft bgs is the least contaminated zone of the three zones evaluated. See Figure 2 above.) In the absence of institutional controls, these exposures would remain a concern for all remediation alternatives except for alternatives 2 and 3. This is because all options under alternatives 4 and 5 requires setbacks for homes, streets and utilities. As result, they would leave impacted soils directly under and proximate to the foundation of the homes, streets and utilities infrastructure. All subsurface utilities repairs or replacement will likely disturb these areas unexcavated under and proximate to these homes, streets and utility infrastructure. As a result any potential risks to utility workers would not be significantly abated by alternatives 4B and 5B.

4.2.3 Clean Soil as "Protective Barrier" in Alternative 4 and 5?

Although the proposed excavation alternatives represented by 4 and 5 may provide a perceived "protective barrier" to residents, this is may only be true for the portions of the lot landscaped (5) or hardscaped and landscaped (4), under which impacted soils would be excavated. However, for alternatives 4 and 5, unexcavated soils will remain under buildings, streets, and utility infrastructure and, due to setbacks at greater excavation depths, also potentially adjacent to these structures. As a result, we suggest that the benefits of these alternatives in offering a protective buffer to individuals within their homes are more limited than may be initially perceived.

4.3 Residential Interim Use Value and Nuisance Losses

The preferred option in the Remedial Action Plan, 4b, will involve the excavation of soils down to 3 ft bgs under all landscaping for potentially up to 183 homes. Although this is the least intrusive of the excavation depth alternatives considered, it is still likely to impose significant, and on occasions, acute costs to some residents over the period of remediation. The deeper excavation alternative, which would take longer, requires more structural safeguards, and require more on-site activity, would impose even larger social costs of the sort discussed later in this section. While the duration of this period of remediation is uncertain, and depends on the coordination of numerous stakeholders, it is likely to take several years to fully complete for the entire neighborhood.

Over this period, some residents may experience the interim lost use value from their residences and experience welfare losses associated with nuisance of on-site and neighborhood excavation and soil removal and replacement. These economic factors need to be taken into consideration when evaluating Resolution 92-49. These impacts could include the following:

Air pollution exposures. Excavation and soil transportation will likely lead to a substantial increase in interim risk of air pollution exposure to residents, since the contaminated soils will be exposed during excavation and heavy equipment and trucks will be operated during the removal and replacement of soils.

In particular, particulate matter levels could increase during excavation. Particle pollution contains microscopic solids or liquid droplets that are so small that they can get deep into the lungs and cause serious health problems, including increased respiratory symptoms such as irritation of the airways, coughing or difficulty breathing. People with heart or lung diseases, children and older adults are most likely to be affected by particle pollution exposure. However, even if you are healthy, one may experience temporary symptoms from exposure to elevated levels of particle pollution. There could be economic costs associated with health impacts, including the cost of medical care and medication.

Noise and odor nuisances. Similarly, excavation and soil removal will likely lead to a substantial level of noise impacts associated with truck trips and the operation of heavy equipment. Odor associated with diesel pollution from the trucks, soil disturbances and other processes could also be expected during an interim period. There could be economic costs associated with mental health impacts from noise and odor nuisances.

Loss of trees/shrubs, interim loss of landscaping and other aesthetic impacts. Preferred option 4b would involve excavation below landscape and thus would require the permanent loss of favored existing tree or scrubs. After the excavation period, new trees or other plants would have to be planted and landscaping would have to be redone by the property owners. During the exaction period, there would be an interim loss of recreational space for children and pets. There would also be an interim loss of access to other yard amenities such as pools, sheds, gardens, etc. This could affect property value.

Impacted ability of residents to their sell properties. While it would be speculative to predict an exact impact on property values, excavation activities are likely to depress home values during the period of excavation, given the disturbance.

Intangible costs associated with temporary household displacement. Interim relocation costs are likely to be highest for households with children and the elderly. Relocation could affect children's ability to attend their regular school and participate in their normal extracurricular activities. Relocation could also affect access to residents' places of employment, childcare, medical care, etc.

Possible short-term loss of utility services. Excavation below hardscapes and landscaped areas will be complicated by utility lines. Some lines may even have to be removed or temporarily unserviceable.

4.3.1 Benefits to Long-Run Real Estate Values

The relative real estate impacts to home owners are unknown for those remediation alternatives that might significantly alter the property such as alternative 2, 3 and 6.

For the remediation alternatives 4 and 5, despite the short-term interim use losses that are possible, we would expect the long-term value of the real estate to return to pre-investigation levels assuming the following:

1) All sub-slab soil vapor concerns are resolved and in full compliance with guidelines.
2) Indoor air quality remains in compliance with accepted exposure guidelines for the subsurface pollutants and their derivatives.

3) Ground surface environmental health conditions related to subsurface conditions are non-compliant with current regulations which affect the properties residential use value.
4) Documented or anticipated environmental liabilities associated with subsurface conditions are mitigated.
5) Threats of future potential losses of interim use value are eliminated.
6) Local nuisance impacts (e.g., air pollution, dust, noise, odor, loss of utility services, road congestion, etc) from nearby land uses and remediation activities have ceased.

Los Angeles Regional Water Quality Control Board

TO: Samuel Unger, Executive Officer

FROM: C.P. Lai *C.P.*
Ph.D., P.E., Water Resources Control Engineer
LOS ANGELES REGIONAL WATER QUALITY CONTROL BOARD

DATE: March 20, 2014

SUBJECT: TPH MASS CALCULATION FOR SUBSOIL AT KAST PROPERTY

As requested by Executive Officer Samuel Unger, I have calculated an estimate of the mass of total petroleum hydrocarbons (TPH) in the subsoil at the Former Shell Tank Farm at the Kast Property (Site).

The total TPH mass was obtained at three depths below ground surface by using the areas of the triangles formed by adjacent sampled stations and the concentrations collected at the sampled stations and depths. The areas of triangles are obtained by using the finite element method. The analysis is based on the following assumptions:

1. Density of sub-soil is assumed to be a constant value of 110 lb/ft3 (1762 kg/m3)
2. Concentration varies linearly within sampling stations
3. Mass varies linearly with depth

The results of total mass and impacted area of TPH at different depths below ground surface are presented in Table 1 through Table 3 for TPH as Diesel, TPH as Motor Oil, and TPH as Gasoline, respectively. Concentration contour lines at different depths are shown in Figure1 through Figure 3.

Table 1 Total Mass and Impact Area of TPH as Diesel

Depth (ft) BGS	Impact Area (ft2)	Mass (lbs)/ft	Total Mass (lbs)
2	1770032	105410	105410
3	1682807	170021	243126
5	1595582	299244	712391
10	1476774	562619	2867049

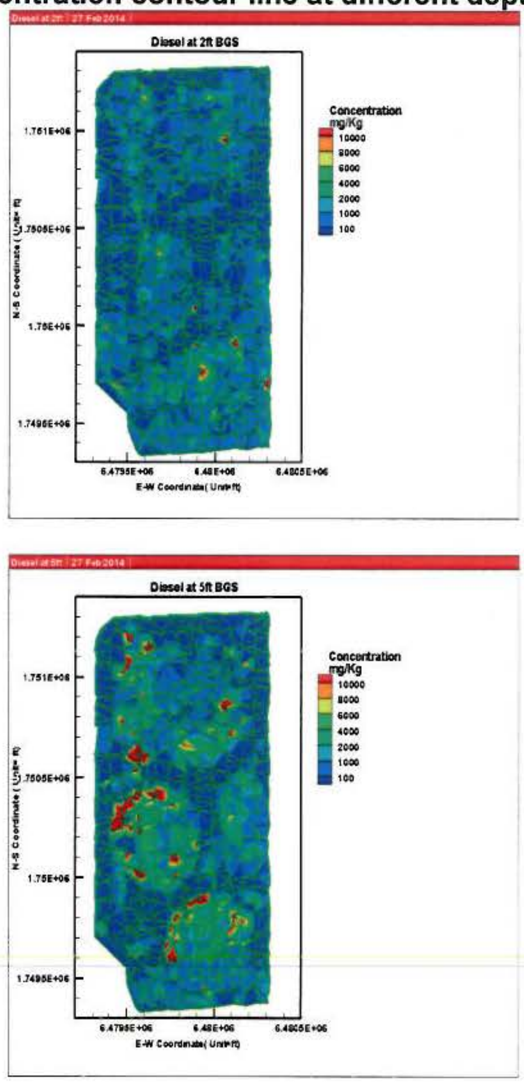
Table 2 Total Mass and Impact Area of TPH as Motor Oil

Depth (ft) BGS	Impact Area (ft2)	Mass (lbs)/ft	Total Mass (lbs)
2	1792074	187857	187857
3	1710030	240675	402123
5	1627986	346310	989108
10	1528505	605052	3367513

Table 3 Total Mass and Impact Area of TPH as Gasoline

Depth (ft) BGS	Impact Area (ft2)	Mass (lbs)/ft	Total Mass (lbs)
2	991603	1797	1797
3	1192861	8596	6994
5	1394119	22164	37739
10	1398650	55342	231504

Figure 1 Concentration contour line at different depths for TPH as Diesel



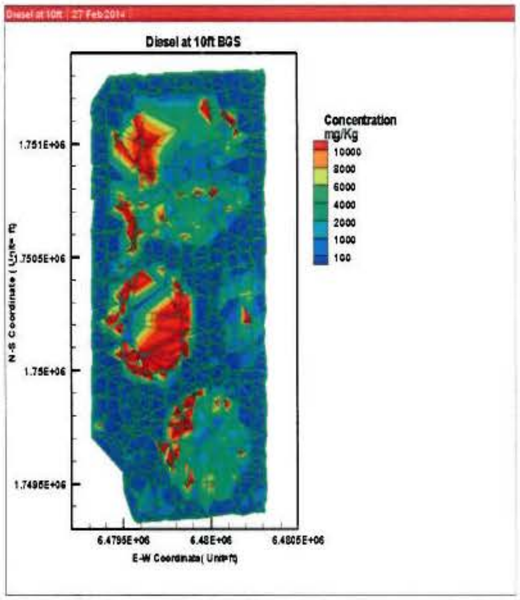
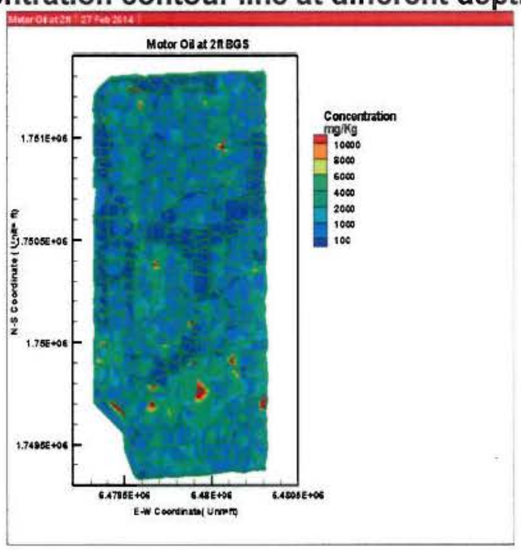
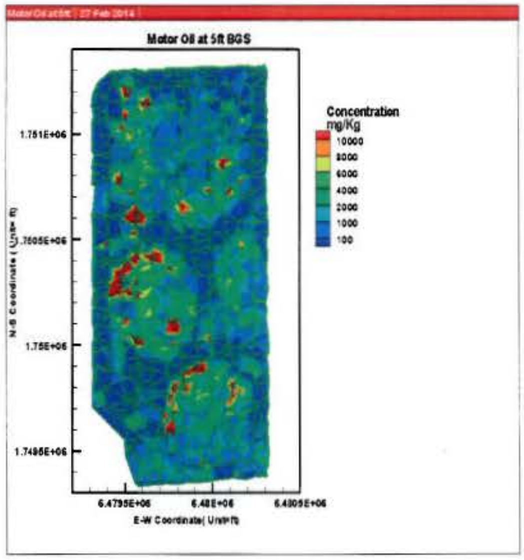


Figure 2 Concentration contour line at different depths for TPH as Motor Oil





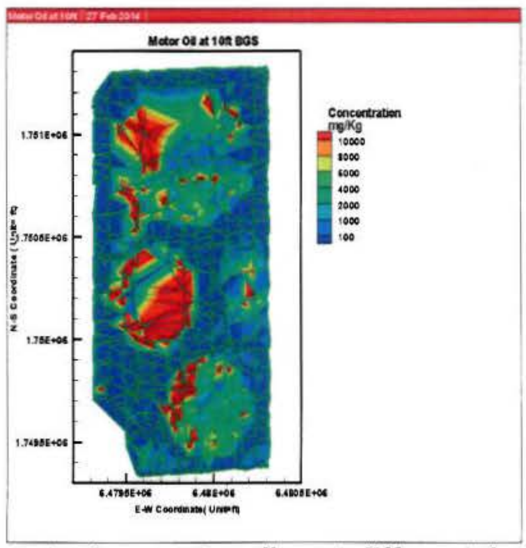
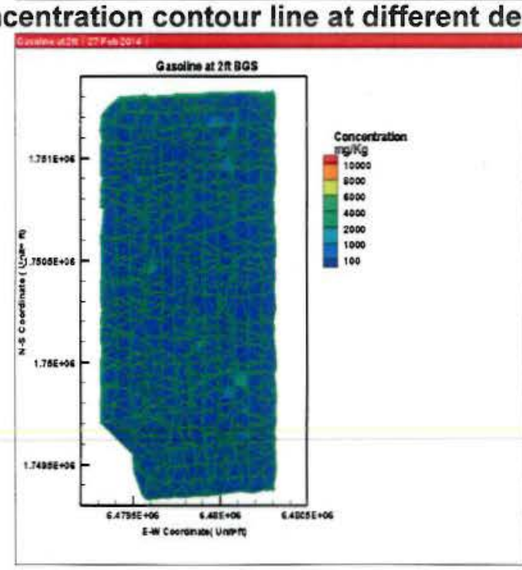
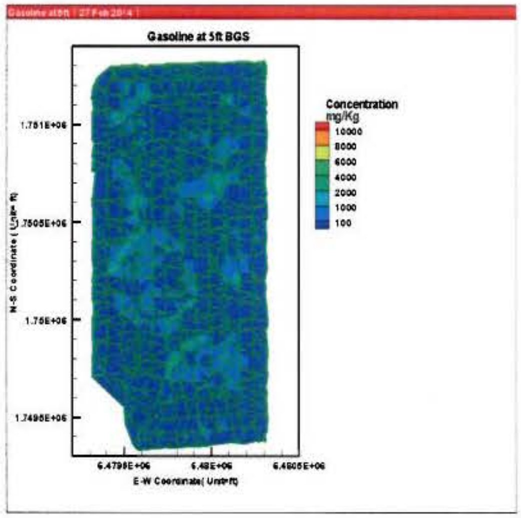


Figure 3 Concentration contour line at different depths for TPH as Gasoline




Gasoline at 5ft BGS
Concentration
mg/Kg
10000
8000
6000
4000
2000
1000
100
1.751E+06
1.75E+06
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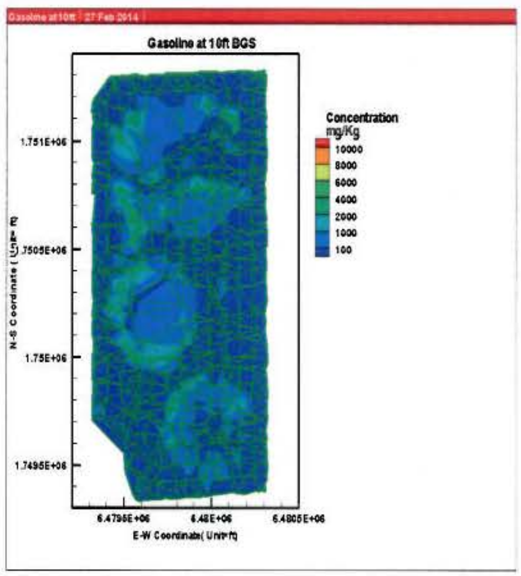
6.4795E+06
6.48E+06
6.4805E+06
E-W Coordinate(Unit=ft)


Gasoline at 10ft BGS
Concentration
mg/Kg
10000
8000
6000
4000
2000
1000
100
1.751E+06
1.7505E+06
1.75E+06
1.7495E+06
N-S Coordinate
6.4795E+06
6.48E+06
6.4805E+06
E-W Coordinate(Unit=ft)