Table 1: Site Specific Cleanup Goals, Soil (revised Table 9-2)

Constituents of Concern	Soil Cleanup Goals (mg/kg)	
Inorganics	**0-5 feet**	**5-10 feet**
Antimony	0.272	0.272
Arsenic	12	12
Cadmium	70	6,100
Chromium VI	1.2	110
Cobalt	23	2,100
Coopper	3,100	270,000
Lead	80	800
Thallium	0.143	0.143
Vanadium	390	34,000
Zinc	23,000	2,100,000
PAHs		
Benz[a]anthracene	1.6	140
Benzo[a]pyrene	0.9	14
Benzo[b]fluoranthene	1.6	140
Benzo[k]fluoranthene	1.6	140
Chrysene	16	1,400
Dibenz[a,h]anthracene	0.11	9.7
Indeno[1,2,3-cd]pyrene	1.6	140
Methylnaphthalene, 1-	16	1,400
Methylnaphthalene, 2-	230	20,000
Naphthalene	4	14.1
Pyrene	1,700	150,000
TPH		
TPH-Gasoline	117	117
TPH-Diesel	625	625
TPH-Motor oil	3,300	8500
SVOCs		
2,4-Dinitrotoluene	1.6	140
Bis(2-Ethylhexyl) Phthalate	35	3,000
VOCs		
1,1,2,2-Tetrachloroethane	0.47	41
Cis-1,2-Dichloroethene	0.00385	0.00385
1,2-Dichloroethane	0.000321	0.000321
1,2,3-Trichloropropane	0.00000417	0.00000417
1,2,4-Trimethylbenzene	83	7,200
1,2-Dichloropropane	0.83	72
1,3,5-Trimethylbenzene	85	7400
1,4-Dichlorobenzene	0.0123	0.0123
Benzene	0.0208	0.208
Bromodichloromethane	0.49	42
Bromomethane	8.8	770
Ethylbenzene	4.8	420
Methylene chloride	5.3	470
tert-Butyl Alcohol	0.00785	0.00785
Tetrachloroethene	0.00577	0.00577
Trichloroethene	0.00321	0.00321
Vinyl Chloride	0.000321	0.000321
Toluene	To be provided by Shell	To be provided by Shell
Xylenes	To be provided by Shell	To be provided by Shell

Table 2: Site-Specific Cleanup Goals, Soil Vapor (revised Table 9-3)

Constituents of Concern	Soil Vapor Cleanup Goals (µg/m^3)
VOCs	
1,1,1-Trichloroethane	2.60E+06
1,1,2,2-Tetrachloroethane	2.10E+01
1,1,2-Trichloroethane	7.50E+01
1,1-Dichloroethane	7.50E+02
1,2,4-Trichlorobenzene	1.05E+03
1,2,4-Trimethylbenzene	3.65E+03
1,2-Dichloroethane	6.00E+01
1,2-Dichloropropane	1.20E+02
1,3,5-Trimethylbenzene	3.65E+03
1,3-Butadiene	7.00E+00
1,4-Dichlorobenzene	1.10E+02
1,4-Dioxane	1.60E+02
2,2,4-Trimethylpentane	5.00E+05
2-Hexanone	1.55E+04
4-Ethyltoluene	5.00E+04
Benzene	4.20E+01
Bromodichloromethane	3.30E+01
Bromomethane	2.60E+03
Carbon disulfide	3.65E+05
Carbon tetrachloride	2.90E+01
Chloroform	2.30E+02
Chloromethane	4.70E+04
Cyclohexane	3.15E+06
Dibromochloromethane	4.50E+01
Dichloroethene, cis-1,2-	3.65E+03
Dichloroethene, trans-1,2-	3.15E+04
Dichloropropene, trans-1,3-	7.50E+01

Constituents of Concern	Soil Vapor Cleanup Goals (µg/m^3)
VOCs	
Ethanol	2.10E+06
Ethylbenzene	4.85E+02
Heptane	3.65E+05
Hexachloro-1,3-butadiene	5.50E+01
Hexane	3.65E+05
Isopropanol	3.65E+06
Isopropylbenzene (cumene)	2.10E+05
Methyl ethyl ketone (2-butanone)	2.60E+06
Methylene chloride	1.20E+03
Methyl-tert-butyl-ether	4.70E+04
Naphthalene	3.60E+01
Propylbenzene	5.00E+05
tert-Butyl Alcohol (TBA)	5.50E+05
Tetrachloroethene	2.05E+02
Tetrahydrofuran	1.05E+06
Toluene	2.60E+06
Trichloroethene	2.95E+02
Vinyl chloride	1.55E+01
Xylene, m-	5.00E+04
Xylene, o-	5.00E+04
Xylene, p-	5.00E+04
TPH	
Aliphatic: C5-C8	3.65E+05
Aliphatic: C9-C18	1.55E+05
Aromatic: C9-C16	2.60E+04
TPH (Nuisance)	5.00E+01

Table 3: Site Specific Cleanup Goals, Groundwater (revised Table 9-4)

Constituents of Concern	Groundwater Cleanup Goals (µg/L)
Benzene	1
Naphthalene	17
tert-Butyl Alcohol (TBA)	12
TPH-Gasoline	100
TPH-Diesel	100
TPH-Motor Oil	100
1,1-Dichloroethane	5
1,1-Dichloroethene	6
1,2,3-Trichloropropane	0.005
1,2-Dichloroethane	0.5
cis-1,2-Dichloroethene	6
Tetrachloroethene	5
trans-1,2-Dichloroethene	10
Trichloroethene	5
Vinyl Chloride	0.5
1,4-Dichlorobenzene	5
Antimony	background
Thallium	background
Arsenic	background

SSCGs Development Support Documents References

1) Plume Delineation Report, Former Kast Property, Carson, California. (URS, September 25, 2010).
2) Human Health Screening Evaluation Work Plan, Former Kast Property, Carson, California. (Geosyntec, October 30, 2009).
3) Soil Vapor Extraction Pilot Test Report. Former Kast Property, Carson, California. (URS, September 30, 2010).
4) Soil Background Evaluation Report. Former Kast Property, Carson, California. (URS, September 14, 2010).
5) Community Outdoor Air Sampling and Analysis Report, Former Kast Property, Carson, California. (Geosyntec, November 5, 2010).
6) Pilot Test Work Plan for Remedial Excavation and In-situ Treatment Pilot Testing, Former Kast Property, Carson, California. (URS & Geosyntec, May 10, 2011).
7) Gage Aquifer Investigation, Former Kast Property, Carson, California. (URS, October 10, 2011).
8) Bioventing Pilot Test Summary Report. Former Kast Property, Carson, California. (Geosyntec, December 6, 2012).
9) Excavation Pilot Test, 24612 Neptune Avenue, Former Kast Property, Carson, California. (URS, January 4, 2013).
10) Phase II ISCO Bench-Scale Test Report. Former Kast Property, Carson, California. (Geosyntec, August 30, 2013).
11) A Human Health Screening Risk Evaluation (HHSRE) was conducted to evaluate the analytical results of the indoor air, soil, and sub-slab soil vapor samples collected at 268 total homes to date and over 600 Residential Sampling Reports prepared (2009 to present).

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TO: Los Angeles Regional Water Quality Control Board

FROM: UCLA Expert Panel, Gary Krieger

PROJECT: Former Kast Property in Carson, California

SUBJECT: Soil depth intervals used to calculate the Site Specific Cleanup Goals

DATE: January 14, 2014

The Revised Site Specific Cleanup Goals Report (Revised Report) submitted by Shell to the Regional Board on Oct. 21, 2013 divides the upper 10-foot soil horizon into two intervals: 0-2 feet, and 2-10 feet. Shell used different exposure frequency to constituents of concern in the soil intervals based on the rationale that residents have more frequent exposures to shallower soils (0-2 feet) than to deeper soils (2-10 feet). On January 14, 2014, the Regional Board requested the UCLA Expert Panel comment on the appropriateness of this rationale of using different exposure frequencies for different soil depths within a 10-foot soil horizon.

The UCLA Expert Panel agrees that this methodology is appropriate to assess human health exposure. The USEPA (1993) has defined that the top 2 centimeters of soil is where direct contact for the residential receptor predominantly occurs. In the guidance for soil screening the USEPA states "the decision to sample soils below 2 centimeters depends on the likelihood of deeper soils being disturbed and brought to the surface (e.g., from gardening, landscaping or construction activities)" (USEPA 1996, page 12). In their supplemental guidance, the USEPA states that "residential activities (e.g., gardening) or commercial/industrial (e.g., outdoor maintenance or landscaping) or construction activities that may disturb soils to a **depth of <u>up to</u> two feet**, potentially exposing receptors to contaminants in subsurface soil via direct contact pathways such as ingestion and dermal absorption" (USEPA 2002, page 2-8). In USEPA's (2003) *Superfund Lead-Contaminated Residential Site Handbook*, the agency states that sampling "does not need to exceed 24 inches to define the vertical extent of contamination for clean-up purposes" as the remediation is being conducted to eliminate the potential for direct exposure in the residential setting. The Handbook (USEPA 2003) goes on to recommend for remediation that "Based on Agency experience, it is strongly recommended that a minimum of twelve (12) inches of clean soil be used to establish an adequate barrier from contaminated soil in a residential yard for the protection of human health. ... With the exception of gardening, the typical activities of children and adults in residential properties do not extend below a 12-inch depth." and "Twenty-four (24) inches of clean soil cover is generally considered to be adequate for gardening areas ..."

We agree that the 0-2 feet interval is appropriate for the typical residential exposure and expect, given the established nature of the neighborhood, the assumption that the resident is exposed 4 times per year to soils at depths greater than 2 feet to be highly conservative. It is our opinion that only if soil concentrations exist below 2 feet that may pose a unacceptable exposure to vapor intrusion should residential exposure be the driver for Site Specific Cleanup Goals for subsurface soil (2 to 10 feet) rather than the utility worker. This opinion is consistent with the Revised Site Specific Cleanup Goals Report submitted by Shell.

References Cited

USEPA 1993, *The Urban Soil Lead Abatement Demonstration Project*. Vol I: Integrated Report Review Draft. National Center for Environmental Publications and Information. EPA 600/AP93001/A. NTIS PB93-222-651. as cited in USEPA 1996.

USEPA 1996, *Soil Screening Guidance: User's Guide*, Second Edition, Office of Solid Waste and Emergency Response, Washington DC Publication 9355.4-23, July 1996.

USEPA 2002, *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites*. Office of Solid Waste and Emergency Response, Washington DC OSWER 9355.4-24, December 2002.

USEPA 2003, *Superfund Lead-Contaminated Residential Sites Handbook*. Office of Emergency and Remedial Response, Washington DC OSWER 9285.7-50, August 2003.

CALIFORNIA Water Boards

EDMUND G. BROWN JR.
GOVERNOR

MATTHEW RODRIQUEZ
SECRETARY FOR
ENVIRONMENTAL PROTECTION

Los Angeles Regional Water Quality Control Board

TO: Samuel Unger, P.E., Executive Officer
California Regional Water Quality Control Board – Los Angeles Region

FROM: Yue Rong, Ph.D., YR
Section Chief, Underground Storage Tank Section
Weixing Tong, Ph.D., PG, CHG WXT
Unit Chief, Underground Storage Tank, Los Angeles Coastal Unit

DATE: December 10, 2013

SUBJECT: COMMENTS ON PROJECT PROPOSAL

We went through the attachment documents presented to us (Revised Site-Specific Cleanup Goal Report, by Geosyntec, dated October 21, 2013, APPENDIX A), particularly to review the calculations for benzene and TPH for groundwater protection (not including vapor intrusion or risk assessment part). The following are our comments as we discussed in the meeting.

1. Soil screening levels calculated in the document did not contain all components in our 1996 Guidebook method, which contains a modification factor due to soil type (a different coefficient for gravel, sand, silt, and clay, respectively). This modification factor was not used in the calculation.

2. In page A-28, it states that the Attenuation Factor method in 1996 Guidebook Step 3 is not conducted in order to "avoid double-counting" the soil type. We disagree with the approach to skip Step 3. The 1st Step using soil type parameter is to calculate VOC partitioning based on soil physical material and contaminant chemical properties. Steps 2 and 3 are to obtain "safety factors" for the attenuation factor, but are not used to count for VOC partitioning. Step 3 is a factor based on leachability. Therefore, Step 1 and Step 3 are different in nature.

3. Based on the 1996 Guidebook method referenced above, the soil cleanup level should be calculated for benzene as follows:

$C_{(cleanup)} = MCL \times AF(\text{T}) / \rho b = (1 \mu g/L \times 33/10) / 1.54\ kg/L = 2.1\ \mu g/kg$

(Please compare with results in page A-31)

4. In page A-31, the report used a dilution factor (DAF=6.24) in the calculation for soil cleanup goals. Note that the same DAF has been used for all other VOCs in table A-17. In Appendix A (Section 5.3.3), it used the Soil Attenuation Model (SAM) to quantify the dilution of dissolved constituents of concern (COCs) when soil leachate mixes with lateral groundwater flow. This method assumes when leachate vertically migrates to the water-bearing unit through infiltration, a contaminant will be diluted by the lateral groundwater flow in the mixing zone. We believe that the use of SAM is

not appropriate in this case because the groundwater underneath the subject site has been impacted by the various COCs (i.e., TPHg, benzene, etc.) and groundwater contamination plumes with concentrations above their respective MCLs or NLs already exist. Any contaminants brought into the water-bearing unit through infiltration will be considered as an addition to the existing plume. Furthermore, the proposed dilution concept is against the State Anti-degradation Policy. The discharge compliance point should be at the groundwater table where the infiltrated water enters the water-bearing unit.

5. Not clear how the TPH cleanup goal is calculated in terms of groundwater protection. TPH cleanup levels calculated in the report seem all based on human health risk factors. If we use Table 4-1 in the 1996 Guidebook, the cleanup levels should be: TPH(gasoline range C4-C12) = 500 mg/Kg, TPH(diesel range C13-C22) = 1000 mg/Kg, and TPH(motor oil range C23-C32) = 10000 mg/kg, respectively. By contrast, Table A-17 presented in the report proposed soil cleanup goals for TPH as gasoline of 730 mg/Kg, TPH as diesel of 3900 mg/Kg, and TPH as motor oil of 50000 mg/Kg.

6 Use of the Attenuation Factor method specified in our 1996 Guidebook can also be considered for determining the TPH cleanup levels. In that case, individual compounds representing each carbon range should be used for calculation. For example, hexane, naphthalene, trimethylbenzene, etc.

7. Specific comments on the document and Appendix A:
   a) Need to number all equations in the report for reference.
   b) The bottom two equations in page A-31 are incorrect. The DAF equation should use 11.3m as input instead of 21.4m, and $C(cleanup)$ equation should have result in unit of $\mu g/kg$, not mg/kg.
   c) Vertical dispersivity αv value seems too high. Need justifications for choosing this value (although it did not really impact the result in this case).

Comments from the Expert Panel on the Revised Site-Specific Cleanup Goal Report

Submitted: December 18, 2013

A. Introduction

As requested by the Los Angeles Regional Water Quality Control Board (Regional Board), the Expert Panel has reviewed the Revised Site-specific Cleanup Goal Report (Revised SSCG Report) prepared for the former Kast Property in Carson, California by Geosyntec Consultants for Shell Oil Products US. This builds upon the Panel's review of the previously submitted Site-specific Cleanup Goal Report (SSCG Report), and precedes the release of the Remedial Action Plan.

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.

In general, Geosyntec did not make many changes to the overall approach taken in the Revised SSGC Report compared to the original SSCG Report. Text and figures were added to help explain reasoning and inconsistencies while improving transparency. Yet we have concerns with the following issues.

B. Concerns and Recommendations

1. Cumulative risk and/or hazard taken into account in the SSCG calculations
2. Finalizing the COC list
3. Attenuation factor for sub-slab vapor concentrations
4. Chlorinated volatile organic compounds (CVOCs) potentially from onsite sources
5. Remediation options
6. Interpretation of State Board Resolution No. 92-49

B.1. Cumulative risk and/or hazards taken into account in the SSCG calculations

One of the Expert Panel's most significant concerns, still not addressed in the Revised SSCG Report, is with the calculation of the SSCGs. Each COC has a calculated SSCG that is based on a cancer risk of one in a million (10^{-6}) or a hazard index of 1. "The final SSCG values were not adjusted by number of chemicals included in the SSCG derivation process therefore there is no impact on the value calculated." (Response to Expert-3 comment regarding the number of COCs selected) We advise the Regional Board to explicitly task Geosyntec to clearly demonstrate how cumulative risk is assessed and calculated for all of the chemicals of concern (COCs).

In response to OEHHA commenting, "The implication of cumulative risks and/or hazards that exceed target levels needs to be considered." Geosyntec replied, "Agreed. This is consistent with the approach described in the SSCG report." (Response to OEHHA-32) However, the Panel still does not see how this is consistent with the approach. In general, Geosyntec states,

> *"... we believe dividing the SSCGs by the number of COCs to calculate a lower value to address cumulative risk issues is overly conservative and assumes that the chemicals are equally distributed. For most sites there are a subset of chemicals that contribute the majority to risk and hazard. Rather than assume a certain distribution of risk and hazard among chemicals ahead of time, the site data will be evaluated in the HHRA to identify the final COCs. In addition as presented in the RAOs section, the forthcoming HHRA [Human Health Risk Assessment] will address cumulative risk."* (Responses [whole or in part] to Expert-4, Expert-5, RWQCB-15 and Expert-8)

This comment pushes things to the forthcoming full Human Health Risk Assessment (HHRA), which the Panel believes should logically have been done already. As stated in our Interim Report on the SSCG Report, "the utility of developing this document after the execution and release of the SSCG is potentially problematic for key decision makers at the Water Board. Typically, a human risk assessment should inform cleanup goals rather than be released after the cleanup goals are determined."

The only step where we see cumulative risk assessed is in the selection of the COCs where the risk-based screening level (RBSL) has been divided by 10. Geosyntec's primary argument for not taking cumulative risk into account in the SSCG report appears to be two-fold: 1) chemicals are not necessarily equally distributed and 2) the upcoming HHRA will do it.

> *"When the forthcoming HHRA is conducted cumulative risks and hazards will be calculated and corrective actions will be based on the SSCGs presented in this report and the cumulative HHRA results." (Response to Expert-3)*

While not discussed explicitly, we have to wonder if the way this will be conducted is similar to the HHSRE where the risk index is calculated using the SSCGs rather than the RBSLs and that a risk index greater than 1 would require remedial action rather than an exceedance of SSCG ("bright line" method). That is how the following text could be interpreted.

> *"The chemical-specific SSCGs will be used in the HHRA along with the exposure point concentration 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 presented in the HHRA."* (Pages 44-45 of the SSCG Report)

If SSCGs will be used to calculate a "risk index" that will trigger action rather than using the SSCGs as "bright line" remediation cleanup values for determining whether an action is required, then our concern with cumulative risk/hazard has probably been addressed, and we can see how the Site's RAOs for soil[1], in particular, can be met/addressed. However, if the SSCGs are actually used as "bright line" cleanup concentrations, we are concerned that once the board approves of this report, there is no modification possible. Geosyntec uses the "they have approved it so it is good" argument several times in their comment responses. Therefore, the Board should be very clear about how these SSCGs are going to be used for making decisions in the RAP.

We would advise the Water Board to clearly and explicitly hold Geosyntec to a work plan that explicitly addresses the key issues and lays out methodology; otherwise this will recycle. And again, we are concerned with how key decisions are continuously pushed forward onto the HHRA, when it is unclear that Geosyntec will perform the calculations in a total manner that is reflected in the cleanup that the Water Board will find acceptable.

B.2. Finalizing the COC list

Geosyntec indicates that the SSGCs are final, but they describe the COC list as preliminary. The Panel agrees with the OEHHA and recommends that the COC list should be presented as the final list; otherwise it will be difficult to argue that the SSCG list is final.

While we did previously point out that HERO HHRA Note 4 (Expert-15 comment) is inconsistent with the COC approach in the SSGC report, we will agree with Geosyntec that "[T]he screening approach used in the SSCG report to select COCs is considered appropriate for this site ..." (Response to Expert-15). However Geosyntec appears to indicate that this COC list is not considered "final" by stating, "The Revised SSCG Report presents the **preliminary** [emphasis added] list of COCs for evaluation in the RAP. The forthcoming HHRA will provide the **final** [emphasis added] analysis following the approached presented in Appendix A" (Response to OEHHA-23). It is unclear why then the COC list is preliminary if it follows the same approach. However, note the COC selection process is in the SSCG report and only summarized in Appendix A. Appendix A states, "Tables 4.5 and 4.6 of the main report present the COCs that have been identified for each media to be carried forward into the RAP" (page A-2).

We recommend that the COC list should be presented as the final list.

B.3. Attenuation factor for sub-slab vapor concentrations

The Revised SSCG Report proposes an attenuation factor (AF) of 0.001 when sub-slab vapor concentrations are greater than 100 ug/m^3 (a high concentration for this site). However, this AF is very low. We recommend using a home-specific attenuation factor rather than a generic AF, to ensure that each individual home is protected.

---

[1] "The RAOs for soil are to prevent human exposures to concentrations of COCs in soil 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." (page 39)

In the analysis presented by Geosyntec (Appendix B), the argument is made that a generic attenuation factor of 0.01 for consideration the pathway from sub-slab to indoor air is in fact conservative. While this may be valid for a large number of the homes, Figures B-10 and B-11 suggest that this is NOT the case for a number of individual homes, when paired data for specific compounds is evaluated. The empirical data does not support using a "generic" attenuation factor for determining the risk, which is consistent with the notion that conditions may be different in each home, and that for a given home owner it is important to reduce her/his individual risk, not the generic risk. In fact, Figure B-10 suggests that the number of cases where the empirical attenuation factor is > 0.01 is large, although mostly at low sub-slab concentrations. Nevertheless, there are a significant number of cases where the empirical attenuation factor is > 0.01 and sub-slab concentrations are > 100 ug/m3.

The recommendation is to not use a generic attenuation factor, but rather a home-specific attenuation factor, to ensure that each individual home is protected.

In addition, it would have been useful for Geosyntec to have provided the spatial distribution of the CVOCs in the sub-slab vapor as it would have likely followed the CVOC groundwater distribution and not the CVOC soil distribution, providing more evidence of a trespassing CVOC plume. This would provide a link between the risk assessment and subsurface evaluation.

B.4. Chlorinated volatile organic compounds potentially from onsite sources

Geosyntec provided in Appendix E the distribution maps of PCE and TCE in both shallow soil and in groundwater. These maps make the best case for the conclusion that the CVOCs in both shallow soil and groundwater are from neighboring source, but the evidence could be presented more clearly and transparently. The "evidence" of "[T]he lack of detections of PCE and TCE in Site soils between 10 feet below ground surface and groundwater (>400 samples)" [Response to comment RSQCB-2] does not "rule out" that CVOCs in shallow soil are sourced from the Site rather only rules out that the Site probably did not source the groundwater plume under the site. We advise the Regional Board to focus attention on this area.

B.5. Remediation options

We recommend not eliminating remediation options at this point in the analysis. Section 9 of the Revised SSCG includes a preliminary evaluation of remedial alternatives, also called a Screening Feasibility Study, and then based on this preliminary evaluation excludes certain technologies and remedial alternatives while prioritizing only certain remaining ones for further evaluation. Geosyntec envisions that later a "detailed evaluation of the recommended remedial alternative will be conducted and presented in the forthcoming Remedial Action Plan." The Expert Panel is concerned that it may be premature to eliminate many remediation technologies and alternatives now and thus exclude these options from further evaluation in the forthcoming RAP.

For instance, Geosyntec indicates that bioventing "would not be technologically and economically feasible to implement and is therefore eliminated from consideration for inclusion in remedial alternatives". This is based on the presumption that "based on the average rate of biodegradation (of petroleum hydrocarbons), the systems would have to be in place for several decades," as well as the significant number (15 to 20) of extraction points that would have to be installed on each property.

While the pilot scale studies did reflect low biodegradation rates, this technology should be kept in consideration, since it may be a cost-effective approach for significantly reducing the risk in those areas where there are elevated concentrations of hydrocarbons within the first 5-20 feet below ground surface. Naturally, the recommended approach would be to first apply soil vapor extraction (which will be considered further in the next phase) to remove the more volatile compounds. But as pointed out by Geosyntec, diesel components and other heavy hydrocarbons will not be removed significantly by soil vapor extraction. The bioventing pilot test results indicated that relatively low flow rates were necessary to deliver sufficient oxygen to the subsurface to meet the bioventing oxygen demand. Geosyntec calculated that "the time frame for bioventing system operations ranged from approximately 1 to 4 years, assuming the higher initial biodegradation rate, to several decades assuming the average biodegradation rate." Thus, for some locations it may be possible to remove a significant mass in a few years. The extraction wells used for soil vapor extraction (SVE) could be used for subsequent bioventing as needed. Key is to determine the conditions that result in the higher biodegradation rate at the site.

Although this technology will not be applicable for all hot spots, it seems premature to dismiss it, without a real economic feasibility analysis. It will certainly be technologically feasible if done correctly, as was done in some of the pilot scale studies. Bioventing would be additive to Alternative 7, and would be considered on a hot spot by hot spot basis. The marginal costs are small (given that SVE would be used first), and there could be considerable savings over the project life, as well as faster risk reduction, if a significant mass of hydrocarbons is removed.

B.6. Interpretation of Resolution No. 92-49

Geosyntec proposes a narrow interpretation of State Water Board Resolution No. 92-49. The Revised SSCG asserts that Resolution No. 92-49 applies only to groundwater quality and excludes soil and soil vapor. We are concerned that the Board's approval of the Revised SSCG would be taken as approval of this narrow interpretation of Resolution in a way that would affect actions for relevant non-water media. We recommend that the Board clarify their scope of authority and respond to the assertion that:

> *Waste in non-water media (such as soil) should be addressed through remediation to promote the attainment of background water quality (not, for example, background levels in soil) or the best water quality that is reasonable feasible given the considerations listed." (Revised SSCG Report, page 78)*

C. Relatively Minor, Miscellaneous Comments Relevant to Application of the Technical Review Principles

- The table of Potentially Complete Exposure Pathways in the report and in Appendix A does not match (e.g., Indoor Air is missing from the version in Appendix A, as well as just matching modifiers). This has to do basically with consistency.

- Table A-3a, second half appears to be missing naphthalene (the volatile PAH).

- Table A-3b appears to be missing $VF_{soil\text{-}OA}$ values for some of the selected COPCs in soil.

- Concentration units should be included on the on the soil figures in Appendix E.

- The use of light pink/pink to represent the >25th to 50th percentile in the indoor vapor figures is unfortunate as it tends to "blend" with the purple used to represent the >90th Percentile and thus upon first glance this reviewer had the "pink houses" with much higher indoor air concentrations than the legend indicates. This reviewer would recommend using a gradual color scheme so colors intensify to the higher concentrations or go from the cool colors to the warm (blue, green, yellow, orange, red). We make this recommendation in the belief that at some point these figures will be presented in a public forum and we have found that the use of this color scheme strategy allows the reader/viewer to make first glance conclusions that match the map interpretation.

TO: Samuel Unger, Executive Officer
California Regional Water Quality Control Board, Los Angeles Region

FROM: Cris Morris CRM
Water Resource Control Engineer
Site Cleanup Program, Unit III

DATE: December 23, 2013

SUBJECT: COMMENTS ON REVISED SITE-SPECIFIC CLEANUP GOAL REPORT

To address the comments in the Soil/Water/Air Protection Enterprise (SWAPE) letter dated November 27, 2013 pertaining to the KAST Screening Feasibility Study in the Revised Site-Specific Cleanup Goal Report (Report), it is necessary to identify the proper approach to a feasibility study of this complexity. If we use the Superfund Remedial Investigation/ Feasibility Study (RI/FS) process as a guideline, the development and screening of alternatives includes:

1. Develop remedial action objectives (RAOs), specifying the contaminants and media of interest, exposure pathways, and preliminary remediation goals.
2. Develop general response actions for each medium of interest (containment, treatment, excavation, pumping etc.) that may be taken either individually, or in combination, to satisfy the RAOs.
3. Identify volumes or areas of media to which general response actions might be applied.
4. Identify and screen the technologies applicable to each response action to eliminate those that cannot be implemented technically at the site. Further define each response action.
5. Identify and evaluate technology process options to select a representative process for each technology type.
6. Assemble the selected representative technologies into alternatives representing a range of treatment and containment options as appropriate.
7. The alternatives are evaluated with respect to effectiveness, implementability and cost. Only the most promising alternatives are included in the detailed alternative analysis.

The abbreviated versions of the RAOs presented in the Report for the Former Kast Property are

- Prevent human exposures to constituents of concern (COC) concentrations in soil, soil vapor, and indoor air such that the cumulative lifetime incremental carcinogenic risks is within $1x10^{-6}$ and 10^{-4} and the noncancer hazard index is less than 1 or concentrations are below background, whichever is higher. The receptors are onsite residents, and construction and utility maintenance workers. The point of departure for onsite residents is $1x10^{-6}$.

- Prevent fire/explosion risk in indoor air and enclosed spaces and 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 the water quality objectives in the Basin Plan.

Rather than utilizing the formalized alternative screening process developed for Superfund RI/FS, this document just identifies technologies that fit into two categories. The categories and the technologies are:

- Interrupt the Human Health Exposure Pathway
  - Sub-slab vapor mitigation
  - Capping portions of the site
  - Institutional Controls
- Remove COC Mass and Interrupt the Human Health Exposure Pathway
  - Excavation
  - Soil vapor extraction
  - Bioventing
  - In-situ chemical oxidation
  - LNAPL/source removal
  - Other removal or remediation of groundwater
  - Monitored natural attenuation

To effectively manage the determination of Site Specific Cleanup Goals (SSCGs), the Report classifies the exposure medium by splitting the soil into a shallow surface soil and a shallow subsurface soil. The justification for this step is that the human exposure frequency varies between the surface soil (0 to 2 feet deep) and the subsurface soil (2 to 10 feet deep) (Refer to Appendix A). By imposing the assumption that the subsurface soil is encountered only infrequently and that any excavated subsurface soil is not distributed onto the surface, a Soil Management Plan and a deed restriction are required for each property. As a result, there are no alternatives without the imposition of Institutional Controls. In addition, the assumption is also made that the Soil Management Plan would be utilized to limit the risk of the construction /worker so there are no technologies necessary to protect the construction worker except for the Institutional Controls

Using the technically feasible technologies, seven alternatives, with some sub-alternatives, were prepared and presented. (Only Alternatives 1 through 6 focus on the soil medium). For an initial screening in a Superfund RI/FS, these alternatives would have only been evaluated with respect to effectiveness, implementability and cost and the cost estimate range would have been +100 / -50 %. The evaluation criteria included in the Report include: Cleanup Goal Achieved; Implementability; Environmental Considerations; Reduction of Toxicity, Mobility and Volume; Social Considerations, Other Issues and Cost. The cost estimate range presented in the Report is +50 / -30 %.

The alternatives for the soil medium included in the analysis and the ones that are not retained for the next phase are indicated below:

1) Removal of all site features and excavation of impacted soil.

   Not retained: not technologically and economically feasible and very high social, environmental and economic costs.

2) Removal of all site features and excavation down to 10 feet.

   Not retained: not technologically and economically feasible and very high social, environmental and economic costs.

3) Excavation to 2 feet bgs in open areas and beneath residential hardscape as required by SSCG.

   Retained

   3A) Excavation to 5 feet bgs in open areas and beneath residential hardscape as required by SSCG.

   Retained

   3B) Excavation to 10 feet bgs in open areas and beneath residential hardscape as required by SSCG.

   Not retained: not technologically and economically feasible and very high social, environmental and economic costs.

4) Excavation to2 feet bgs in open and landscaped areas as required by SSCG.

   Retained

   4A) Excavation to 5 feet bgs in open and landscaped areas as required by SSCG.

   Retained

   4B) Excavation to 10 feet bgs in open and landscaped areas as required by SSCG.

   Not retained: not technologically and economically feasible and very high social, environmental and economic costs.

5) Removal of all site features and cap site.

   Not retained: not technologically and economically feasible and very high social, environmental and economic costs.

6) Capping of exposed soils and landscaped areas.

   Retained

At the conclusion of this screening step, the retained alternatives include

- Alternative3: Excavation to 2 or 5 feet bgs in open areas and beneath residential hardscape
- Alternative 4: Excavation to 2 or 5 feet bgs in open and landscaped areas
- Alternative 6: Capping of exposed soils and landscaped areas

Although this screening included more criteria than the three criteria used for a RI/FS preliminary screening of alternatives (effectiveness, implementability and cost), the issues are whether alternatives have not been retained which should have been and whether valid justification is provided. The evaluation of whether or not each alternative meets the RAOs is the critical issue. If the RAOs are satisfied for each alternative and the screening process retains a representative alternative from each response action, then the screening process is valid. Since the decision making process focuses around the soil medium, the discussion below only addresses the soil.

The premise that a Soil Management Plan (and thus a deed restriction) is required for each residence to disrupt the pathway from the subsurface soil to human receptors is not a valid assumption and has invalidated the RAO review process. Once this restriction is removed, the alternatives need to be reevaluated with respect to whether they satisfy the RAOs. The response actions that need to be addressed by a retained alternative are:

- No Action,
- Institutional Controls (including the Soil Management Plan and deed restriction)
- Collection/Discharge (excavation and disposal)
- Containment (cap)

Once the alternative screening process has been repeated with retained alternatives representing each of the response actions listed above, the alternatives are further developed and the nine National Contingency Plan (NCP) criteria are evaluated. These criteria include: overall protection of human health and the environment, compliance with Applicable or Relevant and Appropriate Requirements (ARARs), long term effectiveness and permanence, reductions in toxicity, mobility and volume through treatment, short term effectiveness, implementability, cost, state acceptance and community acceptance.

The SWAPE comment letter dated November 27, 2013 raised a number of issues including the validity of the screening analysis and the lack of retaining alternatives that relocated the residents and redeveloped the site for non-residential options. The most notable comments are listed below:

1. Pg 1 Alternatives are rejected without any detailed explanation
2. Pg 1-2 Request "to conduct a detailed evaluation of remedial alternatives and present those evaluations in a 'proper' Feasibility Study"
3. Pg 2 Expectation that all feasible alternatives are evaluated in a manner that is "transparent, subject to public participation and that conforms with standard practices and policies"
4. Pg 2 Does not include any alternatives with the relocation of residents and redeveloping the site for non-residential options.
5. Pg 3 Detailed FS required before a proposed RAP can be prepared
6. Pg 3 Understated economic and social impact to residents
7. Pg 5 Difficulties associated with some alternatives are overstated

Depending upon the outcome of the RAO analysis after the Soil Management Plan/deed restriction constraint is removed, the option of relocating and redeveloping the site would need to be reevaluated. However, as long as the RAO can be satisfied with another alternative within a response action that is easier to implement and less expensive, then not retaining that option is valid.

The SWAPE expectation that the screening process and the detailed evaluation of alternatives be transparent is a valid concern but the comments presented in the text and Table 9-5 appear to provide the necessary information to screen the alternatives. This step only requires the evaluation of effectiveness, implementability and cost. During the detailed analysis of alternatives phase, however, the community acceptance criteria will need to be addressed for each alternative individually and in comparison to the others. This analysis will be limited to only the alternatives that are retained from the screening step and will probably not include the option of redeveloping the site. The preparation and review process of the detailed analysis needs to be made prior to the Remedial Action Plan, but can be combined into one document.

In summary, the SSCG report needs to be revised to limit the Soil Management Plan/deed restriction requirement to the Institutional Controls alternative. Once the alternatives are reevaluated with respect to the RAOs and the SSCG report has been resubmitted for review, the detailed analysis of the alternatives should be submitted with the individual and comparative evaluation of each of the retained alternatives to the 9 NCP criteria. If this process is completed per the RI/FS guidance, then the comments presented by the SWAPE letter should be addressed.

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Matthew Rodriquez
Secretary for Environmental Protection

Edmund G. Brown Jr.
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MEMORANDUM

TO: Teklewold Ayalew, Ph.D., P.G.
Engineering Geologist
Regional Water Quality Control Board
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Los Angeles, CA 90013

FROM: James C. Carlisle, D.V.M., M.Sc., J.C.
Staff Toxicologist
Air, Community, and Environmental Research Branch

DATE: November 21, 2013

SUBJECT: REVISED SITE-SPECIFIC CLEANUP GOAL REPORT, FORMER KAST PROPERTY, CARSON, CALIFORNIA
SWRCB#R4-09-17 OEHHA #880212-01

Document reviewed

- Revised Site-Specific Cleanup Goal Report, Former Kast Property, Carson, California, dated October 21, 2010 by Geosyntec Consultants, Inc.

Scope of review

- OEHHA's review is limited to risk assessment issues and does not include evaluation of explosion hazards or leaching/groundwater protection.

Response to previous comments

- OEHHA's April 23, 2013 comments on the first draft SSCG report are summarized below followed by OEHHA's evaluation of Shell's responses to these comments:
  1. Please consider whether major renovation projects such as pool installation or underground utility work are possible and whether residents could be exposed to deeper soils redistributed to the surface during and after such renovation.
     a. SHELL RESPONSE: subsurface soils (e.g. >2-10 feet bgs) are considered for infrequent contact; 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 (e.g., recreational activities, lawn care, landscaping). In addition, it is unlikely that soils from a deeper excavation (such as during a major renovation or utility repair work) would be placed at the surface due to the lack of area to place excavated soils. It is assumed for the infrequent contact scenario that institutional controls (e.g., a notification trigger added to the existing excavation permitting process, a soil management plan) to prevent redistribution of deep soils at the surface would be required.

OEHHA's RESPONSE: Typically, residential exposure scenarios include soil down to 10 feet depth in the standard exposure scenario (i.e. 350 days per year). The rationale is that soils at this depth may be excavated and re-distributed to the surface. Shell's response calls for institutional controls that would prevent this re-distribution and presumably achieve the low exposure goals. The appropriateness of institutional controls is a risk management decision.

2. A Table showing final SSCGs and whether each is health-based or background-based would be very helpful.
    a. OEHHA's RESPONSE: Shell's Table 9-2 complies with this request (although it is unclear why "C" or "NC" were not included in the "Basis" column).
3. OEHHA questions the appropriateness of comparing background-based SSCGs to the 95 percent upper confidence limit (UCL_{95}) for each property.
    a. Shell's RESPONSE: For chemicals that are present at concentrations above the BTV, a one-sample proportion test will be used to compare the Site data with the BTVs.
    b. OEHHA's RESPONSE: Shell's methodology is adequate.
4. In order to fully evaluate background arsenic and PAHs, reviewers need to see site-wide arsenic & PAH data.
    a. OEHHA's RESPONSE: Sell indicates that hese data will be supplied as part of the HHRA.
5. Please consider evaluating the outdoor vapor inhalation pathway for residents or explain the exclusion of this pathway.
    a. OEHHA's RESPONSE: Appendix D includes the statement "soil vapor to outdoor air screening levels were developed for the soil vapor to outdoor air pathway for residential exposures. However, this does not seem to be the case. The soil to outdoor air pathway was evaluated for residential exposures and the community air study and the outdoor air monitoring address outdoor air.
6. OEHHA supports assessing exposure and risk over the area to which individuals are likely to be exposed. This is typically the UCL_{95} for each property, but if there are not enough samples from a given parcel to calculate a UCL, the exposure and risk calculations should be based on the maximum detected concentration in a particular medium on that parcel. OEHHA supports the summation of chemical-specific risks and hazards to estimate cumulative risks and hazards. The implication of cumulative risks and/or hazards that exceed target levels needs to be considered.
    a. OEHHA's RESPONSE: This approach (described on page 44-45) was included in the original SSCG report.

SSCGs

- OEHHA was able to verify selected soil and soil vapor SSCGs by using the SSCG as the exposure concentration in a forward calculation.
- The assumed exposure of 4 days per year for soils from 2 to 10 feet bgs has been commented on previously. This assumption results in very high SSCGs for some contaminants in soils from 2 to 10 feet bgs.

Regression analysis of indoor VOCs and their possible sources

- The use of detection limits as the explanatory variables for 1,2-DCA, benzene, carbon tetrachloride, ethylbenzene, m,p-xylene, and o-xylene may distort the relationship making it more difficult to discern any actual relationship (Table B-14 and Attachment A). Using benzene as an example:
    - In Figure 2 the indoor benzene concentrations corresponding to the non-detects in the sub-slab vary over about 3 orders of magnitude. Since there is no corresponding measured variation in sub-slab benzene it is difficult to tell how much of this variation in indoor benzene could be explained by variation in sub-slab benzene.
    - If sub-slab benzene is contributing to indoor benzene, one would expect the 13 or so data-points where benzene was detected in sub-slab vapors to have indoor values that are higher than those associated with non-detects. No such a difference is apparent in the graphic.
    - Unfortunately, there is no separate analysis of the 13 data points.
- The graphics in Attachment B clearly show that as apparent attenuation factor (AAF) values decline, the correlation between IA-OA and sub-slab VOCs increases.
- The table on page B-18 shows values for the correlation coefficient, usually designated as r. The graphs in Attachment B show similar values for r^2. Please clarify whether these are r or r^2 values. (Presumably these are r values since r^2 [in most cases] cannot have a negative value.) Also, the graphic depicts, a negative r with positive beta, which seems unusual at best.
- Plots of AAF versus sub-slab VOCs (Figures B-10 & B-11) are more instructive in this regard. For chlorinated compounds, the AAF appears to flatten out at around 0.001. For petroleum compounds, the AAF also appears to flatten out at around 0.001, but the trend is less clear. For non-chlorinated solvents, the AAF does not appear to have reached a point of flattening out.
    - The trend-line in B-11 is not labeled and it is unclear what it represents.

Community air

- Section 7.1 states that "all statistical tests (ANOVA, t-test, and Mann-Whitney) show that air concentrations within the Site boundary are not significantly different from concentrations from areas to the east (generally downwind) and west (generally upwind) of the Site." While not disputing the veracity of that statement, OEHHA cautions that failure to reject the null hypothesis does not mean that the alternative hypothesis is proven, i.e. that the VOC concentrations in the different air masses are the same.

- However, alternative methods of data analysis, e.g. binomial distribution, as noted in our August 19, 2013 memorandum, raise the possibility that there are small increases in VOCs other than naphthalene that are below the detection thresholds of the statistical tests employed in the study report.
- OEHHA concurs with the conclusion that VOCs in the outdoor air at the Carousel Tract are within the reported range of VOCs in regional outdoor air, with the possible exception of naphthalene.

Editorial comments

- The factors labeled ECSS-SV-IA and ECSV-OA Section 5.1 of Appendix A would seem to be attenuation factors based on their units, but they are labeled as exposure concentrations.
- The last paragraph on ES-6 seems misplaced.
- The word "receptor" is not only unnecessary jargon but also, offensive to any resident of Carousel Tract who happens to read this document. In most, if not all, cases, "residential receptor" can be replaced with "resident" without loss of meaning.
- Appendix A section 3.1.2.2 presents equations for soil vapor to outdoor air then goes on to show how soil vapor concentrations are estimated from soil concentrations, which begs the question: "If soil vapor concentrations are estimated, why not use standard soil to outdoor air equations?" Based on a recent conference call, it is OEHHS's understanding that the more direct calculation will be used depending on the medium being analyzed.
- In some cases "VF" (meaning "volatilization factor") represents the ratio of VOC concentrations in outdoor air to soil vapor. This is dilution, not volatilization.
- Appendix A section 3.1.2.2, $VF_{soil\text{-}OA}$ is identified as the ratio of the outdoor air exposure point concentration ($EPC_{soil\text{-}OA}$) to the soil exposure point concentration (EPC_{soil}) in the text, but in the following equation, it is the inverse.
- Also in Table A-2 Soil vapor-to-outdoor air volatilization factor $VF_{SV\text{-}OA}$ (µg/m^3 per µg/m^3) is identified as the ratio of chemical concentration in outdoor air (µg/m^3) to chemical concentration in soil vapor (µg/m^3). In Table A-3b, the units for $VF_{SV\text{-}OA}$ are given as "µg/m^3 per µg/m^{3}" without specifying what media are represented by these units, but it is clear from the spreadsheets that $VF_{SV\text{-}OA}$ must be the ratio of chemical concentration in soil vapor to that in outdoor air.
- Similarly, in Table A-6 $EC_{SV\text{-}OA}$ (the exposure concentration for outdoor inhalation of chemicals from soil vapor is given as mg/m^3 per mg/m^3, and $VF_{SV\text{-}OA}$ (the volatilization factor is given as µg/m^3 per µg/m^3. One might think these are the same. But they are apparently inverted. Because the media represented by these units are not specified this inversion is not obvious.
- In Table A-3a (first 3 lines) "-"indicates division, contrary to common usage.

- In Table A-5, $EC_{SS\text{-}SV\text{-}IA}$ is defined as an exposure concentration. But the units are mg/m^3 per mg/kg. This is not a concentration, but a ratio, specifically the inverse of the VF, adjusted for exposure parameters.
- In Table A-7, $EC_{inh,soil}$ is defined as an exposure concentration. But the units are mg/m^3 per mg/ m^3. Clearly it is not a concentration; since the units in the equation cancel out, it must be some kind of a ratio. I might guess that it was intended to have an attenuation factor on the right side of the equation, in which case $EC_{inh,soil}$ could be an attenuation factor, adjusted for exposure parameters.
- The concerns reflected in the above comments refer to communication issues only. Since OEHHA was supplied with spreadsheets, we were able to verify the actual calculations. Not all readers will have that ability.

Conclusions and next steps

- OEHHA has verified the residential and occupational SSCGs for soil and soil vapor, but questions the exposure assumptions for soils from 2 to 10 feet bgs.
- The graphics in Attachment B and Tables B-10 and B-11, support an upper bound on alpha around 0.001. However, please identify the trend-line in B-11 and explain the correlation coefficients in Appendix B, as noted above.
- A univariate regression of sub-slab versus indoor minus outdoor benzene using only detected benzene data would help to dispel controversy concerning this relationship.
- Notwithstanding the conclusion that VOCs in the outdoor air at the Carousel Tract are generally within the reported range of VOCs in regional outdoor air, OEHHA considers the equivalence of upwind, on-site, and downwind VOC concentrations to be an open question.
- Please consider the editorial comments.

Peer reviewed by

H.H.

Hristo Hristov, MD, PhD