

# Office of Environmental Health Hazard Assessment



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## MEMORANDUM

**TO:** Teklewold Ayalew  
Engineering Geologist  
Regional Water Quality Control Board, Los Angeles Region  
320 West 4<sup>th</sup> Street, Suite 200  
Los Angeles, CA 90013

**FROM:** James C. Carlisle, D.V.M., M.Sc.,  
Staff Toxicologist  
Integrated Risk Assessment Branch *J.C.*

**DATE:** August 9, 2010

**SUBJECT:** REVIEW OF THE TENTATIVE CLEANUP AND ABATEMENT ORDER  
FOR THE FORMER KAST PROPERTY TANK FARM IN CARSON, CA  
BY DR. PAUL ROSENFELD, DATED JULY 28, 2010, (R4-09-17)  
OEHHA # 880212-01

### Document reviewed

- Memorandum to Mr. Ken Harris, Interim Assistant Executive Officer for the California Regional Water Quality Control Board, Los Angeles Region, from Dr. Paul Rosenfeld, of the Soil/ Water/ Air/ Protection Enterprise (SWAPE), dated July 28, 2010, regarding the tentative Cleanup and Abatement Order for the former Kast Property Tank Farm in Carson, CA. Dr. Rosenfeld analyzed the sampling data available thus far and conducted an independent preliminary risk assessment.

### OEHHA analysis

- Following is OEHHA's analysis of those points in Dr. Rosenfeld's comments that relate risk and/or hazard assessment. Dr. Rosenfeld's comments are presented in black Arial font, followed by OEHHA's responses in red Tahoma font.

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## SWAPE

Soil vapor data used in the risk assessment were obtained from the State Water Resources Control Board (SWRCB) Geotracker website (soil vapor data including sub-slab vapor data through 5/25/2010) and the independent contractor Environmental Engineering & Contracting (EEC), Inc. (sub-slab vapor data through 6/23/2010). While I have reviewed and incorporated the results of sub-slab vapor sampling into this risk assessment, these values may underestimate the contamination at the Site due to the possible venting of gases to the atmosphere before and during sampling.

## OEHHA

- Some venting of gasses is probably happening continuously and therefore soil vapor levels may have been higher in the past.
- While venting of gases to the atmosphere during sampling is possible, the sampling protocols are designed to prevent or minimize this possibility. OEHHA routinely accepts the results of sampling using these protocols

## SWAPE

Benzene soil vapor data from the Site were evaluated using the USEPA approved software, ProUCL, to determine an upper confidence limit (UCL). The USEPA's 1989 Risk Assessment Guidance for Superfund requires that risk assessments of Superfund Site be based on an estimate of the Reasonable Maximum Exposure (RME) at the entire site (Appendix C – 1989 USEPA Risk Assessment Guidance for Superfund). The document explains, "The reasonable maximum exposure is defined here as the highest exposure that is reasonably expected to occur at a site....Because of the uncertainty associated with any estimate of exposure concentration, the upper confidence limit (i.e. the 95 percent UCL) on the arithmetic average will be used for this variable."

## OEHHA

- The former Kast Property Tank Farm in Carson has been for many years subdivided into approximately 285 individual lots, comprising the Carousel Subdivision. Each resident is exposed primarily to the soil on his or her individual lot and to the air in and around and his or her house. Thus, the site-wide average benzene concentration (and the UCL thereon) is not a useful metric for assessing exposure to these residents. OEHHA supports assessing exposure and risk over the area to which individuals are likely to be exposed. That often means assessing exposure for each parcel separately, as is the case here.
- Parcel-specific risks may be calculated based on the UCL on the mean for that parcel; however, in most cases, there are not enough samples from a given parcel to calculate a UCL, so the exposure and risk calculations are based on the maximum detected concentration on that parcel.
- URS calculated the risks and hazards based on the maximum detected concentration at each property using methodology that was pre-approved by

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OEHHA. Based on the approved workplan and on random checks of the calculations, OEHHA supports their results.

## SWAPE

Following determination of the benzene soil gas UCL concentrations, preliminary cancer risk estimates for residents from indoor benzene vapor intrusion were determined using a model developed by Johnson and Ettinger. The USEPA's Johnson-Ettinger model is designed to allow the user to input soil gas concentrations and sampling depth information and calculate a cancer risk from vapor intrusion to indoor air (Appendix E – User's Guide for Evaluating Subsurface Vapor Intrusion Into Buildings). The UCL at 0-5 ft (incorporating the sub-slab soil vapor results approximated at 0.5 ft bgs) is determined to be 66,161  $\mu\text{g}/\text{m}^3$ . The cancer risk to residents at the site from vapor intrusion to indoor air was calculated to be  $5.0 \times 10^{-4}$ , or 500 excess cancers in one million (or 5 excess cancers in ten thousand). (Appendix F – ProUCL Outputs; Appendix G – Johnson & Ettinger Model Output) The UCL at 0-10 ft bgs is determined to be 66,349  $\mu\text{g}/\text{m}^3$ . The cancer risk to residents at the site from vapor intrusion to indoor air was calculated to be  $5.0 \times 10^{-4}$ , or 500 excess cancers in one million (or 5 excess cancers in ten thousand).

## OEHHA

- SWAPE cites risk estimates for 0-5 feet (based on 459 samples) and for 0-10 feet (based on 460 samples, i.e including one additional sample).
- As previously stated, OEHHA does not consider site-wide data to be useful for estimating individual residents' exposure.
- SWAPE assumed a depth of 17 inches for the 0-5 foot samples and a depth of 36 inches for the 0-10 foot samples. The basis for these assumed depths is not stated. Based on DTSC (2005) guidance, OEHHA does not recommend mixing data from different depth for estimating vapor intrusion.
- Based on DTSC (2005) guidance, OEHHA typically assumes an attenuation factor of 0.01 for sub-slab samples. SWAPE's attenuation factors were 0.00238 and 0.00103 for the depths of 17 and 36 inches, respectively. (Smaller attenuation factors lead to a lower predicted risk.)

## SWAPE

These levels of benzene represent a serious hazard to the residents of the Site. The EPA's "acceptable" carcinogen risk range is  $10^{-6}$  (one excess cancer in one million – more stringent criteria) to  $10^{-4}$  (one excess cancer in ten thousand – less stringent) (Appendix H – User's Guide for USEPA PRG Table).

## OEHHA

- OEHHA and URS' screening levels are based on an upper-bound risk of  $10^{-6}$  (one excess cancer in one million) the more stringent end of the range.

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## SWAPE

Thus, cancer risks to residents at the Site from benzene vapor exceed the EPA's acceptable risk levels at least several times over. Furthermore, benzene levels at the Site are significantly higher than the California Environmental Protection Agency's (Cal/EPA) California Human Health Screening Level (CHHSL) for benzene in soil gas of  $36.2 \mu\text{g}/\text{m}^3$ , established for a residential scenario and developed to protect human health (Appendix I - CalEPA CHHSLs).

## OEHHA

- OEHHA does not agree with SWAPE's calculations, but does agree that estimated upper-bound cancer risks to some residents at the Carousel Tract from benzene vapor exceed the *de minimus* risk level of  $10^{-6}$ .

## SWAPE

The risk to human health from benzene is well-recognized (Appendix J – ATSDR Toxicological Profile for Benzene). Multiple authoritative bodies, including OEHHA, IARC, WHO, USEPA, and DHHS, recognize benzene as a known human carcinogen. The International Agency for Research on Cancer (IARC) classifies benzene as a Group 1 carcinogen, indicating by definition that the evidence of carcinogenicity to humans is sufficient. The USEPA classifies benzene as a Category A known human carcinogen, for all routes of exposure based on human evidence as well as supporting evidence from animal studies. Benzene is also considered a known carcinogen by the Department of Health and Human Services based on human evidence showing a causal relationship between benzene exposure and cancer.

## OEHHA

- OEHHA agrees that benzene is a known human carcinogen.

## SWAPE

Furthermore, studies have demonstrated the negative health effects to residents from exposure to gasoline leaked from underground storage tanks (Appendix K – Patel 2004). In addition, the American Petroleum Institute (API) in 1948, stated that, "Inasmuch as the body develops no tolerance to benzene, and as there is a wide variation in individual susceptibility, it is generally considered that the only absolutely safe concentration for benzene is zero." (Appendix L – 1948 API Toxicological Review of Benzene)

## OEHHA

- OEHHA agrees that the only absolutely safe concentration for benzene - or any other carcinogen - is zero. However, our society has generally accepted that zero concentration and zero risk are not achievable. Instead, we have developed *de minimus* levels (meaning below levels of concern). The screening levels established for this site are based on a *de minimus* risk level of  $10^{-6}$ , the lowest level in common usage and as much as 100-fold lower than levels frequently accepted by US EPA.

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## SWAPE

The levels of benzene and PAHs at the former Kast site are dangerously elevated and the need for a complete remediation is evident. It is clear, furthermore, that remediation should proceed under the principle that the Site is one Operable Unit, as opposed to individual tracts of land with separate contamination, risk, and remediation requirements. The term, "Operable Unit," is defined by the Navy as "a group of one or more clean-up sites that have similar characteristics, such as contaminants, industrial processes, or location" (Appendix M – U.S. Navy Glossary of Acronyms and Terms). In this instance, the homes at the Site all share contaminants of concern, historical industrial processes, and location; thus, the entire Site should be considered one Operable Unit for risk assessment and remediation purposes.

## OEHHA

- Considering the entire site as a single operable unit, as suggested by SWAPE, could result in underestimating the risk for some properties and overestimating the risk for other properties.
- OEHHA has consistently taken the position that exposure and risk should be calculated based on the areas corresponding to individual exposures. If a contaminated site is treated as a single unit for risk assessment purposes, more-contaminated areas are averaged together with less-contaminated areas and the site-wide average or UCL may indicate that there is no problem, even though residents in the more contaminated areas may be subject to risks that would be deemed unacceptable.

## Conclusions

- The SWAPE benzene risk estimates are based on a site-wide database that combines data from different depths, contrary to accepted practice. OEHHA does not believe that these estimates are correctly calculated nor that the results, even if corrected, would be relevant for any individual resident.
- OEHHA is not suggesting that that the high benzene levels detected in some samples are not a problem or that they should not be remediated. The point is that individual residents' risk should be assessed based on the soil gas data directly relevant to that resident.

If you have any questions, do not hesitate to call or e-mail me at 916-323-2635 or [JCarlisle@OEHHA.CA.gov](mailto:JCarlisle@OEHHA.CA.gov), respectively.

Memo reviewed by:

*David Siegel*

David Siegel, Ph.D., DABT.  
Supervising Toxicologist

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## Reference

DTSC, 2005, Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air, Department of Toxic Substances Control, California Environmental Protection Agency, December 15, 2004 (Revised February 7, 2005)

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