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STATE WATER RESOURCES CONTROL BOARD

FOR THE STATE OF CALIFORNIA

In the Matter of the Petition of EQUILON ENTERPRISES LLC dba SHELL OIL PRODUCTS US and SHELL OIL COMPANY Cleanup and Abatement Order R4-2011-0046 California Regional Water Quality Control Board, Los Angeles Region California Water Code § 13304	Case No. **PETITION FOR REVIEW OF REGIONAL BOARD'S APRIL 30, 2014 ORDER PURSUANT TO WATER CODE § 13304; REQUEST FOR HEARING**

Equilon Enterprises LLC dba Shell Oil Products US and Shell Oil Company (collectively "Shell") hereby file this protective Petition for Review ("Petition"), along with the supporting Declaration of Douglas J. Weimer and exhibits (attached hereto and referred to hereafter as "Weimer Decl."). Pursuant to California Code of Regulations, Title 23, § 2050.5(d), Shell requests that this Petition be held in abeyance pending further discussions between Shell and the California Regional Water Quality Board, Los Angeles Region (the "Regional Board"), as they attempt to informally resolve the matters raised herein. However, if Shell's request for this Petition to be held in abeyance is not granted, or if following the abeyance period the issues raised herein are not resolved, Shell requests that a hearing regarding this Petition be held. *See* Water Code § 13320; 23 Cal. Code Regs. § 2052.

Notwithstanding the technical issues raised in this protective Petition, Shell intends to submit the revised Remedial Action Plan ("RAP"), Feasibility Study ("FS"), and Human Health Risk Assessment Report ("HHRA Report") to the Regional Board by the applicable deadline.

Shell alleges as follows:

1. Shell's mailing address is 20945 South Wilmington Avenue, Carson, California 90810. (Weimer Decl., ¶ 2.) Shell requests that all communications relating to this Petition should be sent to Mr. Weimer at the foregoing address with copies sent to the above-captioned counsel.

2. Since 2008, Shell has been conducting an environmental investigation of the former Kast Property located southeast of the intersection of Marbella Avenue and E. 244th Street in Carson, California ("Site"). (Weimer Decl., ¶ 3.)

3. On March 11, 2011, the Regional Board issued Cleanup and Abatement Order No. R4-2011-0046 (the "CAO") which, *inter alia*, directed Shell to "submit site-specific cleanup goals for residential (i.e., unrestricted) land use" that "shall include detailed technical rationale and assumptions underlying each goal." (Exh. 1, p. 13.)[1] On February 22, 2013, Shell timely submitted its initial Site-Specific Cleanup Goal Report ("Initial SSCG Report"). On August 21, 2013, the Regional Board issued a response to the Initial SSCG Report and directed Shell to revise the Site-Specific Cleanup Goals ("SSCGs") for the Site in accordance with certain comments and directives. On October 21, 2013, Shell timely submitted a Revised Site-Specific Cleanup Goal Report ("Revised SSCG Report") that addressed and incorporated the Regional Board's comments and directives.[2]

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[1] All exhibits referenced herein are attached to the Weimer Declaration.

[2] Copies of Shell's Initial SSCG Report, the Regional Board's August 21, 2013 response, and Shell's Revised SSCG Report are submitted as Exhibits 2 to 4, respectively. The texts of the Initial and Revised SSCG Reports are attached to the Weimer Declaration, and copies of the full reports (with the tables, figures and appendices) are included on CDs that are included with the hard copy of the Petition.

4. On January 23, 2014, the Regional Board issued its Review of Revised Site-Specific Cleanup Goal Report and Directive to Submit the Remedial Action Plan, Human Health Risk Analysis, and Environmental Analysis for Cleanup of the Carousel Tract Pursuant to California Water Code section 13304 ("SSCG Directive").[3] In the SSCG Directive, the Regional Board approved the SSCGs proposed in the Revised SSCG Report with certain modifications, and required Shell to submit the RAP for the Site by March 10, 2014, along with the HHRA Report, and draft environmental documents. (Exh. 5, p. 9.)

5. On February 24, 2014, Shell filed a protective Petition for Review and Request for Hearing ("February 24, 2014 Petition") challenging certain requirements in the SSCG Directive.[4] The February 24, 2014 Petition, which is the subject of SWRCB/OCC File A-2294, included a request that it be held in abeyance, which request was granted by the State Water Resources Control Board ("State Board") on May 14, 2014.[5] Shell and the Regional Board have been able to resolve the majority of the issues raised in the February 24, 2014 Petition. However, one of the requirements challenged in the February 24, 2014 Petition has not yet been resolved and is the subject of this Petition, namely what attenuation factor should be used to calculate SSCGs for soil vapor and sub-slab soil vapor.

6. On March 10, 2014, Shell submitted its RAP, FS and HHRA Report for the Site.[6]

7. On April 30, 2014, the Regional Board issued its Review of Remedial Action Plan, Feasibility Study Report and Human Health Risk Assessment Report Pursuant to California Water Code section 13304 Order ("Revised RAP Directive").[7] In the Revised RAP Directive,

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[3] A copy of the Regional Board's SSCG Directive is attached as Exhibit 5.

[4] For the State Board's convenience, a copy of the February 24, 2014 Petition (without exhibits) is attached as Exhibit 6.

[5] A copy of the State Board's order is attached as Exhibit 7.

[6] Copies of Shell's RAP, FS and HHRA Report are submitted as Exhibits 8 to 10, respectively. The text of these documents are attached to the Weimer Declaration, and copies of the full reports are included on CDs that are included with the hard copy of the Petition.

[7] A copy of the Revised RAP Directive is attached as Exhibit 11.

the Regional Board directed Shell to submit a revised RAP, FS and HHRA Report that comply with specific requirements, including that the RAP "[u]tilizes approved SSCGs set forth in the Regional Board's letter of January 23, 2014, including attenuation factors for soil vapor[,]" and "[r]evises the calculation of the sub-slab to indoor air attenuation factor[.]" (Exh. 11, p. 15.) The Revised RAP Directive requires Shell to submit the revised RAP, FS and HHRA Report by June 16, 2014. (*Id.*, p. 16.) Shell submitted a request to the Regional Board for a two-week extension of this submittal date to June 30, 2014.[8] That request is currently pending.

8. On April 30, 2014, the Regional Board also issued a Notice of Violation ("NOV") to Shell alleging that the RAP was not based on the SSCGs approved by the Regional Board in three respects.[9] For multiple reasons, Shell believes that the issuance of the NOV is unsupported, and Shell delivered a letter to the Regional Board on May 12, 2014 requesting that the NOV be withdrawn.[10] On May 29, 2014, the Regional Board issued a response to Shell's letter in which it revised the SSCG for TPH motor oil (thereby addessing one of the issues raised in Shell's letter) and stated that it would address the other issues raised by Shell concerning the NOV at a future time.[11]

9. Shell submits this Petition to request review by the State Board of certain technical requirements in the Regional Board's Revised RAP Directive. Shell is diligently working to address the Regional Board's comments, and to prepare and finalize the revised RAP, FS and HHRA Report, and it intends to submit these documents by the deadline set by the Regional Board. However, Shell believes that certain requirements and statements in the Revised RAP Directive lack evidentiary, legal, and/or technical support and should be revised as described below. Shell, its consultants, and Regional Board staff have engaged in discussions to

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[8] A copy of this letter is attached as Exhibit 12.

[9] A copy of the Regional Board's NOV is attached as Exhibit 13.

[10] A copy of this letter is attached as Exhibit 14.

[11] A copy of the Regional Board's May 29, 2014 letter is attached as Exhibit 15.

clarify and attempt to resolve the issues raised by the Regional Board; however, due to the statutory deadline provided in Water Code § 13320 for the filing of a Petition for Review, Shell is filing this protective Petition in order to protect its rights, and requests that the Petition be held in abeyance while Shell and the Regional Board discuss these issues. If Shell and the Regional Board are unable to resolve the issues raised herein, Shell will request that the State Board proceed with its review of Shell's Petition and the relevant requirements in the Regional Board's Directives.

10. This Petition for Review is made on the following grounds:

a. *First*, the requirement in the Revised RAP Directive that Shell submit a revised RAP that "[u]tilizes approved SSCGs set forth in the Regional Board's letter of January 23, 2014, including attenuation factors for soil vapor" (Exh. 11, p. 15), is based on an inaccurate characterization of the actual requirement in the SSCG Directive concerning the sole attenuation factor approved by the Regional Board. Moreover, Shell *did use* the SSCGs included in Table 2 of the SSCG Directive, which were based on the approved soil vapor attenuation factor of 0.002. Thus, the RAP that Shell submitted on March 10, 2014 *already* complied with the requirement that it utilize the approved attenuation factor in the SSCG Directive. For these reasons, the requirement that Shell "[r]evise[] the calculation of the sub-slab to indoor air attenuation factor and reidentif[y] properties . . . for consideration of sub-slab mitigation" disregards the fact that Shell used the attenuation factor approved in the SSCG Directive. (*Id.*) It should be noted that, although the RAP and HHRA Report incorporated the attenuation factor approved by the Regional Board in the SSCG Directive, Shell still believes that the use of this default attenuation factor is unnecessary and improper because extensive Site data has been collected, and, using that data, Shell calculated an upper bound Site attenuation factor for soil vapor of 0.001. This issue was raised in Shell's February 24, 2014 Petition, and Shell renews its objection to the use of a default attenuation factor.

b. With respect to soil vapor beneath the streets, the RAP included a comparison of soil vapor results to the approved SSCGs for benzene and napthalene (the two primary Site-related compounds of concern ("COCs")), and the proposed remedy presented in the

RAP includes a joint soil vapor extraction ("SVE") and bioventing system to address such exceedances. (*See* Exh. 8, Figures 3-10, 3-11 and pp. 8-9 to 8-13.)

c. *Second*, the requirement that the revised RAP include a confirmation sampling plan for soil in order to verify the effectiveness of the excavation portion of the remedy is inappropriate for this Site due to the manner in which the impacts are distributed in soil at the Site. While confirmation sampling is typically utilized when addressing a discrete soil plume caused by, *e.g.*, an underground storage tank leak, given the varied distribution of impacts and the fact that many impacts are located in areas that will not be excavated, confirmation sampling of soil will not provide meaningful information regarding the effectiveness of the excavations. Moreover, Shell has already collected an extensive data set of over 11,000 soil samples that document the location of impacts.

d. *Third*, there are certain statements contained in the Revised RAP Directive that Shell believes are unsupported and the most significant of these should be revised or withdrawn. Regarding the proposed combined SVE/bioventing system, the Revised RAP Directive states that the time frame required is not "reasonable." (Exh. 11, pp. 8, 9.) However, the Regional Board estimates an 80-year time frame which appears to be based on the bioventing component alone. (*Id.*) In fact, Shell estimates in the RAP that the combined system will take approximately 30 years to remediate soils with TPH concentrations of 10,000 mg/kg, and the volatile (or "mobile") fractions of TPH and VOCs will be removed to cleanup goals by SVE in approximately five years. (Exh. 8, p. 8-14.) The Regional Board has not explained why these time frames would not be reasonable or what time frames it has used at other similar sites when evaluating the use of bioventing *and* SVE. The Regional Board also states that bioventing will generate intermediate waste products that will pose risks to residents (Exh. 11, p. 13), but this concern is not raised in the State Board or US EPA regulatory guidance on the use of bioventing, and this statement fails to recognize that natural biodegradation will degrade any intermediate products that may be generated. Moreover, the combined SVE/bioventing system will remove those intermediate waste products during SVE mode operation The Regional Board also states that the RAP did not consider the Plume Delineation Report (*id.*, p. 9), but this is patently incorrect as data from the Plume Delineation Report (updated to include subsequent data) was considered and used throughout the RAP and the HHRA Report.

11. This Petition is filed pursuant to Water Code section 13320, which authorizes any aggrieved person to petition the State Board to review any action (or failure to act) by a regional board pursuant to, *inter alia*, Section 13304. *See* Water Code § 13223 (actions of the regional board shall include actions by its executive officer pursuant to powers and duties delegated to him by the regional board). Shell is an aggrieved party in this instance because the requirements and statements in the Revised RAP Directive that are the subject of this Petition lack evidentiary, legal, and/or technical support and should be revised as described below.

12. Shell respectfully requests that the State Board grant the relief set forth in the Request for Relief. Shell also requests a hearing regarding this Petition. The arguments that Shell wishes to make at the hearing are summarized in this Petition, as is the testimony and evidence that Shell would introduce at the hearing, which also are contained in the administrative record for this matter. Shell reserves its right to supplement the testimony and evidence both prior to, and at, the hearing on this Petition.

13. Shell's Statement of Points and Authorities in support of the issues raised by this Petition is set forth below. Shell previously raised the issues discussed herein with the Regional Board. (Weimer Decl., ¶ 30.)

14. Shell reserves the right to modify and supplement this Petition, and also requests an opportunity to present additional evidence, including any evidence that comes to light following the filing of this Petition. *See* 23 Cal. Code Regs. § 2050.6.

15. A copy of this Petition are being sent on this day by personal delivery to the Regional Board to the attention of Mr. Samuel Unger, Executive Officer.

STATEMENT OF POINTS AND AUTHORITIES

I. BACKGROUND

Shell's Investigation of the Site

16. The Site is an approximately 44-acre residential housing tract located southeast of Marbella Avenue and E. 244th Street in Carson, California. (Weimer Decl., ¶ 3.) Historical records have established the following background regarding the Site. In 1923, Shell Company of California, a corporation, purchased the Site for use as an oil storage facility at a time when the surrounding area was largely undeveloped. (*Id.*, ¶ 13.) It then constructed three large reservoirs on the property, which were lined with concrete and surrounded by 15-foot-high levees. (*Id.*) The reservoirs were covered by frame roofs on wood posts. (*Id.*) The reservoirs were primarily used to store crude oil. (*Id.*)

17. Active use of the reservoirs generally ceased by the early 1960s. (*Id.*, ¶ 14.) In 1965, after removing most of the oil from the concrete reservoirs, Shell Oil Company sold the property to Richard Barclay of Barclay Hollander Curci and Lomita Development Company (the "Developers"). (*Id.*) Shell is informed and believes that Barclay Hollander Curci became Barclay Hollander Corporation, which is now an affiliate of Dole Food Company, Inc. (*Id.*) The Developers bought the property from Shell with knowledge of the property's former use and agreed to perform the site-clearing work, including removal of the remaining liquids, demolition of the reservoirs, and permitting and grading. (*Id.*) The Developers secured a zoning change for the property, decommissioned the reservoirs, graded the property, and constructed and sold the 285 homes which now form the residential tract in Carson, California known as the Carousel neighborhood. (*Id.*) However, to date, the Developers have not participated in the environmental investigation or agreed to participate in any future cleanup. (*Id.*)

18. In 2008, Turco Products, Inc. ("Turco"), which was investigating contamination (primarily chlorinated compound impacts) at its facility adjacent to the northwest portion of the Site, performed step-out sampling which revealed petroleum hydrocarbon contamination at the Site. (*Id.*, ¶ 15.) The Department of Toxic Substances Control ("DTSC") notified the Regional Board regarding the petroleum contamination, which in turn notified Shell. (*Id.*) Based on

review of historical aerial maps of the area, the former oil storage reservoirs were identified as a potential source of contamination at the Site. (*Id.*)

19. Following notification from the Regional Board, Shell began an extensive and thorough investigation of the soil, soil vapor, groundwater, and indoor and outdoor air at and beneath the Site and adjacent areas, including both public and residential areas. (*Id.*, ¶ 16.) The sampling protocol proposed by Shell and approved by the Regional Board for the 285 residences at the Site requires the collection and analysis of the following samples: (1) soil at multiple locations and depths in the front- and backyards at each residence where exposed; (2) sub-slab soil vapor at three locations from beneath the slabs of each residence at the Site where feasible; and (3) the indoor and outdoor air at the residence on two occasions at least 90 days apart. (*Id.*) In addition, an indoor air methane screening program is utilized early in the process to assess whether methane is an issue in any of the residences. (*Id.*) The results of the tests are submitted to the Regional Board, posted on the State Board's publicly accessible Geotracker website, and also are forwarded to the Carousel residents or their designated legal representatives. (*Id.*)

20. The testing program is ongoing as access is granted by the residents. (*Id.*, ¶ 17.) As of May 23, 2014, Shell has collected samples at 95% of the homes in the Carousel neighborhood, and has completed all required testing at 82% of the homes. (*Id.*) Shell has been conducting outreach to schedule the remaining houses and complete all residential testing. (*Id.*)

21. Shell has also conducted an extensive testing program in the public rights-of-way (*e.g.*, below the streets) in the Carousel neighborhood and surrounding communities that has included soil, soil vapor, and groundwater sampling, and methane monitoring in utility vaults, stormwater drains, and the like. (*Id.*, ¶ 18.) Shell continues to regularly conduct groundwater and sub-surface soil vapor sampling, and conduct methane monitoring on an ongoing basis. (*Id.*) All sampling results are submitted to the Regional Board and posted to the Geotracker website. (*Id.*)

22. The Regional Board has described Shell's investigation of the Site as "thorough" and "extensive" and stated that Shell's site investigation has "provided reliable, comprehensive, and high-quality data." (Exh. 3, p. 2.) Shell has collected over 11,000 soil samples, 2,700 soil

vapor samples, and over 2,450 indoor and outdoor air samples, and Shell's testing program is ongoing. (Weimer Decl., ¶ 19.)

The Results of the Sampling at the Site

23. The Site investigation is nearly completed. (Weimer Decl., ¶ 20.) Based on the data obtained thus far, the results can be summarized as follows.

24. *First*, the Regional Board and the Los Angeles County Department of Public Health have concluded that, while environmental impacts exist at the Site related to Shell's former use of the Site and the subsequent development of the Site by the Developers, the environmental conditions at the Site do not pose an imminent threat to the health and safety of the Carousel residents. (*Id.*, ¶ 21.) Shell has performed regular methane monitoring using field instruments at 69 locations in the public rights-of-way such as utility vaults, stormwater drains, and similar locations, and methane has never been detected at levels of concern. (*Id.*) The Los Angeles County Fire Department has also performed methane monitoring in the public areas of the Site and has not detected methane at levels of concern. (*Id.*)

25. Methane has not been detected in laboratory analysis of any of the more than 1,400 indoor air samples that have been collected from Carousel residences. (*Id.*, ¶ 22.) The residential methane screening program, which is conducted prior to indoor air sampling, has detected only isolated instances of elevated methane due to natural gas leaks from utility lines or appliances, and in those instances Shell has advised the residents to repair those leaks. (*Id.*) Subsequent testing, when performed, has not revealed any methane hazards. (*Id.*) In the single instance where elevated methane detected in the soil gas was determined to be primarily related to petroleum hydrocarbon degradation, Shell installed a methane mitigation system according to an engineering design and work plan approved by the Regional Board and Los Angeles County Department of Public Works Environmental Programs Division. (*Id.*) Multiple rounds of follow-up testing have not shown any methane hazard at that home. (*Id.*)

26. While elevated levels of methane presumably related to anaerobic biodegradation of petroleum hydrocarbons have been detected at depth, the lack of oxygen and any significant vapor pressure at depth mitigates any risk related to explosion or fire. (*Id.*, ¶ 23.) Site data

indicate that methane generated by degradation of petroleum hydrocarbons at depth under anaerobic conditions is naturally controlled through biodegradation as it migrates through aerobic near-surface soil. (*Id.*)

27. *Second*, analysis of the indoor air, outdoor air, and sub-slab soil vapor samples collected from the residences at the Site generally have shown indoor air concentrations to be consistent with background values and to be correlated with garage and outdoor air. (*Id.*, ¶ 24.) As the independent UCLA Expert Panel for this project recently stated, "[b]ased on extensive on-site testing, no properties exhibited health exceedances for indoor air pollutants." (Exh. 11, Memo to Los Angeles Regional Water Quality Control Board from UCLA Expert Panel, dated April 29, 2013, p. 13.)

28. *Third*, there are widespread but uneven petroleum impacts in soil from zero to ten feet at the Site that appear to be related to the grading of the Site. (*Id.*, ¶ 25.) The spatial distribution of the soil impacts is somewhat stochastic and does not appear as a plume. (*Id.*)

29. *Fourth*, the groundwater beneath the Site is impacted by a plume. (*Id.*, ¶ 26.) There exist multiple documented upgradient impacts that likely contribute to the groundwater conditions beneath the Site. (*Id.*) Petroleum hydrocarbons in the form of light non-aqueous phase liquid ("LNAPL") have been detected in two monitoring wells located in the western portion of the Site, and LNAPL removal from these wells is performed on a regular basis. (*Id.*) The groundwater at the Site is not used for municipal supply. (*Id.*) Carousel residents obtain their drinking water from municipal supply provided by California Water Service Company, which has confirmed that the Site's water supply meets quality standards for drinking water. (*Id.*)

<u>Shell's Actions in Response to the CAO</u>

30. On March 11, 2011, the Regional Board issued the CAO for the Site. (Exh. 1.) The CAO directed Shell to (1) complete delineation of on- and off-Site impacts in soil, soil vapor, and groundwater related to Shell's historical use of the Site; (2) continue groundwater monitoring and reporting; (3) develop and conduct a pilot testing work plan to evaluate remedial options for the Site; and (4) conduct an assessment of any potential environmental impacts of

residual concrete slabs that were left at the Site by the developers, and evaluate whether removal of the concrete is necessary and feasible. (Exh. 1, pp. 9-11.) Shell has completed (or, in the case of the residential sampling, nearly completed) the above actions and has submitted reports to the Regional Board that include analysis of the data. (Weimer Decl., ¶ 27.) The pilot test, which was approved by the Regional Board and conducted by Shell, included pilot testing of different excavation methods, soil vapor extraction, bioventing, and chemical oxidation technologies. (*Id.*) Shell continues to perform quarterly groundwater monitoring. (*Id.*)

The Regional Board's SSCG Directive and Shell's February 24, 2014 Petition

31. The CAO also required Shell to prepare and "submit site-specific cleanup goals for residential (i.e., unrestricted) land use" that "shall include detailed technical rationale and assumptions underlying each goal." (Exh. 1, p. 13.) On February 22, 2013, Shell timely submitted its Initial SSCG Report. (Exh. 2.) On August 21, 2013, the Regional Board issued a response to the Initial SSCG Report and directed Shell to revise the SSCGs for the Site in accordance with certain comments and directives. (Exh. 3.) On October 21, 2013, Shell timely submitted a Revised SSCG Report that addressed and incorporated the Regional Board's comments and directives. (Exh. 4.)

32. On January 23, 2014, the Regional Board issued its SSCG Directive. (Exh. 5.) In the SSCG Directive, the Regional Board approved the SSCGs proposed in the Revised SSCG Report with certain modifications, and required Shell to submit the RAP, HHRA Report, and "draft environmental documents consistent with the California Environmental Quality Act (CEQA)." (Exh. 5, p. 9.)

33. Thereafter, Shell filed its February 24, 2014 Petition seeking review of certain requirements contained in the SSCG Directive. (Exh. 6.) The February 24, 2014 Petition, which is the subject of SWRCB/OCC File A-2294, included a request that it be held in abeyance, which request was granted by the State Water Resources Control Board ("State Board") on May 14, 2014. (Exh. 7.) Shell and the Regional Board have been able to resolve the majority of the issues raised in the February 24, 2014 Petition. (Weimer Decl., ¶ 9.) However, one of the requirements challenged in the February 24, 2014 Petition has not been resolved and is the

subject of this Petition, namely what attenuation factor should be used to calculate SSCGs for soil vapor and sub slab soil vapor. (*Id.*)

Shell's RAP, FS and HHRA Report and the Regional Board's Revised RAP Directive

34. On March 10, 2014, Shell submitted its RAP, FS and HHRA Report for the Site. (Exhs. 8-10.) In these documents, Shell proposed a remedial strategy for the Site that consists of excavation of shallow soils, the installation of a Site-wide SVE and bioventing system to address impacts remaining after excavation, sub-slab mitigation systems at certain properties, active LNAPL recovery, and monitoried natural attenuation of groundwater impacts. (Weimer Decl., ¶ 28.)

35. On April 30, 2014, the Regional Board issued its Revised RAP Directive. (Exh. 11.) In the Revised RAP Directive, the Regional Board directed Shell to submit a revised RAP, FS and HHRA Report that comply with specific requirements, including that the RAP "[u]tilizes approved SSCGs set forth in the Regional Board's letter of January 23, 2014, including attenuation factors for soil vapor[,]" and "[r]evises the calculation of the sub-slab to indoor air attenuation factor[.]" (*Id.*, p. 15.) The Revised RAP Directive also directs Shell to submit a confirmation sampling plan for soil to verify the effectiveness of the excavation portion of the remedy. (*Id.*, p. 16.) The Revised RAP Directive requires Shell to submit the revised RAP, FS and HHRA Report by June 16, 2014.[12] (*Id.*)

The Regional Board's NOV and Shell's Response

36. On April 30, 2014, the Regional Board also issued a NOV to Shell alleging that the RAP was not based on the SSCGs approved by the Regional Board. (Exh. 13.) For multiple reasons, Shell believes that the issuance of the NOV is unsupported, and on May 12, 2014, Shell delivered a letter to the Regional Board requesting that the NOV be withdrawn. (*See* Exh. 14.)

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[12] Shell has requested a two-week extension of this deadline to June 30, 2014. (Exh. 12.) That request is pending.

37. Because the grounds stated in the NOV overlap with the comments in the Revised RAP Directive and the issues raised in the February 24, 2014 Petition and this Petition, they are discussed here. The three specific alleged grounds for the NOV are as follows:

- The NOV alleges that Shell did not base the soil SSCGs for Total Petroleum Hydrocarbons ("TPH") for protection of groundwater on those approved by the Regional Board but instead used values provided by the Regional Board in its Interim Site Assessment Cleanup Guidebook (1996). (Exh. 13, p. 2.) On May 12, 2014, Shell sent a letter to the Regional Board explaining that the SSCG for TPH motor oil approved by the Regional Board was based on a calculation error. (Exh. 14, p. 14-001.) This issue appears to be resolved. On May 29, 2014, the Regional Board issued a response in which it approved the SSCG for TPH motor oil provided in its 1996 guidance for use in the revised RAP as proposed by Shell, and will continue to require the use of the SSCGs for TPH diesel and TPH gasoline provided in its SSCG Directive. (Exh. 15, p. 2.) Shell will incorporate these SSCGs in the revised RAP and HHRA Report.
- The NOV further alleges that "Shell did not base the RAP on the SSCGs for soil vapor using an attenuation factor of 0.002 for indoor air concentrations to outdoor air concentrations as modified and approved in the [SSCG Directive]." (Exh. 13, p. 2.) However, the NOV's characterization of what the SSCG Directive required is incorrect. As Shell explained in its May 12, 2014 letter, the SSCG Directive did *not* require that Shell use an attenuation factor "for indoor air concentrations to outdoor air concentrations" and such a requirement (even had it existed) would be technically unsupported. (*See* Exh. 14, p. 14-004; *see also* Exh. 5, pp. 5-6 (Regional Board approving "the SSCGs for COC *in soil vapor* based on the attenuation factor of 0.002" (emphasis added)). Moreover, despite Shell's disagreement with the grounds for using an attenuation factor of 0.002, Shell in fact did use this value when calculating SSCGs for sub-slab soil vapor in the RAP and HHRA Report. Additionally, with respect to soil vapor beneath the streets,

the RAP compared soil vapor data to the approved SSCGs for the two primary Site COCs (benzene and napthalene), and proposed an SVE/bioventing system to address areas where soil vapor concentrations exceed the SSCGs calculated using an attenuation factor of 0.002. For these reasons, Shell believes that this ground for the NOV is not factually or technically justified and must be withdrawn. Shell and the Regional Board are continuing to discuss the appropriate attentuation factor to include in the Revised RAP and HHRA Report, and Shell is in the process of conducting an additional analysis to provide to the Regional Board for review on this topic so that the Regional Board can make a final determination regarding the appropriate value to use. (Weimer Decl., ¶ 9.)

- Finally, the NOV alleges that "[t]he RAP is not based on boundaries from the Site Delineation Report as directed in the [SSCG Directive]" and, instead, "Shell used only the results of the property-by-property investigations in developing the RAP." (Exh. 13, p. 3.) In fact, the RAP did use data from sampling in the public rights-of-way and elsewhere, including data that was reported in the Plume Delineation Report and that has since been updated. (Exh. 14, pp. 14-006 to 14-008.) Thus, this ground of the NOV is unsupported by the record and must be withdrawn. In its May 29, 2014 letter, the Regional Board stated that it will address these last two issues in a future letter. (Exh. 15, p. 2.)

38. Shell is in the process of preparing the revised RAP, FS and HHRA Report and intends to submit these documents to the Regional Board by the applicable deadline. (Weimer Decl., ¶ 29.) However, the Directive contains certain requirements and statements that lack evidentiary, legal, and/or technical support, or are otherwise erroneous, and should be revised as described below. To protect its rights in this regard, Shell is filing this protective Petition, and seeks State Board review of these specific requirements and statements in the event it is not able to resolve these issues with the Regional Board.

II. THE CHALLENGED SECTIONS OF THE DIRECTIVE SHOULD BE RESCINDED AND REVISED

A. *The Regional Board's Requirement that Shell use the "Attenuation Factors for Soil Vapor" In the SSCG Directive Is Factually and Technically Unsupported*

39. In the Revised RAP Directive, the Regional Board directs Shell to submit a revised RAP that "[u]tilizes approved SSCGs set forth in the Regional Board's letter of January 23, 2014, *including attentuation factors for soil vapor*." (Exh. 11, p. 15 (emphasis added).) The Regional Board also directs Shell to "[r]evise[] the calculation of the sub-slab to indoor air attenuation factor and reidentif[y] properties . . . for consideration of sub-slab mitigation[.]" (*Id.*)

40. There are a number of problems raised by these requirements. First, a comparison of indoor air data to data from below the homes and data from outdoor air indicates no correlation suggestive that vapor intrusion is occuring in a measurable way at the Site. Nonetheless, and despite challenging the use of a default value for the attenuation factor for soil vapor in its Feburary 24, 2014 Petition (as discussed below), Shell *did use* in the RAP the SSCGs included in Table 2 of the SSCG Directive, which were based on the approved soil vapor attenuation factor of 0.002. Thus, the RAP that Shell submitted on March 10, 2014 *already* complied with the requirement that it utilize the approved attenuation factor. Additionally, with respect to soil vapor beneath the streets, the RAP compared soil vapor data to the approved SSCGs for the two primary Site COCs (benzene and napthalene), and proposed an SVE/bioventing system to address areas where soil vapor concentrations exceed the SSCGs calculated using an attenuation factor of 0.002. Hence, the Regional Board is now directing Shell to do what it already has done, and Shell is concerned that the Regional Board may issue a further NOV based on a misunderstanding of what is contained in the RAP and the HHRA Report. For this reason, Shell is requesting review by the State Board in the event this issue is not clarified and resolved with the Regional Board.

41. Second, if this issue ultimately is reviewed by the State Board, Shell still believes (as it argued in its February 24, 2014 Petition) that the use of a default attenuation factor for this Site remains technically unjustified. In the Revised SSCG Report, Shell analyzed the extensive

sub-slab soil vapor and indoor air data collected from the Site and, *based on this data*, calculated an attenuation factor for soil vapor and sub-slab soil vapor of 0.001. (Exh. 4, App. B, pp. B-17 and B-18.) In its SSCG Directive, the Regional Board did not criticize Shell's analysis or methodology, but nevertheless directed Shell to use an attenuation factor of 0.002 to calculate SSCGs for soil vapor that the Regional Board based on default numbers it stated are recommended in DTSC and US EPA agency guidance documents. (Exh. 5, pp. 5-6.) However, the *default* attenuation factor values in these guidance documents are intended to be used for preliminary screening evaluations *when indoor air data is not available*. (DTSC Vapor Intrusion Guidance Document, October 2011, p. 16.) Similarly, Dr. James Carlisle of the Office of Environmental Health Hazard Assessment stated that "[p]aired indoor/sub-slab data for various VOCs can be used to estimate site-specific attenuation factors" and that, "[i]f supported by adequate data, [site-specific attenuation factors] may provide an alternative to" generic or default attenuation factors. Exh. 3, Memo. from James C. Carlisle to Regional Water Quality Control Board, July 22, 2013, p. 3.) Here, extensive Site indoor air data—including over 2,700 soil vapor samples and over 1,400 indoor air samples—have already been collected and analyzed. The Regional Board has described this data set as "reliable, comprehensive, and high quality." (Exh. 3, p. 2.) Given this, the Regional Board's reliance on, and use of, *default values* is inappropriate. Therefore, the requirement in the SSCG and Revised RAP Directives to use a default attenuation factor should be rescinded and revised to incorporate the attenuation factor of 0.001 presented in Shell's Revised SSCG Report, which was based on an analysis of actual sub-slab and indoor air data from the Site.

42. Third, the Regional Board's claim that Shell did not use the approved attenuation factor for sub-slab soil vapor is also problematic because the Revised RAP Directive and the NOV do not accurately state what actually was required in the SSCG Directive. While the Revised RAP Directive states that the revised RAP should utilize the "attenuation *factors* for soil vapor" set forth in the SSCG Directive. (Exh. 11, p. 15 (emphasis added), the Regional Board did not require the use of *multiple* attenuation factors for calculating soil vapor SSCGs. Rather, the Regional Board stated in the SSCG Directive that it "hereby approves the SSCGs for COC in

soil vapor *based on the attenuation factor of 0.002*." (Exh. 5, p. 6 (emphasis added).) No other attenuation factor for soil vapor was approved anywhere in the SSCG Directive. Thus, the SSCG Directive only identified *one* attenuation factor to use when calculating soil vapor SSCGs, and it is the one that Shell actually used in the RAP and HHRA Report to evaluate soil vapor and sub-slab soil vapor data.

43. Fourth, the statement in the NOV that "Shell did not base the RAP on the SSCGs for soil vapor using an attenuation factor of 0.002 *for indoor air concentrations to outdoor air concentrations* as modified and approved in the Regional Board's January 23, 2014 letter" (Exh. 13, p. 2 (emphasis added)) is not based on what actually was stated in the Regional Board's SSCG Directive. As noted above, that directive did not require the use of an attenuation factor of 0.002 for "indoor air concentrations to outdoor air concentrations" but instead required the use of that attenuation factor to calculate "SSCGs for COC in soil vapor[.]" (Exh. 5, p. 6.) In addition to not previously being required, the use of an attenuation factor for indoor air to outdoor air concentrations does not follow a reasonable conceptual site model of exposure and is not technically justified.

44. Fifth, the Regional Board states that "[t]he attenuation factor approved in the Regional Board's January 23, 2014 letter addressed development of SSCGs for soil vapor in shallow soil, not SSCGs in sub-slab soil vapor[,]" (Exh. 11, p. 9). In fact, the SSCG Directive was unclear regarding the application of the approved attenuation factor of 0.002. The SSCG Directive stated that it approved the use of SSCGs "based on the attenuation factor of 0.002" and then directed Shell to use "[t]he approved SSCGs for COC in soil vapor . . . provided in Table 2" which the Regional Board said was intended to replace Table 9-3 of Shell's Revised SSCG Report. (Exh. 5, p. 5-6.) Had the Regional Board actually intended 0.002 to be only used in connection with calculating SSCGs for soil vapor in shallow soil, then this would mean that the Regional Board did not comment on the proposed SSCGs for sub-slab soil vapor provided by Shell in its Revised SSCG Report.

45. Moreover, the sub-slab soil vapor data is the relevant data set to evaluate the vapor intrusion pathway, not the underlying soil vapor data The vapor intrusion model

applicable to the Site posits that residents may be exposed to soil vapor impacts if sub-slab soil vapor intrudes into indoor residential spaces, and is not based on the possibility of exposure to soil vapor in the shallow soil. (Shell notes that the data collected to date generally do not indicate a vapor intrusion issue at the Site.) Deep soil vapor (in the five to 15 feet range) is not relevant given that natural bioattenuation of petroleum hydrocarbons in vadose-zone soils has been demonstrated through the Site investigation. Moroever, extensive sub-slab soil vapor data has been collected and this data is more pertinent to analyzing the possibility of vapor intrusion effects.

46. In short, Shell renews its objections to the use of 0.002 as a Site-wide attenuation factor for use in connection with SSCGs in sub-slab soil vapor, but, in any case, it notes that that the RAP and HHRA Report *already* comply with the requirement that they utilize the SSCGs from Table 2 of the SSCG Directive.

B. The Requirement for a Confirmation Sampling Plan to Verify the Effectiveness of Excavation Is Illogical and Not Technically Justified

47. The Revised RAP Directive directs Shell to include "an appropriate confirmation sampling plan, with a schedule of soil, soil vapor, and groundwater [sampling] to verify the performance of the proposed activies (i.e., Soil Vapor Extraction, Bioventing and Excavation) to document achievement of Regional Board approved SSCGs for all COCs." (Exh. 11, p. 16.)

48. Shell agrees that it makes sense to continue periodic groundwater and soil vapor sampling to confirm the effectiveness of the proposed remedy, and it will include a proposed sampling plan in the revised RAP. Shell also agrees that periodic soil sampling should be conducted in the future to evaluate the effectiveness of the combined SVE/bioventing system (along with monitoring of the effluent from the system), and its proposed confirmation sampling plan will include such a component.

49. However, Shell disagrees that a confirmation soil sampling to verify the effectiveness of the excavation portion of the proposed remedy is suitable for this Site. Such confirmation sampling is typically utilized when addressing a discrete soil plume caused by, *e.g.*, an underground storage tank leak, in order to assess whether the plume boundaries have been

reached by the excavation. As is well documented by the over 11,000 soil samples collected at the Site, the soil impacts in the top ten feet at the Site do not represent a plume. Instead, due to the grading work at the Site conducted by the Developers, the soil impacts vary across the Site. Moreover, because many of the impacts are located in areas that are not technically or economically feasible to reach, excavation will not remove all of the impacts, but will—in combination with SVE and bioventing—be protective of human health and will facilitate restoration of groundwater quality. Given this, and because the excavated areas will be backfilled using certified clean fill, confirmation sampling to verify the effectiveness of the excavations, which would make sense for a different site, would not be useful for this Site.

C. Statements in the Revised RAP Directive Are Unsupported

50. The Revised RAP Directive contains a number of statements that are factually or technically unsupported. While Shell does not request State Board review of every such statement, there are three statements that have important implications and, accordingly, are included in this Petition.

51. *First*, the Revised RAP Directive states in numerous places that the time frame required for operation of the combined SVE/bioventing system is not "reasonable." (Exh. 11, p. 8, 9.) In reaching this conclusion, the Regional Board appears to have relied on an 80-year estimate based on the use of bioventing alone, and did not consider the SVE component. In the RAP, Shell estimates that it will take approximately 30 years for the combined SVE/bioventing system to remediate soils with TPH concentrations of 10,000 mg/kg. (Exh. 8, p. 8-14.) Moreover, SVE is expected to achieve cleanup goals for the volatile or "mobile" fractions of TPH and VOCs in approximately five years, which means that the "leachable" portions of the compounds will be removed from the vadose zone relatively quickly and effectively. (*Id.*) The Regional Board has not explained what it considers to be a "reasonable" time frame for remediation, and what time frame it has used at other similar sites. This is important because any proposed remedy that preserves the neighborhood will include an SVE/bioventing component.

52. *Second*, the Revised RAP Directive states that "bioventing will generate intermediate waste products that will continue to pose risks to residents[.]" (Exh. 11, p. 13.)

However, the State Board and US EPA regulatory guidance documents do not identify this concern for the application of bioventing to petroleum hydrocarbons in vadose-zone soils. Moreover, this statement overlooks the facts that natural biodegradation will degrade any intermediate products that may be generated, and the combined SVE/bioventing system will remove those intermediate waste products during SVE mode operation

53. *Third*, the Revised RAP Directive mistakenly states that "the RAP considered only the results of the property-by-property investigations, and did not consider the Site Delineation Reports." (Exh. 11, p. 9.) In fact, as noted above in discussing the NOV, the RAP used data from sampling in the public rights-of-way and elsewhere, including data that was reported in the Plume Delineation Report and that has since been updated. To wit:

- Shell included updated contour maps that originally were prepared in response to the Regional Board comments to the Plume Delineation Report and included them in Appendix B of the RAP. (Exh. 8, App. B.)
- Tables 1a through 3 in the HHRA Report presented statistical summaries of soil matrix data, soil vapor data, and groundwater data from both residential investigations and from the public rights-of way, which were included in the Plume Delineation Report, as well as subsequent data. (Exh. 10, Tables 1-3.)
- Appendix E of the HHRA Report was based on data that was included in the Plume Delineation Report, as well as subsequent data. (Exh. 10, App. E.)
- Figures 3-3 through 3-14 of the RAP were derived from data that were included in the Plume Delineation Report, as well as subsequent data. (Exh. 8, Figs. 3-3 through 3-14.)
- Appendix B of the RAP presents contour maps that updated prior versions of these maps. (Exh. 8, App. B.) The earlier versions of these maps were prepared in response to comments to the Plume Delineation Report. The updated maps are based on data that were included in the Plume Delineation Report, as well as subsequent data.

REQUEST FOR RELIEF

For the reasons set forth above, Shell respectfully requests that the State Board grant Shell the following relief:

1. That the State Board hold this Petition in abeyance pursuant to California Code of Regulations, Title 23, § 2050.5(d) to permit the Regional Board and Shell to engage in discussions in an attempt to informally resolve this matter.

2. That (if Shell's request for this Petition to be held in abeyance is not granted or, following the abeyance period, the issues raised hereinare not resolved) the State Board hold a hearing on the issues raised herein, and Shell be permitted to present evidence and testimony supporting the arguments contained herein. *See* Water Code § 13320; 23 Cal. Code Regs. § 2052.

3. That the challenged portions of the Revised RAP Directive be rescinded by the State Board and that the State Board direct the Regional Board to revise those portions as described above.

4. Such other relief as the State Board may deem just and proper.

DATED: May 30, 2014

CALDWELL LESLIE & PROCTOR, PC
MICHAEL R. LESLIE
DAVID ZAFT

By [signature]
DAVID ZAFT
Attorneys for Petitioners EQUILON ENTERPRISES LLC dba SHELL OIL PRODUCTS US and SHELL OIL COMPANY

DECLARATION OF DOUGLAS J. WEIMER

I, Douglas J. Weimer, declare and state:

1. I am a Senior Principle Program Manager employed by Equilon Enterprises LLC dba Shell Oil Products US ("SOPUS"). My duties include directing and managing environmental investigations and remediation projects. Based on my involvement in SOPUS's activities relating to the former Kast Property, I have personal knowledge of the facts stated herein, or I have been informed of and believe such facts, and could and would testify competently thereto if called as a witness in this matter.

2. SOPUS's mailing address is 20945 South Wilmington Avenue, Carson, California 90810.

3. Since 2008, SOPUS, on behalf of Shell Oil Company, has been conducting an environmental investigation of the former Kast Property, which is approximately 44 acres in size and is located southeast of the intersection of Marbella Avenue and E. 244th Street in Carson, California ("Site"). (SOPUS and Shell Oil Company are referred to collectively as "Shell.") On March 11, 2011, the California Regional Water Quality Control Board, Los Angeles Region (the "Regional Board") issued Cleanup and Abatement Order No. R4-2011-0046 (the "CAO"). A true and correct copy of the CAO is attached hereto as Exhibit 1. The CAO directed Shell to, *inter alia*, "submit site-specific cleanup goals for residential (i.e., unrestricted) land use" that "shall include detailed technical rationale and assumptions underlying each goal." (Exh. 1 (CAO), p. 13.)

4. On February 22, 2013, Shell timely submitted its initial Site-Specific Cleanup Goal Report ("Initial SSCG Report"). A true and correct copy of the Initial SSCG Report is submitted herewith as Exhibit 2.

5. On August 21, 2013, the Regional Board issued a response to the Initial SSCG Report and directed Shell to revise the Site-Specific Cleanup Goals ("SSCGs") for the Site in accordance with certain comments and directives. A true and correct copy of the Regional Board's August 21, 2013 response letter is attached hereto as Exhibit 3.

6. On October 21, 2013, Shell timely submitted a Revised Site-Specific Cleanup Goal Report ("Revised SSCG Report") that addressed and incorporated the Regional Board's comments and directives. A true and correct copy of the Revised SSCG Report is submitted herewith as Exhibit 4.

7. On January 23, 2014, the Regional Board issued its Review of Revised Site-Specific Cleanup Goal Report and Directive to Submit the Remedial Action Plan, Human Health Risk Analysis, and Environmental Analysis for Cleanup of the Carousel Tract Pursuant to California Water Code section 13304 (the "SSCG Directive"), which is the subject of this Petition. A true and correct copy of the Directive is attached hereto as Exhibit 5.

8. In the SSCG Directive, the Regional Board approved the SSCGs proposed in the Revised SSCG Report with certain modifications, and required Shell to submit a RAP for the Site by March 10, 2014, along with an HHRA Report, and draft environmental documents. (Exh. 5, p. 9.)

9. On February 24, 2014, Shell filed a protective Petition for Review and Request for Hearing ("February 24, 2014 Petition") challenging certain requirements in the SSCG Directive. For the State Board's convenience, a true and correct copy of the February 24, 2014 Petition (without exhibits) is attached as Exhibit 6. The February 24, 2014 Petition, which is the subject of SWRCB/OCC File A-2294, included a request that it be held in abeyance, which request was granted by the State Water Resources Control Board ("State Board") on May 14, 2014. A true and correct copy of the State Board's order is attached as Exhibit 7. Shell and the Regional Board have been able to resolve the majority of the issues raised in the February 24, 2014 Petition. However, one of the requirements challenged in the February 24, 2014 Petition has not been resolved and is the subject of this Petition, namely what attenuation factor should be used to calculate SSCGs for soil vapor. Shell and the Regional Board are continuing to discuss the appropriate attentuation factor to include in the Revised RAP and HHRA Report, and Shell is in the process of conducting an additional analysis to provide to the Regional Board for review on this topic so that the Regional Board can make a final determination regarding the appropriate value to use.

10. On March 10, 2014, Shell submitted its RAP, FS and HHRA Report for the Site. True and correct copies of Shell's RAP, FS and HHRA Report are submitted as Exhibits 8 to 10, respectively. The text of these documents are attached hereto, and copies of the full reports are included on CDs that are included with the hard copy of the Petition.

11. On April 30, 2014, the Regional Board issued its Review of Remedial Action Plan, Feasibility Study Report and Human Health Risk Assessment Report Pursuant to California Water Code section 13304 Order ("Revised RAP Directive"). A true and correct copy of the Revised RAP Directive is attached as Exhibit 11. In the Revised RAP Directive, the Regional Board directed Shell to submit a revised RAP, FS and HHRA Report that comply with specific requirements, including that the RAP "[u]tilizes approved SSCGs set forth in the Regional Board's letter of January 23, 2014, including attenuation factors for soil vapor[,]" and "[r]evises the calculation of the sub-slab to indoor air attenuation factor[.]" (Exh. 11, p. 15.) The Revised RAP Directive requires Shell to submit the revised RAP, FS and HHRA Report by June 16, 2014. (*Id.*, p. 16.) On May 29, 2014, Shell requested an extension of this deadline to June 30, 2014 to allow it to prepare and submit additional analysis and information related to certain technical issues that will be addressed in the revised RAP, FS and HHRA Report. A true and correct copy of that request is attached as Exhibit 12.

12. On April 30, 2014, the Regional Board also issued a Notice of Violation ("NOV") to Shell alleging that the RAP was not based on the SSCGs approved by the Regional Board in three respects. A true and correct copy of the Regional Board's NOV is attached as Exhibit 13. For multiple reasons, Shell believes that the issuance of the NOV is unsupported and, on May 12, 2014, I delivered a letter to the Regional Board requesting that the NOV be withdrawn. A true and correct copy of that letter is attached as Exhibit 14. On May 29, 2014, the Regional Board issued a response to Shell's letter in which it revised the SSCG for TPH motor oil (thereby addessing one of the issues raised in Shell's letter) and stated that it would address the other issues raised by Shell concerning the NOV at a future time. A true and correct copy of that letter is attached as Exhibit 15.

Shell's Investigation of the Site

13. Historical records have established the following background regarding the Site. In 1923, Shell Company of California, a corporation, purchased the Site for use as an oil storage facility at a time when the surrounding area was largely undeveloped. It then constructed three large reservoirs on the property, which were lined with concrete and surrounded by 15-foot-high levees. The reservoirs were covered by frame roofs on wood posts. The reservoirs were primarily used to store crude oil.

14. Active use of the reservoirs generally ceased by the early 1960s. In 1965, after removing most of the oil from the concrete reservoirs, Shell Oil Company sold the property to Richard Barclay of Barclay Hollander Curci and Lomita Development Company (the "Developers"). Shell is informed and believes that Barclay Hollander Curci became Barclay Hollander Corporation, which is now an affiliate of Dole Food Company, Inc. The Developers bought the property from Shell with knowledge of the property's former use and agreed to perform the site-clearing work, including removal of the remaining liquids, demolition of the reservoirs, and permitting and grading. The Developers secured a zoning change for the property, decommissioned the reservoirs, graded the property, and constructed and sold the 285 homes which now form a residential tract in Carson, California known as the Carousel neighborhood. However, to date, the Developers have not participated in the environmental investigation or agreed to participate in any future cleanup.

15. In 2008, Turco Products, Inc. ("Turco"), which was investigating contamination (primarily chlorinated compound impacts) at its facility adjacent to the northwest portion of the Site, performed step-out sampling which revealed petroleum hydrocarbon contamination at the Site. The Department of Toxic Substances Control ("DTSC") notified the Regional Board regarding the petroleum contamination, which in turn notified Shell. Based on review of historical aerial maps of the area, the former oil storage reservoirs were identified as a potential source of contamination at the Site.

16. Following notification from the Regional Board, Shell began an extensive and thorough investigation of the soil, soil vapor, groundwater, and indoor and outdoor air at and

beneath the Site and adjacent areas, including both public and residential areas. The sampling protocol proposed by Shell and approved by the Regional Board for the 285 residences at the Site requires the collection and analysis of the following samples: (1) soil at multiple locations and depths in the front- and backyards at each residence where exposed; (2) sub-slab soil vapor at three locations from beneath the slabs of each residence at the Site where feasible; and (3) the indoor and outdoor air at the residence on two occasions at least 90 days apart. In addition, an indoor air methane screening program is utilized early in the process to assess whether methane is an issue in any of the residences. The results of the tests are submitted to the Regional Board, posted on the State Board's publicly accessible Geotracker website, and also are forwarded to the Carousel residents or their designated legal representatives.

17. The testing program is ongoing as access is granted by the residents. As of May 23, 2014, Shell has collected samples at 95% of the homes in the Carousel neighborhood, and has completed all required testing at 82% of the homes. Shell has been conducting outreach to schedule the remaining houses and complete all residential testing.

18. Shell has also conducted an extensive testing program in the public rights-of-way (*e.g.*, below the streets and sidewalks) in the Carousel neighborhood and surrounding communities that has included soil, soil vapor, and groundwater sampling, and methane monitoring in utility vaults, stormwater drains, and the like. Shell continues to regularly conduct groundwater and sub-surface soil vapor sampling, and conduct methane monitoring on an ongoing basis. All sampling results are submitted to the Regional Board and posted to the Geotracker website.

19. The Regional Board has described Shell's investigation of the Site as "thorough" and "extensive" and stated that Shell's site investigation has "provided reliable, comprehensive, and high-quality data." (Exh. 3, p. 2.) As of December 31, 2013, Shell had collected 11,031 soil samples, 2,695 soil vapor samples, and over 2,457 indoor and outdoor air samples. The testing program is ongoing.

The Results of the Sampling at the Site

20. While Shell is continuing to seek access to the remaining residences to complete its investigation of the Site, the investigation is nearly completed. Based on the data obtained thus far (all of which has been submitted to the Regional Board and posted on the State Board's Geotracker website), the results can be summarized as follows.

21. *First*, the Regional Board and the Los Angeles County Department of Public Health have concluded that, while environmental impacts exist at the Site related to Shell's former use of the Site and the subsequent development of the Site by the Developers, the environmental conditions at the Site do not pose an imminent threat to the health and safety of the Carousel residents. Shell has performed regular methane monitoring using field instruments at 69 locations in the public rights-of-way such as utility vaults, stormwater drains, and similar locations, and methane has never been detected at levels of concern. The Los Angeles County Fire Department has also performed methane monitoring in the public areas of the Site and has not detected methane at levels of concern.

22. Methane has not been detected in laboratory analysis of any of the more than 1,400 indoor air samples that have been collected from Carousel residences. The residential methane screening program, which is conducted prior to indoor air sampling, has detected only isolated instances of elevated methane due to natural gas leaks from utility lines or appliances, and in those instances Shell has advised the residents to repair those leaks. Subsequent testing, when performed, has not revealed any methane hazards. In the single instance where elevated methane detected in the soil gas was determined to be primarily related to petroleum hydrocarbon degradation, Shell installed a methane mitigation system according to an engineering design and work plan approved by the Regional Board and Los Angeles County Department of Public Works Environmental Programs Division. Multiple rounds of follow-up testing have not shown any methane hazard at that home.

23. While elevated levels of methane presumably related to anaerobic biodegradation of petroleum hydrocarbons have been detected at depth, the lack of oxygen and any significant vapor pressure at depth mitigates any risk related to explosion or fire. Site data indicate that

methane generated by degradation of petroleum hydrocarbons at depth under anaerobic conditions is naturally controlled through biodegradation as it migrates through aerobic surface soil.

24. *Second*, analysis of the indoor air, outdoor air, and sub-slab soil vapor samples collected from the residences at the Site generally have shown indoor air concentrations to be consistent with background values and to be correlated with garage and outdoor air.

25. *Third*, there are widespread but uneven soil impacts at the Site that appear to be related to the grading of the Site. The spatial distribution of the soil impacts is somewhat stochastic and does not appear as a plume.

26. *Fourth*, the groundwater beneath the Site is impacted by a plume. There exist multiple documented upgradient impacts that likely contribute to the groundwater conditions beneath the Site. Petroleum hydrocarbons in the form of light non-aqueous phase liquid ("LNAPL") has been detected in two monitoring wells located in the western portion of the Site, and LNAPL removal from these wells is performed on a regular basis. The groundwater at the Site is not used for municipal supply. Carousel residents obtain their drinking water from municipal supply provided by California Water Service Company, which has confirmed that the Site's water supply meets quality standards for drinking water.

Shell's Actions in Response to the CAO

27. On March 11, 2011, the Regional Board issued the CAO for the Site. (Exh. 1.) The CAO directed Shell to (1) complete delineation of on- and off-Site impacts in soil, soil vapor, and groundwater related to Shell's historical use of the Site; (2) continue groundwater monitoring and reporting; (3) develop and conduct a pilot testing work plan to evaluate remedial options for the Site; and (4) conduct an assessment of any potential environmental impacts of residual concrete slabs that were left at the Site by the developers, and evaluate whether removal of the concrete is necessary and feasible. (Exh. 1, pp. 9-11.) Shell has completed (or, in the case of the residential sampling, nearly completed) the above actions and has submitted reports to the Regional Board that include analysis of the data. The pilot test work conducted by Shell

included pilot testing of different excavation methods, soil vapor extraction, bioventing, and chemical oxidation technologies. Shell continues to perform quarterly groundwater monitoring.

28. On March 10, 2014, Shell submitted its RAP, FS and HHRA Report for the Site. In these documents, Shell proposed a remedial strategy for the Site that consists of excavation of shallow soils, the installation of a Site-wide SVE and bioventing system to address impacts remaining after excavation, sub-slab mitigation systems at certain properties, active LNAPL recovery, and monitoried natural attenuation of groundwater impacts.

29. Shell is in the process of preparing the revised RAP, FS and HHRA Report. Notwithstanding the issues raised in this Petition, Shell intends to submit these documents to the Regional Board by the applicable deadline.

30. However, the Directive contains certain requirements and statements that are legally, technically, or factually unsupported and Shell believes they should be revised or rescinded. Shell previously raised these issues with the Regional Board, and Shell and the Regional Board have engaged in discussions to resolve these issues. However, to protect its rights in this regard, Shell files this protective Petition and seeks State Board review of these specific requirements and statements in the event it is not able to resolve these issues with the Regional Board.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct, and that this Declaration was executed on May 30, 2014 in Los Angeles, California.

Doug Weimer

DOUGLAS J. WEIMER

CALDWELL LESLIE & PROCTOR

PROOF OF SERVICE

STATE OF CALIFORNIA, COUNTY OF LOS ANGELES

At the time of service, I was over 18 years of age and **not a party to this action**. I am employed in the County of Los Angeles, State of California. My business address is 725 South Figueroa Street, 31st Floor, Los Angeles, California 90017-5524.

On May 30, 2014, I served true copies of the following document(s) described as **PETITION FOR REVIEW OF REGIONAL BOARD'S APRIL 30, 2014 ORDER PURSUANT TO WATER CODE § 13304; REQUEST FOR HEARING** on the interested parties in this action as follows:

State Water Resources Control Board
Office of Chief Counsel
Jeannette L. Bashaw, Legal Analyst
1001 "I" Street, 22nd Floor
Sacramento, CA 95814
Telephone: (916) 341-5155
Facsimile: (916) 341-5199
E-Mail: jeanette.bashaw@waterboards.ca.gov

BY E-MAIL OR ELECTRONIC TRANSMISSION: I caused a copy of the document(s) to be sent from e-mail address odanaka@caldwell-leslie.com to the persons at the e-mail addresses listed in the Service List. I did not receive, within a reasonable time after the transmission, any electronic message or other indication that the transmission was unsuccessful.

BY OVERNIGHT DELIVERY: I enclosed said document(s) in an envelope or package provided by the overnight service carrier and addressed to the persons at the addresses listed in the Service List. I placed the envelope or package for collection and overnight delivery at an office or a regularly utilized drop box of the overnight service carrier or delivered such document(s) to a courier or driver authorized by the overnight service carrier to receive documents.

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

Executed on May 30, 2014, at Los Angeles, California.

Margie Odanaka
Margie Odanaka

PROOF OF SERVICE

STATE OF CALIFORNIA, COUNTY OF LOS ANGELES

At the time of service, I was over 18 years of age and **not a party to this action**. I am employed in the County of Los Angeles, State of California. My business address is Apex Attorney Services, 1055 West Seventh Street, Suite 250, Los Angeles, CA 90017.

On May 30, 2014, I served true copies of the following document(s) described as **PETITION FOR REVIEW OF REGIONAL BOARD'S APRIL 30, 2014 ORDER PURSUANT TO WATER CODE § 13304; REQUEST FOR HEARING** on the interested parties in this action as follows:

Samuel Unger
Executive Officer
California Regional Water Quality Control
Board - Los Angeles Region
320 W. Fourth Street, Suite 200
Los Angeles, CA 90013
Tel.: (213) 576-6600

BY PERSONAL SERVICE: I personally delivered the document(s) to the person being at the addresses listed in the Service List. (1) For a party represented by an attorney, delivery was made to the attorney or at the attorney's office by leaving the documents in an envelope or package clearly labeled to identify the attorney being served with a receptionist or an individual in charge of the office. (2) For a party, delivery was made to the party or by leaving the documents at the party's residence with some person not less than 18 years of age between the hours of eight in the morning and six in the evening.

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

Executed on May 30, 2014, at Los Angeles, California.

Apex Attorney Services

EXHIBIT 1

STATE OF CALIFORNIA
REGIONAL WATER QUALITY CONTROL BOARD
LOS ANGELES REGION

CLEANUP AND ABATEMENT ORDER NO. R4-2011-0046
REQUIRING

SHELL OIL COMPANY

TO CLEANUP AND ABATE WASTE
DISCHARGED TO WATERS OF THE STATE
PURSUANT TO CALIFORNIA WATER CODE SECTION 13304[1]
AT THE FORMER KAST PROPERTY TANK FARM,
CARSON, CALIFORNIA

(FILE NO. 97-043)

Cleanup and Abatement Order No. R4-2011-0046 (Order) requires Shell Oil Company (hereinafter, the "Discharger") to assess, monitor, and cleanup and abate the effects of petroleum hydrocarbon compounds and other contaminants of concern discharged to soil and groundwater at their former Kast Property Tank Farm facility (hereinafter, the "Site") located southeast of the intersection of Marbella Avenue and East 244th Street, in Carson, California.

The California Regional Water Quality Control Board, Los Angeles Region (Regional Board) herein finds:

BACKGROUND

1. **Discharger:** Shell Oil Company (SOC), previously Shell Company of California, is a Responsible Party (RP) due to its: (a) ownership of the former Kast Property Tank Farm, and (b) former operation of a petroleum hydrocarbon tank farm at the Site. The Discharger has caused or permitted waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and has created a condition of pollution or nuisance.

2. **Location:** The Site is located southeast of the intersection of Marbella Avenue and East 244th Street in the City of Carson, California. The Site occupies approximately 44 acres of land and is bordered by the Los Angeles County Metropolitan Transportation Authority railroad right-of-way on the north, Lomita Boulevard on the south, Marbella Avenue on the west, and Panama Avenue on the east (Figure 1). The Site was previously owned by the Discharger, who operated three oil storage reservoirs from the 1920s to the mid-1960s. The central and southern reservoirs each had a capacity of 750,000 barrels of oil and the northernmost reservoir had a capacity of 2,000,000 barrels of oil. The Site presently consists of the Carousel residential neighborhood and city streets.

[1] Water Code section 13304 (a) states: Any person who has discharged or discharges waste into the waters of this state in violation of any waste discharge requirement or other order or prohibition issued by a regional board or the state board, or who has caused or permitted, causes or permits, or threatens to cause or permit any waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates, or threatens to create, a condition of pollution or nuisance, shall upon order of the regional board, clean up the waste or abate the effects of the waste, or, in the case of threatened pollution or nuisance, take other necessary remedial action, including, but not limited to, overseeing cleanup and abatement efforts.

3. **Groundwater Basin:** The Site is located on the Torrance Plain of the West Coast Groundwater Basin (Basin), in the southwestern part of the Coastal Plain of Los Angeles County. Beneath the Site, the first encountered groundwater is estimated at 54 feet below ground surface (bgs). The Basin is underlain by a series of aquifers, the deeper of which are used for drinking water production. These aquifers are with increasing depth, the Gage aquifer, Lynwood aquifer, and Silverado aquifer. The nearest municipal water supply well is located approximately 400 feet west of the Site. As set forth in the *Water Quality Control Plan for the Los Angeles Region* (the Basin Plan), adopted on June 13, 1994, the Regional Board has designated beneficial uses for groundwater (among which include municipal and domestic drinking water supplies) in the West Coast Basin and has established water quality objectives for the protection of these beneficial uses.

4. As detailed in the findings below, the Discharger's activities at the Site have caused or permitted the discharge of waste resulting in soil, soil vapor, and groundwater pollution, including discharges of waste to the waters of the state, and nuisance.

SITE HISTORY

5. **Property Ownership and Leasehold Information:** Based on information submitted to the Regional Board by the Discharger, the Site has the following property ownership and leasehold history:

    a. According to the Sanborn maps dated 1924 and 1925, the Site was owned and operated by "Shell Company of California (Kast Property)" beginning in approximately 1924 until the mid-1960s. The Site was used as a tank farm, which included three crude oil storage reservoirs, Reservoir Nos. 5, 6 and 7. Reservoir No.5, the center reservoir, had a capacity of 750,000 barrels of oil and was under lease to General Petroleum Corporation. Reservoir No. 6, the southernmost reservoir, had a capacity of 750,000 barrels of oil; and Reservoir No. 7, the northernmost reservoir, had a capacity of 2,000,000 barrels of oil. According to Sanborn map notations, the reservoirs had concrete-lined earth-slopes with frame roofs on wood posts, surrounded by earth levees averaging 20 feet in height with 7 foot wide walks on top. One oil pump house was depicted on the 1925 Sanborn map within the southern portion of the Site. Since construction, the Site was used as a crude oil storage reservoir.

    b. In 1966, SOC sold the Site to Lomita Development Company, an affiliate of Richard Barclay and Barclay-Hollander-Curci (BHC), with the reservoirs in place. The Pacific Soils Engineering Reports dated January 7, 1966; March 11, 1966; July 31, 1967; and June 11, 1968 documented that: 1) Lomita Development Company emptied and demolished the reservoirs, and graded the Site prior to it developing the Site as residential housing; 2) part of the concrete floor of the central reservoir was removed by Lomita Development Company from the Site; and 3) where the reservoir bottoms were left in place, Lomita Development Company made 8-inch wide circular trenches in concentric circles approximately 15 feet apart to permit water drainage to allow the percolation of water and sludge present in the reservoirs into the subsurface.

c. In phases between 1967 and 1969, Lomita Development Company developed the Site into one- and two-story single family residential parcels and sold the developed lots to individual homeowners.

6. **Site Description and Activities:** According to information in the Regional Board's file on this Site, oil related operations at the Site began in 1923 and ended by the early 1960s. The Site was previously owned and operated by Shell Company of California, which was subsequently renamed Shell Oil Company, as a crude oil storage facility. The facility included equipment that pumped the oil to the nearby SOC's refinery for processing from three concrete-lined oil storage reservoirs with a total capacity of 3.5 million barrels. In 1966, SOC closed the Site and SOC sold the Site to Lomita Development Company, an affiliate of Richard Barclay and Barclay-Hollander-Curci. Subsequently, Lomita Development Company developed the Site into the Carousel residential neighborhood, which contains 285 single-family homes.

7. **Chemical Usage:** Based on the Phase I Environmental Site Assessment (ESA) dated July 14, 2008 conducted by Shell Oil Products[2] (SOPUS) consultant, URS Corporation, the Site was used for the storage of crude oil in all three reservoirs on the property from at least 1924 to 1966. Subsequent records indicate that in the 1960s the reservoirs may also have been used for storage of bunker oil. Ongoing investigations indicate petroleum hydrocarbon compounds including volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) are impacted in the subsurface soil, soil vapor, and groundwater underlying the Site.

EVIDENCE OF DISCHARGES OF WASTE AND BASIS FOR ORDER

8. **Waste Discharges:** The following summarizes assessment activities associated with the Site:

   a. In 2007, under the regulatory oversight of the California Department of Toxic Substances Control (DTSC), an environmental investigation was initiated at the former Turco Products Facility (TPF). Soil vapor and groundwater were investigated in areas directly west of the Site and at locations in the northwestern portion of the Site. The DTSC-required investigation detected petroleum hydrocarbons, benzene, toluene, and chlorinated solvents in soil and soil vapor. A multi-depth soil vapor survey, which included soil vapor sampling on the Site at locations coincident with the former Kast Site footprints, detected benzene at concentrations up to 150 micrograms per liter (μg/l). Benzene was detected at TPF groundwater monitoring well MW-8, which has a northeast flow direction, at a concentration of 1,800 μg/l. Therefore, groundwater monitoring well MW-8 is located upgradient of the Kast Site. Chlorinated solvents were also detected at the Kast Site groundwater monitoring well MW-5.

   b. The *Final Phase I Site Characterization Report* dated October 15, 2009, which was prepared by URS Corporation on behalf of SOPUS showed that soil impacts consisted primarily of petroleum hydrocarbons spanning a wide range of carbon chains and including Total Petroleum Hydrocarbons (TPH) as gasoline (g), TPH

[2] Shell Oil Products US is the d/b/a for Equilon Enterprises LLC, which is wholly owned by Shell Oil Company.

as diesel (TPHd), TPH as motor oil (TPHmo), benzene, and naphthalene (See Tables 1, 2A, 2B, and 3).

I. In June 2009, a subsurface investigation of public streets in the Carousel neighborhood consisting of ten cone penetrometer/rapid optical screening tools (CPT/ROST) was performed. The CPT/ROST logs indicated several locations within the Site with elevated hydrocarbon concentrations. The CPT/ROST logs also showed that the highest apparent soil impacts occurred at depths of 12 feet bgs, 36 feet bgs, and 40 feet bgs.

II. A total of 228 soil samples were collected during the Phase I Site Characterization. The analytical data for soil samples collected from soil borings advanced on public streets across the Site (Figure 2) were as follows:

i. The highest detected concentration of TPH was 22,000 milligrams per kilogram (mg/kg) and TPHg, TPHd, and TPHmo were 8,800, 22,000, and 21,000 mg/kg, respectively;

ii. Benzene, ethylbenzene, toluene, and xylenes were detected in concentrations as high as 21,000 micrograms per kilogram (µg/kg), 32,000 µg/kg, 12,000 µg/kg, and 140,000 µg/kg, respectively;

iii. SVOCs were detected in concentrations as high as 47 mg/kg of naphthalene, 38 mg/kg of 1-methylnaphthalene, 63 mg/kg of 2-methylnaphthalne, 12 mg/kg phenanthrene, and 9.0 mg/kg pyrene; and

iv. Arsenic and lead were detected in concentrations as high as 53.2 mg/kg and 52.5 mg/kg, respectively.

III. Soil vapor samples collected from a 5-foot depth and greater below the public streets in the Carousel neighborhood indicated elevated benzene and methane (Figures 3 and 4). Benzene was detected at a maximum concentration of 3,800µg/l, which exceeds the California Human Health Screening Level (CHHSL) value of 0.036 µg/l for benzene set for shallow soil vapor in a residential area. Methane was also detected in concentrations as high as 59.7 % (by volume) that significantly exceed its lower explosive limit of 5% (by volume), posing a potential safety hazard.

c. Between September 2009 and February 2010, residential soil and sub-slab soil vapor sampling was conducted at 41 parcels (Figure 5 a – f; Tables 1 and 2) and the results were as follows:

I. Surface and subsurface soil (0 to 10 feet bgs) detected concentrations of chemicals of concern that significantly exceeded soil screening levels as follows:

i. VOCs - Benzene (14,000 µg/kg), tetrachloroethylene (PCE) (22,000 µg/kg), 1,2,4-trimethylbenzene (34,000 µg/kg), and 1,3,5-trimethylbenzene (14,000 µg/kg);

ii. SVOCs - Naphthalene (18 mg/kg), Benzo(a)pyrene (2.9 mg/kg), benzo(a)anthracene (0.1 mg/kg), chrysene (0.27 mg/kg), phenanthrene (0.28 mg/kg), and pyrene (0.19 mg/kg); and

iii. Lead was also detected at a maximum concentration of 307 mg/kg.

II. The highest detected concentration of TPHg was 5,000 mg/kg, TPHd was 33,000 mg/kg, and TPHmo was 41,000 mg/kg;

III. As of September 27, 2010, sub-slab soil vapor samples have been collected from 172 homes in the Carousel neighborhood. Additional data continues to be collected as part of the Phase II Site Characterization. The validated data from the first 41 homes detected benzene, naphthalene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, ethylbenzene, p/m-xylenes, toluene, and acetone, at a maximum concentration of 4,500 micrograms per cubic meter (µg/m^3), 2,200 µg/m^3, 1,000 µg/m^3, 1,100 µg/m^3, 5,200 µg/m^3, 700 µg/m^3, 270 µg/m^3, respectively.

d. Between November 19, 2009 and February 15, 2010, additional step-out soil and soil vapor sampling at the elevated soil vapor sampling locations were conducted in selected locations beneath the public streets at the Site. The measured concentrations for petroleum hydrocarbons in soil were as follows:

I. The highest detected concentrations of TPHg was 9,800 mg/kg, TPHd was 22,000 mg/kg, and TPHmo was 21,100 mg/kg;

II. The highest detected concentrations of benzene was 33,000 µg/kg, Ethylbenzene was 42,000 µg/kg, toluene was 11,000 µg/kg, and xylenes were 140,000 µg/kg, respectively;

III. SVOCs were detected in concentrations as high as 47 mg/kg of naphthalene, 33 mg/kg of 1-methylnaphthalene, 53 mg/kg of 2-methylnaphthalne, 6.1 mg/kg phenanthrene, and 3.9 mg/kg pyrene; and

IV. Arsenic and lead were detected in concentrations as high as 28.2 mg/kg and 13.6 mg/kg, respectively.

e. In July 2009, the installation of six on-site groundwater monitoring wells (Figure 6) were completed and quarterly groundwater monitoring was initiated. Groundwater was encountered at 53 feet bgs. Groundwater samples from five of the six wells contained concentrations of benzene at a maximum concentration of 140 µg/L and trichloroethylene (TCE) at a maximum concentration of 290 µg/L. One of the monitoring wells (MW-3) contains a free product or a light non-aqueous phase liquid (LNAPL) with a maximum measured thickness of 9.01 foot as of May 27, 2010.

9. Source Elimination and Remediation Status at the Site

a. The results of the initial soil and soil vapor investigation indicate the presence of elevated methane and benzene at concentrations exceeding the Lower Explosive Limit and the CHHSL for shallow soil vapor, at several locations beneath the public streets at the Site. On October 15, 2009, the Regional Board directed the Discharger to expeditiously design and implement an interim remedial action.

b. On May 12, 2010 the Regional Board approved SOPUS's proposed Soil Vapor Extraction (SVE) pilot test in order to evaluate the use of this technology as a remedial option for VOCs at the Site.

10. Summary of Findings from Subsurface Investigations

a. Regional Board staff have reviewed and evaluated numerous technical reports and records pertaining to the release, detection, and distribution of wastes on the Site and its vicinity. The Discharger has stored, used, and/or discharged petroleum hydrocarbon compounds at the Site. Elevated levels of TPH and other wastes have been detected in soil, soil vapor and groundwater beneath the Site.

b. The sources for the evidence summarized above include, but are not limited to:

I. Various technical reports and documents submitted by the Discharger or its representatives to Regional Board staff.

II. Site inspections conducted by Regional Board staff, as well as meetings, letters, electronic mails, and telephone communications between Regional Board staff and the Discharger and/or its representatives.

III. Subsurface drainage study for the Site reservoirs submitted by Girardi and Keese, the law firm retained by some of the residents of the Carousel neighborhood.

11. Summary of Current Conditions Requiring Cleanup and Abatement

a. Based on the Phase I ESA for the Site dated July 14, 2008 (prepared by URS Corporation) and the most recent information provided to the Regional Board by SOPUS: 1) SOC sold the Kast Site to Lomita Development Company, an affiliate of Richard Barclay and Barclay-Hollander-Curci, in 1966 with the reservoirs in place; 2) the Pacific Soils Engineering Reports from 1966 to 1968 indicate that Lomita Development Company emptied and demolished the reservoirs, and residential housing; 3) part of the concrete floor of the central reservoir was removed by Lomita Development Company from the Site; and 4) where the reservoir bottoms were left in place, Lomita Development Company made 8-inch wide circular trenches in concentric circles approximately 15 feet apart to permit water drainage to allow percolation of water and sludge present in the reservoirs into the subsurface.

b. There is no consistent trend in the vertical distribution of detected concentrations of petroleum hydrocarbon compounds that can be discerned from soil boring data to date. Although, the majority of the aforementioned highest detected TPH concentrations were obtained from the 2.5-foot depth samples, there were multiple locations where the highest concentrations were in the 5-foot or 10-foot samples. This may be due to the nature of previous development activities by Lomita Development Company at the Site (i.e., the construction and demolition of the former reservoirs and site grading in preparation for development of the residential tract).

c. On May 11, 2010, Environmental Engineering and Contracting, consultants hired by Girardi and Keese, conducted exploratory trenching in order to locate and identify the obstructions that have been frequently encountered during the advancement of shallow soil borings at many of the residential homes investigated to date. Regional Board staff observed the encountering of an approximately 8-inch thick concrete slab extending at the trench excavation termination depth of 9 feet, 2 inches. The Pacific Soils Engineering Report dated January 7, 1966 states that the reservoirs were lined with a "four inch blanket of reinforced concrete". These obstructions are presumed to be remnants of the concrete liners of the former reservoir.

d. Results from the 169 Interim Residential Sampling Reports submitted to the Regional Board through November 17, 2010 indicate that for surface and subsurface soil sampling (0 to 10 feet bgs), the cancer risk index estimate is between 0 and 10 for 107 residential parcels, between 10 and 100 for 60 parcels, and exceeded 100 for 2 parcels. In the area where the highest cancer index is documented, SVOCs (i.e. Benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene and chrysene), benzene, and ethylbenzene were the primary chemicals of potential concern (COPCs) contributing to the cancer risk index.

For the Carousel neighborhood investigation, the Regional Board is using the most protective cancer risk screening levels recommended by the State and federal governments, which is one in one million (1×10^{-6}) additional risks. For screening purposes, the Regional Board routinely uses the most conservative (health-protective assumptions) risk based screening levels of 1×10^{-6} for the target chemical. This screening level is based on a target risk level at the lower end of the US Environmental Protection Agency (USEPA) risk management range of one-in-a-million risk (1×10^{-6}) for cancer risk and a hazard quotient of 1.

The presence of a chemical at concentrations in excess of a CHHSL does not indicate that adverse impacts to human health are occurring or will occur; but suggests that further evaluation of potential human health concerns is warranted (Cal-EPA, 2005). It should also be noted that CHHSLs are not intended to "set … final cleanup or action levels to be applied at contaminated sites" (Cal-EPA, 2005).

e. Results from the 169 Interim Residential Sampling Reports submitted to the Regional Board through November 17, 2010 also indicate that for the sub-slab soil vapor data collected from the residential parcels, the cancer risk index estimate was between 0 and 10 for 147 parcels, between 10 and 100 for 20 parcels, and greater than 100 for 2 parcels. The two highest cancer risk index were estimated as 550 and 120. In most cases, benzene was the primary contributor to the cancer risk index estimate.

f. The Office of Environmental Health Hazard Assessment (OEHHA) performed a quantitative risk evaluation of TPH using surface and subsurface (0 to 10 feet bgs) soil TPH fractionation data for the 41 residential parcels (Table 3). Based on the risk calculation, OEHHA estimated maximum exposures for a child and compared the resulting exposure estimates of reference dosages with that provided by DTSC interim guidance dated June 16, 2009. OEHHA concluded that aromatic hydrocarbons in the C-9 to C-32 range at five parcels exceeded their reference values for children (Exhibit 1).

g. The San Francisco Bay Regional Water Quality Control Board developed the Environmental Screening Level (ESL) as guidance for determining when concentration of TPH may present a nuisance and detectable odor. The ESL, based on calculated odor indexes, for residential land-use. is 100 mg/kg for TPHg and TPHd. The soil TPHg and TPHd data obtained from the Site were detected up to 9,800 mg/kg and 85,000 mg/kg, respectively, which exceed the ESL.

12. **Pollution of Waters of the State**: The Discharger has caused or permitted waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates, or threatens to create, a condition of pollution or nuisance. As described in this Order and the record of the Regional Board, the Discharger owned and/or operated the site in a manner that resulted in the discharges of waste. The constituents found at the site as described in Finding 8 constitute "waste" as defined in Water Code section 13050(d). The discharge of waste has resulted in pollution, as defined in Water Code section 13050(l). The concentration of waste constituents in soil and groundwater exceed water quality objectives contained in the Water Quality Control Plan for the Los Angeles Region (Basin Plan), including state-promulgated maximum contaminant levels. The presence of waste at the Site constitutes a "nuisance" as defined in Water Code section 13050(m). The waste is present at concentrations and locations that *"is injurious to health, or is indecent, or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property . . . and [a]ffects at the same time an entire community or neighborhood, or any considerable number of persons, although the extent of the annoyance or damage inflicted upon individuals may be unequal."*

13. **Need for Technical Reports:** This Order requires the submittal of technical or monitoring reports pursuant to Water Code section 13267[3]. The Discharger is required to submit the reports because, as described in the Findings in this Order, the Discharger is responsible for the discharge of waste that has caused pollution and nuisance. The reports are necessary to evaluate the extent of the impacts on water quality and public health and to determine the scope of the remedy.

[3] Water Code section 13267 authorized the Regional Board to require any person who has discharged, discharges, or is suspect of having discharged or discharging, waste to submit technical or monitoring program reports.

13. Although requested by the Discharger, the Regional Board is declining to name additional potentially responsible parties (PRPs) to this Order at this time. Substantial evidence indicates that the Discharger caused or permitted waste to be discharged into waters of state and is therefore appropriately named as a responsible party in this Order. However, the Regional Board will continue to investigate whether additional PRPs (including, but not limited to, Lomita Development Company, Richard Barclay, Barclay-Hollander-Curci, and/or any of its successors) caused or permitted the discharge of waste at the Site and whether these or other parties should be named as additional responsible parties to this Order or a separate Order. The Regional Board may amend this Order or issue a separate Order in the future as a result of this investigation. Although investigation concerning additional PRPs is ongoing, the Regional Board desires to issue this Order as waiting will only delay remediation of the Site.

14. The Discharger, in a letter to the Regional Board dated May 5, 2010 (Exhibit 2), stated that it is considering a variety of potential alternatives that can be applied at specific parcels and in the public streets in order to avoid environmental impacts and avoid any significant risks to human health at this Site. The Discharger also indicated that if it becomes necessary for residents to relocate temporarily to perform this work, the Discharger will take appropriate steps to minimize any inconvenience and compensate them for any resulting expenses.

15. Issuance of this Order is being taken for the protection of the environment and as such is exempt from provisions of the California Environmental Quality Act (CEQA) (Pubic Resources Code section 21000 et seq.) in accordance with California Code of Regulations, title 14, sections 15061(b)(3), 15306, 15307, 15308, and 15321. This Order generally requires the Discharger to submit plans for approval prior to implementation of cleanup activities at the Site. Mere submittal of plans is exempt from CEQA as submittal will not cause a direct or indirect physical change in the environment and/or is an activity that cannot possibly have a significant effect on the environment. CEQA review at this time would be premature and speculative, as there is simply not enough information concerning the Discharger's proposed remedial activities and possible associated environmental impacts. If the Regional Board determines that implementation of any plan required by this Order will have a significant effect on the environment, the Regional Board will conduct the necessary and appropriate environmental review prior to Executive Officer approval of the applicable plan.

16. Pursuant to section 13304 of the California Water Code, the Regional Board may seek reimbursement for all reasonable costs to oversee cleanup of such waste, abatement of the effects thereof, or other remedial action.

THEREFORE, IT IS HEREBY ORDERED, pursuant to California Water Code section 13304 and 13267, that the Discharger shall cleanup the waste and abate the effects of the discharge, including, but not limited to, total petroleum hydrocarbons (TPH) and other TPH-related wastes discharged to soil and groundwater at the Site in accordance with the following requirements:

1. **Complete Delineation of On- and Off-Site Waste Discharges**: Completely delineate the extent of waste in soil, soil vapor, and groundwater caused by the discharge of wastes including, but not limited to, TPH and other TPH-related waste constituents at

the Site into the saturated and unsaturated zones. Assessment has been ongoing under Regional Board oversight, but assessment is not yet complete. If ongoing reinterpretation of new data derived from the tasks performed suggests that modification or expansion of the tasks approved by the Regional Board is necessary for complete assessment, the Discharger is required to submit a work plan addendum(a).

2. **Continue to Conduct Groundwater Monitoring and Reporting**:

    a. Continue the existing quarterly groundwater monitoring and reporting program previously required by the Regional Board, and

    b. As new wells are installed, they are to be incorporated into the existing groundwater monitoring and reporting program

3. **Conduct Remedial Action**: Initiate a phased cleanup and abatement program for the cleanup of waste in soil, soil vapor, and groundwater and abatement of the effects of the discharges, but not limited to, petroleum and petroleum-related contaminated shallow soils and pollution sources as highest priority.

    Shallow soils in this Order are defined as soils found to a nominal depth of 10 feet, where potential exposure for residents and/or construction and utility maintenance workers is considered likely (Ref. Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities – CalEPA 1996).

    Specifically, the Discharger shall:

    a. Develop a pilot testing work plan, which includes 1) evaluation of the feasibility of removing impacted soils to 10 feet and removal of contaminated shallow soils and reservoir concrete slabs encountered within the uppermost 10 feet, including areas beneath residential houses; and 2) remedial options that can be carried out where site characterization (including indoor air testing) is completed; 3) plans for relocation of residents during soil removal activities, plans for management of excavated soil on-site, and plans to minimize odors and noise during soil removal. The Discharger is required to submit this Pilot Test Work Plan to the Regional Board for review and approval by the Executive Officer no later than 60 days after the date of issuance of this Order. Upon approval of the Pilot Test Work Plan by the Executive Officer, the Discharger shall implement the Pilot Test Work Plan submit the Pilot Test Report that includes the findings, conclusions, and recommendations within 120 days of the issuance of the approval of the Pilot Test Work Plan.

    b. Conduct an assessment of any potential environmental impacts of the residual concrete slabs of the former reservoir that includes: (1) the impact of the remaining concrete floors on waste migration where the concrete floors might still be present; (2) whether there is a need for the removal of the concrete; and (3) the feasibility of removing the concrete floors beneath (i) unpaved areas at the Site, (ii) paved areas at the Site, and (iii) homes at the Site. The Discharger is required to submit this environmental impact assessment of the residual concrete slabs to the Regional Board no later than 30 days after the completion of the Pilot Test.

c. Prepare a full-scale impacted soil Remedial Action Plan (RAP) for the Site. The Discharger is required to submit the RAP to the Regional Board for review and approval by the Executive Officer no later than 60 days after the date of the Executive Officer's approval of the Pilot Test Report.

I. The RAP shall include, at a minimum, but is not limited to:

i. A detailed plan for remediation of wastes in shallow soil that will incorporate the results from the Soil Vapor Extraction Pilot Test currently being performed.

ii. A plan to address any impacted area beneath any existing paved areas and concrete foundations of the homes, if warranted;

iii. A detailed surface containment and soil management plan;

iv. An evaluation of all available options including proposed selected methods for remediation of shallow soil and soil vapor; and

v. Continuation of interim measures for mitigation according to the Regional Board approved Interim Remediation Action Plan (IRAP).

vi. A schedule of actions to implement the RAP.

II. The RAP, at a minimum, shall apply the following guidelines and Policies to cleanup wastes in soil and groundwater. The cleanup goals shall include:

i. Soil cleanup goals set forth in the Regional Board's *Interim Site Assessment and Cleanup Guidebook, May 1996,* waste concentrations, depth to the water table, the nature of the chemicals, soil conditions and texture, and attenuation trends, human health protection levels set forth in *USEPA Regional Screening Levels (Formerly Preliminary Remediation Goals),* for evaluation of the potential intrusion of subsurface vapors (soil vapor) into buildings and subsequent impact to indoor air quality, California Environmental Protection Agency's *Use of Human Heath Screening Levels (CHHSLS) in Evaluation of Contaminated Properties*, dated January 2005, or its latest version, and Total Petroleum Hydrocarbon Criteria Working Group, Volumes 1 through 5, 1997, 1998, 1999; Commonwealth of Massachusetts, Department of Environmental Protection, *Characterizing Risks Posed by Petroleum Contaminated*

Sites: Implementation of MADEP VPH/EPH approach; MADEP 2002; Commonwealth of Massachusetts, Department of Environmental Protection, *Updated Petroleum Hydrocarbon Fraction Toxicity Values for the VPH/EPH/APH Methodology*; MADEP 2003; Commonwealth of Massachusetts, Department of Environmental Protection, Method for the Determination of *Air-Phase Petroleum Hydrocarbons (APH) Final*, MADEP 2008, Soil vapor sampling requirements are stated in the *DTSC Interim Guidance* and the Regional Board's *Advisory – Active Soil Gas Investigations*, dated January 28, 2003, or its latest version, DTSC's *Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air*, revised February 7, 2005, or its latest version, USEPA Risk Assessment Guidance for Superfund, Parts A through E; USEPA User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings, 2003; USEPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, 2002; USEPA Supplemental Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites, 2002; CalEPA Selecting Inorganic Constituents as Chemicals of Potential Concern at Risk Assessments at Hazardous Waste Sites and Permitted Facilities, CalEPA DTSC, February 1997; CalEPA Use of the Northern and Southern California Polynuclear Aromatic Hydrocarbons (PAH) Studies in the Manufactured Gas Plant Site Cleanup Process, CalEPA DTSC, July 2009. Cleanup goals for all contaminant of concerns shall be based on residential (i.e., unrestricted) land use.

ii. Groundwater cleanup goals shall at a minimum achieve applicable Basin Plan water quality objectives, including California's Maximum Contaminant Levels or Action Levels for drinking water as established by the California Department of Public Health, and the State Water Resources Control Board's "Antidegradation Policy" (State Board Resolution No. 68-16), at a point of compliance approved by the Regional Board, and comply with other applicable implementation programs in the Basin Plan.

iii. The State Water Resources Control Board's "Antidegradation Policy",which requires attainment of background levels of water quality, or the highest level of water quality that is reasonable in the event that background levels cannot be restored. Cleanup levels other than background must be consistent with the maximum benefit to the people of the State, not unreasonably affect present and anticipated beneficial uses of water, and not result in exceedence of water quality objectives in the Regional Board's *Basin Plan*.

iv. The State Water Resources Control Board's "Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304" (State Board Resolution No. 92-49), requires cleanup to background or the best water quality which is reasonable if background levels cannot be achieved and sets forth criteria to consider where cleanup to background water quality may not be reasonable.

III. The Discharger shall submit site-specific cleanup goals for residential (i.e., unrestricted) land use for the Executive Officer's approval concurrent with the submittal date of the Pilot Test Report. The proposed site-specific cleanup goals shall include detailed technical rationale and assumptions underlying each goal.

IV. Upon approval of the RAP by the Executive Officer, the Discharger shall implement the RAP within 60 days of the issuance of the approval of the RAP.

d. Continue to conduct residential surface and subsurface soil and sub-slab soil vapor sampling under the current Regional Board approved work plan dated September 24, 2009. If the ongoing reinterpretation of new assessment data derived from the tasks described in the work plan suggests that modification or expansion of the tasks proposed in the RAP is necessary for complete cleanup, then the Discharger shall submit addenda to the September 24, 2009 work plan to the Regional Board for review and approval by the Executive Officer no later than 60 days of the date of issuance of this Order.

e. If the ongoing groundwater monitoring and investigation warrants, the Discharger shall:

I. Install new wells in order to complete the groundwater monitoring well network and to fully delineate the impacted groundwater plume, and

II. Prepare a detailed impacted groundwater RAP. The Regional Board will set forth the due date of the groundwater RAP at a later date.

4. Public Review and Involvement:

a. Cleanup proposals and RAP submitted to the Regional Board for approval in compliance with the terms of this Order shall be made available to the public for a minimum 30-day period to allow for public review and comment. The Regional Board will consider any comments received before taking final action on a cleanup proposal and RAP.

b. The Discharger shall encourage public participation. The Discharger is required to prepare and submit a Public Participation Plan for review and approval by the Executive Officer, with the goal of having the Regional Board provide the stakeholders and other interested persons with:

I. Information, appropriately targeted to the literacy and translational needs of the community, about the investigation and remedial activities concerning the discharges of waste at the Site; and

II. Periodic, meaningful opportunities to review, comment upon, and to influence investigation and cleanup activities at the Site.

c. Public participation activities shall coincide with key decision making points throughout the process as specified or as directed by the Executive Officer of the Regional Board.

5. **Time Schedule:** The Discharger shall submit all required technical work plans and reports by the deadlines stated in this Order, which are summarized in Table 4. As field activities at this Site are in progress, additional technical documents may be required and/or new or revised deadlines for the technical documents may be issued. Therefore, Table 4 may be updated as necessary. The Discharger shall continue any remediation or monitoring activities until such time as the Executive Officer determines that sufficient cleanup has been accomplished to fully comply with this Order..

6. The Regional Board's authorized representative(s) shall be allowed:

a. Entry upon premises where a regulated facility or activity is located, conducted, or where records are stored, under the conditions of this Order;

b. Access to copy any records that are stored under the conditions of this Order;

c. Access to inspect any facility, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Order; and

d. The right to photograph, sample, and monitor the Site for the purpose of ensuring compliance with this Order, or as otherwise authorized by the California Water Code.

7. **Contractor/Consultant Qualification:** A California licensed professional civil engineer or geologist, or a certified engineering geologist or hydrogeologist shall conduct or direct the subsurface investigation and cleanup program. All technical documents required by this Order shall be signed by and stamped with the seal of the above-mentioned qualified professionals.

8. This Order is not intended to permit or allow the Discharger to cease any work required by any other Order issued by this Regional Board, nor shall it be used as a reason to stop or redirect any investigation or cleanup or remediation programs ordered by this Regional Board or any other agency. Furthermore, this Order does

not exempt the Discharger from compliance with any other laws, regulations, or ordinances which may be applicable, nor does it legalize these waste treatment and disposal facilities, and it leaves unaffected any further restrictions on those facilities which may be contained in other statues or required by other agencies.

9. The Discharger shall submit 30-day advance notice to the Regional Board of any planned changes in name, ownership, or control of the facility; and shall provide 30-day advance notice of any planned physical changes to the Site that may affect compliance with this Order. In the event of a change in ownership or operator, the Discharger also shall provide 30-day advance notice, by letter, to the succeeding owner/operator of the existence of this Order, and shall submit a copy of this advance notice to the Regional Board.

10. Abandonment of any groundwater well(s) at the Site must be approved by and reported to the Executive Officer of the Regional Board at least 14 days in advance. Any groundwater wells removed must be replaced within a reasonable time, at a location approved by the Executive Officer. With written justification, the Executive Officer may approve of the abandonment of groundwater wells without replacement. When a well is removed, all work shall be completed in accordance with California Department of Water Resources Bulletin 74-90, "California Well Standards," Monitoring Well Standards Chapter, Part III, Sections 16-19.

11. The Regional Board, through its Executive Officer or other delegate, may revise this Order as additional information becomes available. Upon request by the Discharger, and for good cause shown, the Executive Officer may defer, delete or extend the date of compliance for any action required of the Discharger under this Order. The authority of the Regional Board, as contained in the California Water Code, to order investigation and cleanup, in addition to that described herein, is in no way limited by this Order.

12. Any person aggrieved by this action of the Regional Board may petition the State Water Resources Control Board (State Water Board) to review the action in accordance with Water Code section 13320 and California Code of Regulations, title 23, sections 2050 and following. The State Water Board must receive the petition by 5:00 p.m., 30 days after the date of this Order, except that if the thirtieth day following the date of this Order falls on a Saturday, Sunday, or state holiday, the petition must be received by the State Water Board by 5:00 p.m. on the next business day. Copies of the law and regulations applicable to filing petitions may be found on the Internet at:

http://www.waterboards.ca.gov/public_notices/petitions/water_quality

or will be provided upon request.

13. Failure to comply with the terms or conditions of this Order may result in imposition of civil liabilities, imposed either administratively by the Regional Board or judicially by the Superior Court in accordance with Sections 13268, 13308, and/or 13350, of the California Water Code, and/or referral to the Attorney General of the State of California.

14. None of the obligations imposed by this Order on the Discharger are intended to constitute a debt, damage claim, penalty or other civil action which should be limited or discharged in a bankruptcy proceeding. All obligations are imposed pursuant to the police powers of the State of California intended to protect the public health, safety, welfare, and environment.

Ordered by: ______________________ Date: 3-11-11

Deborah J. Smith
Chief Deputy Executive Officer

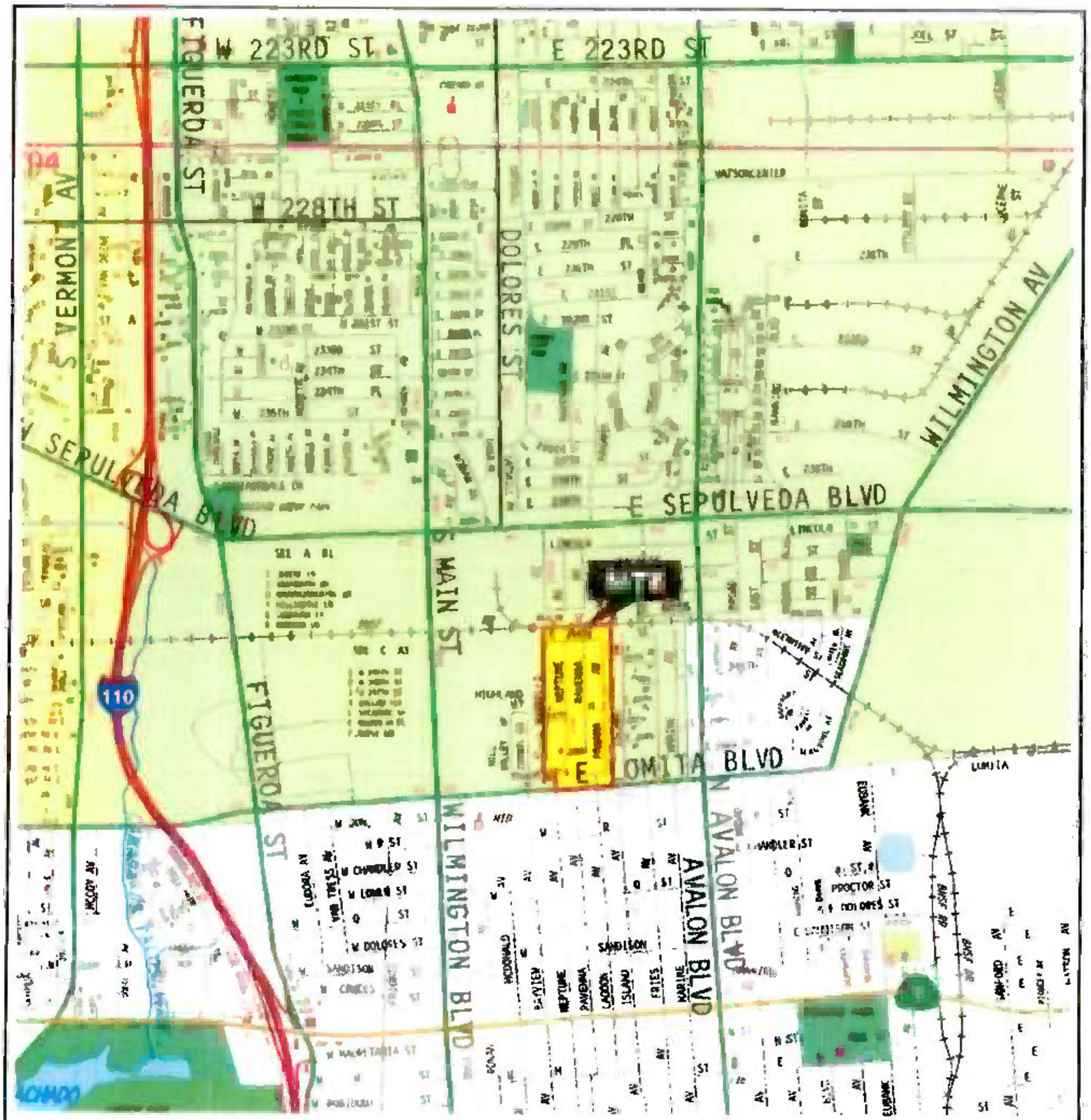
ATTACHMENTS

FIGURES

TABLES

EXHIBITS

Note: All Figures and Tables, except Table 4, were taken from technical reports prepared by SOPUS's consultant, URS Corporation



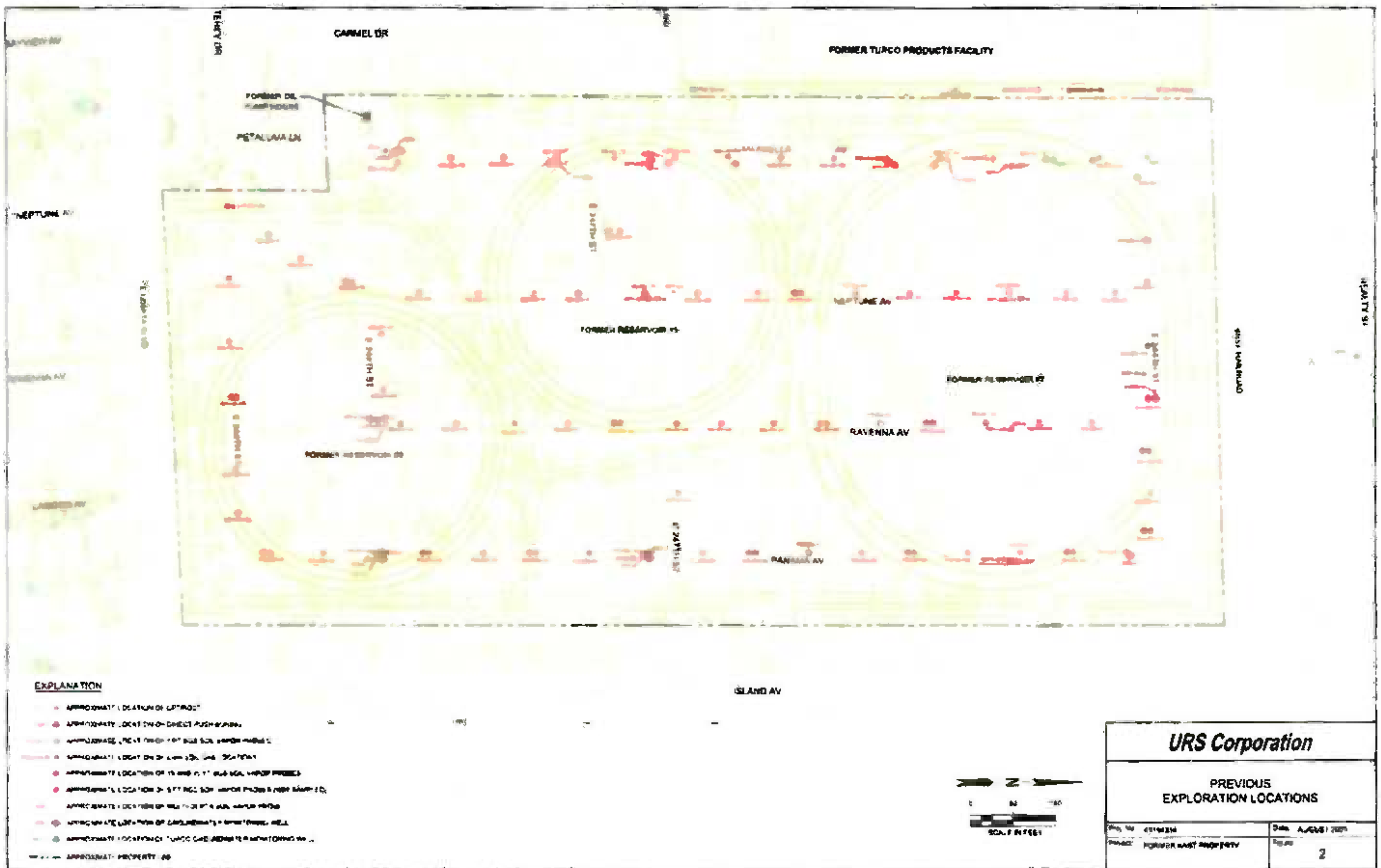
N

K:/2008/KAST/figure 1 Vic Map.ai

SITE VICINITY MAP

Project No. 49194314	Date. JUNE 2008	Project: Former KAST Property	Figure 1

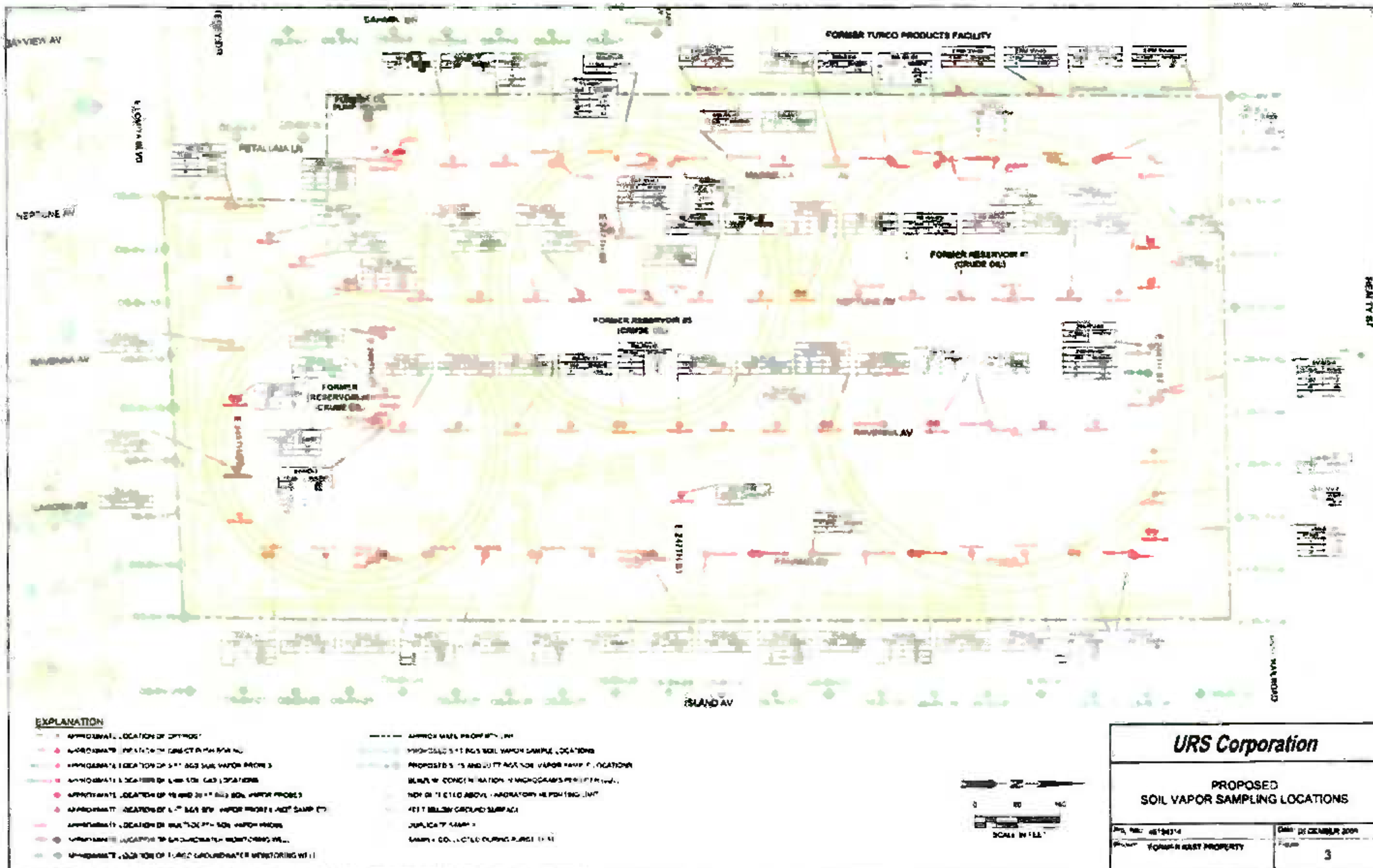
URS

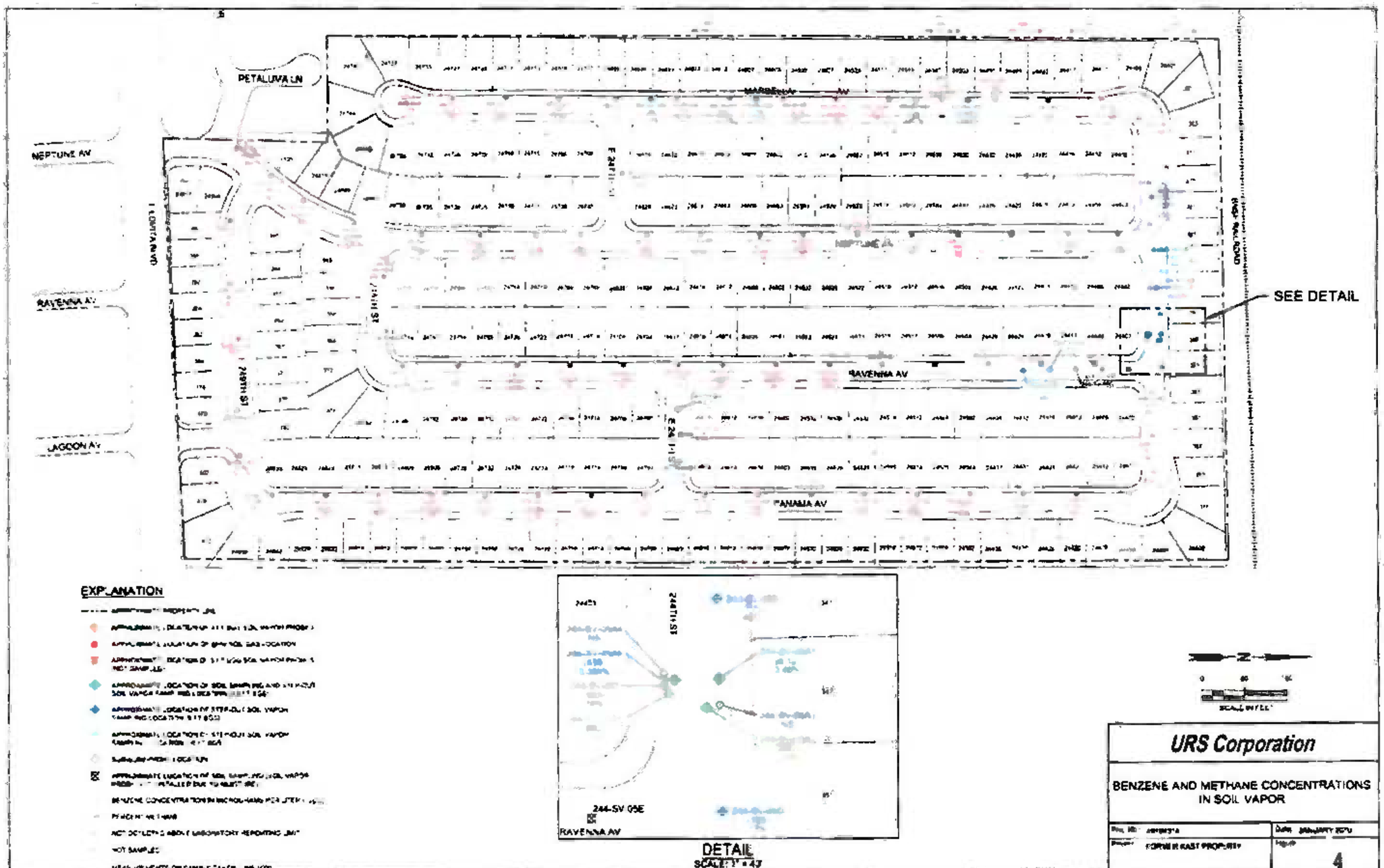


URS Corporation

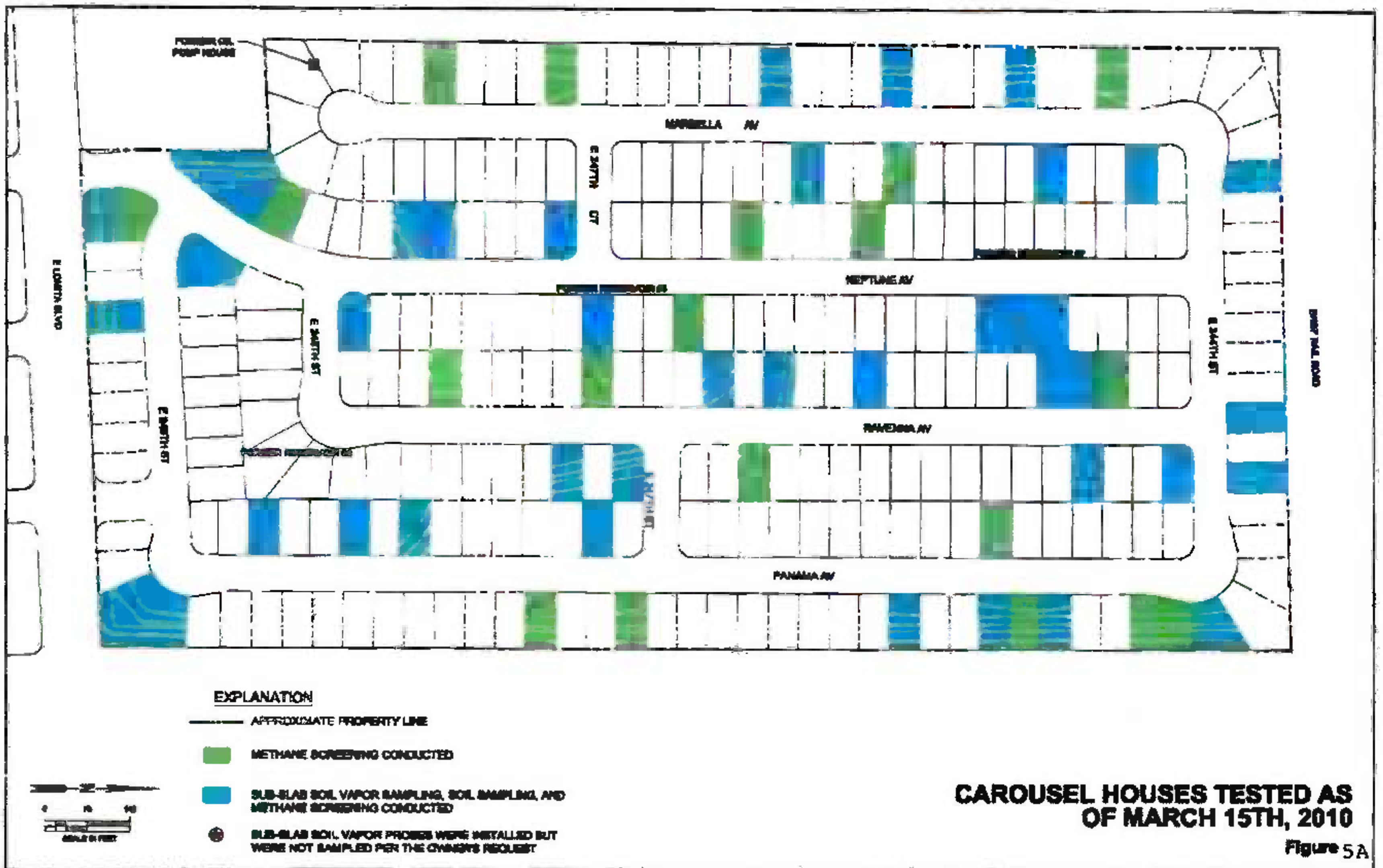
PREVIOUS
EXPLORATION LOCATIONS

Figure 2


FORMER TURCO PRODUCTS FACILITY
FORMER RESERVOIR #7 (CRUDE OIL)
FORMER RESERVOIR #5 (CRUDE OIL)
FORMER RESERVOIR #6 (CRUDE OIL)
PETALUMA LN
NEPTUNE AV
RAVENNA AV
ISLAND AV
REALTY ST
E 247TH ST
EXPLANATION
URS Corporation
PROPOSED
SOIL VAPOR SAMPLING LOCATIONS
3

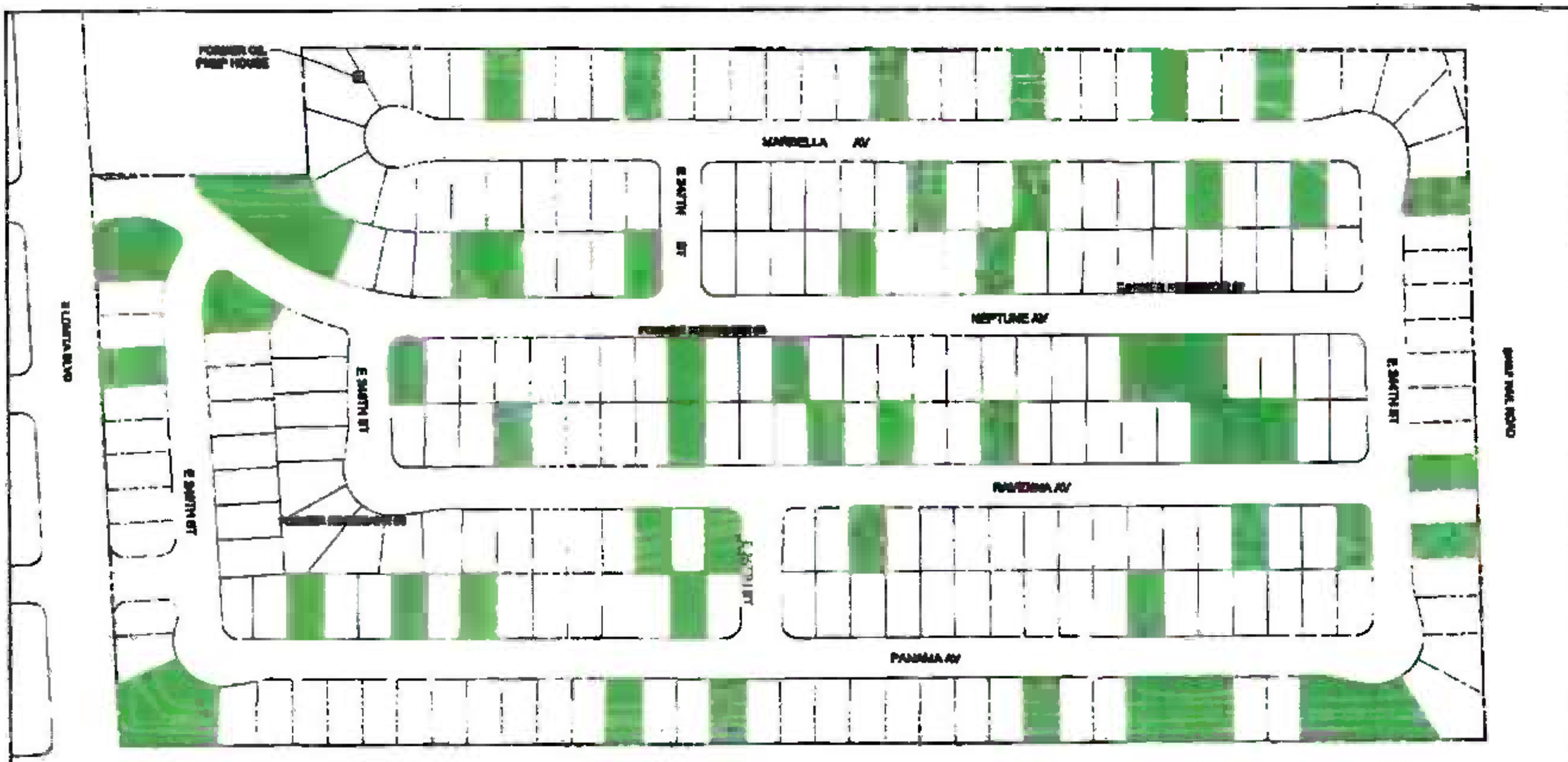


PETALUMA LN
MARBELLA AV
NEPTUNE AV
RAVENNA AV
LAGOON AV
LOMITA BLVD
249TH ST
E 247TH ST
E 244TH ST
BNSF RAILROAD
RAVENNA AV
PANAMA AV
SEE DETAIL
EXPLANATION
244TH ST
244-SV 05E
RAVENNA AV
DETAIL
URS Corporation
BENZENE AND METHANE CONCENTRATIONS
IN SOIL VAPOR
4



CAROUSEL HOUSES TESTED AS OF MARCH 15TH, 2010

Figure 5A



EXPLANATION

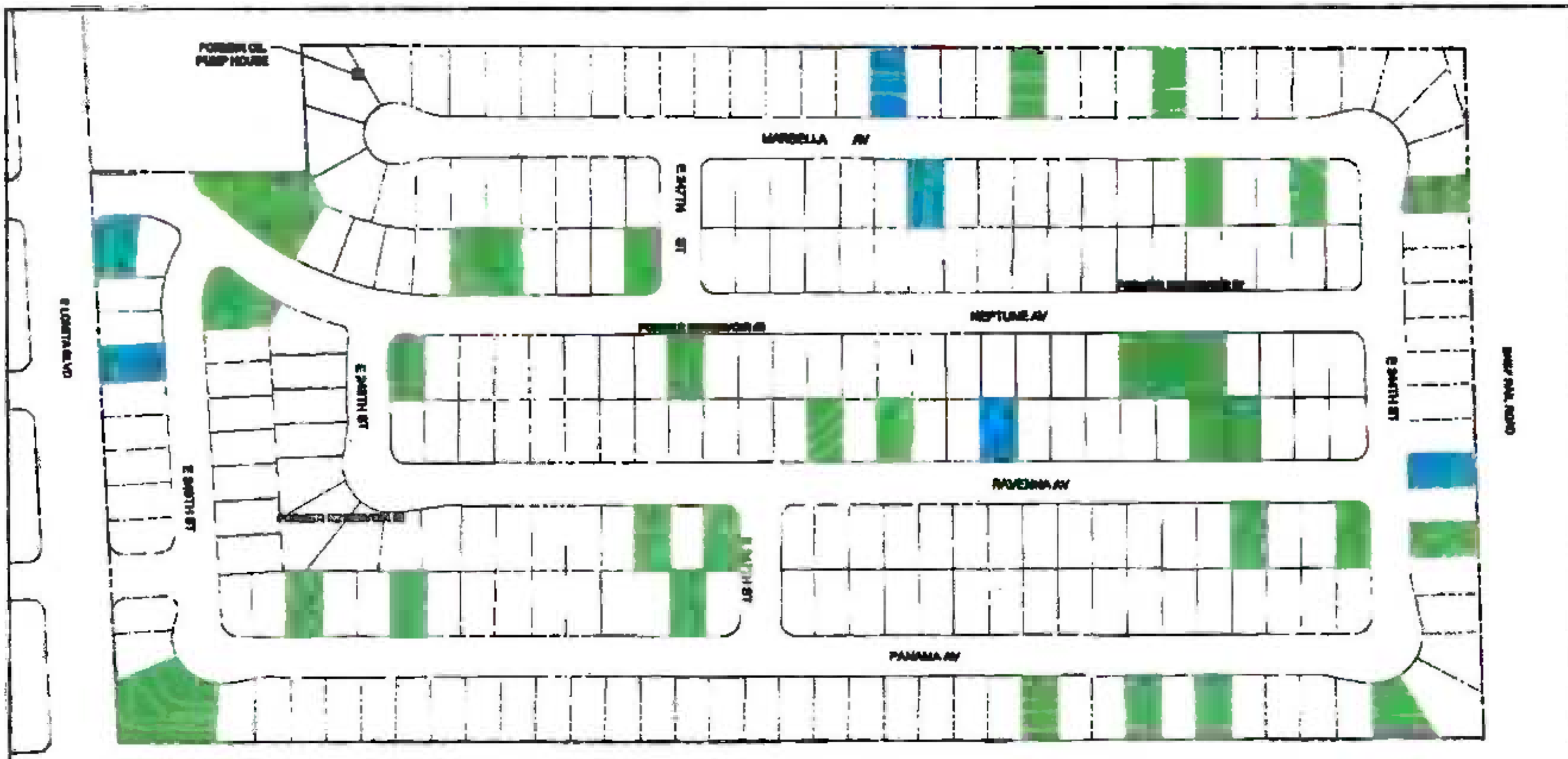
APPROXIMATE PROPERTY LINE

METHANE SCREENING LESS THAN 10% LEL

METHANE SCREENING GREATER THAN OR EQUAL TO 10% LEL (NO HOUSES EXCEED 10% LEL FOR METHANE)

RESIDENTIAL METHANE SCREENING RESULTS AS OF MARCH 15TH, 2010

Figure 5B



EXPLANATION

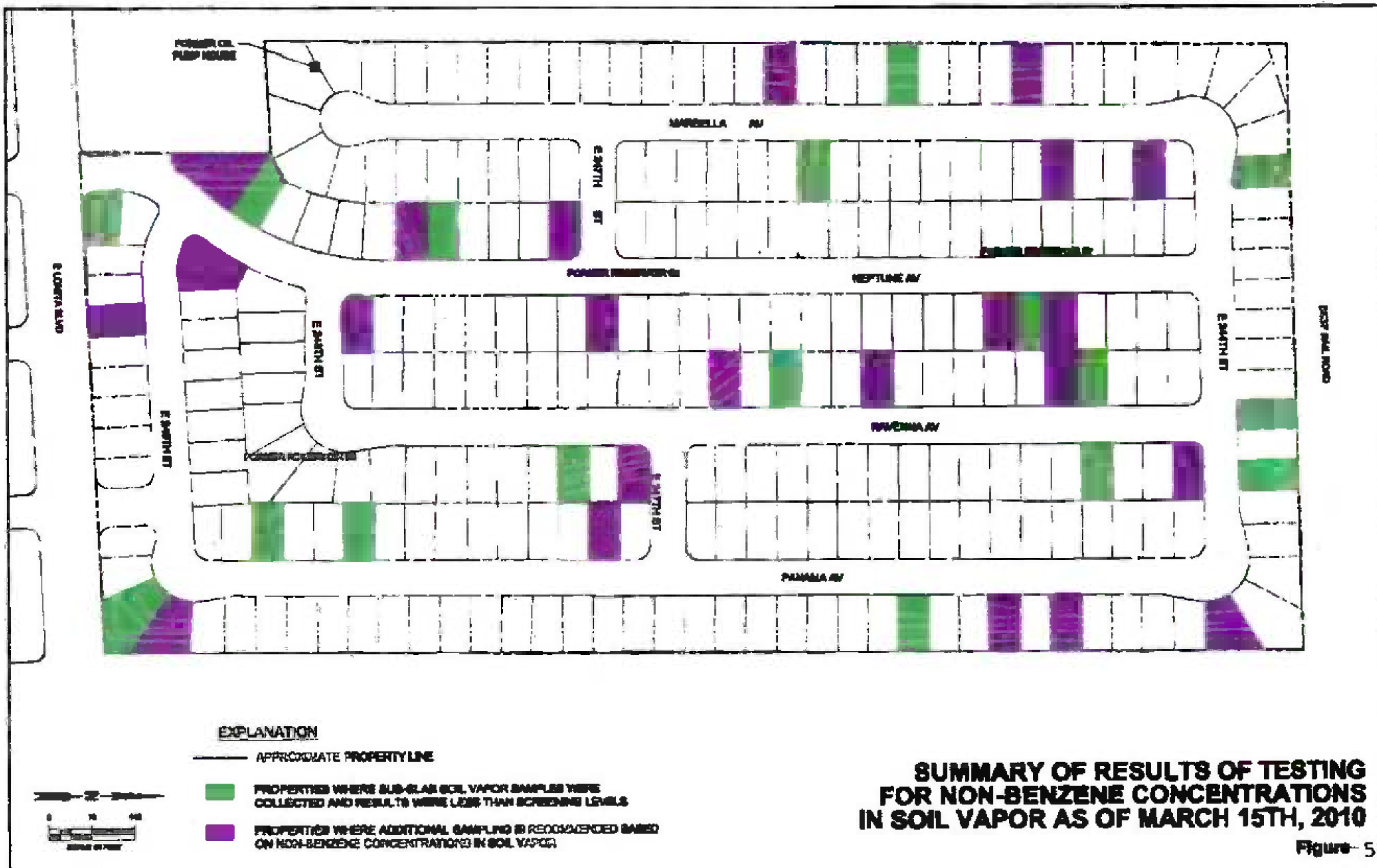
APPROXIMATE PROPERTY LINE

PROPERTIES WHERE SUB-SLAB SOIL VAPOR SAMPLES WERE COLLECTED AND RESULTS WERE LESS THAN SCREENING LEVELS

PROPERTIES WHERE ADDITIONAL SAMPLING IS RECOMMENDED BASED ON BENZENE CONCENTRATIONS IN SOIL VAPOR

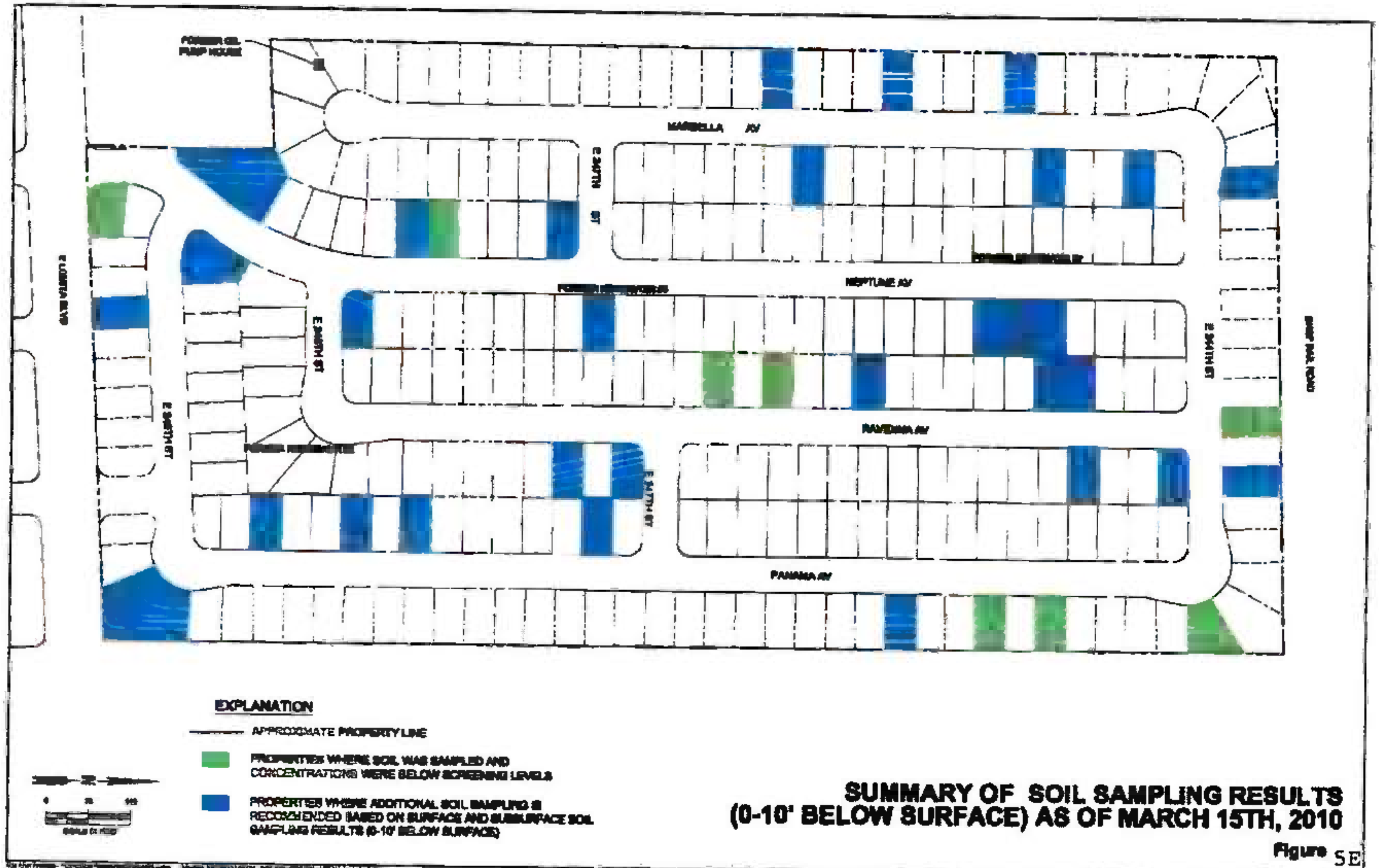
SUMMARY OF RESULTS OF TESTING FOR BENZENE CONCENTRATIONS IN SOIL VAPOR AS OF MARCH 15TH, 2010

Figure 5C



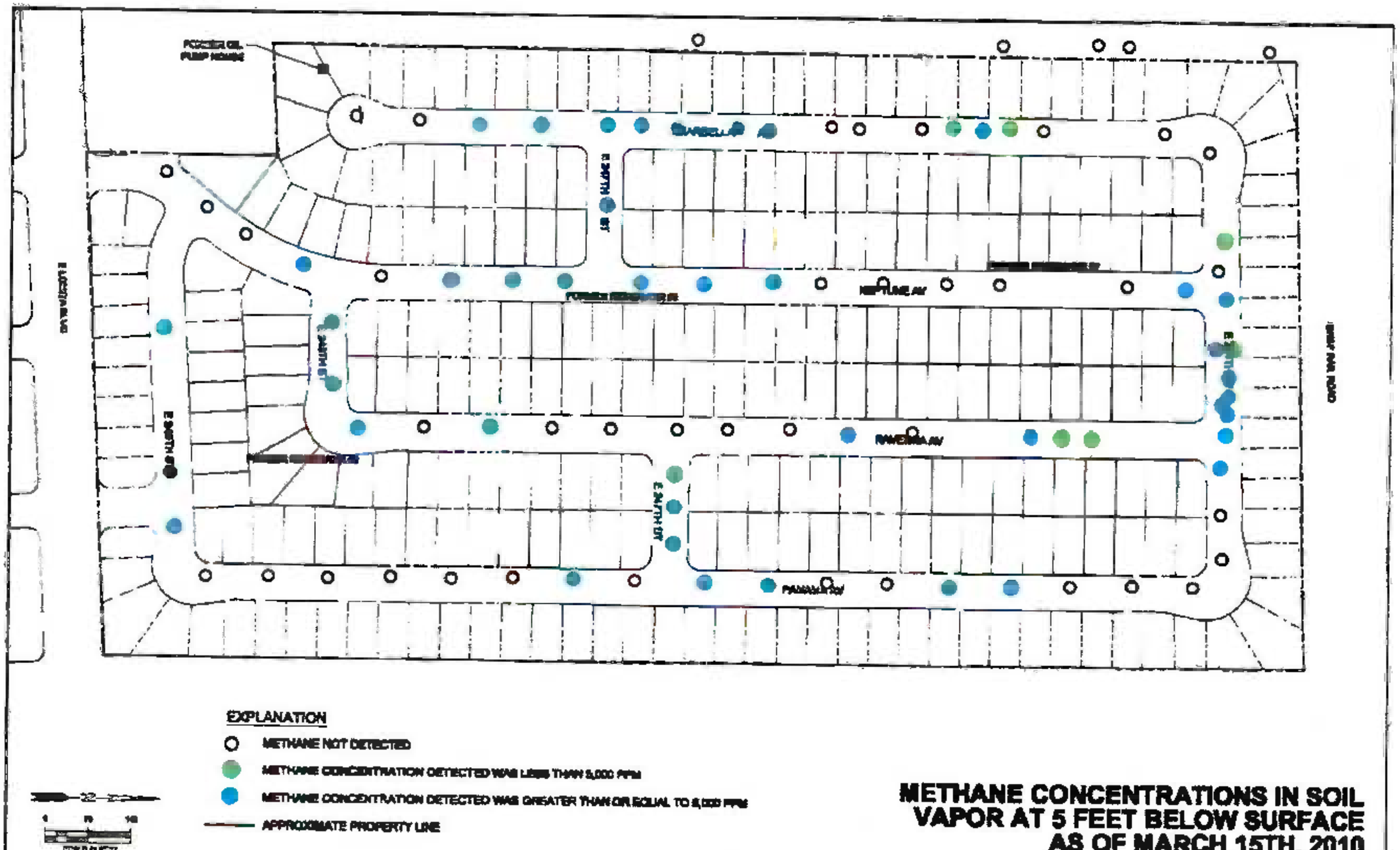
SUMMARY OF RESULTS OF TESTING FOR NON-BENZENE CONCENTRATIONS IN SOIL VAPOR AS OF MARCH 15TH, 2010

Figure 5D



SUMMARY OF SOIL SAMPLING RESULTS (0-10' BELOW SURFACE) AS OF MARCH 15TH, 2010

Figure 5E



METHANE CONCENTRATIONS IN SOIL VAPOR AT 5 FEET BELOW SURFACE AS OF MARCH 15TH, 2010

Figure 5F

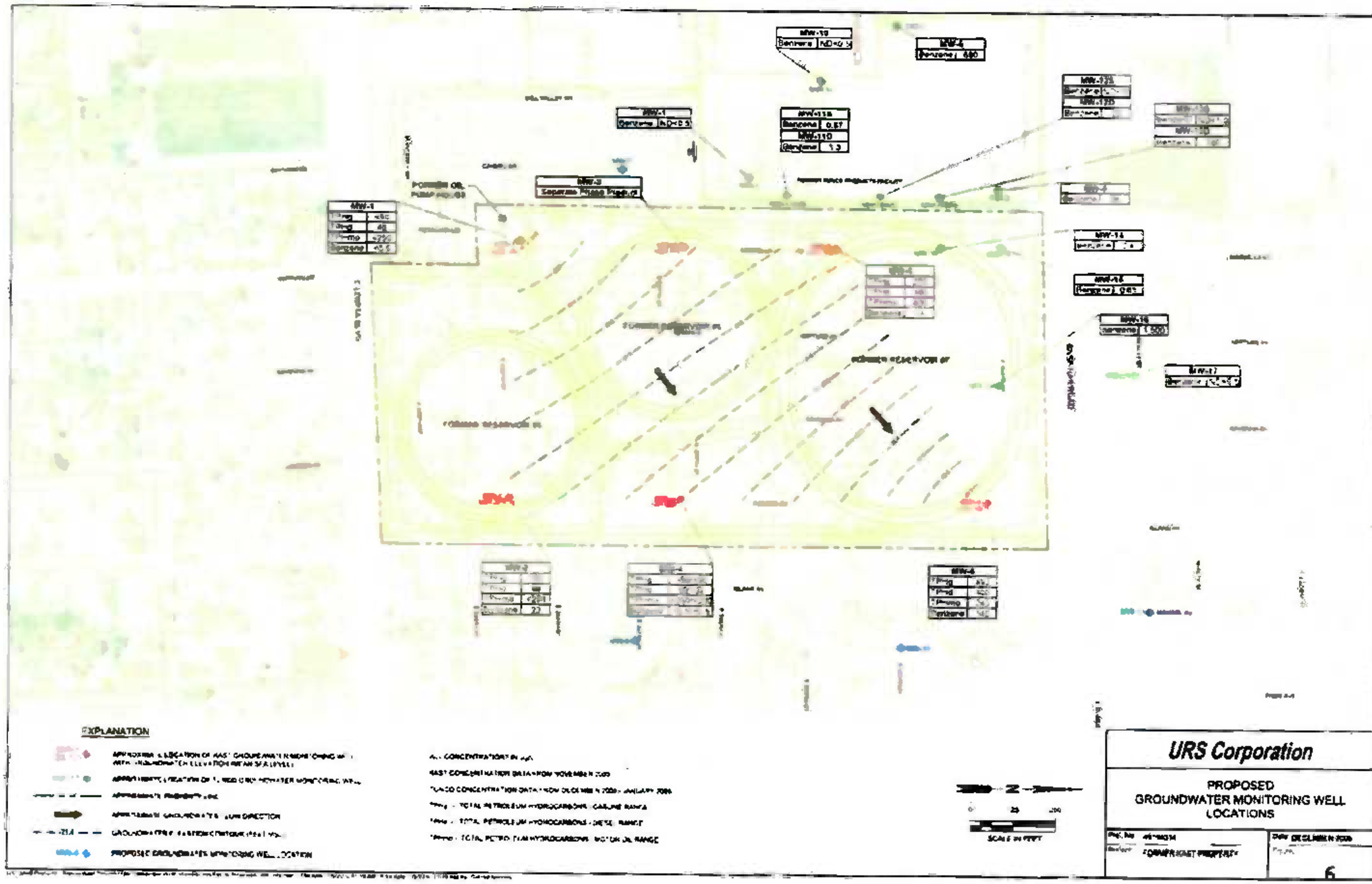

MW-19
Benzene ND<0.5
MW-4
Benzene 680
MW-1
Benzene ND<0.5
MW-11B
Benzene 0.57
MW-11D
Benzene 1.3
MW-3
Separate Phase Product
MW-1
MW-14
MW-15
Benzene 0.83
MW-16
Benzene 1,500
MW-17
MW-2
MW-6
FORMER OIL PUMP HOUSE
FORMER RESERVOIR
EXPLANATION
SCALE IN FEET
URS Corporation
PROPOSED
GROUNDWATER MONITORING WELL
LOCATIONS
6

Table 1. Data Summary - Phase I & II Site Characterization

Medium	Constituents	Phase	Units	% of Sample Detection	5%ile	25%ile	Median	75%ile	95%ile	Maximum Detected Concentration
Soil	Benzene	I	UG/KG	24.0%	ND 0.445	ND 0.5	ND 0.6	ND 110	4600	34000
		II	UG/KG	55.2%	ND 0.13	ND 0.24	0.405	0.48	180	14000
	Benzo (a) Pyrene	I	MG/KG	0%	ND 0.25	ND 0.25	ND 0.25	ND 1.25	ND 2.5	ND
		II	MG/KG	67.2%	ND 0.0025	ND 0.011	0.25	0.25	2.5	3.6
	Naphthalene	I	MG/KG	22.3%	ND 0.00455	ND 0.0055	ND 0.25	ND	14	29
		II	MG/KG	43.5%	0.0015	0.0041	0.013	ND 0.25	4.7	61
	TPH as Diesel	I	MG/KG	39.4%	ND 2.5	ND 2.5	ND 2.5	2700	13000	22000
		II	MG/KG	71.8%	ND 2.5	ND 2.5	70	470	7300	33000
	TPH as Gasoline	I	MG/KG	40.6%	ND 0.11	ND 0.125	ND 0.14	190	4300	8800
		II	MG/KG	43.7%	ND 0.063	ND 0.10	ND 0.10	0.18	660	5500
	TPH as Motor Oil	I	MG/KG	36.0%	ND 12.5	ND 12.5	ND 12.5	3500	11000	21000
		II	MG/KG	74.7%	ND 12.5	ND 12.5	205	930	8900	41000
Soil Vapor	Methane	I	%	55.1%	ND 0.39	ND 0.42	1.35	12.6	50.3	62.6
		II	%	4.1%	ND 0.00011	ND 0.00012	ND 0.00012	ND 0.00012	ND 0.00024	78
	Benzene	I	UG/L	85.1%	ND 0.0016	0.028	0.10	3.3	150	3800
		II	UG/L	27.6%	ND 0.0018	ND 0.0018	ND 0.0019	0.0038	0.013	6.5
	Naphthalene	I	UG/L	3.4%	ND 0.016	ND 0.12	ND 1.1	ND 8.5	ND 46	1.2
		II	UG/L	26.7%	ND 0.0031	ND 0.0115	ND 0.012	0.0125	0.017	0.18

Shaded cells indicate not-detected result. 1/2 Detection limit reported
Phase II investigation reports submitted to Regional Board as of July 19, 2010.

Table 1. Data Summary - Phase I & II Site Characterization

Medium	Constituents	Phase	Units	% of Sample Detection	5%ile	25%ile	Median	75%ile	95%ile	Maximum Detected Concentration
Soil	Benzene	I	UG/KG	24.0%	ND 0.445	ND 0.5	ND 0.6	ND 110	4600	34000
		II	UG/KG	55.2%	ND 0.13	ND 0.24	0.405	0.48	180	14000
	Benzo (a) Pyrene	I	MG/KG	0%	ND 0.25	ND 0.25	ND 0.25	ND 1.25	ND 2.5	ND
		II	MG/KG	67.2%	ND 0.0025	ND 0.011	0.25	0.25	2.5	3.6
	Naphthalene	I	MG/KG	22.3%	ND 0.00455	ND 0.0055	ND 0.25	ND	14	29
		II	MG/KG	43.5%	0.0015	0.0041	0.013	ND 0.25	4.7	61
	TPH as Diesel	I	MG/KG	39.4%	ND 2.5	ND 2.5	ND 2.5	2700	13000	22000
		II	MG/KG	71.8%	ND 2.5	ND 2.5	70	470	7300	33000
	TPH as Gasoline	I	MG/KG	40.6%	ND 0.11	ND 0.125	ND 0.14	190	4300	8800
		II	MG/KG	43.7%	ND 0,063	ND 0.10	ND 0.10	0.18	660	5500
	TPH as Motor Oil	I	MG/KG	36.0%	ND 12.5	ND 12.5	ND 12.5	3500	11000	21000
		II	MG/KG	74.7%	ND 12.5	ND 12.5	205	930	8900	41000
Soil Vapor	Methane	I	%	55.1%	ND 0.39	ND 0.42	1.35	12.6	50.3	62.6
		II	%	4.1%	ND 0.00011	ND 0.00012	ND 0.00012	ND 0.00012	ND 0.00024	78
	Benzene	I	UG/L	85.1%	ND 0.0016	0.028	0.10	3.3	150	3800
		II	UG/L	27.6%	ND 0.0018	ND 0.0018	ND 0.0019	0.0038	0.013	6.5
	Naphthalene	I	UG/L	3.4%	ND 0.016	ND 0.12	ND 1.1	ND 8.5	ND 46	1.2
		II	UG/L	26.7%	ND 0.0031	ND 0.0115	ND 0.012	0.0125	0.017	0.18

Shaded cells indicate not-detected result. 1/2 Detection limit reported
Phase II investigation reports submitted to Regional Board as of July 19, 2010.

TABLE 1A
Summary of Soil Sample Analytical Results- VOCs, SVOCs, and TPH
Addendum to the IRAP- Further Site Characterization Report
Former Kast Property

LOCATION NAME			244SV05A7	244SV05A7	244SV05A7
SAMPLE DATE			2/2/2010	2/2/2010	2/2/2010
SAMPLE DEPTH, ft bgs			2.5	5	10
SAMPLE NAME			244SV05A7-2.5	244SV05A7-5	244SV05A7-10
SAMPLE DELIVERY GROUP (SDG)	Method	Unit	10-02-0133	10-02-0133	10-02-0133
1,2,4-Trimethylbenzene	SW8260B	µg/kg	**14,000**	**9,700**	**33,000**
1,3,5-Trimethylbenzene			**3,300**	**300**	**12,000**
Acetone			< 4000	< 4200	< 11000
Benzene			**11,000**	**9,600**	**3,900**
Chlorobenzene			< 80	< 85	< 220
cis-1,2-Dichloroethene			< 80	< 85	< 220
Cumene (Isopropylbenzene)			**4,000**	**4,500**	**6,300**
Ethylbenzene			**12,000**	**12,000**	**19,000**
Methyl-tert-Butyl Ether			< 160	< 170	< 440
Naphthalene			**7,300**	**7,200**	**9,800**
n-Butylbenzene			**2,800**	**2,400**	**5,100**
p-Isopropyltoluene			**2,500**	**1,800**	**6,000**
Propylbenzene			**6,200**	**6,800**	**9,800**
sec-Butylbenzene			**2,100**	**2,500**	**3,500**
tert-Butylbenzene			**94**	**120**	< 220
Toluene			< 80	< 85	< 220
Vinyl Acetate			< 800	< 850	< 2200
Xylenes, Total			**7,300**	**2,500**	**56,000**
1-Methylnaphthalene	SW8270C	mg/kg	**19**	**9.9**	**13**
2-Methylnaphthalene			**28**	**16**	**21**
Fluorene			< 5.0	< 5.0	< 5.0
Naphthalene			**11**	**7.8**	**10**
Phenanthrene			**7.4**	< 5.0	< 5.0
Pyrene			< 5.0	< 5.0	< 5.0
TPH as Gasoline	M8015	mg/kg	**2,500**	**2,500**	**5,000**
TPH as Motor Oil	M8015	mg/kg	**8,100**	**6,200**	**5,700**
TPH as Diesel	SW8015B	mg/kg	**86,000**	**6,500**	**6,600**

Notes:

Bold text indicates results above laboratory reporting limit

µg/kg = micrograms per kilogram

mg/kg = milligrams per kilogram

ft bgs = feet below ground surface

TABLE 2 B

Summary of Soil Vapor Analytical Results - VOCs and Fixed Gases
IRAP Further Site Characterization
Former Kast Property

LOCATION NAME			244-SV-05A5	244-SV-05A6	244-SV-05A7
SAMPLE DATE			2/4/2010	2/4/2010	2/4/2010
SAMPLE DEPTH, FT BGS			2.5	5	10
SAMPLE NAME			244-SV05A5-2.5	244-SV05A6-5	244-SV05A7-10
SAMPLE DELIVERY GROUP (SDG)	Method	Unit	1002129A/B	1002129A/B	1002129A/B
1,2,4-Trimethylbenzene	TO15	UG/M3	**18000**	< 2800	**31000**
1,3,5-Trimethylbenzene			< 6200	< 2800	**8800**
4-Ethyltoluene			**17000**	< 2800	**20000**
Benzene			**390000 j**	**430000 j**	**630000**
Cumene (isopropylbenzene)			**7600**	**8200**	**14000**
Cyclohexane			**1800000 j**	**470000 j**	**2700000 E**
Ethylbenzene			**50000**	**44000**	**86000**
Heptane			**1000000 j**	< 2400	**120000**
Hexane			**1900000 j**	**3300 j**	**250000**
Naphthalene			**590 J b**	**760 J b**	**1300 J b**
o-Xylene			**20000**	< 2500	< 4900
p/m-Xylene			**110000**	< 2600	**120000**
Propylbenzene			**8400**	**9300**	**15000**
Toluene			**33000**	< 2200	< 4200
Carbon Dioxide	D1946	%	**5.2**	**0.89**	**11**
Methane			**23**	**0.086**	**26**
Oxygen			**4.5**	**20**	**7.3**

Notes:

Bold text indicates results above laboratory reporting limit.

µg/m³ = micrograms per cubic meter

% = percent

B = Compound detected in associated laboratory method blank (laboratory qualified)

J = Estimated value (laboratory qualified)

b = Compound detected in associated laboratory method blank (qualified during validation)

j = Estimated value (qualified during validation as the result is possibly biased high)

E = Estimated value. Result exceeded instrument calibration range during analysis

FT BGS = Feet below ground surface.

Table 3

Maximum Concentrations of Aliphatic and Aromatic Hydrocarbons by Hydrocarbon Fractionation at Individual Properties

Street Name	House No	Units	Aliphatics (C5 - C8)	Aromatics (C6 - C8)	Aliphatics (C9 - C18)	Aromatics (C9 - C16)	Aliphatics (C19 - C32)	Aromatics (C17 - C32)
244TH ST	351	MG/KG	ND	ND	ND	ND	46	26
244TH ST	361	MG/KG	ND	ND	ND	ND	30	29
249TH ST	345	MG/KG	0.84	ND	140	300	220	240
249TH ST	352	MG/KG	ND	ND	ND	17	48	59
249TH ST	412	MG/KG	ND	0.014	ND	39	80	71
MARBELLA AVE	24412	MG/KG	2300	2	4100	2400	3100	4400
MARBELLA AVE	24426	MG/KG	2.2	0.1	220	240	340	210
MARBELLA AVE	24433	MG/KG	ND	ND	1300	6800	7200	6000
MARBELLA AVE	24517	MG/KG	ND	ND	ND	15	12	27
MARBELLA AVE	24532	MG/KG	350	54	1000	1200	1900	1600
MARBELLA AVE	24603	MG/KG	2	0.058	980	2400	1300	2000
NEPTUNE AVE	24422	MG/KG	1.4	ND	79	170	190	180
NEPTUNE AVE	24426	MG/KG	ND	ND	37	63	99	92
NEPTUNE AVE	24502	MG/KG	0.64	ND	32	72	94	110
NEPTUNE AVE	24632	MG/KG	ND	ND	51	220	300	420
NEPTUNE AVE	24703	MG/KG	68	2.5	1100	2500	2000	2300
NEPTUNE AVE	24725	MG/KG	ND	ND	ND	ND	ND	ND
NEPTUNE AVE	24729	MG/KG	ND	ND	ND	ND	37	35
NEPTUNE AVE	24738	MG/KG	710	130	2100	2000	1900	1300
NEPTUNE AVE	24815	MG/KG	ND	ND	ND	ND	100	54
NEPTUNE AVE	24825	MG/KG	ND	ND	ND	22	84	160
NEPTUNE AVE	24912	MG/KG	ND	ND	ND	ND	12	10
PANAMA AVE	24406	MG/KG	ND	ND	ND	56	260	250
PANAMA AVE	24430	MG/KG	ND	ND	ND	ND	ND	ND
PANAMA AVE	24502	MG/KG	ND	ND	ND	ND	ND	ND
PANAMA AVE	24518	MG/KG	ND	ND	17	48	110	130
PANAMA AVE	24709	MG/KG	2.8	1.1	1100	6100	5100	7200
PANAMA AVE	24739	MG/KG	5.9	0.25	14	240	96	250
PANAMA AVE	24809	MG/KG	53	3.8	220	520	440	570
PANAMA AVE	24823	MG/KG	210	ND	610	540	560	1000
PANAMA AVE	24838	MG/KG	ND	ND	ND	22	96	130
RAVENNA AVE	24402	MG/KG	680	60	680	630	920	730
RAVENNA AVE	24416	MG/KG	3.8	0.32	640	1500	2000	1900
RAVENNA AVE	24419	MG/KG	1.2	0.07	280	510	790	880
RAVENNA AVE	24423	MG/KG	780	23	820	830	700	600
RAVENNA AVE	24523	MG/KG	2.4	0.16	100	250	210	290
RAVENNA AVE	24603	MG/KG	ND	ND	ND	ND	15	ND
RAVENNA AVE	24613	MG/KG	76	ND	500	340	590	760
RAVENNA AVE	24700	MG/KG	ND	ND	15	67	340	410
RAVENNA AVE	24712	MG/KG	1.1	0.013	140	130	240	360

Note: The concentrations shown are the maximum concentration detected at each property.

The maximum concentration of aliphatic or aromatic hydrocarbons in a particular carbon-chain range may not occur in the same sample as the maximum concentrations in a different carbon-chain range.

Table 4: Target Schedule

Task	Estimated Start Date	Target Completion Date	Schedule (on, ahead or behind)	Comments
Pilot Testing Work Plan	03/11/11	05/10/11		Within 60 days of the issuance of the CAO
Regional Board review of Pilot Testing Work Plan	05/11/11	07/11/11		Regional Board reviews Report and issues Response and approval
Pilot Test Report	07/12/11	11/07/11		Final Report due within 120 days with a bi monthly progress reporting
Environmental Impact Assessment (EIA) Report	NA	12/07/11		Within 30 days of the completion of the Pilot Testing Report
Regional Board Review of Pilot Test and EIA Reports	11/08/11	01/09/12		Review of Piolot Test & EIA Reports and Response
Site- Specific Cleanup Goals (SSCG)	NA	11/07/11		Due date is concurrent with the Pilot Test Report due date.
30 day Public Review of SSCG	11/08/11	12/08/11		
Remedial Action Plan (RAP)	01/11/12	03/11/12		Within 30 days of the completion of the Pilot Testing Report
30 day Public Review of RAP	03/12/12	04/12/12		
Regional Board Review of Remedial Action Plan	04/13/12	06/13/12		
Implementation of RAP	06/20/12			
Groundwater Monitoring and Reporting	On going			Quarterly Monitoring Program

Notes: (1) Dates are considered estimates and subject to revision in response to evolving field conditions and potential weather-related delays

(2) Project schedule reconciled/updated at the end of each calendar month.

Exhibit 1

Office of Environmental Health Hazard Assessment

Joan E. Denton, Ph.D., Director
Headquarters • 1001 I Street • Sacramento, California 95814
Mailing Address: P.O. Box 4010 • Sacramento, California 95812-4010
Oakland Office • Mailing Address: 1515 Clay Street, 16th Floor • Oakland, California 94612

Linda S. Adams
Secretary for Environmental Protection

Arnold Schwarzenegger
Governor

MEMORANDUM

TO: Dr. Teklewold Ayalew
Engineering Geologist
Regional Water Quality Control Board
320 West 4th Street, Suite 200
Los Angeles, CA 90013

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

DATE: May 19, 2010

SUBJECT: TPH DATA FOR 41 HOMES AT THE FORMER KAST SITE IN CARSON, CA (R4-09-17) OEHHA # 880212-01

Document reviewed

- Memo: "Kast TPH Data for 41 homes" dated April 6, 2010.

Site characterization

- Analytical data for TPH in soils data are supplied for 41 homes. Sample depths are not always stated but those that are provided are either 0.5 or 5 feet.

Hazard Assessment

Based on the data in the memo, I estimated maximum exposures for a child and compared the resulting exposure estimates to DTSC reference dosages (RfDs).

- In the table below, columns 3-8 show the maximum TPH concentrations detected at each property.
- Columns 9-14 show the corresponding TPH ingestion by a 15 kg child ingesting 200 mg soil per day.
- Columns 15-20 show the corresponding hazard quotients for a 15 kg child, obtained by dividing the daily ingestion by the reference dose. Hazard quotients exceeding unity are in bold font.

Street Name	House No	Aliphatics (C5 - C8)	Aromatics (C6 - C8)	Aliphatics (C9 – C18)	Aromatics (C9 - C16)	Aliphatics (C19 - C32)	Aromatics (C17 - C32)	Aliphatics (C5 - C8)	Aromatics (C6 - C8)	Aliphatics (C9 - C18)	Aromatics (C9 - C16)	Aliphatics (C19 - C32)	Aromatics (C17 - C32)	Aliphatics (C5 - C8)	Aromatics (C6 - C8)	Aliphatics (C9 - C18)	Aromatics (C9 - C16)	Aliphatics (C19 - C32)	Aromatics (C17 - C32)
		Detected concentrations (mg/kg)						Estimated child dose (mg/kg/day)						Hazard ratio (child)					
244TH ST	351	ND	ND	ND	ND	46	26					6.1E-4	3.5E-4	0.0E+0	*	0.0E+0	0.0E+0	3.1E-4	1.2E-2
244TH ST	361	ND	ND	ND	ND	30	29					4.0E-4	3.9E-4	0.0E+0	*	0.0E+0	0.0E+0	2.0E-4	1.3E-2
249TH ST	345	0.84	ND	140	300	220	240	1.1E-5		1.9E-3	4.0E-3	2.9E-3	3.2E-3	2.8E-4	*	1.9E-2	1.3E-1	1.5E-3	1.1E-1
249TH ST	352	ND	ND	ND	17	48	59				2.3E-4	6.4E-4	7.9E-4	0.0E+0	*	0.0E+0	7.6E-3	3.2E-4	2.6E-2
249TH ST	412	ND	0.014	ND	39	80	71				5.2E-4	1.1E-3	9.5E-4	0.0E+0	*	0.0E+0	1.7E-2	5.3E-4	3.2E-2
MARBELLA AVE	24412	2300	2	4100	2400	3100	4400	3.1E-2	2.7E-5	5.5E-2	3.2E-2	4.1E-2	5.9E-2	7.7E-1	*	5.5E-1	**1.1**	2.1E-2	**2.0**
MARBELLA AVE	24426	2.2	0.1	220	240	340	210	2.9E-5	1.3E-6	2.9E-3	3.2E-3	4.5E-3	2.8E-3	7.3E-4	*	2.9E-2	1.1E-1	2.3E-3	9.3E-2
MARBELLA AVE	24433	ND	ND	1300	6800	7200	6000			1.7E-2	9.1E-2	9.6E-2	8.0E-2	0.0E+0	*	1.7E-1	**3.0**	4.8E-2	**2.7**
MARBELLA AVE	24517	ND	ND	ND	15	12	27				2.0E-4	1.6E-4	3.6E-4	0.0E+0	*	0.0E+0	6.7E-3	8.0E-5	1.2E-2
MARBELLA AVE	24532	350	54	1000	1200	1900	1600	4.7E-3	7.2E-4	1.3E-2	1.6E-2	2.5E-2	2.1E-2	1.2E-1	*	1.3E-1	5.3E-1	1.3E-2	7.1E-1
MARBELLA AVE	24603	2	0.058	980	2400	1300	2000	2.7E-5	7.7E-7	1.3E-2	3.2E-2	1.7E-2	2.7E-2	6.7E-4	*	1.3E-1	**1.1**	8.7E-3	8.9E-1
NEPTUNE AVE	24422	1.4	ND	79	170	190	180	1.9E-5		1.1E-3	2.3E-3	2.5E-3	2.4E-3	4.7E-4	*	1.1E-2	7.6E-2	1.3E-3	8.0E-2
NEPTUNE AVE	24426	ND	ND	37	63	99	92			4.9E-4	8.4E-4	1.3E-3	1.2E-3	0.0E+0	*	4.9E-3	2.8E-2	6.6E-4	4.1E-2
NEPTUNE AVE	24502	0.64	ND	32	72	94	110	8.5E-6		4.3E-4	9.6E-4	1.3E-3	1.5E-3	2.1E-4	*	4.3E-3	3.2E-2	6.3E-4	4.9E-2
NEPTUNE AVE	24632	ND	ND	51	220	300	420			6.8E-4	2.9E-3	4.0E-3	5.6E-3	0.0E+0	*	6.8E-3	9.8E-2	2.0E-3	1.9E-1
NEPTUNE AVE	24703	68	2.5	1100	2500	2000	2300	9.1E-4	3.3E-5	1.5E-2	3.3E-2	2.7E-2	3.1E-2	2.3E-2	*	1.5E-1	**1.1**	1.3E-2	**1.02**
NEPTUNE AVE	24725	ND	ND	ND	ND	ND	ND							0.0E+0	*	0.0E+0	0.0E+0	0.0E+0	0.0E+0
NEPTUNE AVE	24729	ND	ND	ND	ND	37	35					4.9E-4	4.7E-4	0.0E+0	*	0.0E+0	0.0E+0	2.5E-4	1.6E-2
NEPTUNE AVE	24738	710	130	2100	2000	1900	1300	9.5E-3	1.7E-3	2.8E-2	2.7E-2	2.5E-2	1.7E-2	2.4E-1	*	2.8E-1	8.9E-1	1.3E-2	5.8E-1
NEPTUNE AVE	24815	ND	ND	ND	ND	100	54					1.3E-3	7.2E-4	0.0E+0	*	0.0E+0	0.0E+0	6.7E-4	2.4E-2
NEPTUNE AVE	24825	ND	ND	ND	22	84	160				2.9E-4	1.1E-3	2.1E-3	0.0E+0	*	0.0E+0	9.8E-3	5.6E-4	7.1E-2
NEPTUNE AVE	24912	ND	ND	ND	ND	12	10					1.6E-4	1.3E-4	0.0E+0	*	0.0E+0	0.0E+0	8.0E-5	4.4E-3
PANAMA AVE	24406	ND	ND	ND	56	260	250				7.5E-4	3.5E-3	3.3E-3	0.0E+0	*	0.0E+0	2.5E-2	1.7E-3	1.1E-1
PANAMA AVE	24430	ND	ND	ND	ND	ND	ND							0.0E+0	*	0.0E+0	0.0E+0	0.0E+0	0.0E+0
PANAMA AVE	24502	ND	ND	ND	ND	ND	ND							0.0E+0	*	0.0E+0	0.0E+0	0.0E+0	0.0E+0
PANAMA AVE	24518	ND	ND	17	48	110	130			2.3E-4	6.4E-4	1.5E-3	1.7E-3	0.0E+0	*	2.3E-3	2.1E-2	7.3E-4	5.8E-2
PANAMA AVE	24709	2.8	1.1	1100	6100	5100	7200	3.7E-5	1.5E-5	1.5E-2	8.1E-2	6.8E-2	9.6E-2	9.3E-4	*	1.5E-1	**2.7**	3.4E-2	**3.2**
PANAMA AVE	24739	5.9	0.25	14	240	96	250	7.9E-5	3.3E-6	1.9E-4	3.2E-3	1.3E-3	3.3E-3	2.0E-3	*	1.9E-3	1.1E-1	6.4E-4	1.1E-1
PANAMA AVE	24809	53	3.8	220	520	440	570	7.1E-4	5.1E-5	2.9E-3	6.9E-3	5.9E-3	7.6E-3	1.8E-2	*	2.9E-2	2.3E-1	2.9E-3	2.5E-1

PANAMA AVE	24823	210	ND	610	540	560	1000	2.8E-3		8 1E-3	7.2E-3	7.5E-3	1.3E-2	7.0E-2	*	8.1E-2	2.4E-1	3.7E-3	4.4E-1
PANAMA AVE	24838	ND	ND	ND	22	96	130				2.9E-4	1.3E-3	1.7E-3	0.0E+0	*	0.0E+0	9.8E-3	6.4E-4	5.8E-2
RAVENNA AVE	24402	680	60	680	630	920	730	9.1E-3	8.0E-4	9 1E-3	8.4E-3	1.2E-2	9.7E-3	2.3E-1	*	9.1E-2	2.8E-1	6.1E-3	3.2E-1
RAVENNA AVE	24416	3.8	0.32	640	1500	2000	1900	5.1E-5	4.3E-6	8.5E-3	2.0E-2	2.7E-2	2.5E-2	1.3E-3	*	8.5E-2	6.7E-1	1.3E-2	8.4E-1
RAVENNA AVE	24419	1.2	0.07	280	510	790	890	1.6E-5	9.3E-7	3 7E-3	6.8E-3	1.1E-2	1.2E-2	4.0E-4	*	3.7E-2	2.3E-1	5.3E-3	4.0E-1
RAVENNA AVE	24423	780	23	820	830	700	600	1.0E-2	3.1E-4	1 1E-2	1.1E-2	9.3E-3	8.0E-3	2.6E-1	*	1.1E-1	3.7E-1	4.7E-3	2.7E-1
RAVENNA AVE	24523	2.4	0.16	100	250	210	290	3.2E-5	2.1E-6	1 3E-3	3.3E-3	2.8E-3	3.9E-3	8.0E-4	*	1.3E-2	1.1E-1	1.4E-3	1.3E-1
RAVENNA AVE	24603	ND	ND	ND	ND	15	ND					2.0E-4		0.0E+0	*	0.0E+0	0.0E+0	1.0E-4	0.0E+0
RAVENNA AVE	24613	76	ND	500	340	590	760	1.0E-3		6.7E-3	4.5E-3	7.9E-3	1.0E-2	2.5E-2	*	6.7E-2	1.5E-1	3.9E-3	3.4E-1
RAVENNA AVE	24700	ND	ND	15	67	340	410			2.0E-4	8.9E-4	4.5E-3	5.5E-3	0.0E+0	*	2.0E-3	3.0E-2	2.3E-3	1.8E-1
RAVENNA AVE	24712	1.1	0.013	140	130	240	360	1.5E-5	1.7E-7	1 9E-3	1.7E-3	3.2E-3	4.8E-3	3.7E-4	*	1.9E-2	5.8E-2	1.6E-3	1.6E-1
RfD								0.04		0.1	0.03	2	0.03		* = No RfD				

- Aromatic hydrocarbons in the C-9 to C-32 range at 24412, 24433, and 24603 Marbella Avenue, 24709 Panama Avenue, and 24703 Panama Neptune exceed their reference values for children (i.e. the hazard quotient is ≥ 1.
- While a hazard quotient ≥ 1does not indicate that there will be definite toxic effects, it does indicate that the concentration exceeds the level that we can say is definitely safe.

Conclusions

- Aromatic hydrocarbons in the C-9 to C-32 range at five properties exceed their reference values for children (i.e. the hazard quotient is ≥ 1).

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

Memo reviewed by:

Ned Butler, PhD
Staff Toxicologist
Integrated Risk Assessment Branch

Exhibit 2

May 5, 2010

Shell Oil Company
One Shell Plaza
910 Louisiana Street
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Tel (713) 241 5126
Email: ed.platt@shell.com
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Ms. Tracy Egoscue
Executive Officer
California Regional Water Quality Control Board
Los Angeles Region
320 W. 4th Street, Suite 200
Los Angeles, CA 90013

Reference: **Former Kast Property, Carson, California**
Site Cleanup No. 1230; Site ID 2040330

Dear Ms Egoscue:

As you know, during the past several months, Shell Oil Company employees and contractors have worked tirelessly to investigate and address the environmental issues at the former Kast Property. To date, we have sampled at approximately one-third of the homes in the Carousel neighborhood, and we will continue our work in conjunction with the RWQCB, based upon applicable and appropriate scientific and regulatory standards that are protective of human health and the environment. Like the RWQCB, our goal is to protect the residents of the Carousel neighborhood and address the environmental issues, while minimizing disruption to residents and preserving the integrity of the community.

Although elevated levels of compounds of concern (COCs) have been found beneath the streets and at certain residential properties, based on the data collected so far, there is no imminent risk to residents or the public in the Carousel neighborhood. Also, while Shell's investigation is not yet complete, it does not appear at this time that there is any significant off-site migration of soil impacts or soil vapor impacts from the former Kast Property.

Our approach, which is to develop a coherent conceptual framework for the mitigation and remediation of the Carousel neighborhood, is consistent with the RWQCB's guidelines providing for a principled, phased approach to investigating and remediating environmental impacts. Specifically, this approach follows the guidance set out in the State Water Resources Control Board's Resolution 92-49. In accordance with these guidelines, it includes "an evaluation of cleanup alternatives that are feasible at the site" and consistent with the maximum benefit to the people of the State. Because the soil and groundwater assessment is ongoing, a full evaluation of cleanup alternatives is premature at this time.

Nevertheless, we are considering a variety of potential alternatives that can be applied at specific properties and in the public streets in order to address environmental impacts and avoid any significant risk to human health in the Carousel neighborhood. For example, Shell has submitted a work plan for the soil vapor extraction pilot test. While evaluating alternatives, we place a priority on keeping the community intact and minimizing any disruption to residents of the Carousel community. If it becomes necessary for residents to relocate temporarily to perform this work, Shell will take appropriate steps to minimize any inconvenience and compensate them for any resulting expenses. We are also sensitive to the residents' concerns about their property values and are open to a dialogue with the RWQCB regarding these issues.

In addition, Shell is continuing to monitor the groundwater to ensure that there are no significant impacts emanating from the former Kast Property. In this regard, it is essential that groundwaler conditions both up-gradient and down-gradient be evaluated. To date, our investigation suggests that groundwater up-gradient of the former Kast property is significantly contaminated. One potential source of this contamination appears to be the former Fletcher Oil Refinery, which we understand the County Sanitation District is remediating.

We look forward to further dialogue with the RWQCB regarding the draft Feasibility Study outline, recently submitted, as well as the Site Conceptual Model, to be submitted later this month. The Site Conceptual Model will provide: (1) an overview of our investigation efforts to date; (2) additional information regarding potential on and off-site sources for the COCs; and (3) a review of the available options for remediation of the former Kast property.

We appreciate your leadership on this project.

Sincerely,

William E. Platt
Manager, Environmental Claims
Shell Oil Company

EXHIBIT 2

Prepared for:

Shell Oil Products US
20945 S. Wilmington Avenues
Carson, CA 90810

Site-Specific Cleanup Goal Report

Former Kast Property
Carson, California

Prepared by:

Geosyntec
consultants

engineers | scientists | innovators

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Project Number: SB0484-04-2

February 22, 2013

Geosyntec
consultants

SITE-SPECIFIC CLEANUP GOAL REPORT

Former Kast Property
Carson, California

Prepared for:

Shell Oil Products US

Prepared by:

Geosyntec Consultants, Inc.

REGISTERED GEOLOGIST
MARK C. GRIVETTI
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CERTIFIED
ENGINEERING
GEOLOGIST
STATE OF CALIFORNIA

Mark Grivetti, P.G., CHG
Principal Hydrogeologist

Ruth Custance
Principal

Robert Ettinger
Principal

CERTIFICATION

SITE-SPECIFIC CLEANUP GOAL REPORT

FORMER KAST PROPERTY

CARSON, CALIFORNIA

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

Gene Freed
Project Manager
Shell Oil Company
February 22, 2013

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EXECUTIVE SUMMARY

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

Previous Site Evaluations

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

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

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

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

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

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

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

Constituents of Concern

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

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

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

Remedial Action Objectives and Site-Specific Cleanup Goals

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

- Prevent human exposures to concentrations of Site-related COCs in soil, soil vapor and indoor air such that total lifetime incremental carcinogenic risks are within the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) risk range of 10^{-6} to 10^{-4} (i.e., incremental cancer risk ranging from one in one million to one hundred in one million) and non-cancer hazard indices are less than 1 or concentrations are below background whichever is higher. Potential human exposures include on-site residents and construction and utility maintenance workers,

- Prevent fire/explosion risks in indoor air and/or enclosed spaces (e.g., utility vaults) due to the generation of methane from the anaerobic biodegradation of petroleum hydrocarbons in soils,

- Remove light non-aqueous phase liquid (LNAPL) to the extent practicable and where a significant reduction in current and future risk to groundwater will result, and

- Maintain a stable or decreasing plume of Site-related COCs in groundwater beneath the Site.

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

SSCGs for Soil

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

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

These numerical values are listed in the report.

SSCGs for Soil Vapor and Indoor Air

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

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

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

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

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

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

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

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

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

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

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

SSCGs for Groundwater

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

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

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

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

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

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

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

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

- Return of the Shallow Zone and Gage aquifer to background levels for Site-related benzene (and naphthalene) impacts is expected to eventually occur through natural biodegradation. Although arsenic is not considered herein in setting a cleanup goal, reduction of petroleum hydrocarbon levels through time is also expected to lower arsenic concentrations as groundwater conditions become less reducing.
- No use of Site groundwater is reasonably anticipated in the future given the overlying land use as housing and the adjudicated nature of the groundwater basin. Thus, the people of the State are not expected to be affected by Site-related benzene concentrations persisting into the future at the Site.
- Points of compliance for monitoring benzene plume stability will be established and presented in the RAP based on review of Site data and approved by the Regional Board in order to comply with the SSCG.

1.0 INTRODUCTION

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

1.1 Background.

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

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

The SSCG Report is organized into the following sections:

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

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

1.2 Objectives

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

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

1.3 Previous Response Actions

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

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

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

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

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

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

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

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

2.0 SITE CONCEPTUAL MODEL

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

2.1 Potential Sources and Potential Constituents of Concern

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

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

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

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

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

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

2.1.1 Total Petroleum Hydrocarbons

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

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

2.1.2 Volatile Organic Compounds

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

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

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

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

Former OTC Facility: OTC operated a trucking firm from 1953 to 1996 specializing in the transportation of crude oil and asphalt (Cal-EPA DTSC, 2009a). The OTC site was used for truck parking and maintenance. The OTC site included one active oil well, above ground and underground fuel and water storage tanks, a clarifier, garage and mechanic shops and truck wash down areas (PIC Environmental Services, 1996). In 1997, Blue Jay Partners constructed a residential subdivision called Monterey Pines on the OTC site. Prior to construction operations, seven underground storage tanks (USTs) used to store gasoline, diesel and waste oil and associated piping and dispensing islands were excavated and removed from the site. A brick lined sump and concrete clarifier were also removed. Soil sampling during the UST and clarifier removal indicated TPH, BTEX, TCE and PCE impacts in soil (PIC Environmental Services, 1995). DTSC (2009a) reported that during construction of the residential subdivision contaminated soils were consolidated under the roads of the new subdivision. As part of the environmental investigation and plume delineation for the Former Kast Property, URS documented elevated concentrations of chlorinated VOCs beneath Monterey and Carmel Drives (URS, 2010a). At this time DTSC does not believe the chlorinated VOC plume beneath the current Monterey Pines Development is associated with the Former Kast Property (USEPA, 2012a). The EPA in cooperation with DTSC and the RWQCB is conducting an environmental investigation to further delineate chlorinated VOCs contamination beneath Monterey Pines.

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

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

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

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

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

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

2.1.3 Semi-volatile Organic Compounds (SVOCs)

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

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

2.1.4 Metals

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

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

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

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

2.1.5 Methane

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

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

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

2.1.6 Summary of Potential COCs

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

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

Non-Site-related COCs include:

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

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

2.2 Fate and Transport

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

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

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

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

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

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

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

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

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

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

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

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

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

2.3 Potential Human Health Exposure

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

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

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

3.0 CONSTITUENTS OF CONCERN AND REMEDIAL ACTION OBJECTIVES

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

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

3.1 <u>Constituents of Concern</u>

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

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

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

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

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

3.2 Remedial Action Objectives

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

Various demarcations of acceptable risk have been established by regulatory agencies. The NCP (40 CFR 300) indicates that lifetime incremental cancer risks posed by a site should not exceed a range of one in one million (1×10^{-6}) to one hundred in one million (1×10^{-4}) and noncarcinogenic chemicals should not be present at levels expected to cause adverse health effects (i.e., a Hazard Quotient [HQ] greater than 1). In addition, other relevant guidance (*The Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*, USEPA, 1991c) states that sites posing a cumulative cancer risk of less than 10^{-4} and hazard indices less than unity (1) for noncancer endpoints are generally not considered to pose a significant risk warranting remediation. The California Hazardous Substances Account Act (HSAA) incorporates the NCP by reference, and thus also incorporates the acceptable risk range set forth in the NCP. In California, the Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) regulates chemical exposures to the general population and is based on an acceptable risk level of 1×10^{-5}. The California Department of Toxic Substances Control (DTSC) considers the 1×10^{-6} risk level as the generally accepted point of departure for risk management decisions for unrestricted land use. Cumulative cancer risks in the range of 10^{-6} to 10^{-4} may therefore be considered to be acceptable, with cancer risks less than 10^{-6} considered *de minimis*.

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

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

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

4.0 GUIDANCE DOCUMENTS AND POLICIES CONSIDERED

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

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

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

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

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

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

- The Regional Board's Basin Plan

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

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

5.0 SOIL

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

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

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

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

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

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

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

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

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

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

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

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

5.1 Residential Receptor

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

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

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

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

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

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

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

5.2 Construction Worker

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

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

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

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

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

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

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

6.0 SOIL VAPOR

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

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

6.1 Residential Receptor

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

6.1.1 VOCs

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

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

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

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

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

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

6.1.2 Methane

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

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

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

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

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

6.2 Construction and Utility Maintenance Worker Receptor

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

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

7.0 INDOOR AIR

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

8.0 GROUNDWATER

8.1 Introduction

Cleanup goals for Site groundwater are proposed in this section.

This section contains a summary of:

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

8.2 Groundwater Occurrence

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

Shallow Zone Groundwater

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

Gage Aquifer

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

8.3 Groundwater Quality

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

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

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

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

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

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

8.3.1 Non Site-Related COCs

Tert-Butyl Alcohol (TBA)

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

Chlorinated Compounds

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

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

General Minerals

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

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

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

Metals

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

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

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

8.3.2 Site-Related COCs

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

8.3.2.1 Benzene

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

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

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

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

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

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

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

8.3.2.2 Naphthalene

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

8.3.2.3 Arsenic

Arsenic has been detected in most of the Site monitoring wells. Arsenic concentrations exceeding the MCL of 10 µg/L have been detected in 14 wells (MW-2, 4, 5, 6, 8, 12, 13, 14, 15, G02S, G03S, G-04S, G01D, G03D). Dissolved arsenic is relatively elevated (above 100 µg/L) in four Shallow Zone wells located in the west central portion of the Site: MW-05, MW-08, MW-12 and MW-15. The highest arsenic concentration, 900 µg/L, was reported in a sample collected from MW-08. Arsenic was not detected in the three offsite Shallow Zone downgradient wells.

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

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

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

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

8.4 Proposed Cleanup Goals for Groundwater

8.4.1 Site Conditions Relevant to Establishing Clean Up Goals

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

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

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

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

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

8.4.2 Proposed SSCG for Groundwater

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

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

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

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

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

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

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

9.0 SUMMARY

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

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

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

Media-specific SSCGs are proposed as follows:

Soil

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

Soil Vapor

- The SSCGs for residential exposures are based on the indoor air results and the vapor intrusion evaluation. No numerical SSCGs for soil vapor are proposed.
- The SSCGs for construction and utility maintenance worker exposures are chemical-specific numerical values assuming a target incremental cancer risk of 10^{-5} and a hazard quotient of 1. These numerical SSCGs will be applied to soil vapor from 0-10 feet bgs.

Indoor Air

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

Groundwater

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

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TABLES

Table 1
Statistical Summary of Soil Matrix Data
Former Kast Property
Carson, California

Matrix	CAS Number	Chemical	Number of Samples	Number of Detects	Percent Detected %	Units	Minimum DL	Maximum DL	Minimum Detected Value	Maximum Detected Value
Metals										
Soil	7440-36-0	Antimony	10211	1911	19	mg/kg	0.149	0.306	0.151	6.45
Soil	7440-38-2	Arsenic	10211	10175	100	mg/kg	0.398	0.398	0.398	62.9
Soil	7440-39-3	Barium	10211	10211	100	mg/kg	--	--	10.9	1020
Soil	7440-41-7	Beryllium	10211	10185	100	mg/kg	0.0037	0.137	0.0813	1.21
Soil	7440-43-9	Cadmium	10211	2698	26	mg/kg	0.0064	0.228	0.007	9.02
Soil	7440-47-3	Chromium	10211	10211	100	mg/kg	--	--	2.11	74.2
Soil	CR6	Chromium, Hexavalent	9929	1135	11	mg/kg	0.0025	1.8	0.039	4.8
Soil	7440-48-4	Cobalt	10211	10211	100	mg/kg	--	--	1.19	31.3
Soil	7440-50-8	Copper	10211	10211	100	mg/kg	--	--	1.01	1780
Soil	7439-92-1	Lead	10211	10186	100	mg/kg	0.0527	0.181	0.231	1330
Soil	7439-97-6	Mercury	10211	9807	96	mg/kg	0.0013	0.00588	0.0039	1.33
Soil	7439-98-7	Molybdenum	10211	5690	56	mg/kg	0.0206	0.222	0.0266	24.1
Soil	7440-02-0	Nickel	10211	10211	100	mg/kg	--	--	1.57	43.1
Soil	7782-49-2	Selenium	10211	561	5.5	mg/kg	0.175	0.43	0.198	8.99
Soil	7440-22-4	Silver	10211	123	1.2	mg/kg	0.017	0.166	0.0362	3.82
Soil	7440-28-0	Thallium	10211	422	4.1	mg/kg	0.0987	0.232	0.163	3.47
Soil	7440-62-2	Vanadium	10211	10211	100	mg/kg	--	--	4.16	86
Soil	7440-66-6	Zinc	10211	10211	100	mg/kg	--	--	5.57	5770
PAHs										
Soil	83-32-9	Acenaphthene	10286	3336	32	mg/kg	0.0009	49	0.0009	17
Soil	208-96-8	Acenaphthylene	10286	1947	19	mg/kg	0.0006	64	0.0006	10
Soil	120-12-7	Anthracene	10286	3981	39	mg/kg	0.0004	57	0.00052	16
Soil	56-55-3	Benzo (a) Anthracene	10286	7581	74	mg/kg	0.00065	95	0.0007	47
Soil	50-32-8	Benzo (a) Pyrene	10286	7282	71	mg/kg	0.00049	43	0.0005	27
Soil	205-99-2	Benzo (b) Fluoranthene	10286	6080	59	mg/kg	0.00035	42	0.0005	34
Soil	191-24-2	Benzo (g,h,i) Perylene	10286	6761	66	mg/kg	0.00047	45	0.00052	13
Soil	207-08-9	Benzo (k) Fluoranthene	10286	2257	22	mg/kg	0.0007	55	0.0007	26

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Soil	218-01-9	Chrysene	10286	8213	80	mg/kg	0.00058	2.2	0.00062	130
Soil	53-70-3	Dibenz (a,h) Anthracene	10286	2625	26	mg/kg	0.00052	45	0.00053	3.4
Soil	206-44-0	Fluoranthene	10286	7577	74	mg/kg	0.00049	54	0.0005	78
Soil	86-73-7	Fluorene	10286	4110	40	mg/kg	0.00073	53	0.00076	22
Soil	193-39-5	Indeno (1,2,3-c,d) Pyrene	10286	3847	37	mg/kg	0.00053	49	0.00056	9
Soil	90-12-0	1-Methylnaphthalene	10284	4501	44	mg/kg	0.001	48	0.001	160
Soil	91-57-6	2-Methylnaphthalene	10286	7572	74	mg/kg	0.0006	47	0.0006	280
Soil	91-20-3	Naphthalene	10292	6404	62	µk/kg	0.23	740	0.25	92000
Soil	85-01-8	Phenanthrene	10286	8306	81	mg/kg	0.00051	58	0.00051	95
Soil	129-00-0	Pyrene	10286	8873	86	mg/kg	0.00049	2.1	0.0005	240
PCBs										
Soil	12674-11-2	AROCLOR 1016	47	0	0	µk/kg	10	14	--	--
Soil	11104-28-2	AROCLOR 1221	47	0	0	µk/kg	10	13	--	--
Soil	11141-16-5	AROCLOR 1232	47	0	0	µk/kg	10	11	--	--
Soil	53469-21-9	AROCLOR 1242	47	0	0	µk/kg	10	12	--	--
Soil	12672-29-6	AROCLOR 1248	47	0	0	µk/kg	10	14	--	--
Soil	11097-69-1	AROCLOR 1254	47	0	0	µk/kg	10	12	--	--
Soil	11096-82-5	AROCLOR 1260	47	0	0	µk/kg	11	11	--	--
Soil	37324-23-5	AROCLOR 1262	47	0	0	µk/kg	10	12	--	--
SVOCS										
Soil	95-95-4	2,4,5-Trichlorophenol	10286	1	0.01	mg/kg	0.0116	150	0.075	0.075
Soil	88-06-2	2,4,6-Trichlorophenol	10286	1	0.01	mg/kg	0.0116	160	0.14	0.14
Soil	120-83-2	2,4-Dichlorophenol	10286	2	0.02	mg/kg	0.0116	140	0.078	0.43
Soil	105-67-9	2,4-Dimethylphenol	10286	0	0	mg/kg	0.0116	120	--	--
Soil	51-28-5	2,4-Dinitrophenol	10286	0	0	mg/kg	0.045	720	--	--
Soil	121-14-2	2,4-Dinitrotoluene	10286	15	0.15	mg/kg	0.0116	150	0.061	3.1
Soil	606-20-2	2,6-Dinitrotoluene	10286	2	0.02	mg/kg	0.008	170	0.058	0.18
Soil	91-58-7	2-Chloronaphthalene	10286	3	0.03	mg/kg	0.0083	97	0.16	2.8

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Soil	95-48-7	2-Methylphenol	10286	0	0	mg/kg	0.0116	140	--	--
Soil	88-74-4	2-Nitroaniline	10286	1	0.01	mg/kg	0.046	160	0.18	0.18
Soil	88-75-5	2-Nitrophenol	10286	0	0	mg/kg	0.0116	130	--	--
Soil	91-94-1	3,3'-Dichlorobenzidine	10286	0	0	mg/kg	0.0093	1100	--	--
Soil	106-44-5	3/4-Methylphenol	10284	2	0.02	mg/kg	0.0116	140	0.073	0.28
Soil	99-09-2	3-Nitroaniline	10286	0	0	mg/kg	0.01	160	--	--
Soil	534-52-1	4,6-Dinitro-2-Methylphenol	10286	0	0	mg/kg	0.0463	1600	--	--
Soil	101-55-3	4-Bromophenyl-Phenyl Ether	10286	0	0	mg/kg	0.0067	100	--	--
Soil	59-50-7	4-Chloro-3-Methylphenol	10286	1	0.01	mg/kg	0.0116	150	0.087	0.087
Soil	106-47-8	4-Chloroaniline	10286	0	0	mg/kg	0.0116	120	--	--
Soil	7005-72-3	4-Chlorophenyl-Phenyl Ether	10286	0	0	mg/kg	0.0057	100	--	--
Soil	MEPH4	4-Methylphenol (p-Cresol)	652	8	1.2	mg/kg	0.079	47	0.14	0.22
Soil	100-02-7	4-Nitrophenol	10286	1	0.01	mg/kg	0.0067	160	0.1	0.1
Soil	62-53-3	Aniline	10284	6	0.06	mg/kg	0.056	110	0.088	4
Soil	103-33-3	Azobenzene	10284	1	0.01	mg/kg	0.1	110	0.24	0.24
Soil	92-87-5	Benzidine	10285	0	0	mg/kg	0.071	930	--	--
Soil	65-85-0	Benzoic Acid	10285	8	0.08	mg/kg	0.064	780	0.12	1.5
Soil	100-51-6	Benzyl Alcohol	10285	1	0.01	mg/kg	0.054	150	1.8	1.8
Soil	111-91-1	Bis(2-Chloroethoxy) Methane	10286	0	0	mg/kg	0.0116	120	--	--
Soil	117-81-7	Bis(2-Ethylhexyl) Phthalate	10286	323	3.1	mg/kg	0.039	96	0.083	22
Soil	85-68-7	Butyl Benzyl Phthalate	10286	117	1.1	mg/kg	0.0116	100	0.026	3.1
Soil	132-64-9	Dibenzofuran	10286	7	0.10	mg/kg	0.0073	120	0.13	1.2
Soil	84-66-2	Diethyl Phthalate	10286	512	5.0	mg/kg	0.0063	160	0.06	3.1
Soil	131-11-3	Dimethyl Phthalate	10286	748	7.3	mg/kg	0.008	180	0.052	2.7
Soil	84-74-2	Di-n-Butyl Phthalate	10286	8	0.10	mg/kg	0.033	96	0.13	0.33
Soil	117-84-0	Di-n-Octyl Phthalate	10286	5	0.05	mg/kg	0.0083	120	0.12	0.57
Soil	87-68-3	Hexachloro-1,3-Butadiene	10287	0	0	µk/kg	0.5	100000	--	--
Soil	118-74-1	Hexachlorobenzene	10286	0	0	mg/kg	0.006	100	--	--
Soil	77-47-4	Hexachlorocyclopentadiene	10286	0	0	mg/kg	0.0116	700	--	--

Table 1
Statistical Summary of Soil Matrix Data
Former Kast Property
Carson, California

Matrix	CAS Number	Chemical	Number of Samples	Number of Detects	Percent Detected %	Units	Minimum DL	Maximum DL	Minimum Detected Value	Maximum Detected Value
Soil	78-59-1	Isophorone	10286	0	0	mg/kg	0.0083	120	--	--
Soil	1319-77-3	Methyl Phenol	433	0	0	mg/kg	0.013	3.2	--	--
Soil	62-75-9	N-Nitrosodimethylamine	10284	0	0	mg/kg	0.091	120	--	--
Soil	621-64-7	N-Nitroso-di-n-propylamine	10286	1	0.01	mg/kg	0.0067	120	0.14	0.14
Soil	86-30-6	N-Nitrosodiphenylamine	10286	4	0.04	mg/kg	0.0073	120	0.24	5.5
Soil	87-86-5	Pentachlorophenol	10286	0	0	mg/kg	0.0463	1300	--	--
Soil	108-95-2	Phenol	10286	2	0.02	mg/kg	0.0053	140	0.97	1.8
TPH										
Soil	C19C32ALIPH	Aliphatics (C19 - C32)	2020	1635	81	mg/kg	5	10	5	32000
Soil	C5C8ALIPH	Aliphatics (C5 - C8)	2003	1097	55	mg/kg	0.0091	0.5	0.0091	7000
Soil	C9C18ALIPH	Aliphatics (C9 - C18)	2019	916	45	mg/kg	5	10	5	6300
Soil	C17C32AROM	Aromatics (C17 - C32)	2020	1525	76	mg/kg	5	10	5	36000
Soil	C6C8AROM	Aromatics (C6 - C8)	2004	488	24	mg/kg	0.0002	0.02	0.0002	310
Soil	C9C16AROM	Aromatics (C9 - C16)	2020	1007	50	mg/kg	5	10	5	41000
Soil	TPHC6C44	Total Petroleum Hydrocarbons (C6-C44)	12	9	75	mg/kg	4.8	4.8	350	22000
Soil	68334-30-5	TPH as Diesel	10286	7632	74	mg/kg	4.8	5	4.9	140000
Soil	PHCG	TPH as Gasoline	10286	4786	47	mg/kg	0.0001	12	0.043	9800
Soil	TPHMOIL	TPH as Motor Oil	10286	7873	77	mg/kg	7	7	7	320000
VOCs										
Soil	630-20-6	1,1,1,2-Tetrachloroethane	10285	0	0	µk/kg	0.11	1500	--	--
Soil	71-55-6	1,1,1-Trichloroethane	10285	1	0.01	µk/kg	0.11	1100	0.86	0.86
Soil	79-34-5	1,1,2,2-Tetrachloroethane	10285	31	0.30	µk/kg	0.08	1000	0.1	420
Soil	79-00-5	1,1,2-Trichloroethane	10285	10	0.10	µk/kg	0.16	1100	0.23	59
Soil	75-34-3	1,1-Dichloroethane	10285	1	0.01	µk/kg	0.1	700	0.26	0.26
Soil	75-35-4	1,1-Dichloroethene	10285	1	0.01	µk/kg	0.091	620	0.18	0.18
Soil	563-58-6	1,1-Dichloropropene	10285	0	0	µk/kg	0.14	980	--	--
Soil	87-61-6	1,2,3-Trichlorobenzene	10285	27	0.30	µk/kg	0.13	900	0.17	340
Soil	96-18-4	1,2,3-Trichloropropane	10285	24	0.20	µk/kg	0.2	2900	0.48	180
Soil	120-82-1	1,2,4-Trichlorobenzene	10292	12	0.10	µk/kg	0.12	81000	0.17	320

Table 1
Statistical Summary of Soil Matrix Data
Former Kast Property
Carson, California

Matrix	CAS Number	Chemical	Number of Samples	Number of Detects	Percent Detected %	Units	Minimum DL	Maximum DL	Minimum Detected Value	Maximum Detected Value
Soil	95-63-6	1,2,4-Trimethylbenzene	10285	3573	35	µk/kg	0.077	99	0.089	84000
Soil	96-12-8	1,2-Dibromo-3-Chloropropane	10285	1	0.01	µk/kg	0.5	16000	9.6	9.6
Soil	106-93-4	1,2-Dibromoethane (EDB)	10285	2	0.02	µk/kg	0.12	2000	0.51	950
Soil	95-50-1	1,2-Dichlorobenzene	10292	16	0.20	µk/kg	0.084	41000	0.11	330
Soil	107-06-2	1,2-Dichloroethane	10285	7	0.10	µk/kg	0.11	750	0.2	7.3
Soil	78-87-5	1,2-Dichloropropane	10285	6	0.10	µk/kg	0.17	1200	0.31	100
Soil	108-67-8	1,3,5-Trimethylbenzene	10285	1695	17	µk/kg	0.065	510	0.078	31000
Soil	541-73-1	1,3-Dichlorobenzene	10292	4	0.04	µk/kg	0.084	41000	0.21	30
Soil	142-28-9	1,3-Dichloropropane	10285	1	0.01	µk/kg	0.12	780	0.19	0.19
Soil	106-46-7	1,4-Dichlorobenzene	10292	78	0.80	µk/kg	0.1	61000	0.13	440
Soil	594-20-7	2,2-Dichloropropane	10285	0	0	µk/kg	0.16	2000	--	--
Soil	78-93-3	2-Butanone (Methyl Ethyl Ketone)	10283	787	7.7	µk/kg	1.5	42000	2.1	3000
Soil	95-57-8	2-Chlorophenol	10286	0	0	mg/kg	0.0116	140	--	--
Soil	95-49-8	2-Chlorotoluene	10285	6	0.10	µk/kg	0.076	520	0.15	180
Soil	591-78-6	2-Hexanone	10283	8	0.10	µk/kg	0.8	25000	6.1	31
Soil	106-43-4	4-Chlorotoluene	10285	1	0.01	µk/kg	0.068	460	0.27	0.27
Soil	108-10-1	4-Methyl-2-Pentanone	10283	26	0.30	µk/kg	0.8	9000	1.4	15
Soil	67-64-1	Acetone	10283	7934	77	µk/kg	4.6	28000	4.8	1800
Soil	71-43-2	Benzene	10285	5402	53	µk/kg	0.095	600	0.1	33000
Soil	111-44-4	Bis(2-Chloroethyl) Ether	10286	0	0	mg/kg	0.0116	110	--	--
Soil	108-60-1	Bis(2-Chloroisopropyl) Ether	10286	0	0	mg/kg	0.0116	120	--	--
Soil	108-86-1	Bromobenzene	10285	3	0.03	µk/kg	0.1	930	0.41	1.6
Soil	74-97-5	Bromochloromethane	10283	0	0	µk/kg	0.33	6100	--	--
Soil	75-27-4	Bromodichloromethane	10285	31	0.30	µk/kg	0.08	650	0.12	1300
Soil	75-25-2	Bromoform	10285	9	0.10	µk/kg	0.3	2900	0.65	140
Soil	74-83-9	Bromomethane	10285	283	2.8	µk/kg	0.5	8700	0.69	1300
Soil	75-15-0	Carbon Disulfide	10283	5544	54	µk/kg	0.13	780	0.13	120
Soil	56-23-5	Carbon Tetrachloride	10285	1	0.01	µk/kg	0.13	1400	0.3	0.3

Table 1
Statistical Summary of Soil Matrix Data
Former Kast Property
Carson, California

Matrix	CAS Number	Chemical	Number of Samples	Number of Detects	Percent Detected %	Units	Minimum DL	Maximum DL	Minimum Detected Value	Maximum Detected Value
Soil	108-90-7	Chlorobenzene	10285	141	1.4	µk/kg	0.098	660	0.12	150
Soil	75-00-3	Chloroethane	10285	13	0.10	µk/kg	0.27	1800	0.32	1.8
Soil	67-66-3	Chloroform	10285	791	7.7	µk/kg	0.11	760	0.13	110
Soil	74-87-3	Chloromethane	10285	64	0.60	µk/kg	0.22	13000	0.28	520
Soil	156-59-2	cis-1,2-Dichloroethene	10285	15	0.10	µk/kg	0.13	1300	0.23	440
Soil	10061-01-5	cis-1,3-Dichloropropene	10285	0	0	µk/kg	0.12	810	--	--
Soil	98-82-8	Cumene (Isopropylbenzene)	10285	2643	26	µk/kg	0.078	500	0.092	16000
Soil	124-48-1	Dibromochloromethane	10285	26	0.30	µk/kg	0.08	880	0.1	6.8
Soil	74-95-3	Dibromomethane	10285	3	0.03	µk/kg	0.2	3100	0.41	50
Soil	108-20-3	Diisopropyl Ether (DIPE)	10285	14	0.10	µk/kg	0.16	1100	0.2	1.4
Soil	64-17-5	Ethanol	10282	1045	10	µk/kg	37	240000	45	100000
Soil	100-41-4	Ethylbenzene	10285	2833	28	µk/kg	0.1	48	0.12	42000
Soil	637-92-3	Ethyl-t-Butyl Ether (ETBE)	10285	0	0	µk/kg	0.14	950	--	--
Soil	75-69-4	Freon 11	10285	3	0.03	µk/kg	0.1	690	0.17	0.47
Soil	76-13-1	Freon 113	10283	0	0	µk/kg	0.17	2100	--	--
Soil	75-71-8	Freon 12	10285	27	0.30	µk/kg	0.13	860	0.16	17
Soil	67-72-1	Hexachloroethane	10286	1	0.01	mg/kg	0.0067	110	6.6	6.6
Soil	75-09-2	Methylene Chloride	10285	45	0.40	µk/kg	0.64	23000	1.5	2100
Soil	1634-04-4	Methyl-tert-Butyl Ether	10285	74	0.70	µk/kg	0.087	590	0.11	140
Soil	104-51-8	n-Butylbenzene	10285	2359	23	µk/kg	0.11	36	0.12	13000
Soil	98-95-3	Nitrobenzene	10286	0	0	mg/kg	0.0116	760	--	--
Soil	95-47-6	o-Xylene	1126	101	9.0	µk/kg	0.088	410	0.12	15000
Soil	1330-20-7-1	p/m-Xylene	1126	112	10	µk/kg	0.15	290	0.22	34000
Soil	99-87-6	p-Isopropyltoluene	10285	3136	31	µk/kg	0.076	580	0.088	12000
Soil	103-65-1	Propylbenzene	10285	1838	18	µk/kg	0.14	880	0.18	24000
Soil	110-86-1	Pyridine	10284	0	0	mg/kg	0.082	330	--	--
Soil	135-98-8	sec-Butylbenzene	10285	2733	27	µk/kg	0.068	530	0.079	9800
Soil	100-42-5	Styrene	10285	17	0.20	µk/kg	0.14	910	0.21	78

Table 1
Statistical Summary of Soil Matrix Data
Former Kast Property
Carson, California

Matrix	CAS Number	Chemical	Number of Samples	Number of Detects	Percent Detected %	Units	Minimum DL	Maximum DL	Minimum Detected Value	Maximum Detected Value
Soil	994-05-8	tert-Amyl-Methyl Ether (TAME)	10285	0	0	µk/kg	0.086	580	--	--
Soil	75-65-0	tert-Butyl Alcohol (TBA)	10285	119	1.2	µk/kg	2.5	68000	4.1	430
Soil	98-06-6	tert-Butylbenzene	10285	1450	14	µk/kg	0.072	550	0.096	420
Soil	127-18-4	Tetrachloroethene	10285	165	1.6	µk/kg	0.1	750	0.14	19000
Soil	108-88-3	Toluene	10285	4336	42	µk/kg	0.098	660	0.11	57000
Soil	156-60-5	trans-1,2-Dichloroethene	10285	4	0.04	µk/kg	0.17	1100	0.53	1500
Soil	10061-02-6	trans-1,3-Dichloropropene	10283	0	0	µk/kg	0.16	8400	--	--
Soil	79-01-6	Trichloroethene	10285	51	0.50	µk/kg	0.12	800	0.15	720
Soil	108-05-4	Vinyl Acetate	10282	1	0.01	µk/kg	2.3	33000	9200	9200
Soil	75-01-4	Vinyl Chloride	10285	15	0.10	µk/kg	0.14	950	0.18	49
Soil	1330-20-7	Xylenes, Total	10251	3105	30	µk/kg	0.13	200	0.15	140000

Notes:

" -- " not available

" DL " detection limit

Table 2
Statistical Summary of Soil Vapor Data
Former Kast Property
Carson, California

Matrix	CAS Number	Chemical	Number of Samples	Number of Detects	Percent Detected %	Units	Minimum DL	Maximum DL	Minimum Detected Value	Maximum Detected Value
Soil Vapor, Non-Sub-Slab	71-55-6	1,1,1-Trichloroethane	164	1	0.6	ug/m3	0.3	9800	6.2	6.2
Soil Vapor, Non-Sub-Slab	79-34-5	1,1,2,2-Tetrachloroethane	164	1	0.6	ug/m3	0.64	13000	9000	9000
Soil Vapor, Non-Sub-Slab	79-00-5	1,1,2-Trichloroethane	164	1	0.6	ug/m3	0.5	12000	7.1	7.1
Soil Vapor, Non-Sub-Slab	75-34-3	1,1-Dichloroethane	164	1	0.6	ug/m3	0.27	7500	200	200
Soil Vapor, Non-Sub-Slab	75-35-4	1,1-Dichloroethene	164	1	0.6	ug/m3	0.57	7900	1.8	1.8
Soil Vapor, Non-Sub-Slab	120-82-1	1,2,4-Trichlorobenzene	164	0	0	ug/m3	1.8	97000	--	--
Soil Vapor, Non-Sub-Slab	95-63-6	1,2,4-Trimethylbenzene	164	95	58	ug/m3	0.46	6800	3.2	990000
Soil Vapor, Non-Sub-Slab	106-93-4	1,2-Dibromoethane (EDB)	164	0	0	ug/m3	0.8	15000	--	--
Soil Vapor, Non-Sub-Slab	95-50-1	1,2-Dichlorobenzene	164	0	0	ug/m3	0.59	12000	--	--
Soil Vapor, Non-Sub-Slab	107-06-2	1,2-Dichloroethane	164	6	4	ug/m3	0.48	6900	1.7	1700
Soil Vapor, Non-Sub-Slab	78-87-5	1,2-Dichloropropane	164	0	0	ug/m3	0.44	9500	--	--
Soil Vapor, Non-Sub-Slab	108-67-8	1,3,5-Trimethylbenzene	164	61	37	ug/m3	0.44	3500	3.7	450000
Soil Vapor, Non-Sub-Slab	106-99-0	1,3-Butadiene	82	0	0	ug/m3	0.61	1000	--	--
Soil Vapor, Non-Sub-Slab	541-73-1	1,3-Dichlorobenzene	164	0	0	ug/m3	0.52	14000	--	--
Soil Vapor, Non-Sub-Slab	106-46-7	1,4-Dichlorobenzene	164	1	0.6	ug/m3	0.48	15000	170	170
Soil Vapor, Non-Sub-Slab	123-91-1	1,4-Dioxane	82	0	0	ug/m3	0.87	1500	--	--
Soil Vapor, Non-Sub-Slab	540-84-1	2,2,4-Trimethylpentane	82	2	2	ug/m3	0.32	560	8	14
Soil Vapor, Non-Sub-Slab	78-93-3	2-Butanone (Methyl Ethyl Ketone)	164	80	49	ug/m3	0.6	1600	2.1	160000
Soil Vapor, Non-Sub-Slab	591-78-6	2-Hexanone	164	10	6	ug/m3	0.55	38000	3.6	16000
Soil Vapor, Non-Sub-Slab	107-05-1	3-Chloropropene	82	0	0	ug/m3	1.3	3200	--	--
Soil Vapor, Non-Sub-Slab	622-96-8	4-Ethyltoluene	164	82	50	ug/m3	0.49	3800	1.9	440000
Soil Vapor, Non-Sub-Slab	108-10-1	4-Methyl-2-Pentanone	164	9	6	ug/m3	0.095	11000	3.6	16
Soil Vapor, Non-Sub-Slab	67-64-1	Acetone	164	80	49	ug/m3	0.8	3000	18	240000
Soil Vapor, Non-Sub-Slab	BZLCL	alpha-Chlorotoluene	164	0	0	ug/m3	0.5	37000	--	--
Soil Vapor, Non-Sub-Slab	71-43-2	Benzene	164	140	85	ug/m3	0.44	53	3.4	3800000
Soil Vapor, Non-Sub-Slab	75-27-4	Bromodichloromethane	164	4	2	ug/m3	0.54	12000	2.3	12000
Soil Vapor, Non-Sub-Slab	75-25-2	Bromoform	164	0	0	ug/m3	1.2	29000	--	--
Soil Vapor, Non-Sub-Slab	74-83-9	Bromomethane	164	1	0.6	ug/m3	0.6	6500	1.4	1.4
Soil Vapor, Non-Sub-Slab	75-15-0	Carbon Disulfide	164	94	57	ug/m3	0.5	1200	1.4	170000
Soil Vapor, Non-Sub-Slab	56-23-5	Carbon Tetrachloride	164	0	0	ug/m3	0.46	11000	--	--
Soil Vapor, Non-Sub-Slab	108-90-7	Chlorobenzene	164	1	0.6	ug/m3	0.18	9000	5.9	5.9
Soil Vapor, Non-Sub-Slab	75-00-3	Chloroethane	164	1	0.6	ug/m3	0.6	7400	6.7	6.7
Soil Vapor, Non-Sub-Slab	67-66-3	Chloroform	164	11	7	ug/m3	0.39	8000	3.6	370
Soil Vapor, Non-Sub-Slab	74-87-3	Chloromethane	164	14	9	ug/m3	0.3	3700	1	98
Soil Vapor, Non-Sub-Slab	156-59-2	cis-1,2-Dichloroethene	164	5	3	ug/m3	0.55	9500	2.7	690

Table 2
Statistical Summary of Soil Vapor Data
Former Kast Property
Carson, California

Matrix	CAS Number	Chemical	Number of Samples	Number of Detects	Percent Detected %	Units	Minimum DL	Maximum DL	Minimum Detected Value	Maximum Detected Value
Soil Vapor, Non-Sub-Slab	10061-01-5	cis-1,3-Dichloropropene	164	0	0	ug/m3	0.66	11000	--	--
Soil Vapor, Non-Sub-Slab	98-82-8	Cumene (Isopropylbenzene)	82	56	68	ug/m3	0.42	150	6.2	31000
Soil Vapor, Non-Sub-Slab	110-82-7	Cyclohexane	82	52	63	ug/m3	0.39	220	3.9	2700000
Soil Vapor, Non-Sub-Slab	124-48-1	Dibromochloromethane	164	0	0	ug/m3	0.84	17000	--	--
Soil Vapor, Non-Sub-Slab	108-20-3	Diisopropyl Ether (DIPE)	82	0	0	ug/m3	0.9	10000	--	--
Soil Vapor, Non-Sub-Slab	64-17-5	Ethanol	164	59	36	ug/m3	1.2	2600	1.4	64000
Soil Vapor, Non-Sub-Slab	100-41-4	Ethylbenzene	164	142	87	ug/m3	0.48	160	3.2	1800000
Soil Vapor, Non-Sub-Slab	637-92-3	Ethyl-t-Butyl Ether (ETBE)	82	0	0	ug/m3	2.1	25000	--	--
Soil Vapor, Non-Sub-Slab	75-69-4	Freon 11	164	3	2	ug/m3	0.36	7900	2.5	19
Soil Vapor, Non-Sub-Slab	76-13-1	Freon 113	164	2	1	ug/m3	0.67	14000	54	200
Soil Vapor, Non-Sub-Slab	76-14-2	Freon 114	164	0	0	ug/m3	0.69	14000	--	--
Soil Vapor, Non-Sub-Slab	75-71-8	Freon 12	164	11	7	ug/m3	0.47	13000	2.3	210
Soil Vapor, Non-Sub-Slab	142-82-5	Heptane	82	24	29	ug/m3	0.35	1300	16	1000000
Soil Vapor, Non-Sub-Slab	87-68-3	Hexachloro-1,3-Butadiene	164	3	2	ug/m3	2.2	35000	730	2000
Soil Vapor, Non-Sub-Slab	110-54-3	Hexane	82	29	35	ug/m3	0.28	850	3.1	1900000
Soil Vapor, Non-Sub-Slab	67-63-0	Isopropanol	164	54	33	ug/m3	0.83	960	9.8	450000
Soil Vapor, Non-Sub-Slab	75-09-2	Methylene Chloride	164	36	22	ug/m3	0.28	12000	1.2	7300
Soil Vapor, Non-Sub-Slab	1634-04-4	Methyl-tert-Butyl Ether	164	15	9	ug/m3	0.23	7800	1.2	2800
Soil Vapor, Non-Sub-Slab	91-20-3	Naphthalene	163	65	40	ug/m3	0.37	200000	0.5	5200
Soil Vapor, Non-Sub-Slab	95-47-6	o-Xylene	82	14	17	ug/m3	0.19	1300	6.7	21000
Soil Vapor, Non-Sub-Slab	1330-20-7-1	p/m-Xylene	82	34	42	ug/m3	0.58	820	4.4	170000
Soil Vapor, Non-Sub-Slab	103-65-1	Propylbenzene	82	55	67	ug/m3	0.3	180	9.5	37000
Soil Vapor, Non-Sub-Slab	100-42-5	Styrene	164	28	17	ug/m3	0.52	14000	2.1	5900
Soil Vapor, Non-Sub-Slab	994-05-8	tert-Amyl-Methyl Ether (TAME)	82	0	0	ug/m3	1.2	14000	--	--
Soil Vapor, Non-Sub-Slab	75-65-0	tert-Butyl Alcohol (TBA)	82	6	7	ug/m3	1.2	14000	5.4	140
Soil Vapor, Non-Sub-Slab	127-18-4	Tetrachloroethene	164	32	20	ug/m3	0.54	14000	3.7	5300
Soil Vapor, Non-Sub-Slab	109-99-9	Tetrahydrofuran	82	6	7	ug/m3	0.48	780	3.5	12
Soil Vapor, Non-Sub-Slab	108-88-3	Toluene	164	107	65	ug/m3	0.39	710	4.8	3700000
Soil Vapor, Non-Sub-Slab	156-60-5	trans-1,2-Dichloroethene	164	5	3	ug/m3	0.72	13000	4.6	5600
Soil Vapor, Non-Sub-Slab	10061-02-6	trans-1,3-Dichloropropene	164	1	0.6	ug/m3	0.51	8400	6.5	6.5
Soil Vapor, Non-Sub-Slab	79-01-6	Trichloroethene	164	8	5	ug/m3	0.66	10000	2	6600
Soil Vapor, Non-Sub-Slab	108-05-4	Vinyl Acetate	82	3	4	ug/m3	2.5	29000	2.6	5.1
Soil Vapor, Non-Sub-Slab	75-01-4	Vinyl Chloride	164	0	0	ug/m3	0.33	4700	--	--
Soil Vapor, Sub-Slab	71-55-6	1,1,1-Trichloroethane	1622	28	2	ug/m3	0.21	2200	5.5	22000
Soil Vapor, Sub-Slab	79-34-5	1,1,2,2-Tetrachloroethane	1622	0	0	ug/m3	0.12	4100	--	--

Table 2
Statistical Summary of Soil Vapor Data
Former Kast Property
Carson, California

Matrix	CAS Number	Chemical	Number of Samples	Number of Detects	Percent Detected %	Units	Minimum DL	Maximum DL	Minimum Detected Value	Maximum Detected Value
Soil Vapor, Sub-Slab	79-00-5	1,1,2-Trichloroethane	1622	0	0	ug/m3	0.23	2400	--	--
Soil Vapor, Sub-Slab	75-34-3	1,1-Dichloroethane	1622	0	0	ug/m3	0.23	2100	--	--
Soil Vapor, Sub-Slab	75-35-4	1,1-Dichloroethene	1622	1	0.1	ug/m3	0.37	2400	18	18
Soil Vapor, Sub-Slab	120-82-1	1,2,4-Trichlorobenzene	1622	1	0.1	ug/m3	0.59	8100	1300	1300
Soil Vapor, Sub-Slab	95-63-6	1,2,4-Trimethylbenzene	1622	141	9	ug/m3	0.12	930	2.7	33000
Soil Vapor, Sub-Slab	106-93-4	1,2-Dibromoethane (EDB)	1622	0	0	ug/m3	0.19	3500	--	--
Soil Vapor, Sub-Slab	95-50-1	1,2-Dichlorobenzene	1622	8	0.5	ug/m3	0.17	3800	5.4	780
Soil Vapor, Sub-Slab	107-06-2	1,2-Dichloroethane	1622	15	0.9	ug/m3	0.22	2400	4.5	12000
Soil Vapor, Sub-Slab	78-87-5	1,2-Dichloropropane	1622	5	0.3	ug/m3	0.38	2200	5.2	22
Soil Vapor, Sub-Slab	108-67-8	1,3,5-Trimethylbenzene	1622	74	5	ug/m3	0.14	2300	5.3	16000
Soil Vapor, Sub-Slab	106-99-0	1,3-Butadiene	1622	1	0.1	ug/m3	0.16	1100	2.2	2.2
Soil Vapor, Sub-Slab	541-73-1	1,3-Dichlorobenzene	1622	1	0.1	ug/m3	0.085	3700	36	36
Soil Vapor, Sub-Slab	106-46-7	1,4-Dichlorobenzene	1622	7	0.4	ug/m3	0.18	4100	2	110
Soil Vapor, Sub-Slab	123-91-1	1,4-Dioxane	1622	31	2	ug/m3	0.25	2200	1.6	300
Soil Vapor, Sub-Slab	540-84-1	2,2,4-Trimethylpentane	1622	39	2	ug/m3	0.19	1800	2.1	46000
Soil Vapor, Sub-Slab	78-93-3	2-Butanone (Methyl Ethyl Ketone)	1622	450	28	ug/m3	0.5	1700	2.7	210
Soil Vapor, Sub-Slab	591-78-6	2-Hexanone	1622	19	1	ug/m3	0.37	2500	0.68	360
Soil Vapor, Sub-Slab	107-05-1	3-Chloropropene	1622	0	0	ug/m3	0.32	2300	--	--
Soil Vapor, Sub-Slab	622-96-8	4-Ethyltoluene	1622	103	6	ug/m3	0.14	750	5.4	31000
Soil Vapor, Sub-Slab	108-10-1	4-Methyl-2-Pentanone	1622	5	0.3	ug/m3	0.09	4300	4.5	14
Soil Vapor, Sub-Slab	67-64-1	Acetone	1622	1037	64	ug/m3	1.1	2400	8.2	620
Soil Vapor, Sub-Slab	BZLCL	alpha-Chlorotoluene	1622	0	0	ug/m3	0.14	2400	--	--
Soil Vapor, Sub-Slab	71-43-2	Benzene	1622	264	16	ug/m3	0.2	72	0.53	240000
Soil Vapor, Sub-Slab	75-27-4	Bromodichloromethane	1622	25	2	ug/m3	0.2	3100	0.92	370
Soil Vapor, Sub-Slab	75-25-2	Bromoform	1622	2	0.1	ug/m3	0.11	3200	2.2	3.1
Soil Vapor, Sub-Slab	74-83-9	Bromomethane	1578	33	2	ug/m3	0.26	1500	4.5	95
Soil Vapor, Sub-Slab	75-15-0	Carbon Disulfide	1622	135	8	ug/m3	0.22	1400	0.69	230
Soil Vapor, Sub-Slab	56-23-5	Carbon Tetrachloride	1622	6	0.4	ug/m3	0.39	2900	10	99
Soil Vapor, Sub-Slab	108-90-7	Chlorobenzene	1622	2	0.1	ug/m3	0.18	2600	2.4	48
Soil Vapor, Sub-Slab	75-00-3	Chloroethane	1622	4	0.2	ug/m3	0.29	2000	3.8	66
Soil Vapor, Sub-Slab	67-66-3	Chloroform	1622	267	17	ug/m3	0.27	2900	1.5	8400
Soil Vapor, Sub-Slab	74-87-3	Chloromethane	1622	20	1	ug/m3	0.29	1800	9.7	17000
Soil Vapor, Sub-Slab	156-59-2	cis-1,2-Dichloroethene	1622	15	0.9	ug/m3	0.28	1800	4.2	130
Soil Vapor, Sub-Slab	10061-01-5	cis-1,3-Dichloropropene	1622	0	0	ug/m3	0.29	1600	--	--
Soil Vapor, Sub-Slab	98-82-8	Cumene (Isopropylbenzene)	1622	112	7	ug/m3	0.3	2700	0.75	16000

Table 2
Statistical Summary of Soil Vapor Data
Former Kast Property
Carson, California

Matrix	CAS Number	Chemical	Number of Samples	Number of Detects	Percent Detected %	Units	Minimum DL	Maximum DL	Minimum Detected Value	Maximum Detected Value
Soil Vapor, Sub-Slab	110-82-7	Cyclohexane	1622	109	7	ug/m3	0.24	120	2.5	1200000
Soil Vapor, Sub-Slab	108-87-2	Cyclohexane, methyl-	1	1	100	ug/m3	--	--	56000	56000
Soil Vapor, Sub-Slab	124-48-1	Dibromochloromethane	1622	5	0.3	ug/m3	0.15	4200	0.75	110
Soil Vapor, Sub-Slab	108-20-3	Diisopropyl Ether (DIPE)	1	0	0	ug/m3	66	66	--	--
Soil Vapor, Sub-Slab	64-17-5	Ethanol	1622	448	28	ug/m3	0.26	1800	3	1600
Soil Vapor, Sub-Slab	100-41-4	Ethylbenzene	1622	116	7	ug/m3	0.21	120	4.2	87000
Soil Vapor, Sub-Slab	637-92-3	Ethyl-t-Butyl Ether (ETBE)	1	0	0	ug/m3	60	60	--	--
Soil Vapor, Sub-Slab	75-69-4	Freon 11	1622	33	2	ug/m3	0.16	2800	1.1	72
Soil Vapor, Sub-Slab	76-13-1	Freon 113	1622	23	1	ug/m3	0.3	2900	1.7	150
Soil Vapor, Sub-Slab	76-14-2	Freon 114	1622	1	0.1	ug/m3	0.29	3300	27	27
Soil Vapor, Sub-Slab	75-71-8	Freon 12	1622	153	9	ug/m3	0.14	2300	1.8	120
Soil Vapor, Sub-Slab	142-82-5	Heptane	1622	113	7	ug/m3	0.35	1200	2.3	960000
Soil Vapor, Sub-Slab	87-68-3	Hexachloro-1,3-Butadiene	1622	0	0	ug/m3	0.46	13000	--	--
Soil Vapor, Sub-Slab	110-54-3	Hexane	1622	130	8	ug/m3	0.22	1200	1.7	300000
Soil Vapor, Sub-Slab	67-63-0	Isopropanol	1622	101	6	ug/m3	0.51	1600	0.95	17000
Soil Vapor, Sub-Slab	75-09-2	Methylene Chloride	1622	40	3	ug/m3	0.27	3000	1.8	28000
Soil Vapor, Sub-Slab	1634-04-4	Methyl-tert-Butyl Ether	1622	5	0.3	ug/m3	0.17	1800	10	440
Soil Vapor, Sub-Slab	91-20-3	Naphthalene	1622	772	48	ug/m3	0.27	4300	0.3	1200
Soil Vapor, Sub-Slab	95-47-6	o-Xylene	1622	90	6	ug/m3	0.11	910	4.6	74000
Soil Vapor, Sub-Slab	1330-20-7-1	p/m-Xylene	1622	157	10	ug/m3	0.22	830	3.7	240000
Soil Vapor, Sub-Slab	103-65-1	Propylbenzene	1622	76	5	ug/m3	0.13	2800	4.5	16000
Soil Vapor, Sub-Slab	100-42-5	Styrene	1622	3	0.2	ug/m3	0.15	1800	5.8	20
Soil Vapor, Sub-Slab	994-05-8	tert-Amyl-Methyl Ether (TAME)	1	0	0	ug/m3	51	51	--	--
Soil Vapor, Sub-Slab	75-65-0	tert-Butyl Alcohol (TBA)	1	0	0	ug/m3	48	48	--	--
Soil Vapor, Sub-Slab	127-18-4	Tetrachloroethene	1622	181	11	ug/m3	0.33	3200	1.8	11000
Soil Vapor, Sub-Slab	109-99-9	Tetrahydrofuran	1622	56	4	ug/m3	0.22	2200	2.2	77
Soil Vapor, Sub-Slab	108-88-3	Toluene	1622	211	13	ug/m3	0.17	1200	1.6	140000
Soil Vapor, Sub-Slab	156-60-5	trans-1,2-Dichloroethene	1622	2	0.1	ug/m3	0.32	2500	6.2	12
Soil Vapor, Sub-Slab	10061-02-6	trans-1,3-Dichloropropene	1622	1	0.1	ug/m3	0.13	1400	8.4	8.4
Soil Vapor, Sub-Slab	79-01-6	Trichloroethene	1622	27	2	ug/m3	0.26	2500	2.1	11000
Soil Vapor, Sub-Slab	108-05-4	Vinyl Acetate	1	0	0	ug/m3	150	150	--	--
Soil Vapor, Sub-Slab	75-01-4	Vinyl Chloride	1622	1	0.1	ug/m3	0.17	1400	27	27

Notes: " -- " not available

Table 3
Statistical Summary of Indoor Air Data
Former Kast Property
Carson, California

Matrix	CAS Number	Chemical	Number of Samples	Number of Detects	Percent Detected %	Units	Minimum DL	Maximum DL	Minimum Detected Value	Maximum Detected Value
Air, Indoor	71-55-6	1,1,1-Trichloroethane	409	52	13	ug/m3	0.13	0.38	0.21	5.2
Air, Indoor	79-34-5	1,1,2,2-Tetrachloroethane	409	11	3	ug/m3	0.0021	0.11	0.0062	0.38
Air, Indoor	79-00-5	1,1,2-Trichloroethane	409	10	2	ug/m3	0.0032	0.11	0.0074	0.37
Air, Indoor	75-34-3	1,1-Dichloroethane	409	0	0	ug/m3	0.14	0.38	--	--
Air, Indoor	75-35-4	1,1-Dichloroethene	409	0	0	ug/m3	0.15	0.55	--	--
Air, Indoor	95-63-6	1,2,4-Trimethylbenzene	409	403	99	ug/m3	0.26	0.29	0.25	11
Air, Indoor	95-50-1	1,2-Dichlorobenzene	409	4	1	ug/m3	0.16	0.45	0.28	2.5
Air, Indoor	107-06-2	1,2-Dichloroethane	409	409	100	ug/m3	--	--	0.069	22
Air, Indoor	108-67-8	1,3,5-Trimethylbenzene	409	192	47	ug/m3	0.17	0.4	0.19	2.9
Air, Indoor	541-73-1	1,3-Dichlorobenzene	409	0	0	ug/m3	0.13	0.42	--	--
Air, Indoor	106-46-7	1,4-Dichlorobenzene	409	409	100	ug/m3	--	--	0.025	380
Air, Indoor	123-91-1	1,4-Dioxane	2	0	0	ug/m3	0.26	0.27	--	--
Air, Indoor	78-93-3	2-Butanone (Methyl Ethyl Ketone)	409	407	100	ug/m3	0.24	0.3	0.87	21
Air, Indoor	591-78-6	2-Hexanone	409	162	40	ug/m3	0.15	0.53	0.26	3
Air, Indoor	622-96-8	4-Ethyltoluene	409	176	43	ug/m3	0.18	0.4	0.22	2.5
Air, Indoor	108-10-1	4-Methyl-2-Pentanone	409	287	70	ug/m3	0.14	0.43	0.16	3.7
Air, Indoor	67-64-1	Acetone	409	409	100	ug/m3	--	--	11	180
Air, Indoor	71-43-2	Benzene	409	409	100	ug/m3	--	--	0.23	6.8
Air, Indoor	75-27-4	Bromodichloromethane	409	311	76	ug/m3	0.0034	0.077	0.072	2.9
Air, Indoor	74-83-9	Bromomethane	409	35	9	ug/m3	0.16	0.38	0.2	2.2
Air, Indoor	124-38-9	Carbon Dioxide	409	0	0	MOL %	0.12	0.27	--	--
Air, Indoor	75-15-0	Carbon Disulfide	409	146	36	ug/m3	0.18	0.44	0.19	1.9
Air, Indoor	56-23-5	Carbon Tetrachloride	407	407	100	ug/m3	--	--	0.28	0.67
Air, Indoor	75-00-3	Chloroethane	409	2	0.5	ug/m3	0.15	0.47	1.3	1.3
Air, Indoor	67-66-3	Chloroform	409	409	100	ug/m3	--	--	0.14	2.1
Air, Indoor	74-87-3	Chloromethane	409	402	98	ug/m3	0.2	0.35	0.27	1.2
Air, Indoor	156-59-2	cis-1,2-Dichloroethene	409	0	0	ug/m3	0.16	0.44	--	--
Air, Indoor	98-82-8	Cumene (Isopropylbenzene)	409	5	1	ug/m3	0.15	0.38	0.28	0.45
Air, Indoor	110-82-7	Cyclohexane	409	288	70	ug/m3	0.38	0.7	0.36	8.3

Table 3
Statistical Summary of Indoor Air Data
Former Kast Property
Carson, California

Matrix	CAS Number	Chemical	Number of Samples	Number of Detects	Percent Detected %	Units	Minimum DL	Maximum DL	Minimum Detected Value	Maximum Detected Value
Air, Indoor	64-17-5	Ethanol	409	409	100	ug/m3	--	--	10	2600
Air, Indoor	100-41-4	Ethylbenzene	409	409	100	ug/m3	--	--	0.19	13
Air, Indoor	75-69-4	Freon 11	409	409	100	ug/m3	--	--	0.76	47
Air, Indoor	76-13-1	Freon 113	409	403	99	ug/m3	0.25	0.54	0.35	2.5
Air, Indoor	75-71-8	Freon 12	409	409	100	ug/m3	--	--	1.4	53
Air, Indoor	142-82-5	Heptane	407	398	98	ug/m3	0.25	0.35	0.25	23
Air, Indoor	87-68-3	Hexachloro-1,3-Butadiene	409	0	0	ug/m3	0.19	0.53	--	--
Air, Indoor	110-54-3	Hexane	409	403	99	ug/m3	0.29	0.33	0.29	10
Air, Indoor	67-63-0	Isopropanol	409	403	99	ug/m3	0.57	0.63	0.57	880
Air, Indoor	74-82-8	Methane	409	0	0	MOL %	0.12	0.27	--	--
Air, Indoor	75-09-2	Methylene Chloride	409	409	100	ug/m3	--	--	0.21	67
Air, Indoor	1634-04-4	Methyl-tert-Butyl Ether	409	17	4	ug/m3	0.15	0.4	0.32	1.9
Air, Indoor	91-20-3	Naphthalene	409	409	100	ug/m3	--	--	0.057	4.4
Air, Indoor	OXYARGON	Oxygen/Argon	409	409	100	MOL %	--	--	21.2	22.4
Air, Indoor	95-47-6	o-Xylene	409	399	98	ug/m3	0.26	0.4	0.23	12
Air, Indoor	1330-20-7-1	p/m-Xylene	409	406	99	ug/m3	0.46	0.54	0.54	48
Air, Indoor	103-65-1	Propylbenzene	409	110	27	ug/m3	0.15	0.46	0.19	4
Air, Indoor	100-42-5	Styrene	409	400	98	ug/m3	0.24	0.32	0.23	7
Air, Indoor	127-18-4	Tetrachloroethene	409	409	100	ug/m3	--	--	0.038	45
Air, Indoor	109-99-9	Tetrahydrofuran	409	150	37	ug/m3	0.24	0.7	0.28	8.7
Air, Indoor	108-88-3	Toluene	409	409	100	ug/m3	--	--	1.2	91
Air, Indoor	156-60-5	trans-1,2-Dichloroethene	409	2	0.5	ug/m3	0.16	0.44	0.84	0.85
Air, Indoor	79-01-6	Trichloroethene	407	38	9	ug/m3	0.16	0.38	0.25	10
Air, Indoor	75-01-4	Vinyl Chloride	2	1	50	ug/m3	0.0036	0.0036	0.0036	0.0036

Notes: " -- " not available

Table 4
Statistical Summary of Groundwater Data
Former Kast Property
Carson, California

CAS Number	Chemical	Number of Samples	Number of Detects	Percent Detected %	Units	Minimum DL of NDs	Maximum DL of NDs	Minimum Detected Value	Maximum Detected Value
Metals									
7440-36-0	Antimony	57	11	19	mg/L	0.0021	0.00787	0.009	0.0248
7440-38-2	Arsenic	57	34	60	mg/L	0.0031	0.00611	0.00532	0.9
7440-39-3	Barium	57	56	98	mg/L	0.00296	0.00296	0.0138	0.839
7440-41-7	Beryllium	57	0	0	mg/L	0.0002	0.0044	--	--
7440-43-9	Cadmium	57	0	0	mg/L	0.0004	0.00454	--	--
7440-47-3	Chromium	57	0	0	mg/L	0.0004	0.0044	--	--
7440-48-4	Cobalt	57	0	0	mg/L	0.0007	0.00441	--	--
7440-50-8	Copper	78	13	17	mg/L	0.0013	0.00392	0.00327	0.0181
7439-89-6	Iron	37	37	100	mg/L	--	--	0.0201	67
7439-92-1	Lead	57	3	5.3	mg/L	0.0024	0.00693	0.00473	0.0105
7439-98-7	Molybdenum	57	24	42	mg/L	0.0008	0.0043	0.00379	0.0293
7440-02-0	Nickel	57	2	3.5	mg/L	0.0014	0.00433	0.00306	0.00396
7782-49-2	Selenium	57	7	12	mg/L	0.003	0.0107	0.00823	0.0242
7440-22-4	Silver	57	4	7.0	mg/L	0.0004	0.00211	0.00144	0.00228
7440-28-0	Thallium	57	6	11	mg/L	0.0023	0.0054	0.00292	0.00424
7440-62-2	Vanadium	57	4	7.0	mg/L	0.0003	0.0045	0.00354	0.0273
7440-66-6	Zinc	78	24	31	mg/L	0.0008	0.0067	0.00576	0.465
7439-97-6	Mercury	57	8	14	mg/L	0.00003	0.0001	0.00004	0.00233
Organic									
12674-11-2	AROCLOR 1016	6	0	0	µg/L	0.15	0.15	--	--
11104-28-2	AROCLOR 1221	6	0	0	µg/L	0.1	0.1	--	--
11141-16-5	AROCLOR 1232	6	0	0	µg/L	0.1	0.1	--	--
53469-21-9	AROCLOR 1242	6	0	0	µg/L	0.1	0.1	--	--
12672-29-6	AROCLOR 1248	6	0	0	µg/L	0.1	0.1	--	--
11097-69-1	AROCLOR 1254	6	0	0	µg/L	0.1	0.1	--	--
11096-82-5	AROCLOR 1260	6	0	0	µg/L	0.25	0.25	--	--
37324-23-5	AROCLOR 1262	6	0	0	µg/L	0.1	0.1	--	--

Table 4
Statistical Summary of Groundwater Data
Former Kast Property
Carson, California

CAS Number	Chemical	Number of Samples	Number of Detects	Percent Detected %	Units	Minimum DL of NDs	Maximum DL of NDs	Minimum Detected Value	Maximum Detected Value
SVOCs									
90-12-0	1-Methylnaphthalene	26	7	27	µg/L	0.036	0.036	0.071	0.94
91-57-6	2-Methylnaphthalene	26	9	35	µg/L	0.035	0.035	0.037	0.48
106-44-5	3/4-Methylphenol	32	1	3.1	µg/L	1	1	1.7	1.7
83-32-9	Acenaphthene	26	1	3.8	µg/L	0.037	0.18	0.14	0.14
208-96-8	Acenaphthylene	26	2	7.7	µg/L	0.033	0.16	0.063	0.085
120-12-7	Anthracene	26	0	0	µg/L	0.036	0.18	--	--
56-55-3	Benzo (a) Anthracene	26	0	0	µg/L	0.043	0.22	--	--
50-32-8	Benzo (a) Pyrene	26	0	0	µg/L	0.035	0.18	--	--
205-99-2	Benzo (b) Fluoranthene	26	0	0	µg/L	0.036	0.18	--	--
191-24-2	Benzo (g,h,i) Perylene	26	0	0	µg/L	0.037	0.18	--	--
207-08-9	Benzo (k) Fluoranthene	26	0	0	µg/L	0.05	0.25	--	--
85-68-7	Butyl Benzyl Phthalate	32	0	0	µg/L	1	1	--	--
218-01-9	Chrysene	26	0	0	µg/L	0.041	0.2	--	--
53-70-3	Dibenz (a,h) Anthracene	26	0	0	µg/L	0.039	0.2	--	--
206-44-0	Fluoranthene	26	0	0	µg/L	0.038	0.19	--	--
86-73-7	Fluorene	26	1	3.8	µg/L	0.035	0.18	0.18	0.18
193-39-5	Indeno (1,2,3-c,d) Pyrene	26	0	0	µg/L	0.036	0.18	--	--
91-20-3	Naphthalene	26	21	81	µg/L	0.037	0.037	0.041	11
85-01-8	Phenanthrene	26	0	0	µg/L	0.038	0.19	--	--
129-00-0	Pyrene	26	0	0	µg/L	0.05	0.25	--	--
120-82-1	1,2,4-Trichlorobenzene	32	0	0	µg/L	1.3	1.3	--	--
95-50-1	1,2-Dichlorobenzene	32	5	16	µg/L	1.1	1.1	1.8	4.6
541-73-1	1,3-Dichlorobenzene	32	0	0	µg/L	1.2	1.2	--	--
106-46-7	1,4-Dichlorobenzene	32	5	16	µg/L	1.1	1.1	4.3	11
90-12-0	1-Methylnaphthalene	32	1	3.1	µg/L	1.4	1.4	1.4	1.4
95-95-4	2,4,5-Trichlorophenol	32	0	0	µg/L	0.97	0.97	--	--
88-06-2	2,4,6-Trichlorophenol	32	0	0	µg/L	1.2	1.2	--	--
120-83-2	2,4-Dichlorophenol	32	0	0	µg/L	1.1	1.1	--	--
105-67-9	2,4-Dimethylphenol	32	2	6.3	µg/L	1.2	1.2	7.2	11
51-28-5	2,4-Dinitrophenol	32	0	0	µg/L	2.6	2.6	--	--

Table 4
Statistical Summary of Groundwater Data
Former Kast Property
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CAS Number	Chemical	Number of Samples	Number of Detects	Percent Detected %	Units	Minimum DL of NDs	Maximum DL of NDs	Minimum Detected Value	Maximum Detected Value
121-14-2	2,4-Dinitrotoluene	32	0	0	µg/L	1	1	--	--
606-20-2	2,6-Dinitrotoluene	32	0	0	µg/L	1.1	1.1	--	--
91-58-7	2-Chloronaphthalene	32	0	0	µg/L	1.3	1.3	--	--
95-57-8	2-Chlorophenol	32	0	0	µg/L	1	1	--	--
91-57-6	2-Methylnaphthalene	32	0	0	µg/L	1.2	1.2	--	--
95-48-7	2-Methylphenol	32	0	0	µg/L	1.1	1.1	--	--
88-74-4	2-Nitroaniline	32	0	0	µg/L	1	1	--	--
88-75-5	2-Nitrophenol	32	0	0	µg/L	1.2	1.2	--	--
91-94-1	3,3'-Dichlorobenzidine	32	0	0	µg/L	1.3	1.3	--	--
99-09-2	3-Nitroaniline	32	0	0	µg/L	1.2	1.2	--	--
534-52-1	4,6-Dinitro-2-Methylphenol	32	0	0	µg/L	3.4	3.4	--	--
101-55-3	4-Bromophenyl-Phenyl Ether	32	0	0	µg/L	1.2	1.2	--	--
59-50-7	4-Chloro-3-Methylphenol	32	0	0	µg/L	1.2	1.2	--	--
106-47-8	4-Chloroaniline	32	0	0	µg/L	1.3	1.3	--	--
7005-72-3	4-Chlorophenyl-Phenyl Ether	32	0	0	µg/L	1.2	1.2	--	--
100-01-6	4-Nitroaniline	32	0	0	µg/L	2.4	2.4	--	--
100-02-7	4-Nitrophenol	32	0	0	µg/L	0.86	0.86	--	--
83-32-9	Acenaphthene	32	0	0	µg/L	1.4	1.4	--	--
208-96-8	Acenaphthylene	32	0	0	µg/L	1.4	1.4	--	--
62-53-3	Aniline	32	0	0	µg/L	1.2	1.2	--	--
120-12-7	Anthracene	32	0	0	µg/L	1.5	1.5	--	--
103-33-3	Azobenzene	32	0	0	µg/L	1.7	1.7	--	--
92-87-5	Benzidine	32	0	0	µg/L	0.62	0.62	--	--
56-55-3	Benzo (a) Anthracene	32	0	0	µg/L	1.1	1.1	--	--
50-32-8	Benzo (a) Pyrene	32	0	0	µg/L	0.88	0.88	--	--
205-99-2	Benzo (b) Fluoranthene	32	0	0	µg/L	1.2	1.2	--	--
191-24-2	Benzo (g,h,i) Perylene	32	0	0	µg/L	0.71	0.71	--	--
207-08-9	Benzo (k) Fluoranthene	32	0	0	µg/L	1.7	1.7	--	--
65-85-0	Benzoic Acid	32	1	3.1	µg/L	0.43	0.43	2.6	2.6
100-51-6	Benzyl Alcohol	32	0	0	µg/L	1	1	--	--
111-91-1	Bis(2-Chloroethoxy) Methane	32	0	0	µg/L	1.2	1.2	--	--

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CAS Number	Chemical	Number of Samples	Number of Detects	Percent Detected %	Units	Minimum DL of NDs	Maximum DL of NDs	Minimum Detected Value	Maximum Detected Value
111-44-4	Bis(2-Chloroethyl) Ether	32	0	0	µg/L	1	1	--	--
108-60-1	Bis(2-Chloroisopropyl) Ether	32	0	0	µg/L	1.5	1.5	--	--
117-81-7	Bis(2-Ethylhexyl) Phthalate	32	0	0	µg/L	1	1	--	--
218-01-9	Chrysene	32	0	0	µg/L	1.3	1.3	--	--
53-70-3	Dibenz (a,h) Anthracene	32	0	0	µg/L	0.82	0.82	--	--
132-64-9	Dibenzofuran	32	0	0	µg/L	1.4	1.4	--	--
84-66-2	Diethyl Phthalate	32	0	0	µg/L	1.4	1.4	--	--
131-11-3	Dimethyl Phthalate	32	0	0	µg/L	1.3	1.3	--	--
84-74-2	Di-n-Butyl Phthalate	32	0	0	µg/L	1.5	1.5	--	--
117-84-0	Di-n-Octyl Phthalate	32	0	0	µg/L	1	1	--	--
206-44-0	Fluoranthene	32	0	0	µg/L	1.5	1.5	--	--
86-73-7	Fluorene	32	0	0	µg/L	1.4	1.4	--	--
87-68-3	Hexachloro-1,3-Butadiene	32	0	0	µg/L	1.2	1.2	--	--
118-74-1	Hexachlorobenzene	32	0	0	µg/L	1.2	1.2	--	--
77-47-4	Hexachlorocyclopentadiene	32	0	0	µg/L	0.44	0.44	--	--
67-72-1	Hexachloroethane	32	0	0	µg/L	0.98	0.98	--	--
193-39-5	Indeno (1,2,3-c,d) Pyrene	32	0	0	µg/L	0.83	0.83	--	--
78-59-1	Isophorone	32	0	0	µg/L	1.2	1.2	--	--
91-20-3	Naphthalene	32	4	13	µg/L	1.4	1.4	2.5	11
98-95-3	Nitrobenzene	32	0	0	µg/L	1.3	1.3	--	--
62-75-9	N-Nitrosodimethylamine	32	0	0	µg/L	1.1	1.1	--	--
621-64-7	N-Nitroso-di-n-propylamine	32	0	0	µg/L	1.3	1.3	--	--
86-30-6	N-Nitrosodiphenylamine	32	0	0	µg/L	1.4	1.4	--	--
87-86-5	Pentachlorophenol	32	0	0	µg/L	0.75	0.75	--	--
85-01-8	Phenanthrene	32	0	0	µg/L	1.5	1.5	--	--
108-95-2	Phenol	32	3	9.4	µg/L	1.2	1.2	1.8	13
129-00-0	Pyrene	32	0	0	µg/L	1.4	1.4	--	--
110-86-1	Pyridine	32	0	0	µg/L	1.4	1.4	--	--
TPH									
TPHC11C12	Carbon Chain C11-C12	220	91	41	µg/L	14	50	0.38	510
TPHC13C14	Carbon Chain C13-C14	220	75	34	µg/L	16	50	1.4	520

Table 4
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CAS Number	Chemical	Number of Samples	Number of Detects	Percent Detected %	Units	Minimum DL of NDs	Maximum DL of NDs	Minimum Detected Value	Maximum Detected Value
TPHC15C16	Carbon Chain C15-C16	220	79	36	µg/L	17	50	6.5	430
TPHC17C18	Carbon Chain C17-C18	220	88	40	µg/L	17	50	0.94	360
TPHC19C20	Carbon Chain C19-C20	220	87	40	µg/L	18	50	0.32	250
TPHC21C22	Carbon Chain C21-C22	220	91	41	µg/L	18	50	4.4	220
TPHC23C24	Carbon Chain C23-C24	220	92	42	µg/L	18	50	13	98
TPHC25C28	Carbon Chain C25-C28	220	106	48	µg/L	16	50	5.6	110
TPHC29C32	Carbon Chain C29-C32	220	98	45	µg/L	8.5	50	3.5	110
TPHC33C36	Carbon Chain C33-C36	220	61	28	µg/L	7.9	50	0.019	62
TPHC37C40	Carbon Chain C37-C40	220	66	30	µg/L	6.8	50	0.28	49
TPHC41C44	Carbon Chain C41-C44	220	20	9.1	µg/L	6.6	50	6.7	22
TPHC6	Carbon Chain C6	220	78	35	µg/L	1.4	50	1.8	280
TPHC7	Carbon Chain C7	220	85	39	µg/L	6.1	50	4.8	100
TPHC8	Carbon Chain C8	220	85	39	µg/L	9.9	50	5.5	390
TPHC9C10	Carbon Chain C9-C10	220	86	39	µg/L	13	50	0.9	620
TPHC6C44	Total Petroleum Hydrocarbons (C6-C44)	220	144	65	µg/L	47	47	48	3300
68334-30-5	TPH as Diesel	226	189	84	µg/L	33	33	33	2600
PHCG	TPH as Gasoline	226	131	58	µg/L	48	48	48	3000
TPHMOIL	TPH as Motor Oil	226	70	31	µg/L	210	210	210	1400
VOCs									
630-20-6	1,1,1,2-Tetrachloroethane	227	1	0.44	µg/L	0.35	2	4	4
71-55-6	1,1,1-Trichloroethane	227	3	1.3	µg/L	0.3	1.5	0.44	0.52
79-34-5	1,1,2,2-Tetrachloroethane	227	0	0	µg/L	0.41	2	--	--
79-00-5	1,1,2-Trichloroethane	227	7	3.1	µg/L	0.38	1.9	0.39	1
75-34-3	1,1-Dichloroethane	227	80	35	µg/L	0.28	1.4	0.34	33
75-35-4	1,1-Dichloroethene	227	100	44	µg/L	0.4	2.2	0.48	100
563-58-6	1,1-Dichloropropene	227	0	0	µg/L	0.26	2.3	--	--
87-61-6	1,2,3-Trichlorobenzene	227	0	0	µg/L	0.31	2.5	--	--
96-18-4	1,2,3-Trichloropropane	227	20	8.8	µg/L	0.64	3.2	0.82	27
120-82-1	1,2,4-Trichlorobenzene	227	0	0	µg/L	0.49	2.5	--	--
95-63-6	1,2,4-Trimethylbenzene	227	52	23	µg/L	0.24	0.72	0.24	97
96-12-8	1,2-Dibromo-3-Chloropropane	227	0	0	µg/L	1.2	6.2	--	--

Table 4
Statistical Summary of Groundwater Data
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CAS Number	Chemical	Number of Samples	Number of Detects	Percent Detected %	Units	Minimum DL of NDs	Maximum DL of NDs	Minimum Detected Value	Maximum Detected Value
106-93-4	1,2-Dibromoethane (EDB)	227	0	0	µg/L	0.36	1.8	--	--
95-50-1	1,2-Dichlorobenzene	227	0	0	µg/L	0.27	2.3	--	--
107-06-2	1,2-Dichloroethane	227	38	17	µg/L	0.24	1.2	0.27	3.6
78-87-5	1,2-Dichloropropane	227	0	0	µg/L	0.38	2.1	--	--
108-67-8	1,3,5-Trimethylbenzene	227	34	15	µg/L	0.23	0.57	0.3	25
541-73-1	1,3-Dichlorobenzene	227	0	0	µg/L	0.28	2	--	--
142-28-9	1,3-Dichloropropane	227	0	0	µg/L	0.3	1.5	--	--
106-46-7	1,4-Dichlorobenzene	227	0	0	µg/L	0.21	2.2	--	--
594-20-7	2,2-Dichloropropane	227	0	0	µg/L	0.36	1.8	--	--
78-93-3	2-Butanone (Methyl Ethyl Ketone)	227	1	0.44	µg/L	2.2	14	8.4	8.4
95-49-8	2-Chlorotoluene	227	0	0	µg/L	0.24	1.2	--	--
591-78-6	2-Hexanone	227	0	0	µg/L	2.1	14	--	--
106-43-4	4-Chlorotoluene	227	1	0.44	µg/L	0.13	0.66	0.27	0.27
108-10-1	4-Methyl-2-Pentanone	227	0	0	µg/L	4.4	22	--	--
67-64-1	Acetone	227	10	4.4	µg/L	6	50	6.7	28
71-43-2	Benzene	227	158	70	µg/L	0.14	0.57	0.14	650
108-86-1	Bromobenzene	227	0	0	µg/L	0.3	1.5	--	--
74-97-5	Bromochloromethane	227	2	0.88	µg/L	0.48	2.4	0.79	1.5
75-27-4	Bromodichloromethane	227	0	0	µg/L	0.21	1	--	--
75-25-2	Bromoform	227	0	0	µg/L	0.5	2.5	--	--
74-83-9	Bromomethane	227	0	0	µg/L	3.9	19	--	--
75-15-0	Carbon Disulfide	227	22	10	µg/L	0.41	3.8	0.45	9.3
56-23-5	Carbon Tetrachloride	227	0	0	µg/L	0.23	1.1	--	--
108-90-7	Chlorobenzene	227	0	0	µg/L	0.17	0.86	--	--
75-00-3	Chloroethane	227	0	0	µg/L	1.3	11	--	--
67-66-3	Chloroform	227	20	8.8	µg/L	0.33	2.3	0.5	5.5
74-87-3	Chloromethane	227	1	0.44	µg/L	0.49	8.8	0.6	0.6
156-59-2	cis-1,2-Dichloroethene	227	148	65	µg/L	0.48	0.95	0.5	230
10061-01-5	cis-1,3-Dichloropropene	227	0	0	µg/L	0.25	1.2	--	--
98-82-8	Cumene (Isopropylbenzene)	227	53	23	µg/L	0.23	1.2	0.38	25
124-48-1	Dibromochloromethane	227	0	0	µg/L	0.25	1.2	--	--

Table 4
Statistical Summary of Groundwater Data
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CAS Number	Chemical	Number of Samples	Number of Detects	Percent Detected %	Units	Minimum DL of NDs	Maximum DL of NDs	Minimum Detected Value	Maximum Detected Value
74-95-3	Dibromomethane	227	3	1.3	µg/L	0.46	2.3	0.71	2.1
108-20-3	Diisopropyl Ether (DIPE)	227	10	4.4	µg/L	0.31	1.7	0.36	1.7
64-17-5	Ethanol	227	0	0	µg/L	43	250	--	--
100-41-4	Ethylbenzene	227	88	39	µg/L	0.14	0.44	0.16	150
637-92-3	Ethyl-t-Butyl Ether (ETBE)	227	0	0	µg/L	0.27	2.2	--	--
75-69-4	Freon 11	227	0	0	µg/L	0.31	8.3	--	--
75-71-8	Freon 12	227	0	0	µg/L	0.46	2.3	--	--
76-13-1	Freon 113	227	2	0.88	µg/L	0.64	3.9	0.84	1.1
75-09-2	Methylene Chloride	227	2	0.88	µg/L	0.64	5.2	0.84	0.88
1634-04-4	Methyl-tert-Butyl Ether	227	13	5.7	µg/L	0.3	1.5	0.64	2.5
91-20-3	Naphthalene	227	31	14	µg/L	2.5	5.1	2.7	82
104-51-8	n-Butylbenzene	227	32	14	µg/L	0.23	0.55	0.28	3.4
99-87-6	p-Isopropyltoluene	227	34	15	µg/L	0.16	0.79	0.17	4.4
103-65-1	Propylbenzene	227	51	22	µg/L	0.17	1.6	0.18	26
135-98-8	sec-Butylbenzene	227	59	26	µg/L	0.2	0.49	0.21	3.4
100-42-5	Styrene	227	1	0.44	µg/L	0.17	0.86	0.2	0.2
994-05-8	tert-Amyl-Methyl Ether (TAME)	227	0	0	µg/L	0.22	1.1	--	--
75-65-0	tert-Butyl Alcohol (TBA)	227	93	41	µg/L	3.5	23	4.2	250
98-06-6	tert-Butylbenzene	227	2	0.88	µg/L	0.28	1.4	0.28	0.3
127-18-4	Tetrachloroethene	227	21	9.3	µg/L	0.39	1.9	0.52	190
108-88-3	Toluene	227	24	11	µg/L	0.24	1.2	0.25	12
156-60-5	trans-1,2-Dichloroethene	227	89	39	µg/L	0.37	1.8	0.37	120
10061-02-6	trans-1,3-Dichloropropene	227	0	0	µg/L	0.25	1.3	--	--
79-01-6	Trichloroethene	227	82	36	µg/L	0.3	1.8	0.37	310
108-05-4	Vinyl Acetate	227	0	0	µg/L	2.8	14	--	--
75-01-4	Vinyl Chloride	227	15	6.6	µg/L	0.3	1.5	0.33	0.91
1330-20-7	Xylenes, Total	227	64	28	µg/L	0.24	0.91	0.25	280
General									
ALK	Alkalinity, Total (as CaCO3)	37	37	100	mg/L	--	--	122	1080
ALKB	Bicarbonate Alkalinity as CaCO3	37	37	100	mg/L	--	--	122	1080
7440-70-2	Calcium	37	37	100	mg/L	--	--	8.54	597

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Carson, California

CAS Number	Chemical	Number of Samples	Number of Detects	Percent Detected %	Units	Minimum DL of NDs	Maximum DL of NDs	Minimum Detected Value	Maximum Detected Value
CO3	Carbonate (as CO3)	37	2	5.4	mg/L	0.85	0.85	20	138
16887-00-6	Chloride	37	37	100	mg/L	--	--	57	3200
16984-48-8	Fluoride	37	33	89	mg/L	0.022	0.033	0.065	0.97
HARD	Hardness (as CaCO3)	37	37	100	mg/L	--	--	130	2500
7439-95-4	Magnesium	37	37	100	mg/L	--	--	5.26	211
7439-96-5	Manganese	37	35	95	mg/L	0.0045	0.0045	0.0086	2.55
MBAS	MBAS	37	5	14	mg/L	0.089	0.089	0.1	0.29
14797-55-8	Nitrate (as N)	37	9	24	mg/L	0.017	0.037	0.041	14
14797-65-0	Nitrite (as N)	37	1	2.7	mg/L	0.013	0.032	0.097	0.097
PH	pH	37	37	100	PH units	--	--	6.34	9.29
7440-09-7	Potassium	37	37	100	mg/L	--	--	4.69	15.5
7440-23-5	Sodium	37	37	100	mg/L	--	--	68.1	917
TDS	Solids, Total Dissolved	37	37	100	mg/L	--	--	613	5620
1-01-1	Specific Conductance	37	37	100	UMHOS/CM	--	--	1000	7600
14808-79-8	Sulfate	37	37	100	mg/L	--	--	0.41	450

Notes:
" -- " not available
" DL " detection limit; "NDs " nondetects

Table 5
Soil Matrix Constituent of Concern Screening
Former Kast Property
Carson, California

Matrix	Chemical [1]	Maximum Concentration	Units	RBSLc	RBSLnc	RBSLc x 0.1	RBSLnc x 0.1	Background Concentration	COC Selection Rationale[2]	COC	Site-Related COC
Metal											
Soil	Antimony	6.5E+00	mg/kg	--	3.1E+01	--	3.1E+00	0.74	RBSLnc, background	Yes	No
Soil	Arsenic	6.3E+01	mg/kg	3.9E-01	2.2E+01	3.9E-02	2.2E+00	12	RBSLc, RBSLnc, background	Yes	Yes
Soil	Barium	1.0E+03	mg/kg	--	1.6E+04	--	1.6E+03	267		No	No
Soil	Beryllium	1.2E+00	mg/kg	1.2E+05	1.6E+02	1.2E+04	1.6E+01	0.56		No	No
Soil	Cadmium	9.0E+00	mg/kg	6.7E+04	7.0E+01	6.7E+03	7.0E+00	3.81	RBSLnc, background	Yes	No
Soil	Chromium	7.4E+01	mg/kg	--	1.2E+05	--	1.2E+04	32.6		No	No
Soil	Chromium, Hexavalent [3]	4.8E+00	mg/kg	1.9E+03	2.3E+02	1.9E+02	2.3E+01	--	See footnote	Yes	No
Soil	Cobalt	3.1E+01	mg/kg	3.1E+04	2.3E+01	3.1E+03	2.3E+00	10.91	RBSLnc, background	Yes	No
Soil	Copper	1.8E+03	mg/kg	--	3.1E+03	--	3.1E+02	59	RBSLnc, background	Yes	No
Soil	Lead	1.3E+03	mg/kg	--	8.0E+01	--	8.0E+00	61.5	RBSLnc, background	Yes	Yes
Soil	Mercury	1.3E+00	mg/kg	--	2.3E+01	--	2.3E+00	0.13		No	No
Soil	Molybdenum	1.8E+01	mg/kg	--	3.9E+02	--	3.9E+01	0.41		No	No
Soil	Nickel	4.3E+01	mg/kg	1.1E+06	1.6E+03	1.1E+05	1.6E+02	20.2		No	No
Soil	Selenium	9.0E+00	mg/kg	--	3.9E+02	--	3.9E+01	0.78		No	No
Soil	Silver	3.8E+00	mg/kg	--	3.9E+02	--	3.9E+01	1.29		No	No
Soil	Thallium	3.5E+00	mg/kg	--	7.8E-01	--	7.8E-02	0.23	RBSLnc, background	Yes	No
Soil	Vanadium	8.6E+01	mg/kg	--	5.5E+02	--	5.5E+01	45.66	RBSLnc, background	Yes	No
Soil	Zinc	5.8E+03	mg/kg	--	2.3E+04	--	2.3E+03	291	RBSLnc, background	Yes	No
PAHs											
Soil	Acenaphthene	1.7E+01	mg/kg	--	3.2E+03	--	3.2E+02	--		No	No
Soil	Acenaphthylene	1.0E+01	mg/kg	--	1.7E+04	--	1.7E+03	--		No	No
Soil	Anthracene	1.6E+01	mg/kg	--	1.7E+04	--	1.7E+03	--		No	No
Soil	Benzo (a) Anthracene	4.7E+01	mg/kg	1.6E+00	--	1.6E-01	--	--	RBSLc	Yes	Yes
Soil	Benzo (a) Pyrene	2.7E+01	mg/kg	1.6E-01	--	1.6E-02	--	0.90	RBSLc, background	Yes	Yes
Soil	Benzo (b) Fluoranthene	3.4E+01	mg/kg	1.6E+00	--	1.6E-01	--	--	RBSLc	Yes	Yes
Soil	Benzo (g,h,i) Perylene	1.3E+01	mg/kg	--	1.7E+03	--	1.7E+02	--		No	No
Soil	Benzo (k) Fluoranthene	2.6E+01	mg/kg	1.6E+00	--	1.6E-01	--	--	RBSLc	Yes	Yes
Soil	Chrysene	1.3E+02	mg/kg	1.6E+01	--	1.6E+00	--	--	RBSLc	Yes	Yes
Soil	Dibenz (a,h) Anthracene	3.4E+00	mg/kg	1.1E-01	--	1.1E-02	--	--	RBSLc	Yes	Yes
Soil	Fluoranthene	7.8E+01	mg/kg	--	2.3E+03	--	2.3E+02	--		No	No
Soil	Fluorene	2.2E+01	mg/kg	--	2.2E+03	--	2.2E+02	--		No	No
Soil	Indeno (1,2,3-c,d) Pyrene	9.0E+00	mg/kg	1.6E+00	--	1.6E-01	--	--	RBSLc	Yes	Yes
Soil	1-Methylnaphthalene	1.6E+02	mg/kg	2.2E+01	5.5E+03	2.2E+00	5.5E+02	--	RBSLc	Yes	Yes
Soil	2-Methylnaphthalene	2.8E+02	mg/kg	--	3.1E+02	--	3.1E+01	--	RBSLnc	Yes	Yes
Soil	Naphthalene	9.2E+01	mg/kg	4.1E+00	3.7E+02	4.1E-01	3.7E+01	--	RBSLc, RBSLnc	Yes	Yes
Soil	Phenanthrene	9.5E+01	mg/kg	--	1.7E+03	--	1.7E+02	--		No	No
Soil	Pyrene	2.4E+02	mg/kg	--	1.7E+03	--	1.7E+02	--	RBSLnc	Yes	Yes
SVOCS											
Soil	2,4-Dinitrotoluene	3.1E+00	mg/kg	1.6E+00	1.2E+02	1.6E-01	1.2E+01	--	RBSLc	Yes	No
Soil	Aniline	4.0E+00	mg/kg	8.5E+01	4.3E+02	8.5E+00	4.3E+01	--		No	No

Table 5
Soil Matrix Constituent of Concern Screening
Former Kast Property
Carson, California

Matrix	Chemical [1]	Maximum Concentration	Units	RBSLc	RBSLnc	RBSLc x 0.1	RBSLnc x 0.1	Background Concentration	COC Selection Rationale [2]	COC	Site-Related COC
Soil	Benzoic Acid	1.5E+00	mg/kg	--	2.4E+05	--	2.4E+04	--		No	No
Soil	Bis(2-Ethylhexyl) Phthalate	2.2E+01	mg/kg	3.5E+01	1.2E+03	3.5E+00	1.2E+02	--	RBSLc	Yes	No
Soil	Butyl Benzyl Phthalate	3.1E+00	mg/kg	2.6E+02	1.2E+04	2.6E+01	1.2E+03	--		No	No
Soil	Dibenzofuran	1.2E+00	mg/kg	--	1.5E+02	--	1.5E+01	--		No	No
Soil	Diethyl Phthalate	3.1E+00	mg/kg	--	4.9E+04	--	4.9E+03	--		No	No
Soil	Dimethyl Phthalate	2.7E+00	mg/kg	--	6.1E+05	--	6.1E+04	--		No	No
Soil	Di-n-Butyl Phthalate	3.3E-01	mg/kg	--	6.1E+03	--	6.1E+02	--		No	No
TPH											
Soil	TPH as Diesel	1.4E+05	mg/kg	--	1.3E+03	--	1.3E+02	--	RBSLnc	Yes	Yes
Soil	TPH as Gasoline	7.0E+03	mg/kg	--	7.6E+02	--	7.6E+01	--	RBSLnc	Yes	Yes
Soil	TPH as Motor Oil	3.2E+05	mg/kg	--	3.3E+03	--	3.3E+02	--	RBSLnc	Yes	Yes
VOCs											
Soil	1,1,2,2-Tetrachloroethane	4.2E+02	µg/kg	4.8E+02	1.3E+05	4.8E+01	1.3E+04	--	RBSLc	Yes	No
Soil	1,1,2-Trichloroethane	5.9E+01	µg/kg	8.9E+02	7.4E+04	8.9E+01	7.4E+03	--		No	No
Soil	1,2,3-Trichlorobenzene	3.4E+02	µg/kg	--	6.3E+04	--	6.3E+03	--		No	No
Soil	1,2,3-Trichloropropane	1.8E+02	µg/kg	2.1E+01	2.5E+03	2.1E+00	2.5E+02	--	RBSLc	Yes	No
Soil	1,2,4-Trichlorobenzene	3.2E+02	µg/kg	1.8E+05	1.5E+05	1.8E+04	1.5E+04	--		No	No
Soil	1,2,4-Trimethylbenzene	6.0E+04	µg/kg	--	1.4E+05	--	1.4E+04	--	RBSLnc	Yes	Yes
Soil	1,2-Dichlorobenzene	3.3E+02	µg/kg	--	2.1E+06	--	2.1E+05	--		No	No
Soil	1,2-Dichloroethane	7.3E+00	µg/kg	4.4E+02	8.0E+05	4.4E+01	8.0E+04	--		No	No
Soil	1,2-Dichloropropane	1.0E+02	µg/kg	8.0E+02	1.5E+04	8.0E+01	1.5E+03	--	RBSLc	Yes	No
Soil	1,3,5-Trimethylbenzene	2.5E+04	µg/kg	--	4.9E+04	--	4.9E+03	--	RBSLnc	Yes	Yes
Soil	1,4-Dichlorobenzene	4.4E+02	µg/kg	2.8E+03	3.6E+06	2.8E+02	3.6E+05	--	RBSLc	Yes	No
Soil	2-Butanone (Methyl Ethyl Ketone)	2.7E+03	µg/kg	--	2.8E+07	--	2.8E+06	--		No	No
Soil	2-Chlorotoluene	3.7E+01	µg/kg	--	6.1E+05	--	6.1E+04	--		No	No
Soil	2-Hexanone	3.1E+01	µg/kg	--	2.0E+05	--	2.0E+04	--		No	No
Soil	4-Methyl-2-Pentanone	1.5E+01	µg/kg	--	5.3E+06	--	5.3E+05	--		No	No
Soil	Acetone	1.8E+03	µg/kg	--	6.0E+07	--	6.0E+06	--		No	No
Soil	Benzene	2.4E+04	µg/kg	2.2E+02	1.1E+05	2.2E+01	1.1E+04	--	RBSLc, RBSLnc	Yes	Yes
Soil	Bromodichloromethane	1.7E+02	µg/kg	5.0E+02	4.4E+05	5.0E+01	4.4E+04	--	RBSLc	Yes	No
Soil	Bromoform	1.4E+02	µg/kg	2.4E+04	7.1E+05	2.4E+03	7.1E+04	--		No	No
Soil	Bromomethane	1.3E+03	µg/kg	--	8.9E+03	--	8.9E+02	--	RBSLnc	Yes	No
Soil	Carbon Disulfide	1.2E+02	µg/kg	--	8.9E+05	--	8.9E+04	--		No	No
Soil	Chlorobenzene	2.9E+01	µg/kg	--	1.3E+06	--	1.3E+05	--		No	No
Soil	Chloroethane	1.8E+00	µg/kg	--	1.4E+07	--	1.4E+06	--		No	No
Soil	Chloroform	1.1E+02	µg/kg	1.1E+03	4.1E+05	1.1E+02	4.1E+04	--		No	No
Soil	Chloromethane	5.2E+02	µg/kg	--	9.8E+04	--	9.8E+03	--		No	No
Soil	cis-1,2-Dichloroethene	4.4E+02	µg/kg	--	9.3E+04	--	9.3E+03	--		No	No
Soil	Cumene (Isopropylbenzene)	1.5E+04	µg/kg	--	4.3E+05	--	4.3E+04	--		No	No
Soil	Dibromochloromethane	6.8E+00	µg/kg	1.1E+03	5.9E+05	1.1E+02	5.9E+04	--		No	No
Soil	Diisopropyl Ether (DIPE)	1.4E+00	µg/kg	--	1.2E+06	--	1.2E+05	--		No	No

Table 5
Soil Matrix Constituent of Concern Screening
Former Kast Property
Carson, California

Matrix	Chemical [1]	Maximum Concentration	Units	RBSLc	RBSLnc	RBSLc x 0.1	RBSLnc x 0.1	Background Concentration	COC Selection Rationale[2]	COC	Site-Related COC
Soil	Ethanol	1.0E+05	µg/kg	--	2.5E+07	--	2.5E+06	--		No	No
Soil	Ethylbenzene	3.3E+04	µg/kg	4.9E+03	4.6E+06	4.9E+02	4.6E+05	--	RBSLc	Yes	Yes
Soil	Freon 12	1.7E+01	µg/kg	--	2.7E+05	--	2.7E+04	--		No	No
Soil	Methylene Chloride	2.1E+03	µg/kg	5.4E+03	8.6E+05	5.4E+02	8.6E+04	--	RBSLc	Yes	No
Soil	Methyl-tert-Butyl Ether	1.4E+02	µg/kg	3.5E+04	2.9E+07	3.5E+03	2.9E+06	--		No	No
Soil	n-Butylbenzene	1.1E+04	µg/kg	--	8.8E+05	--	8.8E+04	--		No	No
Soil	o-Xylene	1.5E+04	µg/kg	--	4.5E+06	--	4.5E+05	--		No	No
Soil	p/m-Xylene	3.4E+04	µg/kg	--	4.0E+06	--	4.0E+05	--		No	No
Soil	p-Isopropyltoluene	1.1E+04	µg/kg	--	3.8E+06	--	3.8E+05	--		No	No
Soil	Propylbenzene	2.1E+04	µg/kg	--	7.3E+05	--	7.3E+04	--		No	No
Soil	sec-Butylbenzene	9.1E+03	µg/kg	--	9.9E+05	--	9.9E+04	--		No	No
Soil	Styrene	2.3E+01	µg/kg	--	7.1E+06	--	7.1E+05	--		No	No
Soil	tert-Butyl Alcohol (TBA)	4.3E+02	µg/kg	--	6.4E+06	--	6.4E+05	--		No	No
Soil	tert-Butylbenzene	4.2E+02	µg/kg	--	7.9E+05	--	7.9E+04	--		No	No
Soil	Tetrachloroethene	1.9E+04	µg/kg	5.6E+02	8.4E+04	5.6E+01	8.4E+03	--	RBSLc, RBSLnc	Yes	No
Soil	Toluene	5.7E+04	µg/kg	--	1.1E+06	--	1.1E+05	--		No	No
Soil	Trichloroethene	7.2E+02	µg/kg	3.9E+03	2.3E+04	3.9E+02	2.3E+03	--	RBSLc	Yes	No
Soil	Vinyl Chloride	4.9E+01	µg/kg	3.2E+01	7.4E+04	3.2E+00	7.4E+03	--	RBSLc	Yes	No
Soil	Xylenes, Total	1.4E+05	µg/kg	--	3.4E+06	--	3.4E+05	--		No	No

Notes:

[1] Chemicals included if greater than 5 detects in soil from 0-10 feet below ground surface.

[2] COC when maximum Site-wide concentration exceeded 0.1 x Residential RBSL or background. The exceeded criterion or criteria are noted in this column. For metals and PAHs, a compound is selected as a COC only when the maximum concentration exceeds both the RBSL and the background concentration (when data available)

[3] Due to change in oral cancer assessment not reflected in RBSLs from HHSRE Work Plan hexavalent chromium included as COC.

Site-Related COCs may be related to site activities associated with crude oil storage prior to redevelopment

RBSLc - Risk-based Concentration for carcinogenic effects

RBSLnc - Risk-based Concentration for noncarcinogenic effects

-- not available

Table 6
Soil Vapor Constituent of Concern Screening
Former Kast Property
Carson, California

Matrix	Series	Chemical	Maximum Concentration	Units	RBSLc	RBSLnc	RBSLc x 0.1	RBSLnc x 0.1	COC Selection Rationale[1]	COC	Site-Related COC
Soil Vapor	Non-Sub-Slab <= 10 ft.	1,1,1-Trichloroethane	6.2E+00	µg/m3	--	1.0E+05	--	1.0E+04	--	No	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	1,1,2,2-Tetrachloroethane	9.0E+03	µg/m3	4.2E+00	1.5E+03	4.2E-01	1.5E+02	RBSLc, RBSLnc	Yes	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	1,1,2-Trichloroethane	7.1E+00	µg/m3	1.5E+01	1.5E+03	1.5E+00	1.5E+02	RBSLc	Yes	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	1,1-Dichloroethane	2.0E+02	µg/m3	1.5E+02	7.3E+04	1.5E+01	7.3E+03	RBSLc	Yes	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	1,1-Dichloroethene	1.8E+00	µg/m3	--	7.3E+03	--	7.3E+02	--	No	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	1,2,4-Trimethylbenzene	9.9E+05	µg/m3	--	7.3E+02	--	7.3E+01	RBSLnc	Yes	Yes
Soil Vapor	Non-Sub-Slab <= 10 ft.	1,2-Dichloroethane	1.7E+03	µg/m3	1.2E+01	4.2E+04	1.2E+00	4.2E+03	RBSLc	Yes	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	1,3,5-Trimethylbenzene	4.5E+05	µg/m3	--	6.3E+02	--	6.3E+01	RBSLnc	Yes	Yes
Soil Vapor	Non-Sub-Slab <= 10 ft.	1,4-Dichlorobenzene	1.7E+02	µg/m3	2.2E+01	8.3E+04	2.2E+00	8.3E+03	RBSLc	Yes	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	2,2,4-Trimethylpentane	1.4E+01	µg/m3	--	1.1E+05	--	1.1E+04	--	No	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	2-Butanone (Methyl Ethyl Ketone)	1.6E+06	µg/m3	--	5.2E+05	--	5.2E+04	RBSLnc	Yes	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	2-Hexanone	1.6E+04	µg/m3	--	3.1E+03	--	3.1E+02	RBSLnc	Yes	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	4-Ethyltoluene	4.4E+05	µg/m3	--	7.3E+04	--	7.3E+03	RBSLnc	Yes	Yes
Soil Vapor	Non-Sub-Slab <= 10 ft.	4-Methyl-2-Pentanone	1.6E+01	µg/m3	--	3.1E+05	--	3.1E+04	--	No	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	Acetone	2.4E+05	µg/m3	--	3.2E+06	--	3.2E+05	--	No	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	Benzene	3.8E+06	µg/m3	8.4E+00	6.3E+03	8.4E-01	6.3E+02	RBSLc, RBSLnc	Yes	Yes
Soil Vapor	Non-Sub-Slab <= 10 ft.	Bromodichloromethane	1.2E+04	µg/m3	6.6E+00	7.3E+03	6.6E-01	7.3E+02	RBSLc, RBSLnc	Yes	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	Bromomethane	1.4E+00	µg/m3	--	5.2E+02	--	5.2E+01	--	No	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	Carbon Disulfide	1.7E+05	µg/m3	--	8.3E+04	--	8.3E+03	RBSLnc	Yes	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	Chlorobenzene	5.9E+00	µg/m3	--	1.0E+05	--	1.0E+04	--	No	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	Chloroethane	6.7E+00	µg/m3	--	3.1E+06	--	3.1E+05	--	No	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	Chloroform	3.7E+02	µg/m3	4.6E+01	3.1E+04	4.6E+00	3.1E+03	RBSLc	Yes	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	Chloromethane	9.8E+01	µg/m3	--	9.4E+03	--	9.4E+02	--	No	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	cis-1,2-Dichloroethene	6.9E+02	µg/m3	--	3.7E+03	--	3.7E+02	RBSLnc	Yes	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	Cumene (Isopropylbenzene)	3.1E+04	µg/m3	--	4.2E+04	--	4.2E+03	RBSLnc	Yes	Yes
Soil Vapor	Non-Sub-Slab <= 10 ft.	Cyclohexane	2.7E+06	µg/m3	--	6.3E+05	--	6.3E+04	RBSLnc	Yes	Yes
Soil Vapor	Non-Sub-Slab <= 10 ft.	Ethanol	5.4E+04	µg/m3	--	4.2E+05	--	4.2E+04	RBSLnc	Yes	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	Ethylbenzene	1.8E+06	µg/m3	9.7E+01	2.1E+05	9.7E+00	2.1E+04	RBSLc, RBSLnc	Yes	Yes
Soil Vapor	Non-Sub-Slab <= 10 ft.	Freon 11	1.9E+01	µg/m3	--	7.3E+04	--	7.3E+03	--	No	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	Freon 113	2.0E+02	µg/m3	--	3.1E+06	--	3.1E+05	--	No	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	Freon 12	2.1E+02	µg/m3	--	2.1E+04	--	2.1E+03	--	No	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	Heptane	1.0E+06	µg/m3	--	7.3E+05	--	7.3E+04	RBSLnc	Yes	Yes
Soil Vapor	Non-Sub-Slab <= 10 ft.	Hexachloro-1,3-Butadiene	2.0E+03	µg/m3	1.1E+01	3.7E+02	1.1E+00	3.7E+01	RBSLc, RBSLnc	Yes	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	Hexane	1.9E+06	µg/m3	--	7.3E+05	--	7.3E+04	RBSLnc	Yes	Yes
Soil Vapor	Non-Sub-Slab <= 10 ft.	Isopropanol	4.5E+05	µg/m3	--	7.3E+05	--	7.3E+04	RBSLnc	Yes	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	Methylene Chloride	7.3E+03	µg/m3	2.4E+02	4.2E+04	2.4E+01	4.2E+03	RBSLc, RBSLnc	Yes	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	Methyl-tert-Butyl Ether	2.8E+03	µg/m3	9.4E+02	8.3E+05	9.4E+01	8.3E+04	RBSLc	Yes	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	Naphthalene	5.2E+03	µg/m3	7.2E+00	9.4E+02	7.2E-01	9.4E+01	RBSLc, RBSLnc	Yes	Yes
Soil Vapor	Non-Sub-Slab <= 10 ft.	o-Xylene	2.1E+04	µg/m3	--	7.3E+04	--	7.3E+03	RBSLnc	Yes	Yes

Table 6
Soil Vapor Constituent of Concern Screening
Former Kast Property
Carson, California

Matrix	Series	Chemical	Maximum Concentration	Units	RBSLc	RBSLnc	RBSLc x 0.1	RBSLnc x 0.1	COC Selection Rationale[1]	COC	Site-Related COC
Soil Vapor	Non-Sub-Slab <= 10 ft.	p/m-Xylene	1.7E+05	µg/m3	--	7.3E+04	--	7.3E+03	RBSLnc	Yes	Yes
Soil Vapor	Non-Sub-Slab <= 10 ft.	Propylbenzene	3.7E+04	µg/m3	--	1.5E+04	--	1.5E+03	RBSLnc	Yes	Yes
Soil Vapor	Non-Sub-Slab <= 10 ft.	Styrene	5.9E+03	µg/m3	--	9.4E+04	--	9.4E+03	--	No	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	t-Butyl Alcohol (TBA)	1.4E+02	µg/m3	--	1.2E+03	--	1.2E+02	RBSLnc	Yes	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	Tetrachloroethene	5.3E+03	µg/m3	4.1E+01	3.7E+03	4.1E+00	3.7E+02	RBSLc, RBSLnc	Yes	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	Tetrahydrofuran	1.2E+01	µg/m3	1.3E+02	3.1E+04	1.3E+01	3.1E+03	--	No	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	Toluene	3.7E+06	µg/m3	--	3.1E+04	--	3.1E+03	RBSLnc	Yes	Yes
Soil Vapor	Non-Sub-Slab <= 10 ft.	trans-1,2-Dichloroethene	5.6E+03	µg/m3	--	6.3E+03	--	6.3E+02	RBSLnc	Yes	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	trans-1,3-Dichloropropene	6.5E+00	µg/m3	1.5E+01	2.1E+03	1.5E+00	2.1E+02	RBSLc	Yes	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	Trichloroethene	6.6E+03	µg/m3	1.2E+02	6.3E+04	1.2E+01	6.3E+03	RBSLc, RBSLnc	Yes	No
Soil Vapor	Non-Sub-Slab <= 10 ft.	Vinyl Acetate	5.1E+00	µg/m3	--	2.1E+02	--	2.1E+01	--	No	No
Soil Vapor	Sub-Slab	1,1,1-Trichloroethane	2.2E+04	µg/m3	--	1.0E+05	--	1.0E+04	RBSLnc	Yes	No
Soil Vapor	Sub-Slab	1,1-Dichloroethene	1.8E+01	µg/m3	--	7.3E+03	--	7.3E+02	--	No	No
Soil Vapor	Sub-Slab	1,2,4-Trichlorobenzene	1.3E+03	µg/m3	--	4.2E+02	--	4.2E+01	RBSLnc	Yes	No
Soil Vapor	Sub-Slab	1,2,4-Trimethylbenzene	3.3E+04	µg/m3	--	7.3E+02	--	7.3E+01	RBSLnc	Yes	Yes
Soil Vapor	Sub-Slab	1,2-Dichlorobenzene	7.8E+02	µg/m3	--	2.1E+04	--	2.1E+03	--	No	No
Soil Vapor	Sub-Slab	1,2-Dichloroethane	1.2E+04	µg/m3	1.2E+01	4.2E+04	1.2E+00	4.2E+03	RBSLc, RBSLnc	Yes	No
Soil Vapor	Sub-Slab	1,2-Dichloropropane	2.2E+01	µg/m3	2.4E+01	4.2E+02	2.4E+00	4.2E+01	RBSLc	Yes	No
Soil Vapor	Sub-Slab	1,3,5-Trimethylbenzene	1.6E+04	µg/m3	--	6.3E+02	--	6.3E+01	RBSLnc	Yes	Yes
Soil Vapor	Sub-Slab	1,3-Butadiene	2.2E+00	µg/m3	1.4E+00	2.1E+03	1.4E-01	2.1E+02	RBSLc	Yes	No
Soil Vapor	Sub-Slab	1,3-Dichlorobenzene	3.6E+01	µg/m3	--	1.1E+04	--	1.1E+03	--	No	No
Soil Vapor	Sub-Slab	1,4-Dichlorobenzene	1.1E+02	µg/m3	2.2E+01	8.3E+04	2.2E+00	8.3E+03	RBSLc	Yes	No
Soil Vapor	Sub-Slab	1,4-Dioxane	3.0E+02	µg/m3	3.2E+01	3.1E+05	3.2E+00	3.1E+04	RBSLc	Yes	No
Soil Vapor	Sub-Slab	2,2,4-Trimethylpentane	4.6E+04	µg/m3	--	1.1E+05	--	1.1E+04	RBSLnc	Yes	Yes
Soil Vapor	Sub-Slab	2-Butanone (Methyl Ethyl Ketone)	2.1E+02	µg/m3	--	5.2E+05	--	5.2E+04	--	No	No
Soil Vapor	Sub-Slab	2-Hexanone	3.6E+02	µg/m3	--	3.1E+03	--	3.1E+02	RBSLnc	Yes	No
Soil Vapor	Sub-Slab	4-Ethyltoluene	3.1E+04	µg/m3	--	7.3E+04	--	7.3E+03	RBSLnc	Yes	Yes
Soil Vapor	Sub-Slab	4-Methyl-2-Pentanone	1.4E+01	µg/m3	--	3.1E+05	--	3.1E+04	--	No	No
Soil Vapor	Sub-Slab	Acetone	6.2E+02	µg/m3	--	3.2E+06	--	3.2E+05	--	No	No
Soil Vapor	Sub-Slab	Benzene	2.4E+05	µg/m3	8.4E+00	6.3E+03	8.4E-01	6.3E+02	RBSLc, RBSLnc	Yes	Yes
Soil Vapor	Sub-Slab	Bromodichloromethane	3.7E+02	µg/m3	6.6E+00	7.3E+03	6.6E-01	7.3E+02	RBSLc	Yes	No
Soil Vapor	Sub-Slab	Bromoform	3.1E+00	µg/m3	2.2E+02	7.3E+03	2.2E+01	7.3E+02	--	No	No
Soil Vapor	Sub-Slab	Bromomethane	9.5E+01	µg/m3	--	5.2E+02	--	5.2E+01	RBSLnc	Yes	No
Soil Vapor	Sub-Slab	Carbon Disulfide	2.3E+02	µg/m3	--	8.3E+04	--	8.3E+03	--	No	No
Soil Vapor	Sub-Slab	Carbon Tetrachloride	9.9E+01	µg/m3	5.8E+00	4.2E+03	5.8E-01	4.2E+02	RBSLc	Yes	No
Soil Vapor	Sub-Slab	Chlorobenzene	4.8E+01	µg/m3	--	1.0E+05	--	1.0E+04	--	No	No
Soil Vapor	Sub-Slab	Chloroethane	6.6E+01	µg/m3	--	3.1E+06	--	3.1E+05	--	No	No

Table 6
Soil Vapor Constituent of Concern Screening
Former Kast Property
Carson, California

Matrix	Series	Chemical	Maximum Concentration	Units	RBSLc	RBSLnc	RBSLc x 0.1	RBSLnc x 0.1	COC Selection Rationale[1]	COC	Site-Related COC
Soil Vapor	Sub-Slab	Chloroform	8.4E+03	µg/m3	4.6E+01	3.1E+04	4.6E+00	3.1E+03	RBSLc, RBSLnc	Yes	No
Soil Vapor	Sub-Slab	Chloromethane	1.7E+04	µg/m3	--	9.4E+03	--	9.4E+02	RBSLnc	Yes	No
Soil Vapor	Sub-Slab	cis-1,2-Dichloroethene	1.3E+02	µg/m3	--	3.7E+03	--	3.7E+02	--	No	No
Soil Vapor	Sub-Slab	Cumene (Isopropylbenzene)	1.6E+04	µg/m3	--	4.2E+04	--	4.2E+03	RBSLnc	Yes	Yes
Soil Vapor	Sub-Slab	Cyclohexane	1.2E+06	µg/m3	--	6.3E+05	--	6.3E+04	RBSLnc	Yes	Yes
Soil Vapor	Sub-Slab	Dibromochloromethane	1.1E+02	µg/m3	9.0E+00	7.3E+03	9.0E-01	7.3E+02	RBSLc	Yes	No
Soil Vapor	Sub-Slab	Ethanol	1.6E+03	µg/m3	--	4.2E+05	--	4.2E+04	--	No	No
Soil Vapor	Sub-Slab	Ethylbenzene	6.7E+04	µg/m3	9.7E+01	2.1E+05	9.7E+00	2.1E+04	RBSLc, RBSLnc	Yes	Yes
Soil Vapor	Sub-Slab	Freon 11	7.2E+01	µg/m3	--	7.3E+04	--	7.3E+03	--	No	No
Soil Vapor	Sub-Slab	Freon 113	1.5E+02	µg/m3	--	3.1E+06	--	3.1E+05	--	No	No
Soil Vapor	Sub-Slab	Freon 114	2.7E+01	µg/m3	--	3.1E+06	--	3.1E+05	--	No	No
Soil Vapor	Sub-Slab	Freon 12	1.2E+02	µg/m3	--	2.1E+04	--	2.1E+03	--	No	No
Soil Vapor	Sub-Slab	Heptane	9.6E+05	µg/m3	--	7.3E+05	--	7.3E+04	RBSLnc	Yes	Yes
Soil Vapor	Sub-Slab	Hexane	3.0E+05	µg/m3	--	7.3E+05	--	7.3E+04	RBSLnc	Yes	Yes
Soil Vapor	Sub-Slab	Isopropanol	1.7E+04	µg/m3	--	7.3E+05	--	7.3E+04	--	No	No
Soil Vapor	Sub-Slab	Methylene Chloride	2.8E+04	µg/m3	2.4E+02	4.2E+04	2.4E+01	4.2E+03	RBSLc, RBSLnc	Yes	No
Soil Vapor	Sub-Slab	Methyl-tert-Butyl Ether	4.4E+02	µg/m3	9.4E+02	8.3E+05	9.4E+01	8.3E+04	RBSLc	Yes	No
Soil Vapor	Sub-Slab	Naphthalene	1.2E+03	µg/m3	7.2E+00	9.4E+02	7.2E-01	9.4E+01	RBSLc, RBSLnc	Yes	Yes
Soil Vapor	Sub-Slab	o-Xylene	7.4E+04	µg/m3	--	7.3E+04	--	7.3E+03	RBSLnc	Yes	Yes
Soil Vapor	Sub-Slab	p/m-Xylene	2.4E+05	µg/m3	--	7.3E+04	--	7.3E+03	RBSLnc	Yes	Yes
Soil Vapor	Sub-Slab	Propylbenzene	1.6E+04	µg/m3	--	1.5E+04	--	1.5E+03	RBSLnc	Yes	Yes
Soil Vapor	Sub-Slab	Styrene	2.0E+01	µg/m3	--	9.4E+04	--	9.4E+03	--	No	No
Soil Vapor	Sub-Slab	Tetrachloroethene	1.1E+04	µg/m3	4.1E+01	3.7E+03	4.1E+00	3.7E+02	RBSLc, RBSLnc	Yes	No
Soil Vapor	Sub-Slab	Tetrahydrofuran	7.7E+01	µg/m3	1.3E+02	3.1E+04	1.3E+01	3.1E+03	RBSLc	Yes	No
Soil Vapor	Sub-Slab	Toluene	1.4E+05	µg/m3	--	3.1E+04	--	3.1E+03	RBSLnc	Yes	Yes
Soil Vapor	Sub-Slab	trans-1,2-Dichloroethene	1.2E+01	µg/m3	--	6.3E+03	--	6.3E+02	--	No	No
Soil Vapor	Sub-Slab	trans-1,3-Dichloropropene	8.4E+00	µg/m3	1.5E+01	2.1E+03	1.5E+00	2.1E+02	RBSLc	Yes	No
Soil Vapor	Sub-Slab	Trichloroethene	1.1E+04	µg/m3	1.2E+02	6.3E+04	1.2E+01	6.3E+03	RBSLc, RBSLnc	Yes	No
Soil Vapor	Sub-Slab	Vinyl Chloride	2.7E+01	µg/m3	3.1E+00	1.0E+04	3.1E-01	1.0E+03	RBSLc	Yes	No

Notes:

COC when maximum Site-wide concentration exceeded 0.1 x Residential RBSL or background. Selection criterion or criteria are listed in this column.

Site-Related COCs may be related to site activities associated with crude oil storage prior to redevelopment

RBSLc - Risk-based Concentration for carcinogenic effects

RBSLnc - Risk-based Concentration for noncarcinogenic effects

-- not available

Table 7
Site-specific Cleanup Goals for Soil - Resident
Former Kast Property
Carson, California

Chemical of Potential Concern	CAS Number	Resident Soil (mg/kg) EF = 350 d/y		Resident Soil (mg/kg) EF = 4 d/y	
		$SSCG_{nc}$	$SSCG_{c}$	$SSCG_{nc}$	$SSCG_{c}$
Metals					
Antimony	7440-36-0	3.1E+01	--	2.7E+03	--
Arsenic	7440-38-2	2.2E+01	6.1E-02	1.9E+03	5.4E+00
Cadmium	7440-43-9	7.0E+01	1.6E+03	6.1E+03	1.4E+05
Chromium VI	18540-29-9	2.3E+02	1.2E+00	2.1E+04	1.1E+02
Cobalt	7440-48-4	2.3E+01	7.6E+02	2.1E+03	6.7E+04
Copper	7440-50-8	3.1E+03	--	2.7E+05	--
Lead	7439-92-1	8.0E+01	--	--	--
Thallium	7440-28-0	7.8E-01	--	6.8E+01	--
Vanadium	7440-62-2	3.9E+02	--	3.4E+04	--
Zinc	7440-66-6	2.3E+04	--	2.1E+06	--
PAHs					
Benz[a]anthracene	56-55-3	--	1.6E+00	--	1.4E+02
Benzo[a]pyrene	50-32-8	--	1.6E-01	--	1.4E+01
Benzo[b]fluoranthene	205-99-2	--	1.6E+00	--	1.4E+02
Benzo[k]fluoranthene	207-08-9	--	1.6E+00	--	1.4E+02
Chrysene	218-01-9	--	1.6E+01	--	1.4E+03
Dibenz[a,h]anthracene	53-70-3	--	1.1E-01	--	9.7E+00
Indeno[1,2,3-cd]pyrene	193-39-5	--	1.6E+00	--	1.4E+02
Methylnaphthalene, 1-	90-12-0	4.0E+03	1.6E+01	3.5E+05	1.4E+03
Methylnaphthalene, 2-	91-57-6	2.3E+02	--	2.0E+04	--
Naphthalene	91-20-3	1.5E+02	4.0E+00	1.3E+04	3.5E+02
Pyrene	129-00-0	1.7E+03	--	1.5E+05	--
TPH					
Aliphatic: C5-C8		7.1E+02	--	6.2E+04	--
Aliphatic: C9-C18		1.4E+03	--	1.3E+05	--
Aliphatic: C19-C32		1.1E+05	--	1.0E+07	--
Aromatic: C6-C8		--	--	--	--
Aromatic: C9-C16		6.0E+02	--	5.3E+04	--
Aromatic: C17-C32		1.7E+03	--	1.5E+05	--
TPHg		7.6E+02	--	6.6E+04	--
TPHd		1.3E+03	--	1.1E+05	--
TPHmo		3.3E+03	--	1.9E+05	--
SVOCs					
2,4-Dinitrotoluene	121-14-2	1.2E+02	1.6E+00	1.1E+04	1.4E+02
Bis(2-Ethylhexyl) Phthalate	117-81-7	1.2E+03	3.5E+01	1.1E+05	3.0E+03
VOCs					
1,1,2,2-Tetrachloroethane	79-34-5	6.2E+02	4.7E-01	5.4E+04	4.1E+01
1,2,3-Trichloropropane	96-18-4	2.4E+00	2.1E-02	2.1E+02	1.9E+00
1,2,4-Trimethylbenzene	95-63-6	8.3E+01	--	7.2E+03	--

Table 7
Site-specific Cleanup Goals for Soil - Resident
Former Kast Property
Carson, California

Chemical of Potential Concern	CAS Number	Resident Soil (mg/kg) EF = 350 d/y		Resident Soil (mg/kg) EF = 4 d/y	
		$SSCG_{nc}$	$SSCG_c$	$SSCG_{nc}$	$SSCG_c$
1,2-Dichloropropane	78-87-5	**1.5E+01**	**8.3E-01**	**1.3E+03**	**7.2E+01**
1,3,5-Trimethylbenzene	108-67-8	**8.5E+01**	**--**	**7.4E+03**	**--**
1,4-Dichlorobenzene	106-46-7	**3.6E+03**	**2.8E+00**	**3.2E+05**	**2.4E+02**
Benzene	71-43-2	**6.7E+01**	**2.2E-01**	**5.8E+03**	**1.9E+01**
Bromodichloromethane	75-27-4	**4.3E+02**	**4.9E-01**	**3.8E+04**	**4.2E+01**
Bromomethane	74-83-9	**8.8E+00**	**--**	**7.7E+02**	**--**
Ethylbenzene	100-41-4	**3.3E+03**	**4.8E+00**	**2.9E+05**	**4.2E+02**
Methylene chloride	75-09-2	**3.6E+02**	**5.3E+00**	**3.2E+04**	**4.7E+02**
Tetrachloroethene	127-18-4	**8.6E+01**	**5.5E-01**	**7.5E+03**	**4.9E+01**
Trichloroethene	79-01-6	**5.8E+00**	**1.7E+00**	**5.0E+02**	**1.5E+02**
Vinyl chloride	75-01-4	**7.4E+01**	**3.2E-02**	**6.4E+03**	**2.8E+00**

Notes:

" -- " not applicable; " na " not available

" EF " exposure frequency; " d/y " days per year

" $SSCG_{nc}$ " site-specific cleanup goal using a target noncancer hazard = 1

" $SSCG_c$ " site-specific cleanup goal using a target cancer risk = 1×10^{-6} for residents

Soil SSCGs based on incidental ingestion, dermal contact with soil, and outdoor air inhalation

Table 8
Site-specific Cleanup Goals for Soil - Construction and Utility Maintenance Worker
Former Kast Property
Carson, California

Chemical of Potential Concern	CAS Number	Construction and Utility Maintenance Worker	
		Soil (mg/kg)	
		$SSCG_{nc}$	$SSCG_c$
Metals			
Antimony	7440-36-0	**3.1E+03**	--
Arsenic	7440-38-2	**4.1E+02**	**1.5E+01**
Cadmium	7440-43-9	**6.4E+02**	**2.4E+02**
Chromium VI	18540-29-9	**3.2E+03**	**6.7E+00**
Cobalt	7440-48-4	**2.0E+02**	**1.1E+02**
Copper	7440-50-8	**3.1E+05**	--
Lead	7439-92-1	--	--
Thallium	7440-28-0	**7.7E+01**	--
Vanadium	7440-62-2	**3.9E+04**	--
Zinc	7440-66-6	**2.3E+06**	--
PAHs			
Benz[a]anthracene	56-55-3	--	**2.6E+02**
Benzo[a]pyrene	50-32-8	--	**2.6E+01**
Benzo[b]fluoranthene	205-99-2	--	**2.6E+02**
Benzo[k]fluoranthene	207-08-9	--	**2.6E+02**
Chrysene	218-01-9	--	**2.6E+03**
Dibenz[a,h]anthracene	53-70-3	--	**1.9E+01**
Indeno[1,2,3-cd]pyrene	193-39-5	--	**2.6E+02**
Methylnaphthalene, 1-	90-12-0	**1.9E+05**	**2.7E+03**
Methylnaphthalene, 2-	91-57-6	**1.1E+04**	--
Naphthalene	91-20-3	**1.4E+02**	**3.9E+01**
Pyrene	129-00-0	**6.7E+04**	--
TPH			
Aliphatic: C5-C8		**8.3E+02**	--
Aliphatic: C9-C18		**1.6E+03**	--
Aliphatic: C19-C32		**5.5E+06**	--
Aromatic: C6-C8		--	--
Aromatic: C9-C16		**7.5E+02**	--
Aromatic: C17-C32		**8.3E+04**	--
TPHg		**8.6E+02**	--
TPHd		**1.9E+03**	--
TPHmo		**1.6E+05**	--
SVOCs			
2,4-Dinitrotoluene	121-14-2	**6.3E+03**	**2.8E+02**
Bis(2-Ethylhexyl) Phthalate	117-81-7	**6.3E+04**	**6.4E+03**
VOCs			
1,1,2,2-Tetrachloroethane	79-34-5	**8.3E+02**	**5.7E+00**

Table 8
Site-specific Cleanup Goals for Soil - Construction and Utility Maintenance Worker
Former Kast Property
Carson, California

Chemical of Potential Concern	CAS Number	Construction and Utility Maintenance Worker Soil (mg/kg)	
		$SSCG_{nc}$	$SSCG_c$
1,2,3-Trichloropropane	96-18-4	**2.0E+00**	**7.2E+00**
1,2,4-Trimethylbenzene	95-63-6	**7.5E+01**	--
1,2-Dichloropropane	78-87-5	**1.2E+01**	**8.5E+00**
1,3,5-Trimethylbenzene	108-67-8	**7.7E+01**	--
1,4-Dichlorobenzene	106-46-7	**8.7E+03**	**2.8E+01**
Benzene	71-43-2	**6.9E+01**	**2.2E+00**
Bromodichloromethane	75-27-4	**4.9E+02**	**5.3E+00**
Bromomethane	74-83-9	**7.8E+00**	--
Ethylbenzene	100-41-4	**4.5E+03**	**5.1E+01**
Methylene chloride	75-09-2	**1.2E+03**	**5.9E+01**
Tetrachloroethene	127-18-4	**8.6E+01**	**1.0E+01**
Trichloroethene	79-01-6	**5.5E+00**	**1.9E+01**
Vinyl chloride	75-01-4	**8.7E+01**	**3.1E-01**

Notes:

" -- " not applicable or not available

" $SSCG_{nc}$ " site-specific cleanup goal using a target noncancer hazard = 1

" $SSCG_c$ " site-specific cleanup goal using a target cancer = 1×10^{-5} for workers

Soil SSCGs based on incidental ingestion, dermal contact with soil, and outdoor air inhalation

Table 9
Site-specific Cleanup Goals for Soil Vapor – Construction and Utility Maintenance Worker
Former Kast Property
Carson, California

Chemical of Concern	CAS Number	Soil Vapor (µg/m^3)	
		$SSCG_{nc}$	$SSCG_c$
PAHs			
Naphthalene	91-20-3	2.3E+05	6.3E+04
VOCs			
1,1,1-Trichloroethane	71-55-6	7.4E+09	--
1,1,2,2-Tetrachloroethane	79-34-5	1.8E+07	1.2E+05
1,1,2-Trichloroethane	79-00-5	1.0E+05	8.6E+05
1,1-Dichloroethane	75-34-3	9.9E+08	2.5E+07
1,2,4-Trichlorobenzene	120-82-1	3.9E+05	--
1,2,4-Trimethylbenzene	95-63-6	2.3E+06	--
1,2-Dichloroethane	107-06-2	4.4E+06	8.5E+05
1,2-Dichloropropane	78-87-5	3.6E+06	2.5E+06
1,3,5-Trimethylbenzene	108-67-8	2.3E+06	--
1,3-Butadiene	106-99-0	3.7E+06	3.0E+05
1,4-Dichlorobenzene	106-46-7	2.3E+08	7.2E+05
1,4-Dioxane	123-91-1	1.3E+08	1.6E+05
2,2,4-Trimethylpentane	540-84-1	6.5E+08	--
2-Hexanone	591-78-6	7.9E+06	--
4-Ethyltoluene	622-96-8	2.5E+07	--
Benzene	71-43-2	3.2E+07	1.0E+06
Bromodichloromethane	75-27-4	7.2E+07	7.8E+05
Bromomethane	74-83-9	9.5E+06	--
Carbon disulfide	75-15-0	1.4E+09	--
Carbon tetrachloride	56-23-5	1.6E+08	1.1E+06
Chloroform	67-66-3	9.0E+07	4.9E+06
Chloromethane	74-87-3	1.7E+08	--
Cyclohexane	110-82-7	1.8E+10	--
Dibromochloromethane	124-48-1	6.0E+07	8.8E+05
Dichloroethene, cis-1,2-	156-59-2	8.3E+06	--
Dichloroethene, trans-1,2-	156-60-5	9.3E+07	--
Dichloropropene, trans-1,3-	10061-02-6	4.4E+07	3.9E+06
Ethanol	64-17-5	1.9E+08	--
Ethylbenzene	100-41-4	6.3E+08	7.0E+06
Heptane	142-82-5	2.3E+09	--
Hexachloro-1,3-butadiene	87-68-3	4.4E+08	8.0E+04
Hexane	110-54-3	1.7E+09	--
Isopropanol	67-63-0	5.7E+08	--
Isopropylbenzene (cumene)	98-82-8	1.5E+09	--

Table 9
Site-specific Cleanup Goals for Soil Vapor – Construction and Utility Maintenance Worker
Former Kast Property
Carson, California

Chemical of Concern	CAS Number	Soil Vapor (μg/m^3)	
		SSCG$_{nc}$	SSCG$_c$
Methyl ethyl ketone (2-butanone)	78-93-3	1.1E+09	--
Methylene chloride	75-09-2	6.1E+08	2.8E+07
Methyl-tert-butyl ether	1634-04-4	1.8E+09	6.5E+07
Propylbenzene	103-65-1	6.6E+08	--
tert-Butyl Alcohol (TBA)	75-65-0	2.6E+08	--
Tetrachloroethene	127-18-4	5.5E+07	6.6E+06
Tetrahydrofuran	109-99-9	4.9E+08	--
Toluene	108-88-3	3.7E+09	--
Trichloroethene	79-01-6	2.0E+06	6.7E+06
Vinyl chloride	75-01-4	2.3E+08	8.3E+05
Xylene, m-	108-38-3	6.0E+07	--
Xylene, o-	95-47-6	4.8E+07	--
Xylene, p-	106-42-3	5.9E+07	--

Notes:
" -- " not applicable or not available
" SSCG$_{nc}$ " site-specific cleanup goal using a target noncancer hazard = 1
" SSCG$_c$ " site-specific cleanup goal using a target cancer = $1{\times}10^{-5}$ for workers
Soil Vapor SSCGs based on outdoor air inhalation of vapors emanating from the subsurface

Table 10
Background Sources of Chemicals in Indoor Air
Former Kast Property
Carson, California

Analyte	CAS	Common Sources[1,2,3]	Typical Value[4] (ug/m^3)	Max Value[5,6] (ug/m^3)
1,1,1-Trichloroethane	71-55-6	Automotive adhesive, lubricant, wood parquet adhesive, silicone lubricant, floor adhesive, furniture cleaner, horticulture spreader/sticker	1.9	150
1,1,2,2-Tetrachloroethane	79-34-5	Paint, pesticide, adhesives, lubricant	NR	NR
1,1,2-Trichloroethane	79-00-5	Electronics lubricant, automotive adhesive, glass cleaner	NR	NR
1,1-Dichloroethane	75-34-3	Air freshener	NR	0.9
1,2,4-Trimethylbenzene	95-63-6	Gasoline, paints, automotive parts cleaners, wood floor wax, pesticides	3.9	NR
1,2-Dichloroethane	107-06-2	Molded plastic consumer products (e.g., toys and holiday decorations), Dorersol (Dexol Industries), home defense fogger (pepper spray)	0.04	1.1
1,3,5-Trimethylbenzene	108-67-8	Gasoline, paints, automotive parts cleaners, wood floor wax, pesticides	1.2	32
1,4-Dichlorobenzene	106-46-7	Mothballs, bathroom fresheners. A common fumigant for moths, molds and mildews; minor use for control of tree-boring insects	0.54	160
2-Butanone	78-93-3	Paint, automotive parts cleaners, adhesives	NR	NR
4-Methyl-2-Pentanone (MIBK)	108-10-1	Paint, shellac, dry erase marker	NR	NR
Acetone	67-64-1	Paints, laquers, paint thinners, adhesives, automotive parts cleaners, nail polish remover, air fresheners, super glue remover, household cleaners, pet care, foggers	36	670
Benzene	71-43-2	Gasoline, other petroluem products, natural gas, tobacco smoke, solvents	2.9	58
Bromodichloromethane	75-27-4	Byproduct of municipal water chlorination process	NR	NR
Bromomethane	74-83-9	Byproduct of municipal water chlorination process	NR	2.8
Carbon Tetrachloride	56-23-5	Automotive trim/detail adhesive, Radio Shack plastic bonder, adhesive remover, byproduct of chemical bleach reacting with surfactants, auto brake cleaner, Clorox cleanup, Formula 44/40, Lysol toilet bowl cleaner with bleach	0.57	1.8
Chloroform	67-66-3	Byproduct of municipal water chlorination process, solvent (adhesive remover), Fix-a-Flat, Clorox Cleanup, Lysol toilet bowl cleaner with bleach	1.1	13
Chloromethane	74-87-3	Static guard, aerosol	NR	NR
Cyclohexane	110-87-7	Adhesive/glue, laquer thinner, degreaser, paint	0.62	NR
Ethanol	64-17-5	Paints, cleaners, air fresheners, adhesives, windshield treatment/glass cleaners, soaps/detergents, aerosol sprays, personal care products, insecticides, pet care products, beverages	NR	NR
Ethylbenzene	100-41-4	Gasoline, other petroluem products, paints, degreaser, pesticides	2.3	48
Freon 11	75-69-4	Refrigerant, electronics cleaner (flux stripper)	NR	NR
Freon 113	76-13-1	Refrigerant, solvent	NR	7
Freon 12	75-71-8	Refrigerant	NR	NR
Heptane	142-82-5	Gasoline, other petroleum products, adhesive, laquer, automotive cleaner and lubricant, water repellant, pesticide	1.1	NR

Table 10
Background Sources of Chemicals in Indoor Air
Former Kast Property
Carson, California

Analyte	CAS	Common Sources[1,2,3]	Typical Value[4] (ug/m^3)	Max Value[5,6] (ug/m^3)
Hexane	110-54-3	Gasoline, other petroleum products, adhesive, automotive parts cleaner, solvent, flea treatment for pets	1.8	NR
Isopropanol	67-63-0	Personal care products, paints, adhesive, cleaning products, water repellant, automotive parts cleaner, ink cartridges, household cleaning products	NR	NR
Methylene Chloride	75-09-2	Automotive cleaner/lubricant/degreaser, adhesive and paint remover, herbicide	4.9	260
Naphthalene	91-20-3	Gasoline, other petroluem products, mothballs, automotive parts cleaner, paint, herbicide, pesticide	0.47	5.0
n-Propylbenzene	103-65-1	Gasoline, other petroleum products	0.54	17
o-Xylene	95-47-6	Gasoline, other petroleum products, paint, automotive parts cleaner, adhesive, pesticide, pet care products	2.2	61
p/m-Xylene	1330-20-7-1	Gasoline, other petroleum products, paint, automotive parts cleaner, adhesive, pesticide, pet care products	5.7	290
Styrene	100-42-5	Gasoline, other petroleum products, automotive care, adhesive	0.98	23
Tetrachloroethene	127-18-4	Dry cleaner solvent, adhesive, automotive parts cleaner/degreaser/lubricant, stain remover, garage door lubricant, gutter seal, electrical parts, Gunk cleaner/lubricants, Shoo Goo, tire inflator and sealer, windshield cleaner	0.95	47
Tetrahydrofuran	109-99-9	Solvent, primer, cement,	NR	NR
Toluene	108-88-3	Gasoline, other petroleum products, paints, adhesives, automotive parts cleaner, pesticide	12	180
Trichloroethene	79-01-6	Dry cleaner solvent, automotive parts-solvent cleaner/degreaser garage door lubricant, auto brake cleaner, fabric stain remover/cleaner, electronics cleaner, gun cleaner/lubricant, insecticide, pepper spray, rain and stain guard, rubber cement, leather finish, windshield cleaner	0.38	10

All concentrations reported in ug/m^3 (micrograms per cubic meter)

NR Not reported

1. Taken from NIH Household Products Database (http://householdproducts.nlm.nih.gov/index.htm)

2. Taken from ATSDR Toxic Substances Database (http://www.atsdr.cdc.gov/substances/index.asp)

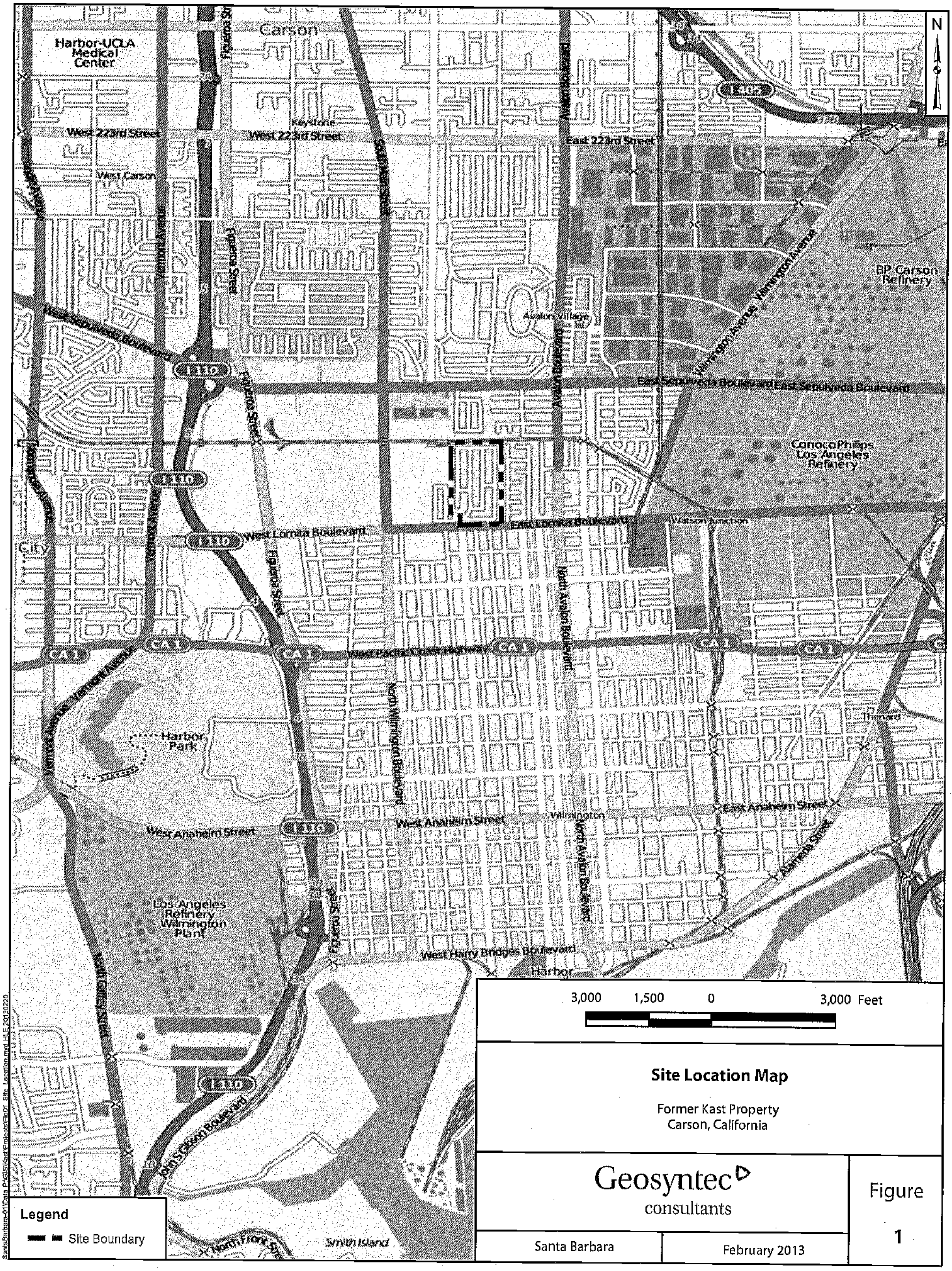
3. Gorder and Dettenmaier. Department of Defense Hill Air Force Base, Detailed Indoor Air Characterization and Interior Source Identification by Portable GC/MS. AWMA, 30 September 2010 (http://events.awma.org/education/vapor-proceed.html)

4. "Best Estimate" average value from Hodgson and Levin, 2003. Volatile Organic Compounds in Indoor Air: A Review of Concentrations Measured in North America Since 1990, LBNL-51715

5. Maximum value from Hodgson and Levin, 2003. Volatile Organic Compounds in Indoor Air: A Review of Concentrations Measured in North America Since 1990, LBNL-51716. When available geometric mean of maximum values reported among studies

6. Maximum values from Dawson and McAlary, 2009. A Compilation of Statistics for VOCs from Post-1990 Indoor Air Concentration Studies in North American Residences Unaffected by Subsurface Vapor Intrusion. Ground Water Monitoring & Remediation 29, no. 1/Winter 2009/pages 60-69.

FIGURES



Site Location Map

Former Kast Property
Carson, California

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Figure 1

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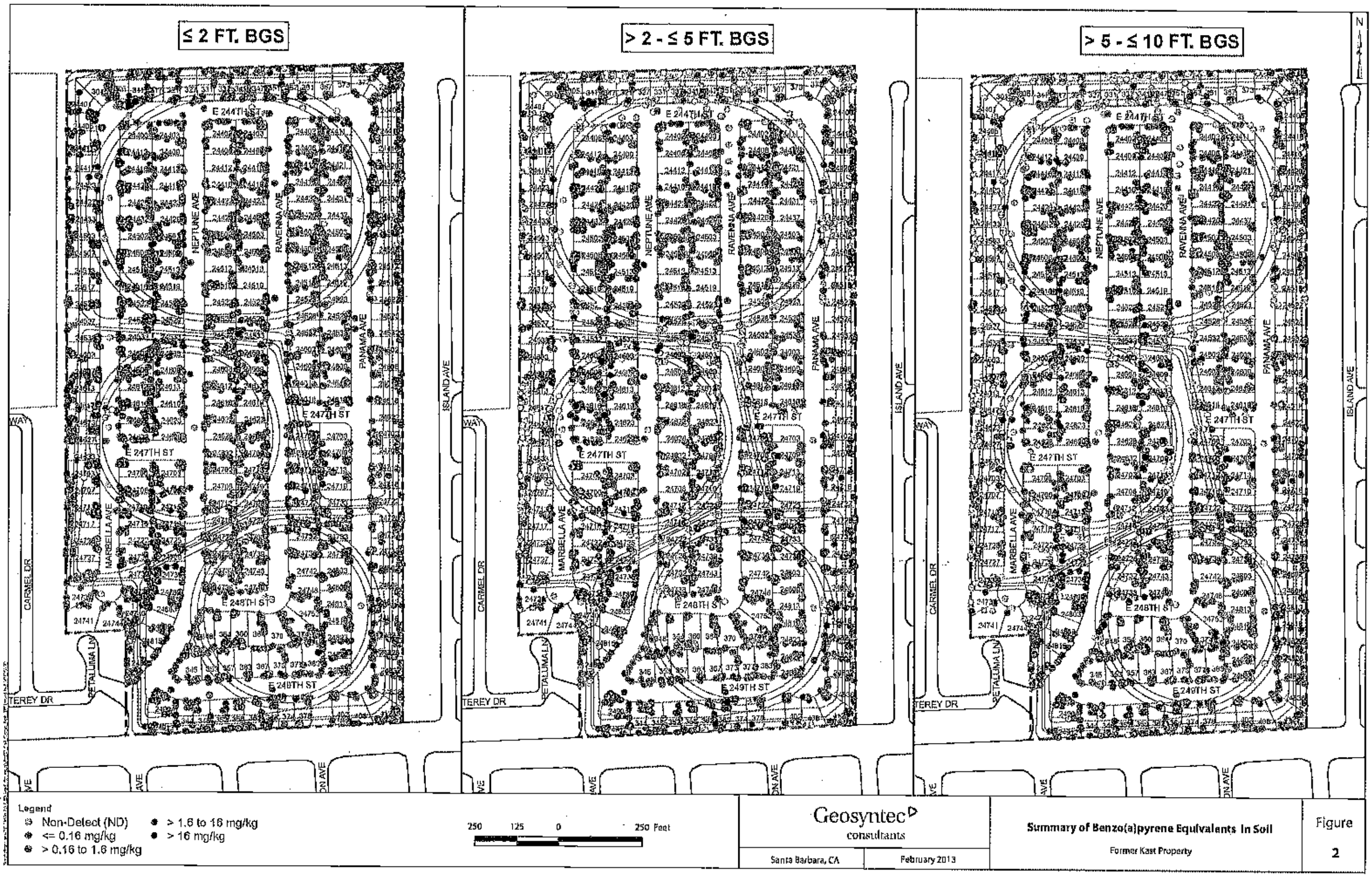

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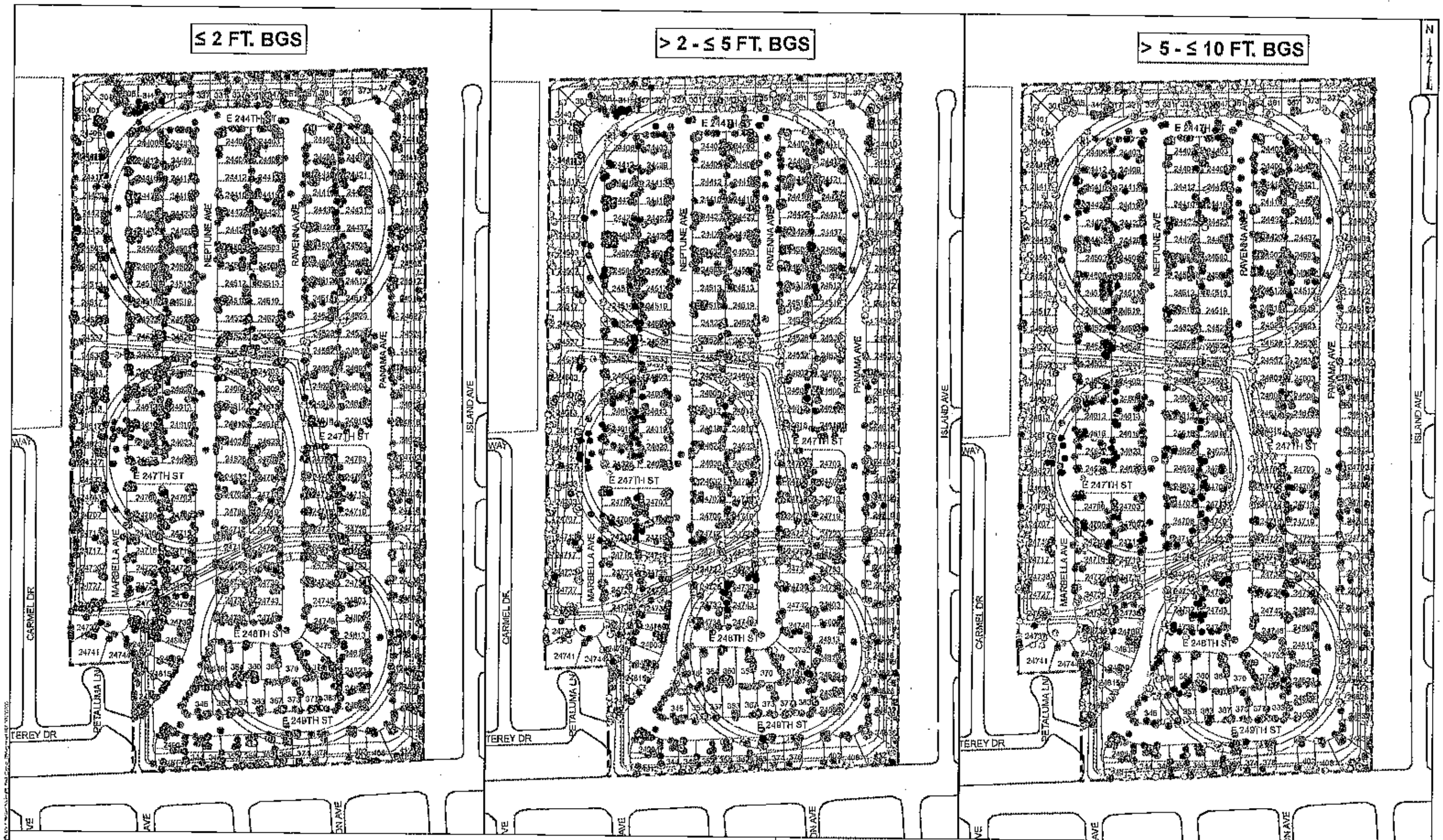
Summary of Benzo(a)pyrene Equivalents In Soil

Former Kast Property

Figure 2



Legend
- Non-Detect (ND)
- <= 1000 mg/kg
- > 1000 to 10000 mg/kg
- > 10000 mg/kg

250 125 0 250 Feet

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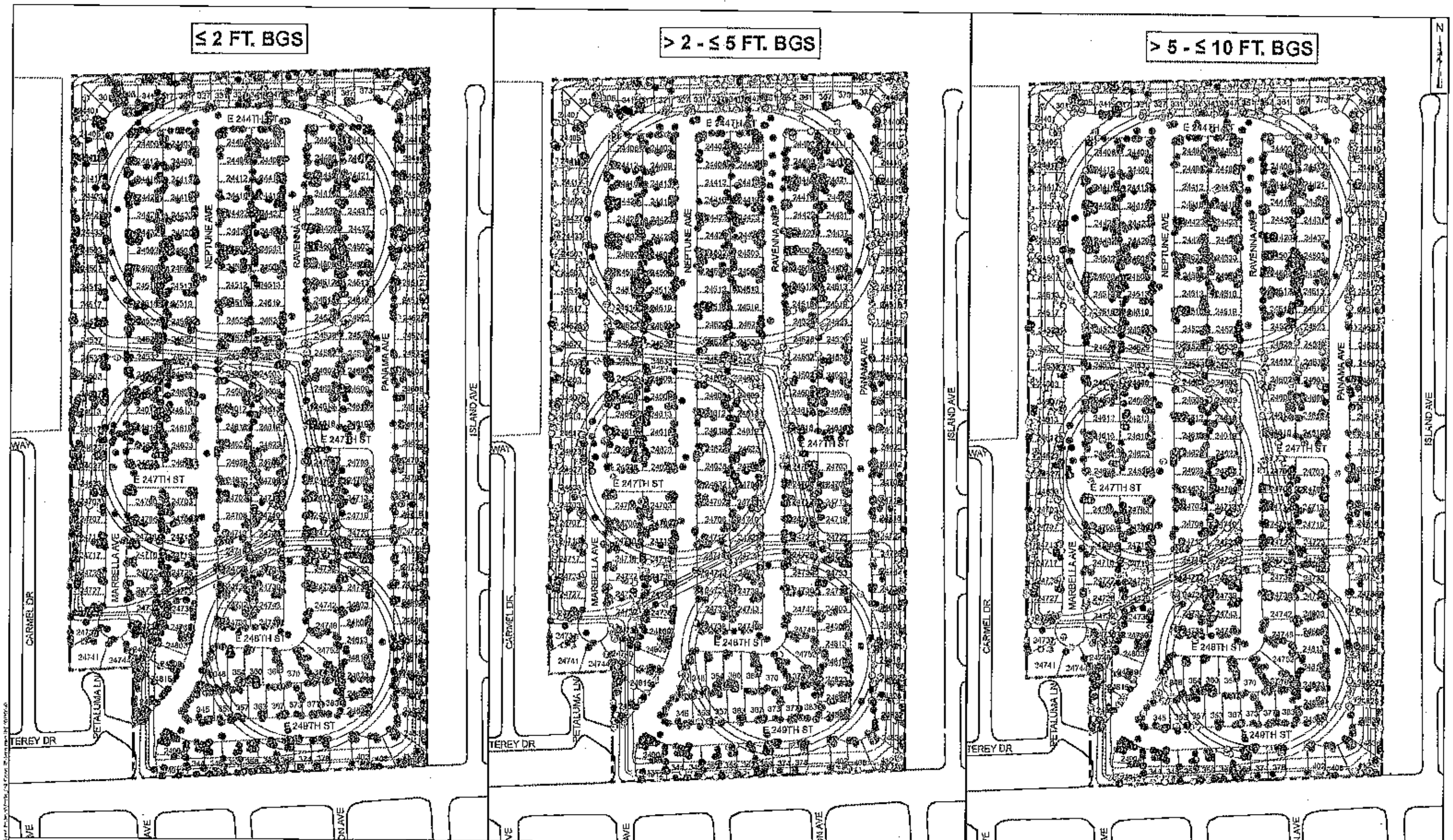
Summary of TPH-Diesel Concentrations in Soil

Former Kast Property

Figure 3



Legend
Non-Detect (ND)
<= 10000 mg/kg
> 10000 to 100000 mg/kg
> 100000 mg/kg

250 125 0 250 Feet

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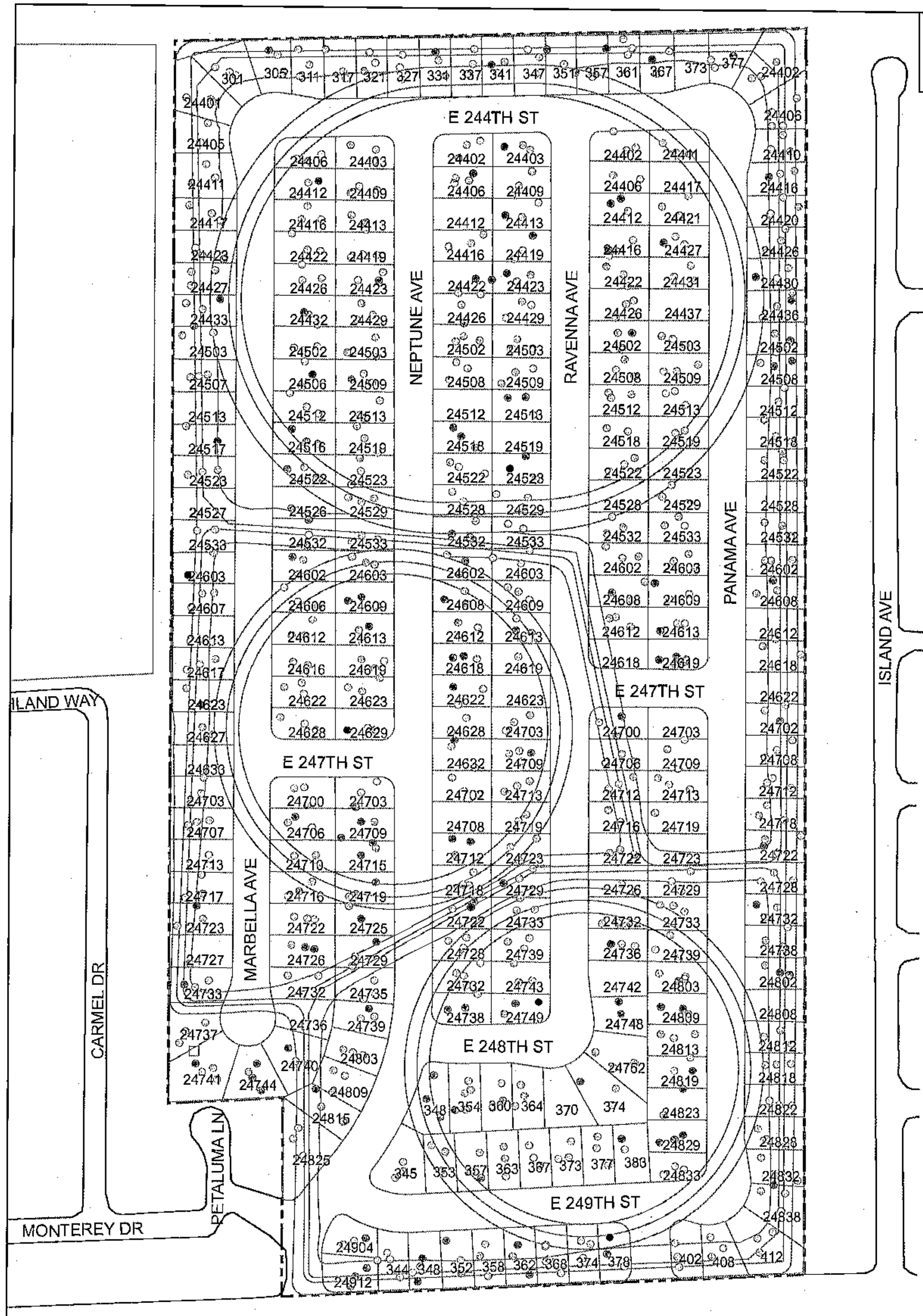
Summary of TPH-Motor Oil Concentrations in Soil

Former Kast Property

Figure 4



Legend

- Non-Detect (ND)
- <= 8.4 ug/m3
- > 8.4 to 84 ug/m3
- > 84 to 840 ug/m3
- > 840 ug/m3

Summary of Benzene Concentrations in Sub-Slab Soil Vapor

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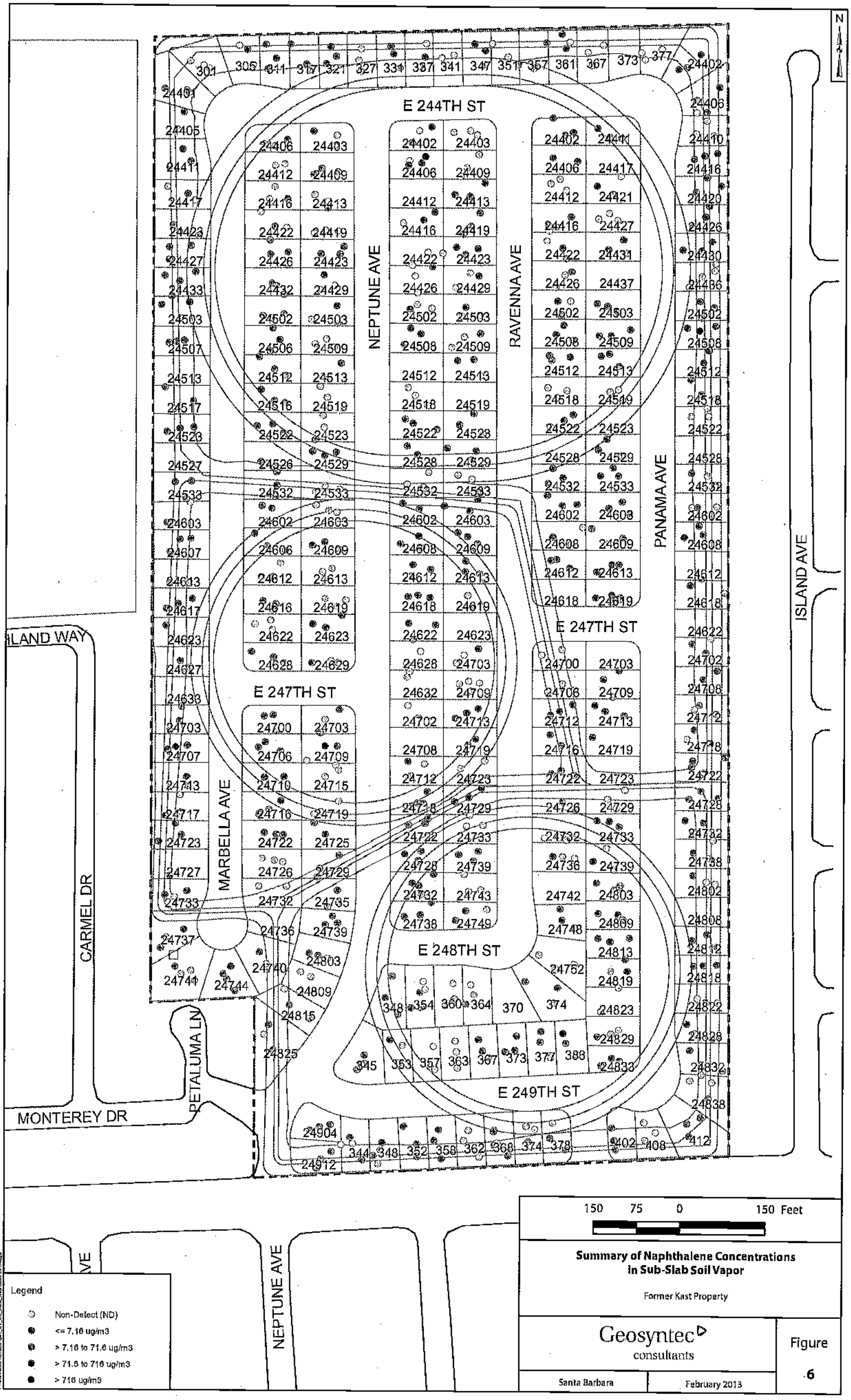
Figure 5



Summary of Naphthalene Concentrations in Sub-Slab Soil Vapor

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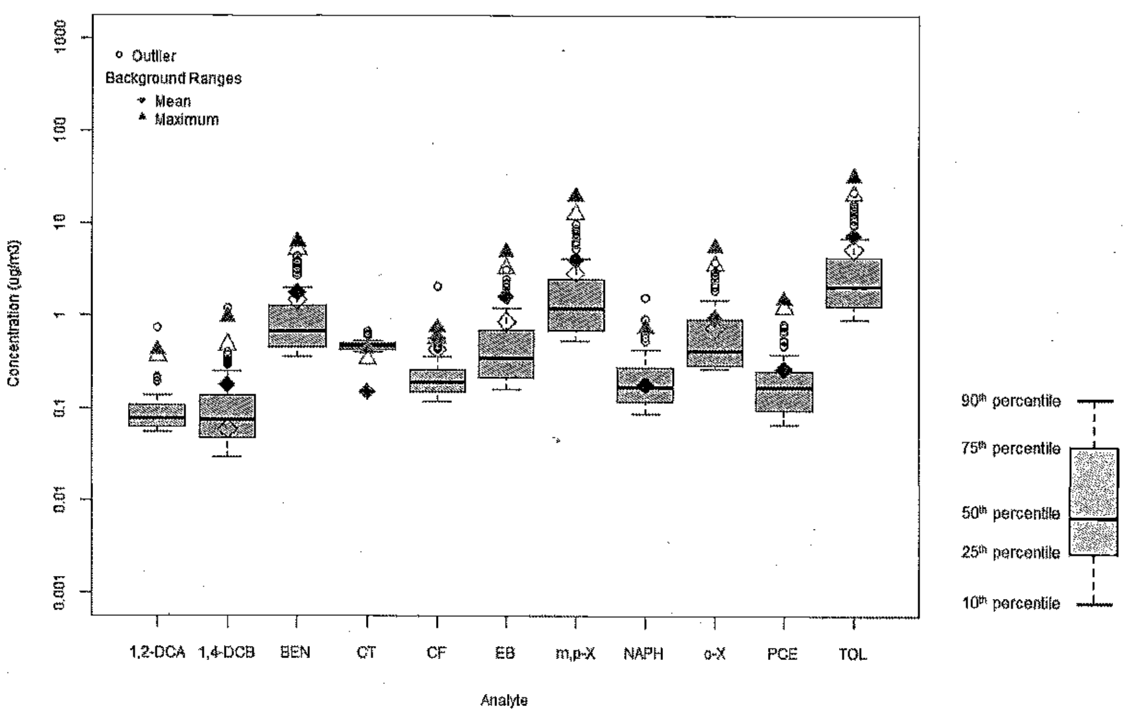
Figure 6



Comparison of Outdoor Air Results to Literature Background Concentrations

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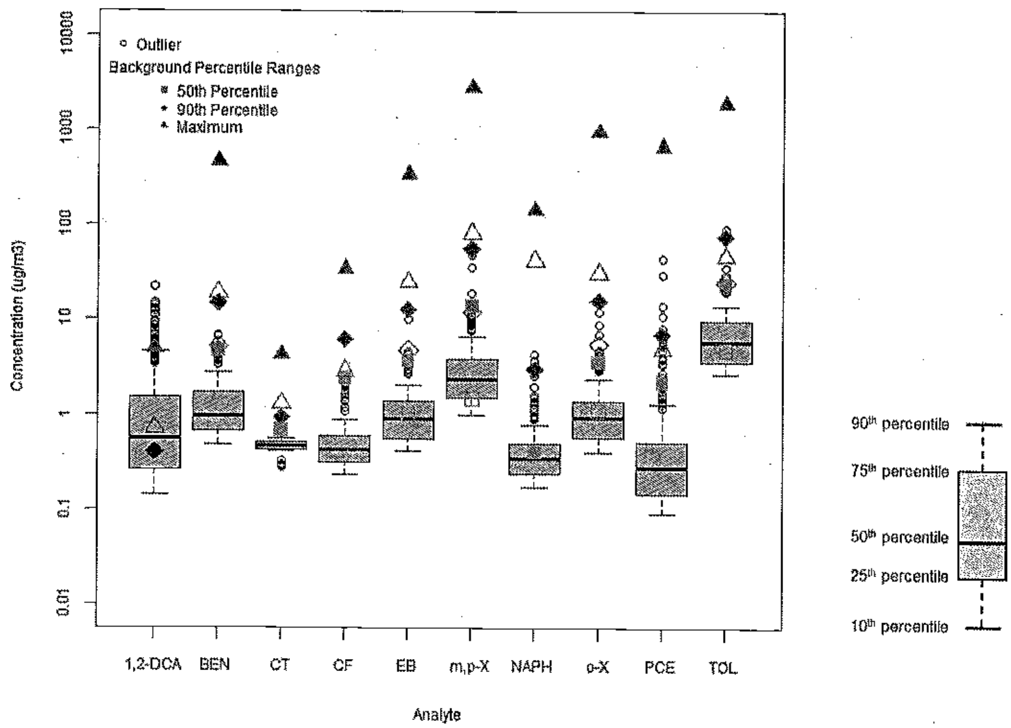
Figure 7



Comparison of Indoor Air Results to Literature Background Concentrations

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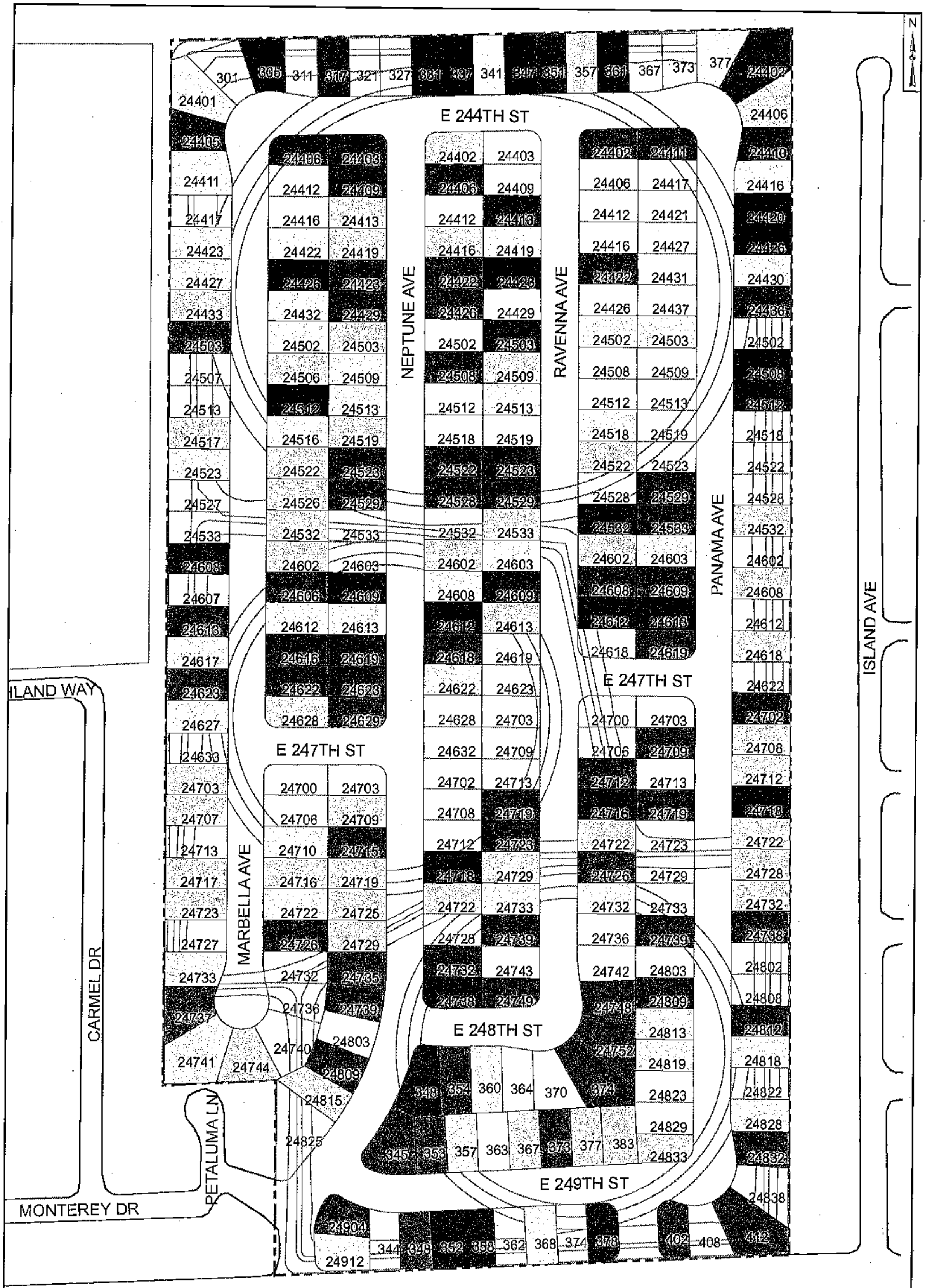
Figure 8



150 75 0 150 Feet

Legend

- <= 25th Percentile
- > 25th to <= 50th Percentile
- > 50th to <= 75th Percentile
- > 75th to <= 90th Percentile
- > 90th Percentile

Summary of Benzene Concentrations in Indoor Air

Former Kast Property

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Figure 9

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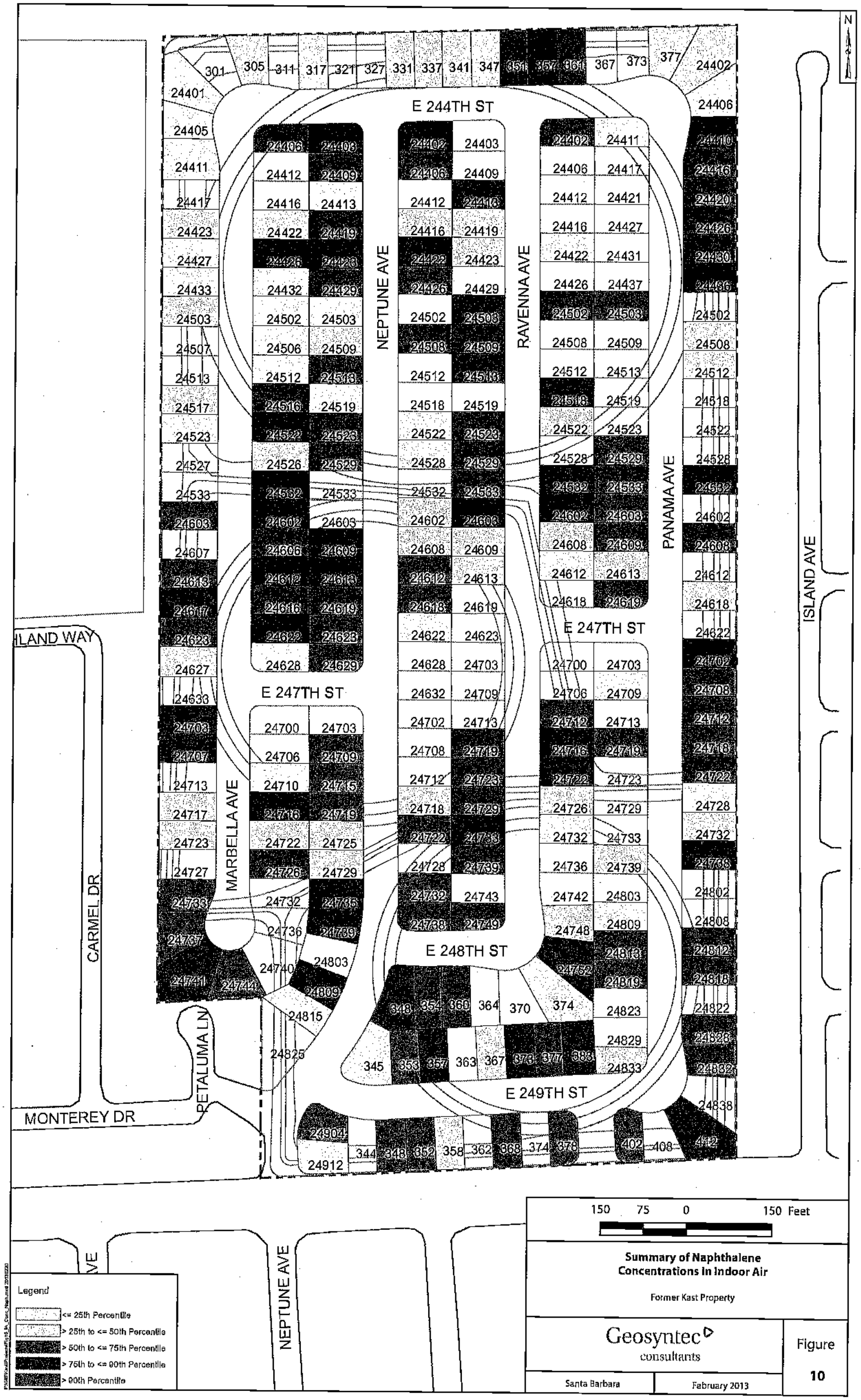

Summary of Naphthalene Concentrations in Indoor Air

Former Kast Property

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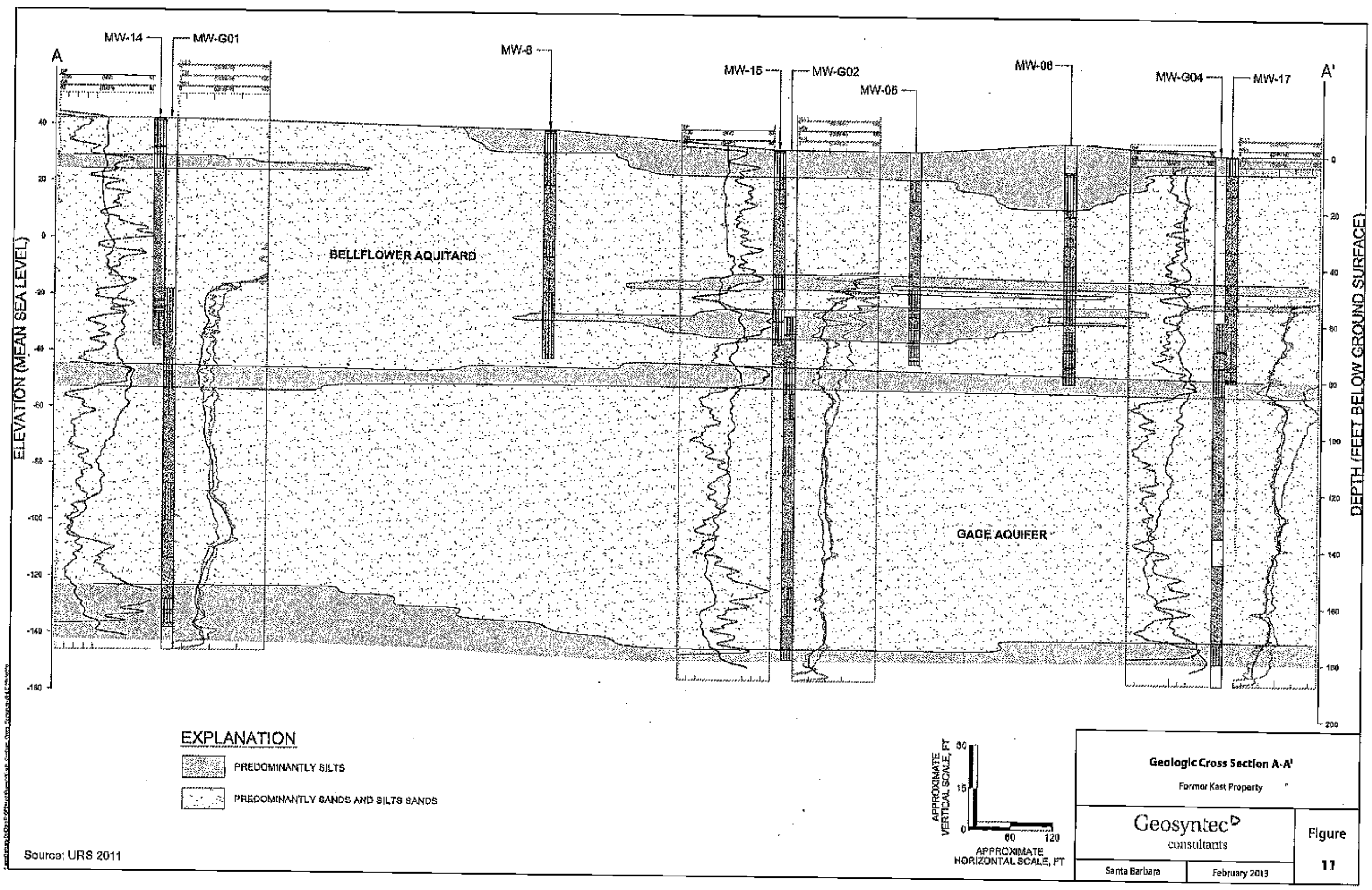
Figure 10



Geologic Cross Section A-A'

Former Kast Property

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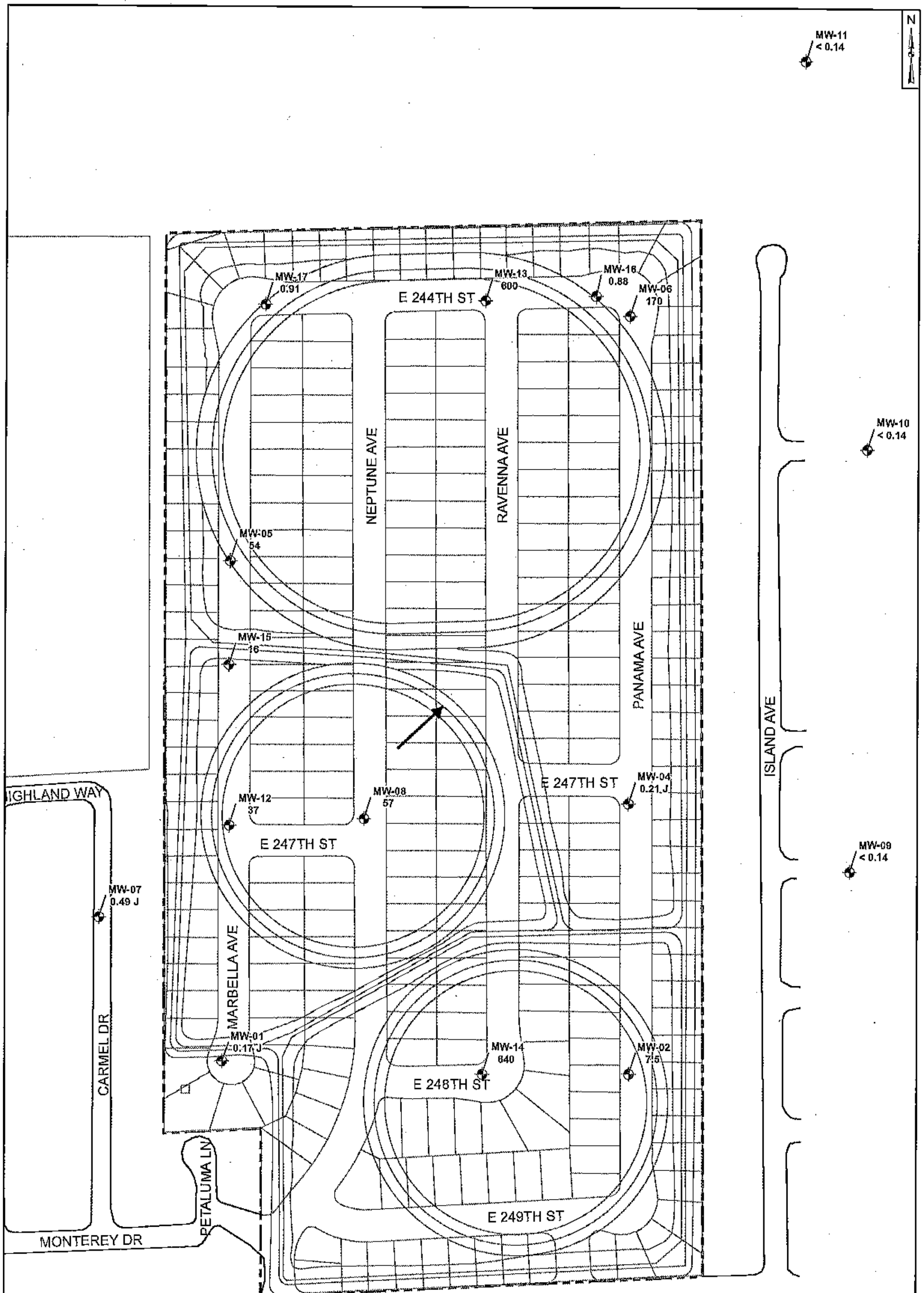
Figure 11



175 87.5 0 175 Feet

Legend

- Monitoring Well
- Approximate Groundwater Flow Direction
- Site Boundary

MW-08 Monitoring well designation
57 Benzene concentration in micrograms per liter (µg/l) collected in October 2012
< : Less than detection limit
J : Estimated value

Benzene Concentrations in Groundwater - 4Q 2012
Shallow Zone Wells

Former Kast Property

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Figure 12

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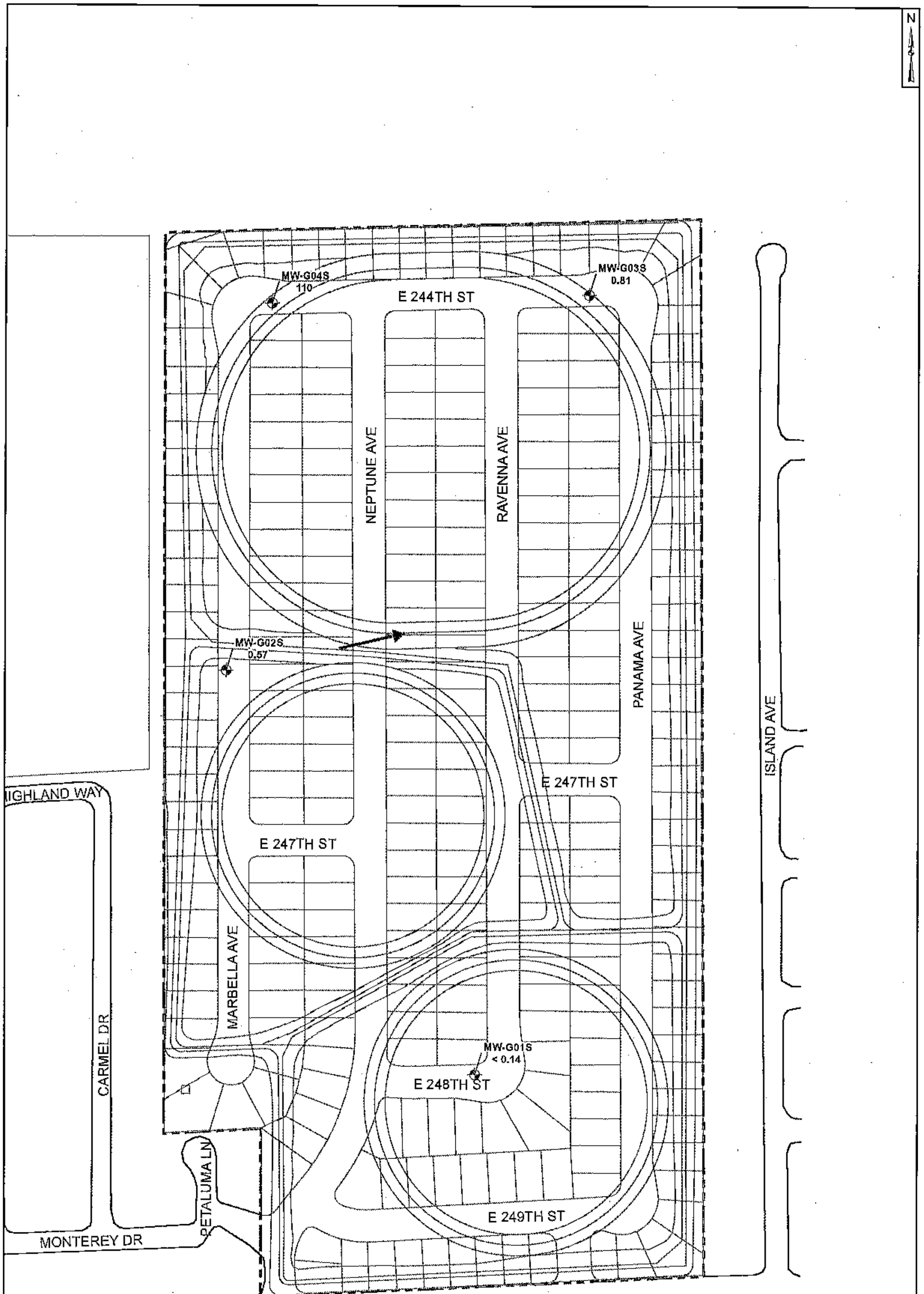

175 87.5 0 175 Feet

Benzene Concentrations in Groundwater - 4Q 2012
Shallow Gage Aquifer

Former Kast Property

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Figure **13**

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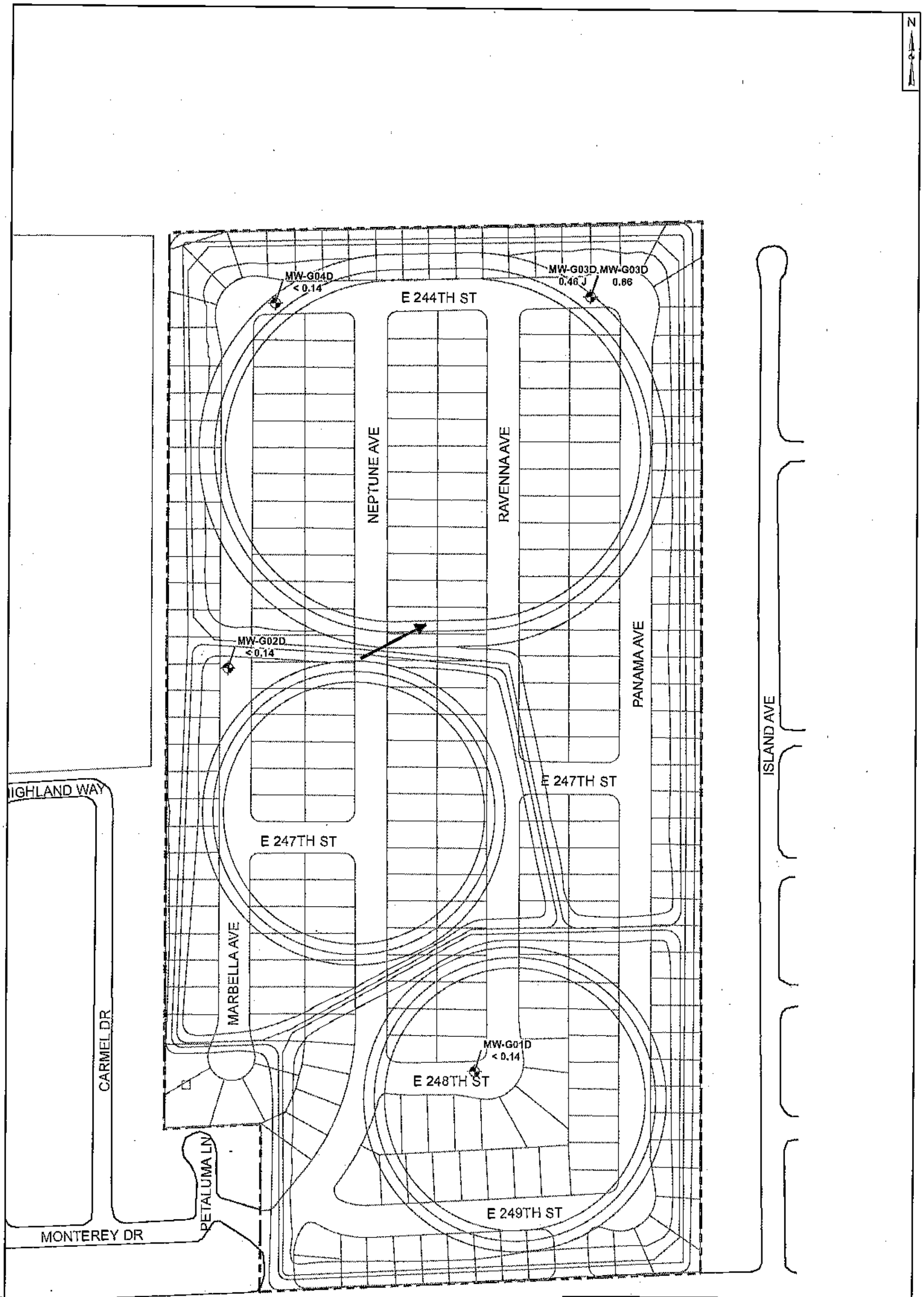
Legend
- Monitoring Well
- Approximate Groundwater Flow Direction
- Site Boundary

MW-G02S Monitoring well designation
0.57 Benzene concentration in micrograms per liter (µg/l) collected in October 2012
< : Less than detection limit
J : Estimated value



Legend

- Monitoring Well
- Approximate Groundwater Flow Direction
- Site Boundary

MW-G03D Monitoring well designation
0.66 Benzene concentration in micrograms per liter (μg/l) collected in October 2012
< : Less than detection limit
J : Estimated value

Benzene Concentrations in Groundwater - 4Q 2012
Deep Gage Aquifer

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Figure 14

APPENDIX A

SOIL AND SOIL VAPOR SITE-SPECIFIC CLEANUP GOAL DERIVATION

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ATTACHMENTS

1.0 INTRODUCTION

This appendix presents the approach and methodologies that were used to derive Site-specific cleanup goals (SSCGs) for chemicals of concern (COCs) detected in soil and soil vapor at the former Kast Property (Site) located in Carson, California. The Site is a former oil storage facility that was sold by Shell Oil Company in the late 1960s and later redeveloped into the Carousel subdivision containing 285 single family houses. Based on historical operations, the primary Site COCs are related to crude oil and bunker oil.

Site-specific SSCGs were derived to provide target cleanup goals for the development of a Site remediation strategy. The SSCG calculation approach is consistent with current United States Environmental Protection Agency (USEPA) and California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC) guidance documents (USEPA, 1989; 1991a; 2002; 2009; 2012; Cal-EPA 1999; 2011a) including the withdrawn *Interim Guidance on Evaluating Human Health Risks from Total Petroleum Hydrocarbons (TPH)* (Cal-EPA, 2009a)[1]. Both risk-based SSCGs and values based on local and regional background have been developed for the Site. A discussion of the input parameters, the algorithms, and SSCGs are included in this appendix.

2.0 DATA EVALUATION AND COC SELECTION

An initial step in the risk assessment process is an evaluation of available data to identify media-specific COCs. A variety of samples have been collected as a part of the Site investigation process. Detected compounds include inorganics, polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) and metals. These compounds, if they were detected in at least one sample in a given media (soil or soil vapor), were included in the COC selection process. A toxicity-concentration screen was then used to focus the list of COCs to those chemicals that have the potential to contribute significantly to potential risk at the Site, as discussed below.

COC screening was conducted using risk-based screening levels (RBSLs) that were calculated assuming potential residential exposures to COCs in soil and soil vapor as part of the HHSRE process (Geosyntec, 2009, 2010, 2011). The RBSLs represent chemical concentrations in the relevant environmental media that would be consistent with a target risk level for the current land use under conservative (i.e., protective) exposure conditions. For soil vapor, the screening levels were developed to address potential sub-slab soil vapor migration to indoor air and therefore are considered to be very conservative values for use in

[1] Note that the Cal-EPA *Interim Guidance on Evaluating Human Health Risks from Total Petroleum Hydrocarbons (TPH)* is no longer active; however, information provided in this document is considered in this evaluation.

screening subsurface soil vapor for potential outdoor construction and utility maintenance worker exposures. For the carcinogenic PAHs and metals, a background comparison value was used along with the calculated RBSLs for COC selection.

In the first step of COC selection, a list of detected chemicals in each media was identified. Tables 1 through 4 of the main report present the prevalence and range of concentrations of all chemicals that were detected at least once in soil, soil vapor, indoor air and groundwater, respectively across the Site. As discussed in the main report, quantitative SSCGs are being developed for soil (for residential and construction and utility maintenance worker receptor scenarios) and soil vapor (for the construction and utility maintenance worker receptor scenario). Therefore, chemicals detected in these media were carried forward into the COC selection.

To identify COCs for each media, the maximum concentration for that media was compared to one-tenth of its respective RBSL. If the maximum concentration was greater than one-tenth of the RBSL it was selected as a COC for the Site. One-tenth of the RBSL was used as a conservative approach to screen chemicals for further analysis and to address potential cumulative effects. In addition to the RBSL screen, background concentrations for metals and carcinogenic PAHs (cPAHs as benzo(a)pyrene equivalents) were considered.

Tables 5 and 6 of the main report present the COCs that have been identified for each media to be carried forward into the RAP.

3.0 EXPOSURE ASSESSMENT

To evaluate whether the levels of COCs present in soil and soil vapor would pose a risk to human populations, it is necessary to (i) identify the populations that may potentially be exposed to these COCs, and (ii) define the pathways by which the exposures may occur. The following table summarizes the receptor, exposure media, and potential exposure pathways that were considered in deriving the SSCGs. The following table summarizes the exposure scenarios that were evaluated.

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

The SSCGs for the residential scenario are based on surface soil (0-2 feet bgs) and subsurface soil (>2-10 feet bgs) exposure assumptions. SSCGs were derived for onsite residents who may typically contact surface soils using the Cal-EPA and USEPA default exposure frequency (EF) of 350 days per year. Surface soils are considered for typical residential exposures, whereas subsurface soils are considered for infrequent contact, because the likelihood of a resident contacting soils at deeper depths is very low given the developed nature of the Site and typical residential activities where exposure to soil could occur (e.g., lawn care, recreational activities, landscaping). Typical lawn care and gardening would occur in the surface soil horizon. The potential does exist for deeper soils to be contacted, i.e. if a sizable tree is planted, but this would not occur on a regular basis for a given property. To address the unlikely, infrequent exposure to subsurface soils (>2-10 feet bgs), SSCGs were developed for residents assuming a lower frequency of exposure (i.e., an exposure frequency of 4 days per year[2]).

A summary of the exposure parameters used to derive the SSCGs for the receptors identified above is presented in **Table A-1.** These parameters are consistent with those recommended by Cal-EPA and USEPA and include separate child and adult exposure parameters that are used in an integrated child/adult exposure scenario consistent with guidance.

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

3.1 Fate and Transport Modeling

Fate and transport modeling was employed to predict the movement of COCs from impacted soil and soil vapor to points of exposure for human populations. Fate and transport modeling was employed to develop transfer factors for the following transport mechanisms:

- Transport of particulate-phase chemicals from soil matrix to outdoor air;
- Transport of vapor-phase chemicals from soil matrix to outdoor air; and
- Transport of vapor-phase chemicals from soil vapor to outdoor air.

Fate and transport modeling for migration from soil to outdoor air was conducted using the models presented in the *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (Soil Screening Guidance) (USEPA, 2002). Standard equations presented in the Soil Screening Guidance were used, incorporating local meteorological conditions for the Los Angeles area, for derivation of COC-specific volatilization factors (VFs) and the particulate emission factor (PEF). The definitions for each of the transfer factors listed above are presented in **Table A-2**. Calculations for the VF and PEF are summarized in **Table A-3a** for a resident and in **Table A-3b** for a construction and utility maintenance worker, and are discussed below. Additional details regarding these transfer factors were discussed in the HHSE Work Plan (Geosyntec, 2009; 2010).

3.1.1 Fugitive Dust Emissions into Outdoor Air

COCs at the Site may become airborne due to fugitive dust emissions. Compounds (e.g., SVOCs) can adhere to soil particles then become airborne due to wind erosion, which could generate dust containing COCs. Exposure to these chemicals may then occur via inhalation of airborne fugitive dust. Inhalation exposure to non-volatile compounds is typically minor in fugitive dust when compared to direct ingestion exposure (USEPA, 2002). Nevertheless, a relationship can be estimated between the COC concentration in soil and the corresponding concentration in air (secondary media) attributable to fugitive dust emissions from soil.

Potential exposure to airborne dust is estimated using a particulate emission factor (PEF) that relates the concentration of soil constituent to the concentration of dust particles in air. The PEF represents an annual average emission rate based on wind erosion. The PEF equation described in the Soil Screening Guidance (USEPA, 2002) was used in this evaluation. The emissions part of the PEF equation is based on the "unlimited reservoir" model developed to estimate PM_{10} emissions (particulate matter less than 10 micrometers in diameter [PM_{10}]) due to wind erosion (Cowherd et al., 1985).

3.1.1.1 *Onsite Residential Scenario*

For onsite residents, the following equation was used to estimate their PEF:

$$PEF = \frac{(Q/C \times CF)}{[0.036 \times (1 - G) \times \left(\frac{U_M}{U_T}\right)^3 \times F_x]}$$

Where:

PEF	=	particulate emission factor as cubic meters per kilogram (m^3/kg)
Q/C	=	inverse of mean concentration at center of source (g/m^2-s per kg/m^3)
CF	=	units conversion factor (3600 s/hr)
0.036	=	respirable fraction (g/m^2-hr)
G	=	fraction of vegetative or other cover (0.5 unitless; USEPA, 2002)
U_M	=	mean annual wind speed (3.31 m/s, average for Los Angeles; NCDC, 2011)
U_T	=	equivalent threshold value of wind speed at 7 meters above ground surface (11.32 m/s; USEPA, 2002)
F_x	=	function dependent on U_M/U_T (0.194 unitless; USEPA, 2002)

The dispersion part of the PEF equation includes a dispersion coefficient (Q/C) in units of grams per square meter-second per kilogram per cubic meter (g/m^2-s per kg/m^3). The Q/C term was generated using the Industrial Source Complex model and varies depending on the source area, city, and climatic zone. This term accounts for the dispersion of particulate matter, once emitted and was estimated using the following equation (USEPA, 2002):

$$(Q/C) = A \times \exp\left[\frac{(\ln A_{SITE} - B)^2}{C}\right]$$

Where:

A_{SITE}	=	areal extent of soil impact (0.5 acres)
A	=	constant = 11.911, based on air dispersion modeling (USEPA, 2002)
B	=	constant = 18.4385 (USEPA, 2002)
C	=	constant = 209.7845 (USEPA, 2002)

The coefficients A, B, and C for the Los Angeles area are published in the Soil Screening Guidance (USEPA, 2002). A Q/C value of 68.18 g/m^2-s per kg/m^3 was estimated as the inverse of the mean concentration at the center of a 0.5-acre source. The resulting PEF for onsite residents was estimated at $2.8\times10^{+9}$ m^3/kg (see **Table A-3a**).

3.1.1.2 Construction and Utility Maintenance Worker Scenario

Existing utilities that supply the residential properties with water, sewerage, communications, and natural gas are present at the Site. Therefore, a construction and utility maintenance worker may contact soils during repair or maintenance of these utilities both on residential properties as well as in the streets. It is assumed that construction and utility workers may be exposed to COCs in the upper 10 feet of soil. Fugitive dust can also be generated during the use of heavy equipment such as backhoes during utility work in trenches. As a conservative exposure assumption, a dust concentration equal to 1 mg/m^3 or 1×10^{-6} kg/m^3 (Cal-EPA, 2011a)[3] was assumed for the construction and utility maintenance worker. The PEF is related to the concentration of particulate matter (dust) in air:

$$PEF = \frac{1}{CD}$$

Where:

CD = concentration of dust in air, 1×10^{-6} (kg/m^3) (Cal-EPA, 2011a)

The resulting PEF for the construction and utility maintenance worker is $1\times10^{+6}$ m^3/kg (see **Table A-3b**).

3.1.2 <u>Vapor Emissions into Outdoor Air</u>

Because VOCs were detected in soil and soil vapor at the Site, individuals could potentially be exposed to vapors migrating through the soil to the surface. Outdoor vapor concentrations are typically negligible considering the significant quantity of ambient air diluting the vapor emissions. Although this pathway is considered potentially insignificant, outdoor air exposures were evaluated for VOCs detected in soil matrix and soil vapor as discussed below.

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[3] The respirable dust concentration of 1 mg/m^3 is based on a maximum concentration of dust in air of 10 mg/m^3 recommended by the American Conference of Governmental Industrial Hygienists (ACGIH 2004, Threshold Limit Values and Biological Exposure Indices), and the assumption that 10 percent of the mass of particles are in the respirable PM_{10} range.

3.1.2.1 Onsite Residential Scenario

Soil to Outdoor Air

For onsite residents, potential migration of vapors from shallow soil to outdoor air was estimated using the VF, as presented in Section 4.2.3 of the Soil Screening Guidance (USEPA, 2002; Equation 4-8: *Derivation of the VF*). The COC-specific VF_{soil} for onsite residential exposures was derived using the following equation (USEPA, 2002):

$$VF_{soil} = Q/C \times \left(10^{-4}\,\frac{m^2}{cm^2}\right) \times \left(\frac{1}{P_b}\right)\left(\frac{3.14 \times T_{resident} \times K_{sw} \times P_b}{4 \times D_{eff} \times H'}\right)^{1/2}$$

Where:

- Q/C = inverse of mean concentration at center of source (g/m^2-sec per kg/m^3);
- $T_{resident}$ = exposure interval ($9.5 \times 10^{+8}$ sec);
- K_{sw} = soil to water partition coefficient, defined above (cm^3-water/g-soil);
- Pb = dry soil bulk density (1.5 g/cm^3);
- D_{eff} = COC-specific effective diffusion coefficient for vadose-zone soils, defined above (cm^2/sec); and
- H' = COC-specific Henry's law coefficient (unitless).

A Q/C value of 68.18 g/m^2-s per kg/m^3 was estimated using the equations presented in Section 3.1.1.2 above. The following equation from the American Society for Testing and Materials (ASTM) *Standard Guide For Provisional Risk-Based Corrective Action* (ASTM, 2004) was used to estimate the soil to water partition coefficient, K_{sw}:

$$K_{sw} = \frac{\theta_w + \theta_a H' + PbK_d}{Pb}$$

Where:

- θ_w = water-filled porosity (0.15 cm^3-water/cm^3-soil);
- θ_a = air-filled porosity (0.28 cm^3-air/cm^3-soil);
- H' = COC-specific Henry's law coefficient (unitless);
- Pb = soil bulk density (1.5 g/cm^3); and
- K_d = soil-organic carbon distribution coefficient (where K_d = fraction organic carbon [f_{oc}] × organic carbon partition coefficient [K_{oc}]) (cm^3/g).

The following equation was used to estimate COC-specific effective diffusion coefficients for vadose-zone soils, D_{eff} (ASTM, 2004):

$$D_{eff} = D_{air}\frac{\theta_a^{3.33}}{\theta_T^{2}} + \frac{D_{water}}{H'}\frac{\theta_w^{3.33}}{\theta_T^{2}}$$

Where:

D_{air} = COC-specific diffusivity in air (cm^2/s);
D_{water} = COC-specific diffusivity in water (cm^2/s);
θ_a = air-filled porosity (0.28 cm^3-air/cm^3-soil);
θ_w = water-filled porosity (0.15 cm^3-water/cm^3-soil);
θ_T = total soil porosity (0.43 cm^3-air/cm^3-soil); and
H' = COC-specific Henry's law coefficient (unitless).

The derivation of COC-specific VF_{soil} for onsite residents is presented in **Table A-3a**.

3.1.2.2 Onsite Construction and Utility Maintenance Worker Scenarios

Soil to Outdoor Air

For the construction and utility maintenance worker scenario, VOC emissions into a utility trench and subsequent mixing in air were estimated using the volatilization factor (VF) for transport of COCs from soil to outdoor air from the ASTM *Standard Guide For Provisional Risk-Based Corrective Action* (ASTM, 2004). The soil to outdoor air volatilization factor, $VF_{soil\text{-}OA}$, is the ratio of the outdoor air exposure point concentration ($EPC_{soil\text{-}OA}$) to the soil exposure point concentration (EPC_{soil}):

$$VF_{soil\text{-}OA} = \frac{EPC_{soil}}{EPC_{soil\text{-}OA}}$$

The COC-specific $VF_{soil\text{-}OA}$ for construction and utility maintenance worker exposures was derived using the following equation (ASTM, 2004):

$$VF_{soil\text{-}OA} = \frac{DF_{amb}}{Pb} \times \left[\frac{(3.14 \times T_{CUW} \times K_{sw} \times Pb)}{(4 \times D_{eff} \times H')}\right]^{1/2} \times CF_1 \times CF_2$$

Where:

$VF_{soil\text{-}OA}$ = volatilization factor, surficial soils to outdoor (ambient) air (m^3-air/kg-soil);
DF_{amb} = dispersion factor for outdoor (ambient) air (cm/s);
Pb = dry soil bulk density (1.5 g/cm^3);
T_{CUW} = averaging time for surface emission vapor flux ($7.9 \times 10^{+8}$ sec);

K_{sw} = soil to water partition coefficient (cm^3-water/g-soil);

D_{eff} = COC-specific effective diffusion coefficient for vadose-zone soils (cm^2/sec);

H' = COC-specific Henry's law coefficient (unitless);

CF_1 = conversion factor ($1 \times 10^{+3}$ g/kg); and

CF_2 = conversion factor (1×10^{-6} m^3/cm^3).

The following equation was used to estimate the dispersion factor for outdoor air, DF_{amb}, assuming a trench is 91 centimeters (cm) wide by 457 cm long by 183 cm deep an estimate of what a typical trench size could be:

$$DF_{amb} = \frac{U_{air} \times W \times H}{A}$$

Where:

U_{air} = outdoor air velocity in mixing zone (cm/s);

W = width of source-zone area (457 cm; assume length of trench = 15 ft);

H = mixing zone height (183 cm; assume depth of trench = 6 ft); and

A = source-zone area (assume 4 sidewalls and bottom area of trench = $2.4 \times 10^{+5} cm^2$).

The outdoor air velocity in the mixing zone, U_{air}, is estimated using the following equation:

$$U_{air} = \frac{ACH \times W_t}{3600}$$

Where:

ACH = air changes per hour (20 hr^{-1});

W_t = length of shortest side of trench (91 cm; assume width of trench = 3 ft); and

3600 = conversion (1 hour = 3600 seconds).

To develop the air exchange rate, a site-specific computational fluid dynamic (CFD) model was constructed to model air flow within the trench as defined above. CFD models have been used to evaluate air dispersion within urban canyon environments and can provide a more refined evaluation of potential air exchange within a trench. Using the CFD model (Ansys, 2011), air flow was calculated using the geometry of the trench and a reference velocity of 1.3 m/s which is the lowest monthly average wind speed reported for Long Beach from the last several years (January 2009 to April 2011) (NCDC, 2011) at a height of 10 m. The CFD model was used to monitor the decrease in concentration of a tracer uniformly distributed in the trench. The model assumed an initial concentration of 1 in the trench and zero within the atmosphere. Convection and diffusion of the tracer out of the trench was evaluated and the reduction in the concentration in the trench over time was calculated.

The ACH was calculated following the calculation methods presented for the air exchange rate from ASTM (2011):

$$1)\quad ACH = -\frac{[\ln(Ct_2) - \ln(Ct_1)]}{t_2 - t_1}$$

where:

ACH	=	air exchange rate per hour (hr^{-1})
C_{t2}	=	final tracer concentration at time 2
Ct_1	=	initial tracer concentration at time 1
$t_2 - t_1$	=	time interval of simulation (hr)

An ACH of approximately 20 hr^{-1} was calculated for the trench. Derivation of the COC-specific $VF_{soil\text{-}OA}$ for the construction and utility maintenance worker is presented in **Table A-3a**.

Soil Vapor to Outdoor Air

The conceptual exposure scenario for the construction and utility maintenance worker receptor is the same as that considered for the soil to outdoor air scenario – exposure during excavation. The volatilization factor for soil vapor to a trench was calculated using the same relationships as those used for soil, except a soil vapor source term was used. This section details the methodology for deriving the volatilization factor for the soil vapor to outdoor air pathway. The soil vapor to outdoor air $VF_{SV\text{-}OA}$ represents the ratio of the outdoor air exposure point concentration ($EPC_{SV\text{-}OA}$) to the soil vapor exposure point concentration (EPC_{SV}) presented in the equation below:

$$VF_{SV\text{-}OA} = \frac{EPC_{SV}}{EPC_{SV\text{-}OA}}$$

Where:

$VF_{SV\text{-}OA}$	=	soil vapor to outdoor air volatilization factor (mg/m^3 per mg/m^3);
$EPC_{SV\text{-}OA}$	=	exposure point concentration of COC in outdoor air from soil vapor (mg/m^3); and
EPC_{SV}	=	exposure point concentration, soil vapor (mg/m^3).

This section presents the approach used to model vapor migration from the subsurface (using soil vapor data) to outdoor air within a utility trench where workers could potentially be exposed via inhalation. The soil vapor exposure point concentration, EPC_{SV}, was calculated from soil exposure point concentration, EPC_{soil}, using the following partitioning relationship proposed by Feenstra et al. (1991):

$$EPC_{SV} = EPC_{soil} \times \frac{H'}{K_{sw}} \times CF_1 \times CF_2$$

Where:

EPC_{SV}	=	COC concentration in soil vapor (mg/m^3);
EPC_{soil}	=	COC concentration in soil (mg/kg);
H'	=	COC-specific Henry's law coefficient (unitless);
K_{sw}	=	soil to water partition coefficient, defined above (cm^3-water/g-soil);
CF_1	=	conversion factor (1×10^{-3} kg/g); and
CF_2	=	conversion factor ($1\times10^{+6}$ cm^3/m^3).

The outdoor air concentrations of vapors from soil for a construction and utility maintenance worker can be estimated using the following relationship:

$$EPC_{OA} = \frac{EPC_{soil}}{VF_{soil\text{-}OA}}$$

Where:

EPC_{OA}	=	COC concentration in outdoor air (mg/m^3) (either from soil or from soil vapor);
EPC_{soil}	=	COC concentration in soil (mg/kg); and
$VF_{soil\text{-}OA}$	=	volatilization factor, surficial soils to outdoor (ambient) air (m^3-air/kg-soil).

Rearranging these two equations results in the following:

$$EPC_{OA} = \frac{EPC_{soil}}{VF_{soil\text{-}OA}} = \frac{EPC_{SV}}{VF_{soil\text{-}OA}} \times \frac{K_{sw}}{H'} \times \left(\frac{1}{CF_1 \times CF_2}\right)$$

This equation was then rearranged to calculate the ratio of $EPC_{SV\text{-}OA}$ and EPC_{SV} and provide the equation for the soil vapor to outdoor air volatilization factor, $VF_{SV\text{-}OA}$, for a construction and utility maintenance worker:

$$VF_{SV\text{-}OA} = \frac{EPC_{SV}}{EPC_{SV\text{-}OA}} = VF_{soil\text{-}OA} \times \frac{H'}{K_{sw}} \times (CF_1 \times CF_2)$$

Where:

$VF_{SV\text{-}OA}$	=	soil vapor to outdoor air volatilization factor (μg/m³ per μg/m³);
$EPC_{SV\text{-}OA}$	=	exposure point concentration of COC in outdoor air from soil vapor (μg/m³); and
EPC_{SV}	=	exposure point concentration, soil vapor (μg/m³).

Derivation of the COC-specific $VF_{SV\text{-}OA}$ for the construction and utility maintenance worker is presented in **Table A-3b**.

4.0 TOXICITY ASSESSMENT

The toxicity assessment characterizes the relationship between the magnitude of exposure to a COC and the nature and magnitude of adverse health effects that may result from such exposure. Consistent with regulatory risk assessment policy, adverse health effects resulting from potential chemical exposures are classified into two broad categories: carcinogens and noncarcinogens. Toxicity criteria are generally developed based on the threshold approach for noncarcinogenic effects and the non-threshold approach for carcinogenic effects.

For carcinogens, it is assumed that there is no level of exposure that does not have a finite possibility of causing cancer (i.e., there is no threshold dose for carcinogenic effects). That is, a single exposure of a carcinogen may, at any level, result in an increased probability of developing cancer. For chemicals exhibiting noncarcinogenic effects, it is believed that organisms have protective mechanisms that must be overcome before the toxic endpoint results (i.e., there is a threshold dose for these effects). For example, if a large number of cells perform the same or similar functions, it would be necessary for significant damage or depletion of these cells to occur before a toxic effect could be seen. As a result, a range of exposures exists from zero to some finite value that can be tolerated by the organism with essentially no chance of expression of adverse effects (USEPA, 1989). Some chemicals may elicit both carcinogenic and noncarcinogenic effects.

The key dose-response criteria are (i) cancer slope factors (CSFs) or inhalation unit risk factors (IURs) for estimating cancer risks from exposure to carcinogens; and (ii) reference doses (RfDs) or inhalation reference concentrations (RfCs) for estimating hazard from exposure to noncarcinogens. In addition, Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA; Cal-EPA 2013) has developed chronic Reference Exposure Levels (RELs) for noncarcinogenic effects from inhalation exposures. For this HHRA, cancer toxicity criteria (except for trichloroethene [TCE] as discussed below) were selected from the following sources, in order of preference:

1) Cal-EPA OEHHA Toxicity Criteria Database, online (Cal-EPA, 2013);
2) USEPA's (2013) Integrated Risk Information System (IRIS);
3) USEPA RSLs for Chemical Contaminants at Superfund Sites (USEPA, 2012);
4) USEPA National Center of Environmental Assessment (USEPA, 2012);
5) Agency for Toxic Substances Disease Registry (as reported in USEPA, 2012); and
6) Health Effects Assessment Summary Tables (as reported in USEPA, 2012).

The noncancer toxicity criteria were selected from the following sources, in order of preference:

1) USEPA's (2013) IRIS database; and
2) Cal-EPA OEHHA Toxicity Criteria Database online (Cal-EPA, 2013).

For TCE, the updated USEPA inhalation IUR of 4.1×10^{-6} $(\mu g/m^3)^{-1}$ and oral CSF of 4.6×10^{-2} $(mg/kg\text{-}day)^{-1}$ were used in this HHRA, which are consistent with the most recent USEPA published toxicity values for TCE (USEPA, 2011).

At the present time, Cal-EPA and USEPA have only developed toxicity criteria for the oral and inhalation routes of exposure. As recommended by Cal-EPA and USEPA, in the absence of values specific to the dermal route, the oral toxicity criteria were used to evaluate dermal exposures. In addition, route-to-route extrapolation between ingestion and inhalation routes of exposure was used for those chemicals for which toxicity criteria are extrapolated in the USEPA Region 9 Preliminary Remedial Goal (PRG) table (USEPA, 2004a). This can be considered a conservative approach as current USEPA RSL guidance (USEPA, 2012) does not include the route-to-route extrapolation. For some of the COCs, neither Cal-EPA nor USEPA have identified a toxicity value. In these cases, a surrogate chemical approach was employed in which the toxicity value developed for a structurally similar compound was assigned to the COC which is lacking the toxicity value (e.g., hexane for heptane).

Toxicity values for TPH have not been published by Cal-EPA OEHHA or USEPA. Toxicity factors for TPH have been suggested by Cal-EPA Department of Substances Control (Cal-EPA, 2009a). Even though these toxicity factors for TPH have not gone through the same level of peer review as the other toxicity factor references used for the other COCs, the toxicity factors presented in Cal-EPA DTSC TPH guidance were used for TPH SSCGs.

For lead, the residential soil SSCG of 80 mg/kg was based on the California Human Health Screening Level (CHHSL) (Cal-EPA, 2009b). For the resident potentially exposed to deeper soils for a limited time and the construction and utility maintenance worker, the SSCGs were calculated using the CHHSL methodology for residential and industrial/commercial worker adjusted for exposure frequency and ingestion rate.

A summary of the cancer and noncancer toxicity criteria for the COCs is presented in **Table A-4.**

5.0 SITE-SPECIFIC CLEANUP GOALS

This section presents the methodology that was used to derive SSCGs for onsite residents and for the construction and utility maintenance worker that may be present at the Site and have the potential to be exposed to residual chemicals present in soil and soil vapor.

5.1 Risk-based SSCG Methodology

Deriving risk-based SSCGs for COCs in soil and soil vapor requires information regarding the level of human intake of the COC (exposure assessment), the relationship between intake of the chemical and its toxicity (toxicity assessment), and the acceptable target risk. The sections below present the equations that were used in the development of the SSCGs for soil and soil vapor. The methodology that was used to derive SSCGs is based principally on guidelines provided by the USEPA in *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A), Interim Final* (USEPA, 1989) and in the *Soil Screening Guidance* (USEPA, 2002) and by the DTSC in *Preliminary Endangerment Assessment Guidance Manual* and in *Recommended DTSC Default Exposure Factors For Use In Risk Assessment At California Military Facilities* (Cal-EPA, 1999 and 2011a).

Various demarcations of acceptable risk have been established by regulatory agencies. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP; 40 CFR 300) indicates that lifetime incremental cancer risks posed by a site should not exceed a range of one in one million (1×10^{-6}) to one hundred in one million (1×10^{-4}) and noncarcinogenic chemicals should not be present at levels expected to cause adverse health effects (i.e., a Hazard Index [HI] greater than 1). In addition, other relevant guidance (USEPA, 1991b) states that sites posing a cumulative cancer risk of less than 10^{-4} and hazard indices less than unity (1) for noncancer endpoints are generally not considered to pose a significant risk warranting remediation. The California Hazardous Substances Account Act (HSAA) incorporates the NCP by reference, and thus also incorporates the acceptable risk range set forth in the NCP. The Safe Drinking Water and Toxic Enforcement Act of 1986 (California Proposition 65) regulates chemical exposures to the general population and is based on an acceptable risk level of 1×10^{-5}. The DTSC considers the 1×10^{-6} risk level as the generally accepted point of departure for unrestricted land use.

Under most situations, cancer risks in the range of 1×10^{-6} to 1×10^{-4} may be considered to be acceptable with cancer risks less than 10^{-6} considered insignificant. The risk range between 10^{-6} and 10^{-4} is commonly called the "discretionary risk range." This risk range is in addition to the background risk of Americans in the general population developing cancer from causes unrelated to a Site-specific exposure. The background risk is one chance in three (0.3 or 3×10^{-1}) for an American female, and one chance in two (0.5 or 5×10^{-1}) for an American male of eventually developing cancer (ACS, 2013).

A target cancer risk level of 1×10^{-6} was used to derive SSCGs for onsite residents. For the construction and utility maintenance worker, the SSCGs were derived using a target cancer risk level of 1×10^{-5} (the "mid-point" of the risk management range and commonly used for managing commercial/industrial land uses). A target HI of 1 was used for noncarcinogens for all exposure scenarios. These risk levels are used to provide context to the risk results and to support the following discussion which focuses on those pathways and chemicals that contribute the majority to the risk estimates. It is acknowledged that additional risk management considerations such as technical feasibility, economic, social, political, and legal factors may be part of the final risk management decision. The results of the risk characterization are really the starting point for risk management considerations for a site (USEPA, 1995).

5.1.1 SSCGs Based on Cancer Health Effects

The SSCG equations below describe the established relationship between estimated intake, toxicity, and potential risk for cancer health effects (USEPA, 1989).

For COCs in soil:

$$SSCG_{soil\text{-}c} = \frac{TR}{(CSF_{oral})\times(IF_{oral} + IF_{dermal}) + (IUR)\times(EC_{inh,soil})}$$

For COCs in soil vapor:

$$SSCG_{sv\text{-}c} = \frac{TR}{(IUR)\times(EC_{SV\text{-}OA})}$$

Where:

$SSCG_{soil\text{-}c}$	=	Site-specific cleanup goal for soil based on cancer effects (mg/kg);
TR	=	target cancer risk level (unitless);
CSF_{oral}	=	cancer slope factor for oral (ingestion and dermal contact) exposures $(mg/kg\cdot d)^{-1}$;
IF_{oral}	=	intake factor for ingestion (kg soil per kg body weight per day);
IF_{dermal}	=	intake factor for dermal contact (kg soil per kg body weight per day);
IUR	=	inhalation unit risk factor $(\mu g/m^3)^{-1}$;
$EC_{inh,soil}$	=	exposure concentration for inhalation of COCs from soil (mg/m^3 per mg/kg);

$SSCG_{sv\text{-}c}$	=	Site-specific cleanup goal for soil vapor to outdoor air based on cancer effects (mg/m^3); and
$EC_{SV\text{-}OA}$	=	exposure concentration for outdoor inhalation (mg/m^3 per mg/m^3).

The formulas for developing the soil intake factors for ingestion and dermal contact, as well as for developing the exposure concentrations for soil and soil vapor are presented in **Tables A-5** through **A-8**. The exposure parameters that were used to estimate the intake factors and exposure concentrations are presented in **Table A-1**. The soil SSCGs for the onsite resident are presented in **Table A-9**. The SSCGs for soil and soil vapor are presented in **Tables A-9** and **A-10**, respectively, for the construction and utility maintenance worker. SSCG calculations are presented in **Attachment A1**.

5.1.2 <u>SSCGs Based on Noncancer Health Effects</u>

The SSCG equations below describe the established relationship between estimated intake, toxicity, and risk for noncancer health effects (USEPA, 1989).

For COCs in soil:

$$SSCG_{soil\text{-}nc} = \frac{THI}{\left(\frac{IF_{oral}}{RfD_{oral}}\right) + \left(\frac{IF_{dermal}}{RfD_{oral}}\right) + \left(\frac{EC_{inh,soil}}{RfC}\right)}$$

For COCs in soil vapor:

$$SSCG_{sv\text{-}c} = \frac{THI}{\left(\frac{EC_{SV\text{-}OA}}{RfC}\right)}$$

Where:

$SSCG_{soil\text{-}nc}$	=	Site-specific cleanup goal for soil based on noncancer effects (mg/kg);
THI	=	target noncancer hazard index (unitless);
IF_{oral}	=	intake factor for ingestion (kg soil per kg body weight per day);
RfD_{oral}	=	noncancer reference dose for oral (ingestion and direct-contact) exposures (mg/kg·d);
IF_{dermal}	=	intake factor for dermal contact (kg soil per kg body weight per day);
$EC_{inh,soil}$	=	exposure concentration for inhalation of COCs from soil (mg/m^3 per mg/kg from soil);
RfC	=	noncancer reference concentration for inhalation exposure (mg/m^3);
$SSCG_{sv\text{-}nc}$	=	Site-specific cleanup goal for soil vapor to outdoor air based on

noncancer effects (mg/m^3); and

$EC_{SV\text{-}OA}$ = exposure concentration for indoor inhalation of COCs (mg/m^3 per mg/m^3).

The formulas for developing the soil intake factors for ingestion and dermal contact, as well as for developing the exposure concentrations for soil and soil vapor are presented in **Tables A-5** through **A-8**. The exposure parameters that were used to estimate the intake factors and exposure concentrations are presented in **Table A-1**. The soil SSCGs for the onsite resident are presented in **Table A-9**. The SSCGs for soil and soil vapor are presented in **Tables A-9** and **A-10**, respectively, for the construction and utility maintenance worker. SSCG calculations are presented in **Attachment A1**.

5.1.3 TPH Fraction-Specific SSCGs

TPH compounds include a wide range of chemicals that are found in crude oils, petroleum products, and other petroleum-related materials. Because TPH mixtures can encompass a large range of hydrocarbons, chemical properties and environmental behavior vary widely among the many hundreds of compounds present in these mixtures. Methods to evaluate potential risks associated with TPH analytical results have been published in state and national working group guidance documents including the DTSC (Cal-EPA, 2009a), the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG, 1997ab; 1998ab; 1999), and Massachusetts Department of Environmental Protection (MADEP, 2002; 2003). Approaches presented in these documents were used to develop SSCGs for comparison to TPH data collected at the Site.

TPH may refer to a variety of products or wastes, but for the soil samples collected at the Site and analyzed by USEPA Method 8015B (M)[4], analytical results are grouped into three product ranges according to the number of carbon chain atoms:

TPH Product Range	Carbon Chain Range
$TPH_{gasoline}$ (TPH_g)	$C_4 - C_{12}$
TPH_{diesel}, (TPH_d)	$C_{10} - C_{22}$
$TPH_{motor\ oil}$ (TPH_{mo})	$C_{17} - C_{44}$

TPH product range concentrations reported (i.e., TPH_g, TPH_d or TPH_{mo}) do not necessarily indicate the presence of gasoline, diesel, or motor oil, only that there are hydrocarbons present that fall in those specific carbon-chain length ranges.

[4] Results from USEPA Method 8015B (M) are equivalent to USEPA Method 8015C for TPH analysis.

For each of the carbon chain ranges, two different types of compounds or fractions may be present: aliphatic or aromatic. Therefore, TPH fractionation analysis was performed on soil and soil vapor samples to refine the TPH characterization. In the TPH fractionation analysis, aliphatic and aromatic fractions are quantified consistent with the Cal-EPA Interim TPH Guidance (Cal-EPA, 2009a). These TPH fractions are:

TPH Product Range	Aliphatic Fraction	Aromatic Fraction
Light	$C_5 - C_8$	$C_6 - C_8$
Medium	$C_9 - C_{18}$	$C_9 - C_{16}$
Heavy	$C_{19} - C_{32}$	$C_{17} - C_{32}$

Both types of analyses (i.e., product range analysis and fractionation analysis) have been conducted at the Site, and the TPH fractionation analytical results are used in the derivation of SSCGs for product-range TPH results as described in later sections.

The fraction-specific SSCGs for soil and soil vapor are presented below:

TPH Fractions	Onsite Resident		Construction and Utility Maintenance Worker	
	Soil SSCG (EF350) (mg/kg)	Soil SSCG (EF4) (mg/kg)	Soil SSCG (mg/kg)	Soil Vapor SSCG (µg/m^3)
Aliphatic: C_5-C_8	7.1E+02	6.2E+04	8.0E+02	1.2E+09
Aliphatic: C_9-C_{18}	1.4E+03	1.3E+05	1.5E+03	1.2E+08
Aliphatic: C_{19}-C_{32}	1.1E+05	1.0E+07	5.5E+06	--
Aromatic: C_6-C_8	--	--	--	--
Aromatic: C_9-C_{16}	6.0E+02	5.3E+04	7.2E+02	6.7E+06
Aromatic: C_{17}-C_{32}	1.7E+03	1.5E+05	8.3E+04	--

Notes:

- EF: exposure frequency; 350 days/year for a typical resident and 4 days/year for a resident who infrequently contacts subsurface soils.
- "– " not calculated
- SSCGs for the C_6-C_8 aromatic fraction are not calculated because individual constituents in this fraction (i.e., benzene, toluene, ethylbenzene) were analyzed.
- Soil vapor SSCGs for the C_{19}-C_{32} aliphatic and C_{17}-C_{32} aromatic fractions are not calculated because the volatility of these fractions are low and no RfC is available for these fractions.

5.1.4 SSCGs for TPH Product Ranges

Fraction-specific soil and soil vapor SSCGs for the different TPH fraction ranges presented above are used to derive soil and soil vapor SSCGs for TPH product ranges: TPH gasoline (TPH_g), TPH diesel (TPH_d), and TPH motor oil (TPH_{mo}). Fractionation results from soil samples collected through February 24, 2011 were used to evaluate the aromatic/aliphatic composition of the different TPH ranges. The analytical results correlation analysis was presented in a letter to the RWQCB dated August 15, 2011 (Geosyntec, 2011). The aromatic/aliphatic ratios for each TPH range are as follows:

- Light Range TPH = 0.03
- Medium Range TPH = 1.3
- Heavy Range TPH = 1.0

The carbon number ranges used in the TPH product range (TPH_g, TPH_d, and TPH_{mo}) analyses are different from those used in the TPH fractionation analyses. As a result, there is overlap in the product range carbon-chain values and what is encompassed by the fraction results. Consequently, the contribution to the TPH product range from the different aliphatic and aromatic fractions was estimated based on a comparison of the carbon ranges encompassed by the different analyses (Geosyntec, 2011). The following contributions were assumed:

- TPH_g: 50% contribution from the light fractions and 50% contribution from the medium fractions;
- TPH_d: 50% contribution from the medium fractions and 50% contribution from the heavy fractions; and
- TPH_{mo}: 100% contribution from the heavy fractions.

The following equation was used to derive the SSCGs for TPH_g, TPH_d, and TPH_{mo}:

$$\text{SSCG}\ (\text{TPH}_g, \text{TPH}_d, \text{TPH}_{mo}) = 100\% \times \left[\sum \frac{\text{Fraction }\%}{\text{Fraction SSCG}} \right]^{-1}$$

Where:

Fraction % = % contribution of TPH fraction to product range TPH (unitless); and

Fraction SSCG = Site-specific cleanup goal determined above for the different TPH fraction (soil in mg/kg; soil vapor in $\mu g/m^3$).

The following table summarizes the SSCG calculations for TPH_g, TPH_d, and TPH_{mo}:

TPH Product Ranges	% Contribution to Product Range TPH	Aromatic/ Aliphatic Ratio	% Contribution of TPH Fraction	Onsite Resident		Construction and Utility Maintenance Worker	
				Soil SSCG (EF350) (mg/kg)	Soil SSCG (EF4) (mg/kg)	Soil SSCG (mg/kg)	Soil Vapor SSCG ($\mu g/m^3$)
TPH-g							
Light Fraction	50%	0.03					
Aliphatic: C_5-C_8			49%	7.1E+02	6.2E+04	8.0E+02	1.2E+09
Aromatic: C_6-C_8			1%	6.0E+02	5.3E+04	7.2E+02	6.7E+06
Medium Fraction	50%	1.3					
Aliphatic: C_9-C_{18}			22%	1.4E+03	1.3E+05	1.5E+03	1.2E+08
Aromatic: C_9-C_{16}			28%	6.0E+02	5.3E+04	7.2E+02	6.7E+06
			TPH-g =	**7.6E+02**	**6.6E+04**	**8.6E+02**	**2.2E+07**
TPH-d							
Medium Fraction	50%	1.3					
Aliphatic: C_9-C_{18}			22%	1.4E+03	1.3E+05	1.5E+03	1.2E+08
Aromatic: C_9-C_{16}			28%	6.0E+02	5.3E+04	7.2E+02	6.7E+06
Heavy Fraction	50%	1.0					
Aliphatic: C_{19}-C_{32}			25%	1.1E+05	1.0E+07	5.5E+06	--
Aromatic: C_{17}-C_{32}			25%	1.7E+03	1.5E+05	8.3E+04	--
			TPH-d =	**1.3E+03**	**1.1E+05**	**1.9E+03**	**2.3E+07**
TPH-mo							
Heavy Fraction	100%	1.0					
Aliphatic: C_{19}-C_{32}			49%	1.1E+05	1.0E+07	5.5E+06	--
Aromatic: C_{17}-C_{32}			51%	1.7E+03	1.5E+05	8.3E+04	--
			TPH-mo =	**3.3E+03**	**2.9E+05**	**1.6E+05**	**--**

Note: Because individual C_6-C_8 aromatic constituents are evaluated separately, SSCG for C_9-C_{16} aromatic fraction used for evaluation

5.2 Background-based SSCG Methodology

Metals may be naturally occurring in the environment. According to the DTSC (Cal-EPA DTSC 1997, 2009a, 2009c, 2009d, 2011b) for naturally occurring materials such as metals, an evaluation of background concentrations is important to evaluate whether the metals concentrations on the property are consistent with naturally occurring levels in the area, and whether they should be included in the risk assessment. If concentrations of a metal are within background, the metal is not considered a COC and is not evaluated further.

In addition to metals, cPAHs can be naturally occurring or present at ambient levels not associated with former site activities. A background dataset and methodology has been developed by DTSC that can be used to evaluate the presence of cPAHs in soil (Cal-EPA DTSC, 2009c).

Background-based SSCGs for metals and cPAHs were developed for the Site consistent with USEPA and Cal-EPA methodologies as presented in **Attachment A2** using local and regional background datasets. The background-based SSCGs are presented in **Table A-12.** These values represent Background Threshold Values (BTVs) which are single-point background thresholds that represent an upper plausible limit of the background distributions of individual compounds (USEPA, 2009a; 2009b; Helsel, 2005). These values are commonly used to evaluate site data and to determine if site concentrations are above background. In addition to the BTVs, Site data can be evaluated using guidance from Cal-EPA (Cal-EPA, 1997) to determine if Site concentrations are consistent with background.

Due to the preponderance of Site data (over 10,000 samples and 265 individual study areas), a streamlined approach was developed to evaluate background at the Site. In the first step, Site samples will be compared to the BTVs to evaluate whether onsite metal or cPAH concentrations are above or below background concentrations. In the second step, 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. This is consistent with agency guidance that states that when BTVs and cleanup standards are known, one-sample hypotheses are used to compare site data with the known and pre-established threshold values (USEPA, 2010). If warranted, additional analysis using Site data and methodologies using guidance from Cal-EPA (Cal-EPA, 1997) will be used.

If onsite concentrations are below background, the area will not be evaluated further in the risk assessment process for that chemical. The background comparison will be conducted as part of the full Human Health Risk Assessment (HHRA) that will be conducted once the Phase II Site Characterization work is complete. It is anticipated that the HHRA will be included in the Remedial Action Plan (RAP).

6.0 REFERENCES

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TABLES

Table A-1
Exposure Parameters

Parameter		Units	Onsite Resident		Source	Onsite Construction and Utility Maintenance Worker	Source
			Adult	Child			
IR	Soil ingestion rate	mg/d	100	200	(1,2)	330	(1)
SA	Skin surface area	cm^2	5,700	2,800	(1,3)	5,700	(1)
AF	Soil-to-skin adherence factor	--	0.07	0.2	(1,3)	0.8	(1)
EF	Exposure frequency	d/yr	350	350	(1,2)	10	PJ
	Infrequent exposure to subsurface soils	d/yr	4	4	PJ	--	
ED	Exposure duration	yr	24	6	(1,2)	25	(2)
ET	Exposure time	hours	24	24	(2)	20 m^3/day for the 8 hour workday	(1)
BW	Body weight	kg	70	15	(1,2)	70	(1,2)
AT_C	Averaging time for carcinogenic effects	d	25,550	25,550	(1,2)	25,550	(1,2)
AT_{NC}	Averaging time for noncarcinogenic effects	d	8,760	2,190	(1,2)	9,125	(1,2)

Note:

"--" not applicable; " PJ " Professional Judgement

Source:

(1) Cal-EPA 2011a. Human Health Risk Assessment (HHRA) Note. Office of Human and Ecological Risk (HERO) HHRA Note Number 1. Recommended DTSC Default Exposure Factors For Use In Risk Assessment At California Hazardous Waste Sites and Permitted Facilities. Issued: May 20, 2011.

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(3) USEPA 2004b. RAGS. Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), Interim Guidance. EPA/540/R-99/005

Table A-2
Definition of Transfer Factors

Exposure Route	Transfer Factor	Definition
Inhalation of particulates in outdoor air	Particulate emission factor (PEF) (kg/m^3)	Ratio of chemical concentration in outdoor air (mg/m^3) to chemical concentration in soil (mg/kg)
Inhalation of vapors in outdoor air	Soil-to-outdoor air volatilization factor ($VF_{soil-OA}$ or VF_{soil}) (kg/m^3)	Ratio of chemical concentration in outdoor air (mg/m^3) to chemical concentration in soil (mg/kg)
	Soil vapor-to-outdoor air volatilization factor (VF_{SV-OA}) ($\mu g/m^3$ per $\mu g/m^3$)	Ratio of chemical concentration in outdoor air ($\mu g/m^3$) to chemical concentration in soil vapor ($\mu g/m^3$)

Table A-3a
Derivation of Particulate Emission and Volatilization Factors, Onsite Resident

Parameter	Value	Units	Reference
Water-filled soil porosity (θw)	1.50E-01	(Lwater-Lsoil)	USEPA 2012 RSL default
Total soil porosity (θ_T)	4.30E-01	(Lpore-Lsoil)	USEPA 2012 RSL default
Air-filled soil porosity (θa)	2.80E-01	(Lair-Lsoil)	USEPA 2012 RSL default
Soil bulk density (Pb)	1.5	g/cm^3	USEPA 2012 RSL default
Fraction organic carbon in soil (foc)	0.006	unitless	USEPA 2012 RSL default
Exposure interval ($T_{resident}$)	9.46E+08	sec	30 year exposure duration
Inverse of mean conc, $Q/C_{resident}$	68.18	(g/m^2-s per kg/m^3)	Calculated for a 0.5-acre site in Los Angeles (USEPA 2002)
Fraction of vegetative cover, $G_{resident}$	0.5	unitless	Default (USEPA 2002)
Mean annual windspeed (Um)	3.31	m/s	Average for Los Angeles, 7.4 mph (NCDC 2011)
Equivalent threshold value of windspeed at 7m (Ut)	11.32	m/s	Default (USEPA 2002)
Function dependent on Um/Ut (Fx)	1.94E-01	unitless	Default (USEPA 2002)
Particulate Emission Factor, $PEF_{resident}$	2.8E+09	(m^3/kg)	Estimated for a limited area, 0.5-acre (USEPA 2002)

Particulate Emission Factor; $PEF_{resident}$ (USEPA 2002); $PEF = [(Q/C_{resident} * 3600) / (0.036 * (1-G_{resident}) * (Um/Ut)^3 * Fx)]$

CAS Number	Chemical of Concern	Diffusivity in Air (D_{air}) (cm^2/s)	Henry's Law Constant (H') (unitless)	Diffusivity in Water (D_{water}) (cm^2/s)	Organic Carbon Partition Coefficient (K_{oc}) (cm^3/g)	Soil-Water Partition Coefficient (Kd) (cm^3/g)	Apparent Diffusivity (D_A) (cm^2/s)	Effective Diffusion Coefficient (D_{eff}) (cm^2/s)	Soil-water partition coefficient (K_{sw}) (cm^3/g)	**Onsite Resident VF_{soil} (m^3/kg)**
79-34-5	1,1,2,2-Tetrachloroethane	7.1E-02	1.4E-02	7.9E-06	9.3E+01	5.6E-01	7.8E-05	5.5E-03	6.6E-01	**1.4E+04**
96-18-4	1,2,3-Trichloropropane	7.1E-02	1.7E-02	7.9E-06	2.2E+01	1.3E-01	2.8E-04	5.5E-03	2.4E-01	**7.6E+03**
95-63-6	1,2,4-Trimethylbenzene	6.1E-02	2.5E-01	7.9E-06	1.4E+03	8.1E+00	9.8E-05	4.7E-03	8.3E+00	**1.3E+04**
78-87-5	1,2-Dichloropropane	7.8E-02	1.1E-01	8.7E-06	4.4E+01	2.8E-01	1.2E-03	6.1E-03	3.8E-01	**3.6E+03**
108-67-8	1,3,5-Trimethylbenzene	6.0E-02	2.4E-01	8.7E-06	1.4E+03	8.1E+00	9.1E-05	4.7E-03	8.3E+00	**1.3E+04**
106-46-7	1,4-Dichlorobenzene	6.9E-02	9.8E-02	7.9E-06	6.2E+02	3.7E+00	9.2E-05	5.4E-03	3.8E+00	**1.3E+04**
71-43-2	Benzene	8.8E-02	2.3E-01	9.8E-06	5.9E+01	3.5E-01	2.1E-03	6.9E-03	5.0E-01	**2.7E+03**
75-27-4	Bromodichloromethane	3.0E-02	6.5E-02	1.1E-05	5.5E+01	3.3E-01	2.3E-04	2.3E-03	4.4E-01	**8.2E+03**
74-83-9	Bromomethane	7.3E-02	2.6E-01	1.2E-05	1.1E+01	6.3E-02	4.6E-03	5.7E-03	2.1E-01	**1.8E+03**
100-41-4	Ethylbenzene	7.5E-02	3.2E-01	7.8E-06	3.6E+02	2.2E+00	5.4E-04	5.9E-03	2.3E+00	**5.3E+03**
75-09-2	Methylene chloride	1.0E-01	9.0E-02	1.2E-05	1.2E+01	7.0E-02	2.5E-03	7.9E-03	1.9E-01	**2.5E+03**
127-18-4	Tetrachloroethene	7.2E-02	7.5E-01	8.2E-06	1.6E+02	9.3E-01	2.4E-03	5.6E-03	1.2E+00	**2.5E+03**
79-01-6	Trichloroethene	7.9E-02	4.2E-01	8.1E-06	1.7E+02	1.0E+00	1.5E-03	8.2E-03	1.2E+00	**3.2E+03**
75-01-4	Vinyl chloride	1.1E-01	1.1E+00	1.2E-05	1.9E+01	1.1E-01	1.5E-02	8.3E-03	4.2E-01	**1.0E+03**

Volatilization Factor; VF_{soil} (USEPA 2002); $$VF_{soil} = Q/C \times \left(10^{-4}\frac{m^2}{cm^2}\right) \times \left(\frac{1}{P_b}\right)\left(\frac{3.14 \times T_{resident} \times K_{sw} \times P_b}{4 \times D_{eff} \times H'}\right)^{1/2}$$

Table A-3b

Derivation of Particulate Emission and Volatilization Factors, Onsite Construction and Utility Maintenance Worker

Parameter	Value	Units	Reference
Water-filled soil porosity (θw)	1.5E-01	(Lwater-Lsoil)	USEPA 2012 RSL default
Total soil porosity (θ_T)	4.3E-01	(Lpore-Lsoil)	USEPA 2012 RSL default
Air-filled soil porosity (θa)	2.8E-01	(Lair-Lsoil)	USEPA 2012 RSL default
Soil bulk density (Pb)	1.5	g/cm^3	USEPA 2012 RSL default
Fraction organic carbon in soil (foc)	0.006	unitless	USEPA 2012 RSL default
Exposure Interval (T_{CUW})	7.9E+08	sec	25 year exposure duration for the construction/utility maintenance worker
Ambient air velocity in mixing zone (U_{air})	5.1E-01	cm/s	Based on an air exchange rate of 20 hr^{-1}, wind direction parallel to the short side of the trench (3 ft or 91 cm), professional judgment
Width of source-zone area (W)	457	cm	Assume length of trench = 4.57 meters
Mixing zone height (H)	183	cm	Assume depth of trench = 1.83 meters
Width of trench (W_t)	91	cm	Assume width of trench = 0.91 meters
Source-zone area (A)	2.4E+05	cm^2	4 sidewalls and bottom area of trench
Dispersion factor for ambient air (DF_{amb})	1.7E-01	cm/s	Calculated (ASTM 2004)
Particulate Emission Factor, PEF_{CUW}	1.0E+06	(m^3/kg)	DTSC HERO HHRA Note Number 1 (Cal-EPA. 2011)

CAS Number	Chemical of Concern	Diffusivity in Air (D_{air}) (cm^2/s)	Henry's Law Constant (H') (unitless)	Diffusivity in Water (D_{water}) (cm^2/s)	Organic Carbon Partition Coefficient (K_{oc}) (cm^3/g)	Soil-Water Partition Coefficient (Kd) (cm^3/g)	Apparent Diffusivity (D_A) (cm^2/s)	Effective Diffusion Coefficient (D_{eff}) (cm^2/s)	Soil-water partition coefficient (K_{sw}) (cm^3/g)	Construction and Utility Maintenance Worker $VF_{soil-OA}$ (m^3/kg)	Construction and Utility Maintenance Worker VF_{SV-OA} (µg/m^3 per µg/m^3)
71-55-6	1,1,1-Trichloroethane	7.8E-02	7.0E-01	8.8E-06	1.1E+02	6.6E-01	3.2E-03	6.1E-03	8.9E-01	--	**4.0E+04**
79-34-5	1,1,2,2-Tetrachloroethane	7.1E-02	1.4E-02	7.9E-06	9.3E+01	5.6E-01	7.8E-05	5.5E-03	6.6E-01	--	**7.0E+03**
79-00-5	1,1,2-Trichloroethane	7.8E-02	3.7E-02	8.8E-06	5.0E+01	3.0E-01	3.7E-04	6.1E-03	4.1E-01	--	**1.4E+04**
75-34-3	1,1-Dichloroethane	7.4E-02	2.3E-01	1.1E-05	3.2E+01	1.9E-01	2.7E-03	5.8E-03	3.3E-01	--	**3.9E+04**
96-18-4	1,2,3-Trichloropropane	7.1E-02	1.7E-02	7.9E-06	2.2E+01	1.3E-01	2.6E-04	5.5E-03	2.4E-01	**1.8E+02**	**1.3E+04**
120-82-1	1,2,4-Trichlorobenzene	3.0E-02	5.8E-02	8.2E-06	1.8E+03	1.1E+01	8.4E-06	2.3E-03	1.1E+01	--	**5.4E+03**
95-63-6	1,2,4-Trimethylbenzene	6.1E-02	2.5E-01	7.9E-06	1.4E+03	8.1E+00	9.6E-05	4.7E-03	8.3E+00	**3.0E+02**	**9.0E+03**
107-06-2	1,2-Dichloroethane	1.0E-01	4.0E-02	9.9E-06	1.7E+01	1.0E-01	1.0E-03	8.1E-03	2.1E-01	--	**1.7E+04**
78-87-5	1,2-Dichloropropane	7.8E-02	1.1E-01	8.7E-06	4.4E+01	2.6E-01	1.2E-03	6.1E-03	3.8E-01	--	**2.5E+04**

Table A-3b
Derivation of Particulate Emission and Volatilization Factors, Onsite Construction and Utility Maintenance Worker

CAS Number	Chemical of Concern	Diffusivity in Air (D_{air}) (cm^2/s)	Henry's Law Constant (H') (unitless)	Diffusivity in Water (D_{water}) (cm^2/s)	Organic Carbon Partition Coefficient (K_{oc}) (cm^3/g)	Soil-Water Partition Coefficient (Kd) (cm^3/g)	Apparent Diffusivity (D_A) (cm^2/s)	Effective Diffusion Coefficient (D_{eff}) (cm^2/s)	Soil-water partition coefficient (K_{sw}) (cm^3/g)	**Construction and Utility Maintenance Worker $VF_{soil-OA}$ (m^3/kg)**	**Construction and Utility Maintenance Worker VF_{sv-OA} (µg/m³ per µg/m³)**
108-67-8	1,3,5-Trimethylbenzene	6.0E-02	2.4E-01	8.7E-06	1.4E+03	8.1E+00	9.1E-05	4.7E-03	8.3E+00	**3.0E+02**	**8.8E+03**
106-99-0	1,3-Butadiene	2.5E-01	3.0E+00	1.1E-05	1.9E+01	1.1E-01	5.0E-02	1.9E-02	7.8E-01	--	**5.0E+04**
106-46-7	1,4-Dichlorobenzene	6.9E-02	9.8E-02	7.9E-06	6.2E+02	3.7E+00	9.2E-05	5.4E-03	3.8E+00	--	**7.8E+03**
123-91-1	1,4-Dioxane	2.3E-01	2.3E-04	1.0E-05	1.0E+00	6.0E-03	2.6E-05	1.8E-02	1.1E-01	--	**1.2E+03**
540-84-1	2,2,4-Trimethylpentane	1.0E-01	1.8E+02	1.0E-05	1.5E+05	9.0E+02	1.0E-03	7.8E-03	9.3E+02	--	**1.8E+04**
591-78-6	2-Hexanone	7.5E-02	3.8E-03	8.4E-06	9.4E+00	5.7E-02	9.4E-05	5.8E-03	1.6E-01	--	**7.2E+03**
622-96-8	4-Ethyltoluene	6.8E-02	2.1E-01	7.3E-06	1.8E+03	1.1E+01	6.7E-05	5.3E-03	1.1E+01	--	**6.7E+03**
71-43-2	Benzene	8.8E-02	2.3E-01	9.8E-06	5.9E+01	3.5E-01	2.1E-03	6.9E-03	5.0E-01	**6.3E+01**	**2.9E+04**
75-27-4	Bromodichloromethane	3.0E-02	6.5E-02	1.1E-05	5.5E+01	3.3E-01	2.3E-04	2.3E-03	4.4E-01	--	**2.8E+04**
74-83-9	Bromomethane	7.3E-02	2.6E-01	1.2E-05	1.1E+01	6.3E-02	4.6E-03	5.7E-03	2.1E-01	--	**5.2E+04**
75-15-0	Carbon disulfide	1.0E-01	1.2E+00	1.0E-05	4.6E+01	2.7E-01	1.1E-02	8.1E-03	6.1E-01	--	**5.6E+04**
56-23-5	Carbon tetrachloride	7.8E-02	1.2E+00	8.8E-06	1.7E+02	1.0E+00	3.6E-03	6.1E-03	1.4E+00	--	**4.3E+04**
67-66-3	Chloroform	1.0E-01	1.5E-01	1.0E-05	4.0E+01	2.4E-01	2.2E-03	8.1E-03	3.7E-01	--	**2.5E+04**
74-87-3	Chloromethane	1.3E-01	3.6E-01	6.5E-06	2.1E+00	1.3E-02	1.3E-02	9.8E-03	1.8E-01	--	**5.1E+04**
110-82-7	Cyclohexane	7.4E-02	7.9E+00	8.5E-06	1.7E+02	9.9E-01	1.2E-02	5.7E-03	2.6E+00	--	**8.2E+04**
124-48-1	Dibromochloromethane	2.0E-02	3.2E-02	1.1E-05	6.3E+01	3.8E-01	6.7E-05	1.5E-03	4.8E-01	--	**2.3E+04**
156-59-2	Dichloroethene, cis-1,2-	7.4E-02	1.7E-01	1.1E-05	3.6E+01	2.1E-01	1.8E-03	5.7E-03	3.4E-01	--	**3.3E+04**
156-60-5	Dichloroethene, trans-1,2-	7.1E-02	3.8E-01	1.2E-05	5.3E+01	3.2E-01	2.9E-03	5.6E-03	4.9E-01	--	**4.2E+04**
10061-02-6	Dichloropropene, trans-1,3-	6.3E-02	7.2E-01	1.0E-05	4.6E+01	2.7E-01	4.6E-03	4.9E-03	5.1E-01	--	**6.1E+04**
64-17-5	Ethanol	1.5E-01	1.9E-04	1.6E-05	1.0E+00	6.0E-03	1.5E-05	1.3E-02	1.1E-01	--	**1.3E+03**
100-41-4	Ethylbenzene	7.5E-02	3.2E-01	7.8E-06	3.6E+02	2.2E+00	5.4E-04	5.9E-03	2.3E+00	**1.2E+02**	**1.7E+04**
142-82-5	Heptane	9.3E-02	8.2E+01	7.6E-06	2.7E+02	1.6E+00	2.3E-02	7.2E-03	1.7E+01	--	**9.2E+04**
87-68-3	Hexachloro-1,3-butadiene	5.6E-02	3.3E-01	6.2E-06	5.4E+04	3.2E+02	3.0E-06	4.4E-03	3.2E+02	--	**1.7E+03**
110-54-3	Hexane	2.0E-01	6.8E+01	7.8E-06	4.3E+01	2.6E-01	5.4E-02	1.6E-02	1.3E+01	--	**6.5E+04**
67-63-0	Isopropanol	8.0E-02	3.6E-04	9.3E-06	6.9E+00	4.2E-02	1.1E-05	6.5E-03	1.4E-01	--	**2.2E+03**
98-82-8	Isopropylbenzene (cumene)	6.5E-02	4.7E+01	7.1E-06	4.9E+02	2.9E+00	1.3E-02	5.1E-03	1.2E+01	--	**1.0E+05**
78-93-3	Methyl ethyl ketone (2-butanone)	8.1E-02	2.3E-03	9.8E-06	2.3E+00	1.4E-02	8.4E-05	6.3E-03	1.1E-01	--	**6.3E+03**

Table A-3b

Derivation of Particulate Emission and Volatilization Factors, Onsite Construction and Utility Maintenance Worker

CAS Number	Chemical of Concern	Diffusivity in Air (D_{air}) (cm^2/s)	Henry's Law Constant (H') (unitless)	Diffusivity in Water (D_{water}) (cm^2/s)	Organic Carbon Partition Coefficient (K_{oc}) (cm^3/g)	Soil-Water Partition Coefficient (Kd) (cm^3/g)	Apparent Diffusivity (D_A) (cm^2/s)	Effective Diffusion Coefficient (D_{eff}) (cm^2/s)	Soil-water partition coefficient (K_{sw}) (cm^3/g)	**Construction and Utility Maintenance Worker $VF_{soil-OA}$ (m^3/kg)**	**Construction and Utility Maintenance Worker VF_{SV-OA} ($\mu g/m^3$ per $\mu g/m^3$)**
75-09-2	Methylene chloride	1.0E-01	9.0E-02	1.2E-05	1.2E+01	7.0E-02	2.5E-03	7.9E-03	1.9E-01	--	**2.8E+04**
1634-04-4	Methyl-tert-butyl ether	1.0E-01	2.6E-02	1.1E-05	7.3E+00	4.4E-02	9.1E-04	8.0E-03	1.5E-01	--	**1.6E+04**
103-65-1	Propylbenzene	6.0E-02	4.4E-01	7.8E-06	5.6E+02	3.4E+00	3.8E-04	4.7E-03	3.6E+00	--	**1.8E+04**
75-65-0	tert-Butyl Alcohol (TBA)	8.5E-02	3.0E-03	9.1E-06	4.2E+00	2.5E-02	1.1E-04	6.7E-03	1.3E-01	--	**6.7E+03**
127-18-4	Tetrachloroethene	7.2E-02	7.5E-01	8.2E-06	1.6E+02	9.3E-01	2.4E-03	5.6E-03	1.2E+00	--	**3.8E+04**
109-99-9	Tetrahydrofuran	9.8E-02	2.9E-03	1.1E-05	9.5E-01	5.7E-03	1.4E-04	7.7E-03	1.1E-01	--	**6.7E+03**
108-88-3	Toluene	8.7E-02	2.7E-01	8.6E-06	1.8E+02	1.1E+00	9.8E-04	6.8E-03	1.2E+00	--	**2.0E+04**
79-01-6	Trichloroethene	7.9E-02	4.2E-01	9.1E-06	1.7E+02	1.0E+00	1.5E-03	6.2E-03	1.2E+00	--	**2.7E+04**
75-01-4	Vinyl chloride	1.1E-01	1.1E+00	1.2E-05	1.9E+01	1.1E-01	1.5E-02	8.3E-03	4.2E-01	--	**6.3E+04**
108-38-3	Xylene, m-	7.0E-02	3.0E-01	7.8E-06	4.1E+02	2.4E+00	4.2E-04	5.5E-03	2.6E+00	--	**1.6E+04**
95-47-6	Xylene, o-	8.7E-02	2.1E-01	1.0E-05	3.6E+02	2.2E+00	4.1E-04	6.8E-03	2.3E+00	--	**1.3E+04**
106-42-3	Xylene, p-	7.7E-02	3.1E-01	8.4E-06	3.9E+02	2.3E+00	5.0E-04	6.0E-03	2.5E+00	--	**1.6E+04**
1330-20-7	Xylenes, total	8.5E-02	2.7E-01	9.9E-06	4.4E+02	2.7E+00	4.2E-04	6.6E-03	2.8E+00	**1.4E+02**	**1.4E+04**
91-20-3	Naphthalene	5.9E-02	2.0E-02	7.5E-06	2.0E+03	1.2E+01	5.0E-06	4.6E-03	1.2E+01	--	**2.1E+03**

Note:

--: Not selected as COC for this medium.

Volatilization Factor:

$$VF_{soil\text{-}OA} = \frac{DF_{amb}}{Pb} \times \left[\frac{(3.14 \times T_{CUW} \times K_{sw} \times Pb)}{(4 \times D_{eff} \times H')} \right]^{1/2} \times CF_1 \times CF_2 \quad \text{and} \quad VF_{SV\text{-}OA} = VF_{soil\text{-}OA} \times \frac{H'}{K_{sw}} \times (CF_1 \times CF_2)$$

Table A-4

Chronic Toxicity Criteria

CAS Number	Chemical of Concern	Dermal ABS	GI ABS	Cancer Toxicity Criteria: Oral Cancer Slope Factor (mg/kg-day)$^{-1}$	Source	Dermal Cancer Slope Factor (mg/kg-day)$^{-1}$	Inhalation Unit Risk (µg/m^3)$^{-1}$	Source	Noncancer Toxicity Criteria: Oral RfD (mg/kg-day)	Dermal RfD (mg/kg-day)	Source	Inhalation RfC or REL (mg/m^3)	Source
	Inorganics												
7440-36-0	Antimony	NA	0.15	NC		NC	NC		4.0E-04	6.0E-05	I	NA	
7440-38-2	Arsenic	0.03	1	9.5E+00	C	9.5E+00	3.3E-03	C	3.0E-04	3.0E-04	I	1.5E-05	C
7440-43-9	Cadmium	0.001	0.025	NC		NC	4.2E-03	C	1.0E-03	2.5E-05	I	2.0E-05	C
18540-29-9	Chromium, hexavalent	NA	0.025	5.0E-01	J	NC	1.5E-01	C	3.0E-03	7.5E-05	I	1.0E-04	I
7440-48-4	Cobalt	NA	1	NC		NC	9.0E-03	P	3.0E-04	3.0E-04	P	6.0E-06	P
7440-50-8	Copper	NA	1	NC		NC	NC		4.0E-02	4.0E-02	H	NA	
7439-92-1	Lead	NA	1	NC		NC	NC		NA	NA		NA	
7440-28-0	Thallium	NA	1	NC		NC	NC		1.0E-05	1.0E-05	X	NA	
7440-62-2	Vanadium	NA	1	NC		NC	NC		5.0E-03	5.0E-03	S	NA	
7440-66-6	Zinc	NA	1	NC		NC	NC		3.0E-01	3.0E-01	I	NA	
	PAHs												
56-55-3	Benzo (a) anthracene	0.13	1	2.9E-01	C*	2.9E-01	1.1E-04	C	NA	NA		NA	
50-32-8	Benzo (a) pyrene	0.13	1	2.9E+00	C*	2.9E+00	1.1E-03	C	NA	NA		NA	
205-99-2	Benzo (b) fluoranthene	0.13	1	2.9E-01	C*	2.9E-01	1.1E-04	C	NA	NA		NA	
207-08-9	Benzo (k) fluoranthene	0.13	1	2.9E-01	C*	2.9E-01	1.1E-04	C	NA	NA		NA	
218-01-9	Chrysene	0.13	1	2.9E-02	C*	2.9E-02	1.1E-05	C	NA	NA		NA	
53-70-3	Dibenz (a,h) anthracene	0.13	1	4.1E+00	C	4.1E+00	1.2E-03	C	NA	NA		NA	
193-39-5	Indeno (1,2,3-cd) pyrene	0.13	1	2.9E-01	C*	2.9E-01	1.1E-04	C	NA	NA		NA	
90-12-0	Methylnaphthalene, 1-	0.13	1	2.9E-02	P	2.9E-02	NC		7.0E-02	7.0E-02	A	NA	
91-57-6	Methylnaphthalene, 2-	0.13	1	NC		NC	NC		4.0E-03	4.0E-03	I	NA	
91-20-3	Naphthalene	0.13	1	NC		NC	3.4E-05	C	2.0E-02	2.0E-02	I	3.0E-03	I
129-00-0	Pyrene	0.13	1	NC		NC	NC		3.0E-02	3.0E-02	I	1.1E-01	R
	TPH												
	TPH Aliphatic: C5-C8	0.13	1	NC		NC	NC		4.0E-02	4.0E-02	B	7.0E-01	B
	TPH Aliphatic: C9-C18	0.13	1	NC		NC	NC		1.0E-01	1.0E-01	B	3.0E-01	B
	TPH Aliphatic: C19-C32	0.13	1	NC		NC	NC		2.0E+00	2.0E+00	B	--	B
	TPH Aromatic: C6-C8	0.13	1	NC		NC	NC		--	--	B	--	B
	TPH Aromatic: C9-C16	0.13	1	NC		NC	NC		3.0E-02	3.0E-02	B	6.0E-02	B
	TPH Aromatic: C17-C32	0.13	1	NC		NC	NC		3.0E-02	3.0E-02	B	--	B
	SVOCs												
121-14-2	2,4-Dinitrotoluene	0.102	1	3.1E-01	C	3.1E-01	8.9E-05	C	2.0E-03	2.0E-03	I	7.0E-03	R
117-81-7	Bis(2-Ethylhexyl) Phthalate	0.1	1	1.4E-02	I	1.4E-02	2.4E-06	C	2.0E-02	2.0E-02	I	7.0E-02	R

Table A-4
Chronic Toxicity Criteria

CAS Number	Chemical of Concern	Dermal ABS	GI ABS	Cancer Toxicity Criteria: Oral Cancer Slope Factor (mg/kg-day)$^{-1}$	Source	Dermal Cancer Slope Factor (mg/kg-day)$^{-1}$	Inhalation Unit Risk (μg/m^3)$^{-1}$	Source	Noncancer Toxicity Criteria: Oral RfD (mg/kg-day)	Dermal RfD (mg/kg-day)	Source	Inhalation RfC or REL (mg/m^3)	Source
	VOCs												
71-55-6	1,1,1-Trichloroethane	NA	1	NC		NC	NC		2.0E+00	2.0E+00	I	5.0E+00	I
79-34-5	1,1,2,2-Tetrachloroethane	NA	1	2.7E-01	C	2.7E-01	5.8E-05	C	2.0E-02	2.0E-02	I	7.0E-02	R
79-00-5	1,1,2-Trichloroethane	NA	1	7.2E-02	C	7.2E-02	1.6E-05	C	4.0E-03	4.0E-03	I	2.0E-04	X
75-34-3	1,1-Dichloroethane	NA	1	5.7E-03	C	5.7E-03	1.6E-06	C	2.0E-01	2.0E-01	P	7.0E-01	R
96-18-4	1,2,3-Trichloropropane	NA	1	3.0E+01	I	3.0E+01	NC		4.0E-03	4.0E-03	I	3.0E-04	I
120-82-1	1,2,4-Trichlorobenzene	NA	1	3.6E-03	C	3.6E-03	NC		1.0E-02	1.0E-02	I	2.0E-03	P
95-63-6	1,2,4-Trimethylbenzene	NA	1	NC		NC	NC		1.0E-02	1.0E-02	X	7.0E-03	P
107-06-2	1,2-Dichloroethane	NA	1	4.7E-02	C	4.7E-02	2.1E-05	C	6.0E-03	6.0E-03	X	7.0E-03	P
78-87-5	1,2-Dichloropropane	NA	1	3.6E-02	C	3.6E-02	1.0E-05	C	9.0E-02	9.0E-02	A	4.0E-03	I
108-67-8	1,3,5-Trimethylbenzene	NA	1	NC		NC	NC		1.0E-02	1.0E-02	X	7.0E-03	P
106-99-0	1,3-Butadiene	NA	1	3.4E+00	C	3.4E+00	1.7E-04	C	5.7E-04	5.7E-04	R	2.0E-03	I
106-46-7	1,4-Dichlorobenzene	NA	1	5.4E-03	C	5.4E-03	1.1E-05	C	7.0E-02	7.0E-02	A	8.0E-01	C
123-91-1	1,4-Dioxane	0.1	1	2.7E-02	C	2.7E-02	7.7E-06	C	3.0E-02	3.0E-02	I	3.0E+00	C
540-84-1	2,2,4-Trimethylpentane	NA	1	NC		NC	NC		NA	NA		1.0E+00	D
591-78-6	2-Hexanone	NA	1	NC		NC	NC		5.0E-03	5.0E-03	I	3.0E-02	I
622-96-8	4-Ethyltoluene*	NA	1	NC		NC	NC		2.0E-01	2.0E-01	S	1.0E-01	S
71-43-2	Benzene	NA	1	1.0E-01	C	1.0E-01	2.9E-05	C	4.0E-03	4.0E-03	I	3.0E-02	I
75-27-4	Bromodichloromethane	NA	1	1.3E-01	C	1.3E-01	3.7E-05	C	2.0E-02	2.0E-02	I	7.0E-02	R
74-83-9	Bromomethane	NA	1	NC		NC	NC		1.4E-03	1.4E-03	I	5.0E-03	C
75-15-0	Carbon disulfide	NA	1	NC		NC	NC		1.0E-01	1.0E-01	I	7.0E-01	I
56-23-5	Carbon tetrachloride	NA	1	1.5E-01	C	1.5E-01	4.2E-05	C	4.0E-03	4.0E-03	I	1.0E-01	I
67-66-3	Chloroform	NA	1	3.1E-02	C	3.1E-02	5.3E-06	C	1.0E-02	1.0E-02	I	9.8E-02	A
74-87-3	Chloromethane	NA	1	NC		NC	NC		2.6E-02	2.6E-02	R	9.0E-02	I
110-82-7	Cyclohexane	NA	1	NC		NC	NC		1.7E+00	1.7E+00	R	6.0E+00	I
124-48-1	Dibromochloromethane	0.1	1	9.4E-02	C	9.4E-02	2.7E-05	C	2.0E-02	2.0E-02	I	7.0E-02	R
156-59-2	Dichloroethene, cis-1,2-	NA	1	NC		NC	NC		2.0E-03	2.0E-03	I	7.0E-03	R
156-60-5	Dichloroethene, trans-1,2-	NA	1	NC		NC	NC		2.0E-02	2.0E-02	I	6.0E-02	P
10061-02-6	Dichloropropene, trans-1,3-*	NA	1	9.1E-02	C	9.1E-02	1.6E-05	C	3.0E-02	3.0E-02	I	2.0E-02	I
64-17-5	Ethanol*	NA	1	NC		NC	NC		5.0E-01	5.0E-01	I	4.0E+00	C
100-41-4	Ethylbenzene	NA	1	1.1E-02	C	1.1E-02	2.5E-06	C	1.0E-01	1.0E-01	I	1.0E+00	I
142-82-5	Heptane*	NA	1	NC		NC	NC		6.0E-02	6.0E-02	H	7.0E-01	I
87-68-3	Hexachloro-1,3-butadiene	0.1	1	7.8E-02	I	7.8E-02	2.2E-05	I	1.0E-03	1.0E-03	P	7.0E+00	C

Table A-4
Chronic Toxicity Criteria

CAS Number	Chemical of Concern	Dermal ABS	GI ABS	Cancer Toxicity Criteria: Oral Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Source	Dermal Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Inhalation Unit Risk $(\mu g/m^3)^{-1}$	Source	Noncancer Toxicity Criteria: Oral RfD (mg/kg-day)	Dermal RfD (mg/kg-day)	Source	Inhalation RfC or REL (mg/m^3)	Source
110-54-3	Hexane	NA	1	NC		NC	NC		6.0E-02	6.0E-02	H	7.0E-01	I
67-63-0	Isopropanol	0.1	1	NC		NC	NC		NA	NA		7.0E+00	C
98-82-8	Isopropylbenzene (cumene)	NA	1	NC		NC	NC		1.0E-01	1.0E-01	I	4.0E-01	I
78-93-3	Methyl ethyl ketone (2-butanone)	NA	1	NC		NC	NC		6.0E-01	6.0E-01	I	5.0E+00	I
75-09-2	Methylene chloride	NA	1	1.4E-02	C	1.4E-02	1.0E-06	C	6.0E-03	6.0E-03	I	6.0E-01	I
1634-04-4	Methyl-tert-butyl ether	NA	1	1.8E-03	C	1.8E-03	2.6E-07	C	8.6E-01	8.6E-01	R	3.0E+00	I
103-65-1	Propylbenzene	0.1	1	NC		NC	NC		1.0E-01	1.0E-01	X	1.0E+00	X
75-65-0	tert-Butyl Alcohol (TBA)*	0.1	1	NC		NC	NC		3.0E-01	3.0E-01	I	1.1E+00	R
127-18-4	Tetrachloroethene	NA	1	5.4E-01	C	5.4E-01	5.9E-06	C	6.0E-03	6.0E-03	I	4.0E-02	I
109-99-9	Tetrahydrofuran	0.1	1	NC		NC	NC		9.0E-01	9.0E-01	I	2.0E+00	I
108-88-3	Toluene	NA	1	NC		NC	NC		8.0E-02	8.0E-02	I	5.0E+00	I
79-01-6	Trichloroethene	NA	1	4.6E-02	I	4.6E-02	4.1E-06	I	5.0E-04	5.0E-04	I	2.0E-03	I
75-01-4	Vinyl chloride	NA	1	2.7E-01	C	2.7E-01	7.8E-05	C	3.0E-03	3.0E-03	I	1.0E-01	I
108-38-3	Xylene, m-	NA	1	NC		NC	NC		2.0E-01	2.0E-01	S	1.0E-01	S
95-47-6	Xylene, o-	NA	1	NC		NC	NC		2.0E-01	2.0E-01	S	1.0E-01	S
106-42-3	Xylene, p-	NA	1	NC		NC	NC		2.0E-01	2.0E-01	S	1.0E-01	S

Notes:

" NA " not available; " -- " not applicable; " NC " not considered a carcinogen; " ABS " absorption; " GI " gastrointestinal; " PAH " Polycyclic Aromatic Hydrocarbons; " RfD " reference dose; " RfC " reference concentration; " REL " reference exposure level

Surrogates: * p-Xylene for 4-Ethyltoluene; Hexane for Heptane; Isobutyl alcohol for tert-Butyl Alcohol; 1,3-Dichloropropene for trans-1,3-Dichloropropene; Methanol for Ethanol

Key:

C* = Cal-EPA 2010

C = Cal-EPA 2013

A = Agency For Toxic Substances And Disease Registry (ATSDR) as reported in USEPA 2012

B = Cal-EPA 2009. Interim Guidance: Evaluating Human Health Risks from Total Petroleum Hydrocarbons.

D = TPHCWG, 1997. Develoment of Fraction Specific Reference Doses (RfDs) and Reference Concentrations (RfCs) for TPH

H = Health Effects Assessment Summary Tables (HEAST). July. EPA 540/R-97-036-PB97-921199 as reported in USEPA 2012

I = Integrated Risk Information System Database, IRIS in USEPA 2013

J = New Jersey; reported in USEPA 2012

P = Provisional Peer Reviewed Toxicity Value (PPRTV) as reported in USEPA 2012

R = route-to-route extrapolation

S = reported in USEPA 2012

X = PPRTV Appendix; reported in USEPA 2012

Table A-5
Exposure Concentration for Outdoor Inhalation of Particulates/Vapors from Soil
Former Kast Property
Carson, California

(1) Exposure Concentration Equations

a) Noncarcinogenic Chemicals

$$EC_{inh,soil} = \frac{EF \times ED \times ET}{AT_{NC} \times \left(VF_{soil} \text{ or } VF_{soil\text{-}OA}\right)}$$

b) Carcinogenic Chemicals – Onsite Resident

$$EC_{inh,soil} = \left[\frac{EF \times ED \times ET}{AT_C \times VF_{soil}}\right]_{CHILD} + \left[\frac{EF \times ED \times ET}{AT_C \times VF_{soil}}\right]_{ADULT}$$

c) Carcinogenic Chemicals – Construction and Utility Maintenance Worker

$$EC_{inh,soil} = \frac{EF \times ED \times ET}{AT_C \times VF_{soil\text{-}OA}}$$

(2) Explanation of Variables

Variable	Description	Units
$EC_{inh,soil}$	Exposure concentration outdoor inhalation of chemicals from soil	mg/m^3 per mg/kg
PEF	Particulate emission factor for non-VOCs	m^3/kg
VF_{soil}	Volatilization factor, onsite resident	mg/m^3 per mg/kg
$VF_{soil\text{-}OA}$	Volatilization factor for VOCs, construction and utility maintenance worker	mg/m^3 per mg/kg
EF	Exposure frequency	day/yr
ED	Exposure duration	yr
ET	Exposure time	hour/hour
AT_C	Averaging time – cancer effects	day
AT_{NC}	Averaging time – noncancer effects	day

Table A-6
Exposure Concentration for Outdoor Inhalation from Soil Vapor
Former Kast Property
Carson, California

(1) Exposure Concentration Equations

a) Noncarcinogenic Chemicals – Construction and Utility Maintenance Worker

$$EC_{SV\text{-}OA} = \frac{EF \times ED \times ET}{AT_{NC} \times CF \times VF_{SV\text{-}OA}}$$

b) Carcinogenic Chemicals – Construction and Utility Maintenance Worker

$$EC_{SV\text{-}OA} = \frac{EF \times ED \times ET}{AT_{C} \times CF \times VF_{SV\text{-}OA}}$$

(2) Explanation of Variables

Variable	Description	Units
$EC_{SV\text{-}OA}$	Exposure concentration for outdoor inhalation of chemicals from soil vapor	mg/m^3 per mg/m^3
$VF_{SV\text{-}OA}$	Volatilization factor	$\mu g/m^3$ per $\mu g/m^3$
EF	Exposure frequency	day/yr
ED	Exposure duration	yr
ET	Exposure time	hour/hour
CF	Units conversion factor	µg/mg
AT_C	Averaging time – cancer effects	day
AT_{NC}	Averaging time – noncancer effects	day

Table A-7
Intake Factor for Dermal Contact with Soil
Former Kast Property
Carson, California

(1) Intake Factor Equations

a) Noncarcinogenic Chemicals

$$IF_{dermal} = \frac{SA \times AF \times ABS \times CF \times EF \times ED}{BW \times AT_{NC}}$$

b) Carcinogenic Chemicals – Onsite Resident

$$IF_{dermal} = \left[\frac{SA \times AF \times ABS \times CF \times EF \times ED}{BW \times AT_{C}}\right]_{CHILD} + \left[\frac{SA \times AF \times ABS \times CF \times EF \times ED}{BW \times AT_{C}}\right]_{ADULT}$$

c) Carcinogenic Chemicals – Construction and Utility Maintenance Worker

$$IF_{dermal} = \frac{SA \times AF \times ABS \times CF \times EF \times ED}{BW \times AT_{C}}$$

(2) Explanation of Variables

Variable	Description	Units
IF_{dermal}	Intake factor for dermal contact with soil	kg soil / kg body weight per day
SA	Surface area of exposed skin	cm^2/day
AF	Soil-to-skin adherence factor	mg/cm^2
ABS	Absorption factor	–
CF	Units conversion factor	kg/mg
EF	Exposure frequency	day/yr
ED	Exposure duration	yr
BW	Body weight	kg
AT_C	Averaging time – cancer effects	day
AT_{NC}	Averaging time – noncancer effects	day

Table A-8
Intake Factor for Incidental Soil Ingestion
Former Kast Property
Carson, California

(1) Intake Factor Equations

a) Noncarcinogenic Chemicals

$$IF_{oral} = \frac{IR \times CF \times EF \times ED}{BW \times AT_{NC}}$$

b) Carcinogenic Chemicals – Onsite Resident

$$IF_{oral} = \left[\frac{IR \times CF \times EF \times ED}{BW \times AT_{C}}\right]_{CHILD} + \left[\frac{IR \times CF \times EF \times ED}{BW \times AT_{C}}\right]_{ADULT}$$

c) Carcinogenic Chemicals – Construction and Utility Maintenance Worker

$$IF_{oral} = \frac{IR \times CF \times EF \times ED}{BW \times AT_{C}}$$

(2) Explanation of Variables

Variable	Description	Units
IF_{oral}	Intake factor for soil ingestion	kg soil / kg body weight per day
IR	Ingestion rate of soil	mg/day
CF	Units conversion factor	kg/mg
EF	Exposure frequency	day/yr
ED	Exposure duration	yr
BW	Body weight	kg
AT_C	Averaging time – cancer effects	day
AT_{NC}	Averaging time – noncancer effects	day

Table A-9
Site-Specific Cleanup Goals for Soil, Onsite Resident

Chemical of Concern	CAS Number	Onsite Resident Soil (mg/kg) EF = 350 d/y*		EF = 4 d/y*	
		$SSCG_{nc}$	$SSCG_c$	$SSCG_{nc}$	$SSCG_c$
Inorganics					
Antimony	7440-36-0	3.1E+01	--	2.7E+03	--
Arsenic	7440-38-2	2.2E+01	6.1E-02	1.9E+03	5.4E+00
Cadmium	7440-43-9	7.0E+01	1.6E+03	6.1E+03	1.4E+05
Chromium VI	18540-29-9	2.3E+02	1.2E+00	2.1E+04	1.1E+02
Cobalt	7440-48-4	2.3E+01	7.6E+02	2.1E+03	6.7E+04
Copper	7440-50-8	3.1E+03	--	2.7E+05	--
Lead	7439-92-1	8.0E+01[a]	--	9.9E+03[b]	--
Thallium	7440-28-0	7.8E-01	--	6.8E+01	--
Vanadium	7440-62-2	3.9E+02	--	3.4E+04	--
Zinc	7440-66-6	2.3E+04	--	2.1E+06	--
PAHs					
Benz[a]anthracene	56-55-3	--	1.6E+00	--	1.4E+02
Benzo[a]pyrene	50-32-8	--	1.6E-01	--	1.4E+01
Benzo[b]fluoranthene	205-99-2	--	1.6E+00	--	1.4E+02
Benzo[k]fluoranthene	207-08-9	--	1.6E+00	--	1.4E+02
Chrysene	218-01-9	--	1.6E+01	--	1.4E+03
Dibenz[a,h]anthracene	53-70-3	--	1.1E-01	--	9.7E+00
Indeno[1,2,3-cd]pyrene	193-39-5	--	1.6E+00	--	1.4E+02
Methylnaphthalene, 1-	90-12-0	4.0E+03	1.6E+01	3.5E+05	1.4E+03
Methylnaphthalene, 2-	91-57-6	2.3E+02	--	2.0E+04	--
Naphthalene	91-20-3	1.5E+02	4.0E+00	1.3E+04	3.5E+02
Pyrene	129-00-0	1.7E+03	--	1.5E+05	--
TPH					
Aliphatic: C5-C8		7.1E+02	--	6.2E+04	--
Aliphatic: C9-C18		1.4E+03	--	1.3E+05	--
Aliphatic: C19-C32		1.1E+05	--	1.0E+07	--
Aromatic: C6-C8		--	--	--	--
Aromatic: C9-C16		6.0E+02	--	5.3E+04	--
Aromatic: C17-C32		1.7E+03	--	1.5E+05	--
TPHg		7.6E+02		6.6E+04	--
TPHd		1.3E+03		1.1E+05	--
TPHmo		3.3E+03		2.9E+05	--
SVOCs					
2,4-Dinitrotoluene	121-14-2	1.2E+02	1.6E+00	1.1E+04	1.4E+02
Bis(2-Ethylhexyl) Phthalate	117-81-7	1.2E+03	3.5E+01	1.1E+05	3.0E+03
VOCs					
1,1,2,2-Tetrachloroethane	79-34-5	6.2E+02	4.7E-01	5.4E+04	4.1E+01
1,2,3-Trichloropropane	96-18-4	2.4E+00	2.1E-02	2.1E+02	1.9E+00
1,2,4-Trimethylbenzene	95-63-6	8.3E+01	--	7.2E+03	--
1,2-Dichloropropane	78-87-5	1.5E+01	8.3E-01	1.3E+03	7.2E+01
1,3,5-Trimethylbenzene	108-67-8	8.5E+01	--	7.4E+03	--

Table A-9
Site-Specific Cleanup Goals for Soil, Onsite Resident

Chemical of Concern	CAS Number	Onsite Resident Soil (mg/kg) EF = 350 d/y*		EF = 4 d/y*	
		$SSCG_{nc}$	$SSCG_c$	$SSCG_{nc}$	$SSCG_c$
1,4-Dichlorobenzene	106-46-7	3.6E+03	2.8E+00	3.2E+05	2.4E+02
Benzene	71-43-2	6.7E+01	2.2E-01	5.8E+03	1.9E+01
Bromodichloromethane	75-27-4	4.3E+02	4.9E-01	3.8E+04	4.2E+01
Bromomethane	74-83-9	8.8E+00	--	7.7E+02	--
Ethylbenzene	100-41-4	3.3E+03	4.8E+00	2.9E+05	4.2E+02
Methylene chloride	75-09-2	3.6E+02	5.3E+00	3.2E+04	4.7E+02
Tetrachloroethene	127-18-4	8.6E+01	5.5E-01	7.5E+03	4.9E+01
Trichloroethene	79-01-6	5.8E+00	1.7E+00	5.0E+02	1.5E+02
Vinyl chloride	75-01-4	7.4E+01	3.2E-02	6.4E+03	2.8E+00

Notes:

" -- " not applicable; " na " not available

* EF: exposure frequency; 350 days/year (d/y) for a typical resident and 4 days/year for a resident who infrequently contacts subsurface soils.

" $SSCG_{nc}$ " Site-Specific cleanup goal using a target noncancer hazard = 1

" $SSCG_c$ " Site-Specific cleanup goal using a target cancer risk = 1×10^{-6} for residents

Soil SSCGs based on incidental ingestion, dermal contact with soil, and outdoor air inhalation

[a] Cal-EPA 2009b. Revised California Human Health Screening Levels for Lead. September 2009.

[b] Based on revised residential CHHSL to account for lower exposure frequency and higher ingestion rate (Cal-EPA 2009b)

Table A-10
Site-Specific Cleanup Goals for Soil,
Construction and Utility Maintenance Worker

Chemical of Concern	CAS Number	Construction and Utility Maintenance Worker	
		Soil (mg/kg)	
		$SSCG_{nc}$	$SSCG_{c}$
Inorganics			
Antimony	7440-36-0	3.1E+03	--
Arsenic	7440-38-2	4.1E+02	1.5E+01
Cadmium	7440-43-9	6.4E+02	2.4E+02
Chromium VI	18540-29-9	3.2E+03	6.7E+00
Cobalt	7440-48-4	2.0E+02	1.1E+02
Copper	7440-50-8	3.1E+05	--
Lead	7439-92-1	1.2E+03[a]	--
Thallium	7440-28-0	7.7E+01	--
Vanadium	7440-62-2	3.9E+04	--
Zinc	7440-66-6	2.3E+06	--
PAHs			
Benz[a]anthracene	56-55-3	--	2.6E+02
Benzo[a]pyrene	50-32-8	--	2.6E+01
Benzo[b]fluoranthene	205-99-2	--	2.6E+02
Benzo[k]fluoranthene	207-08-9	--	2.6E+02
Chrysene	218-01-9	--	2.6E+03
Dibenz[a,h]anthracene	53-70-3	--	1.9E+01
Indeno[1,2,3-cd]pyrene	193-39-5	--	2.6E+02
Methylnaphthalene, 1-	90-12-0	1.9E+05	2.7E+03
Methylnaphthalene, 2-	91-57-6	1.1E+04	--
Naphthalene	91-20-3	1.4E+02	3.9E+01
Pyrene	129-00-0	6.7E+04	--
TPH			
Aliphatic: C5-C8		8.3E+02	--
Aliphatic: C9-C18		1.6E+03	--
Aliphatic: C19-C32		5.5E+06	--
Aromatic: C6-C8		--	--
Aromatic: C9-C16		7.5E+02	--
Aromatic: C17-C32		8.3E+04	--
TPHg		8.6E+02	--
TPHd		1.9E+03	--
TPHmo		1.6E+05	--
SVOCs			
2,4-Dinitrotoluene	121-14-2	6.3E+03	2.8E+02
Bis(2-Ethylhexyl) Phthalate	117-81-7	6.3E+04	6.4E+03
VOCs			
1,1,2,2-Tetrachloroethane	79-34-5	8.3E+02	5.7E+00
1,2,3-Trichloropropane	96-18-4	2.0E+00	7.2E+00
1,2,4-Trimethylbenzene	95-63-6	7.5E+01	--
1,2-Dichloropropane	78-87-5	1.2E+01	8.5E+00

Table A-10
Site-Specific Cleanup Goals for Soil,
Construction and Utility Maintenance Worker

Chemical of Concern	CAS Number	Construction and Utility Maintenance Worker	
		Soil (mg/kg)	
		$SSCG_{nc}$	$SSCG_{c}$
1,3,5-Trimethylbenzene	108-67-8	7.7E+01	--
1,4-Dichlorobenzene	106-46-7	8.7E+03	2.8E+01
Benzene	71-43-2	6.9E+01	2.2E+00
Bromodichloromethane	75-27-4	4.9E+02	5.3E+00
Bromomethane	74-83-9	7.8E+00	--
Ethylbenzene	100-41-4	4.5E+03	5.1E+01
Methylene chloride	75-09-2	1.2E+03	5.9E+01
Tetrachloroethene	127-18-4	8.6E+01	1.0E+01
Trichloroethene	79-01-6	5.5E+00	1.9E+01
Vinyl chloride	75-01-4	8.7E+01	3.1E-01

Notes:

" -- " not applicable or not available

" $SSCG_{nc}$ " Site-Specific cleanup goal using a target noncancer hazard = 1

" $SSCG_{c}$ " Site-Specific cleanup goal using a target cancer = 1×10^{-5} for workers

Soil SSCGs based on incidental ingestion, dermal contact with soil, and outdoor air inhalation

[a] Based on revised worker CHHSL to account for lower exposure frequency and higher soil ingestion rate (Cal-EPA 2009b)

Table A-11

Site-Specific Cleanup Goals for Soil Vapor, Construction and Utility Maintenance Worker

Chemical of Concern	CAS Number	Construction and Utility Maintenance Worker Soil Vapor (µg/m³)	
		$SSCG_{nc}$	$SSCG_{c}$
PAHs			
Naphthalene	91-20-3	2.3E+05	6.3E+04
VOCs			
1,1,1-Trichloroethane	71-55-6	7.4E+09	--
1,1,2,2-Tetrachloroethane	79-34-5	1.8E+07	1.2E+05
1,1,2-Trichloroethane	79-00-5	1.0E+05	8.6E+05
1,1-Dichloroethane	75-34-3	9.9E+08	2.5E+07
1,2,4-Trichlorobenzene	120-82-1	3.9E+05	--
1,2,4-Trimethylbenzene	95-63-6	2.3E+06	--
1,2-Dichloroethane	107-06-2	4.4E+06	8.5E+05
1,2-Dichloropropane	78-87-5	3.6E+06	2.5E+06
1,3,5-Trimethylbenzene	108-67-8	2.3E+06	--
1,3-Butadiene	106-99-0	3.7E+06	3.0E+05
1,4-Dichlorobenzene	106-46-7	2.3E+08	7.2E+05
1,4-Dioxane	123-91-1	1.3E+08	1.6E+05
2,2,4-Trimethylpentane	540-84-1	6.5E+08	--
2-Hexanone	591-78-6	7.9E+06	--
4-Ethyltoluene	622-96-8	2.5E+07	--
Benzene	71-43-2	3.2E+07	1.0E+06
Bromodichloromethane	75-27-4	7.2E+07	7.8E+05
Bromomethane	74-83-9	9.5E+06	--
Carbon disulfide	75-15-0	1.4E+09	--
Carbon tetrachloride	56-23-5	1.6E+08	1.1E+06
Chloroform	67-66-3	9.0E+07	4.9E+06
Chloromethane	74-87-3	1.7E+08	--
Cyclohexane	110-82-7	1.8E+10	--
Dibromochloromethane	124-48-1	6.0E+07	8.8E+05
Dichloroethene, cis-1,2-	156-59-2	8.3E+06	--
Dichloroethene, trans-1,2-	156-60-5	9.3E+07	--
Dichloropropene, trans-1,3-	10061-02-6	4.4E+07	3.9E+06
Ethanol	64-17-5	1.9E+08	--
Ethylbenzene	100-41-4	6.3E+08	7.0E+06
Heptane	142-82-5	2.3E+09	--
Hexachloro-1,3-butadiene	87-68-3	4.4E+08	8.0E+04
Hexane	110-54-3	1.7E+09	--
Isopropanol	67-63-0	5.7E+08	--
Isopropylbenzene (cumene)	98-82-8	1.5E+09	--
Methyl ethyl ketone (2-butanone)	78-93-3	1.1E+09	--
Methylene chloride	75-09-2	6.1E+08	2.8E+07
Methyl-tert-butyl ether	1634-04-4	1.8E+09	6.5E+07
Propylbenzene	103-65-1	6.6E+08	--

Table A-11

Site-Specific Cleanup Goals for Soil Vapor, Construction and Utility Maintenance Worker

Chemical of Concern	CAS Number	Construction and Utility Maintenance Worker Soil Vapor (µg/m³)	
		$SSCG_{nc}$	$SSCG_{c}$
tert-Butyl Alcohol (TBA)	75-65-0	2.6E+08	--
Tetrachloroethene	127-18-4	5.5E+07	6.6E+06
Tetrahydrofuran	109-99-9	4.9E+08	--
Toluene	108-88-3	3.7E+09	--
Trichloroethene	79-01-6	2.0E+06	6.7E+06
Vinyl chloride	75-01-4	2.3E+08	8.3E+05
Xylene, m-	108-38-3	6.0E+07	--
Xylene, o-	95-47-6	4.8E+07	--
Xylene, p-	106-42-3	5.9E+07	--

Notes:

" -- " not applicable or not available

" $SSCG_{nc}$ " Site-Specific cleanup goal using a target noncancer hazard = 1

" $SSCG_{c}$ " Site-Specific cleanup goal using a target cancer = 1×10^{-5} for workers

Soil Vapor SSCGs based on outdoor air inhalation of vapors emanating from the subsurface

Table A-12

Site-Specific Cleanup Goals for Soil, Background

Chemical of Concern	CAS Number	SSCG (mg/kg)
Inorganics		
Antimony	7440-36-0	0.74
Arsenic	7440-38-2	12
Barium	7440-39-3	267
Beryllium	7440-41-7	0.56
Cadmium	7440-43-9	3.81
Chromium	16065-83-1	32.5
Chromium VI	18540-29-9	--
Cobalt	7440-48-4	10.9
Copper	7440-50-8	59.0
Lead	7439-92-1	61.5
Mercury	7439-97-6	0.13
Molybdenum	7439-98-7	0.41
Nickel	7440-02-0	20.2
Selenium	7782-49-2	0.78
Silver	7440-22-4	1.29
Thallium	7440-28-0	0.23
Vanadium	7440-62-2	45.7
Zinc	7440-66-6	291
PAHs		
Bap-TEQ		0.9

Notes:

" -- " not available

" SSCG " Site-Specific cleanup goal

Geosyntec consultants

ATTACHMENTS

ATTACHMENT A-1

SSCG Derivation Spreadsheets

Attachment A1, Table A1-1
Derivation of Site-Specific Cleanup Goals, Soil
Onsite Resident
Former Kast Property
Carson, California

CAS Number	Chemical of Concern	Noncancer Effects							Cancer Effects						
		Ingestion		Dermal Contact		Outdoor Inhalation			Ingestion		Dermal Contact		Outdoor Inhalation		
		IF_{oral} (mg/kg-day)	Reference Dose (mg/kg-day)	IF_{dermal} (mg/kg-day)	Reference Dose (mg/kg-day)	$EC_{inh,soil}$ (mg/m^3-mg/kg)	Reference Concentration (mg/m^3)	$SSCG_{soil-nc}$ (mg/kg)	IF_{oral} (mg/kg-day)	Cancer Slope Factor (mg/kg-day)$^{-1}$	IF_{dermal} (mg/kg-day)	Cancer Slope Factor (mg/kg-day)$^{-1}$	$EC_{inh,soil}$ (mg/m^3-mg/kg)	Inhalation Unit Risk (µg/m^3)$^{-1}$	$SSCG_{soil-c}$ (mg/kg)
	Inorganics														
7440-36-0	Antimony	1.3E-05	4.0E-04	--	6.0E-05	3.4E-10	NA	3.1E+01	1.6E-06	NC	--	NC	1.5E-10	NC	--
7440-38-2	Arsenic	1.3E-05	3.0E-04	1.1E-06	3.0E-04	3.4E-10	1.5E-05	2.2E+01	1.6E-06	9.5E+00	1.5E-07	9.5E+00	1.5E-10	3.3E-03	6.1E-02
7440-43-9	Cadmium	1.3E-05	1.0E-03	3.6E-08	2.5E-05	3.4E-10	2.0E-05	7.0E+01	1.6E-06	NC	4.9E-09	NC	1.5E-10	4.2E-03	1.6E+03
18540-29-9	Chromium VI	1.3E-05	3.0E-03	--	7.5E-05	3.4E-10	1.0E-04	2.3E+02	1.6E-06	5.0E-01	--	NC	1.5E-10	1.5E-01	1.2E+00
7440-48-4	Cobalt	1.3E-05	3.0E-04	--	3.0E-04	3.4E-10	6.0E-06	2.3E+01	1.6E-06	NC	--	NC	1.5E-10	9.0E-03	7.6E+02
7440-50-8	Copper	1.3E-05	4.0E-02	--	4.0E-02	3.4E-10	NA	3.1E+03	1.6E-06	NC	--	NC	1.5E-10	NC	--
7439-92-1	Lead	1.3E-05	NA	--	NA	3.4E-10	NA	--	1.6E-06	NC	--	NC	1.5E-10	NC	--
7440-28-0	Thallium	1.3E-05	1.0E-05	--	1.0E-05	3.4E-10	NA	7.8E-01	1.6E-06	NC	--	NC	1.5E-10	NC	--
7440-62-2	Vanadium	1.3E-05	5.0E-03	--	5.0E-03	3.4E-10	NA	3.9E+02	1.6E-06	NC	--	NC	1.5E-10	NC	--
7440-66-6	Zinc	1.3E-05	3.0E-01	--	3.0E-01	3.4E-10	NA	2.3E+04	1.6E-06	NC	--	NC	1.5E-10	NC	--
	PAHs														
56-55-3	Benz[a]anthracene	1.3E-05	NA	4.7E-06	NA	3.4E-10	NA	--	1.6E-06	2.9E-01	6.4E-07	2.9E-01	1.5E-10	1.1E-04	1.6E+00
50-32-8	Benzo[a]pyrene	1.3E-05	NA	4.7E-06	NA	3.4E-10	NA	--	1.6E-06	2.9E+00	6.4E-07	2.9E+00	1.5E-10	1.1E-03	1.6E-01
205-99-2	Benzo[b]fluoranthene	1.3E-05	NA	4.7E-06	NA	3.4E-10	NA	--	1.6E-06	2.9E-01	6.4E-07	2.9E-01	1.5E-10	1.1E-04	1.6E+00
207-08-9	Benzo[k]fluoranthene	1.3E-05	NA	4.7E-06	NA	3.4E-10	NA	--	1.6E-06	2.9E-01	6.4E-07	2.9E-01	1.5E-10	1.1E-04	1.6E+00
218-01-9	Chrysene	1.3E-05	NA	4.7E-06	NA	3.4E-10	NA	--	1.6E-06	2.9E-02	6.4E-07	2.9E-02	1.5E-10	1.1E-05	1.6E+01
53-70-3	Dibenz[a,h]anthracene	1.3E-05	NA	4.7E-06	NA	3.4E-10	NA	--	1.6E-06	4.1E+00	6.4E-07	4.1E+00	1.5E-10	1.2E-03	1.1E-01
193-39-5	Indeno[1,2,3-cd]pyrene	1.3E-05	NA	4.7E-06	NA	3.4E-10	NA	--	1.6E-06	2.9E-01	6.4E-07	2.9E-01	1.5E-10	1.1E-04	1.6E+00
90-12-0	Methylnaphthalene, 1-	1.3E-05	7.0E-02	4.7E-06	7.0E-02	1.4E-05	NA	4.0E+03	1.6E-06	2.9E-02	6.4E-07	2.9E-02	5.9E-06	NC	1.6E+01
91-57-6	Methylnaphthalene, 2-	1.3E-05	4.0E-03	4.7E-06	4.0E-03	1.4E-05	NA	2.3E+02	1.6E-06	NC	6.4E-07	NC	6.1E-06	NC	--
91-20-3	Naphthalene	1.3E-05	2.0E-02	4.7E-06	2.0E-02	1.7E-05	3.0E-03	1.5E+02	1.6E-06	NC	6.4E-07	NC	7.4E-06	3.4E-05	4.0E+00
129-00-0	Pyrene	1.3E-05	3.0E-02	4.7E-06	3.0E-02	2.5E-07	1.1E-01	1.7E+03	1.6E-06	NC	6.4E-07	NC	1.1E-07	NC	--
	TPH														
1	Aliphatic: C5-C8	1.3E-05	4.0E-02	4.7E-06	4.0E-02	6.8E-04	7.0E-01	7.1E+02	1.6E-06	NC	6.4E-07	NC	2.9E-04	NC	--
2	Aliphatic: C9-C18	1.3E-05	1.0E-01	4.7E-06	1.0E-01	1.6E-04	3.0E-01	1.4E+03	1.6E-06	NC	6.4E-07	NC	6.7E-05	NC	--
3	Aliphatic: C19-C32	1.3E-05	2.0E+00	4.7E-06	2.0E+00	--	NA	1.1E+05	1.6E-06	NC	6.4E-07	NC	--	NC	--
4	Aromatic: C6-C8	1.3E-05	NA	4.7E-06	NA	2.2E-04	NA	--	1.6E-06	NC	6.4E-07	NC	9.6E-05	NC	--

Attachment A1, Table A1-1
Derivation of Site-Specific Cleanup Goals, Soil
Onsite Resident
Former Kast Property
Carson, California

CAS Number	Chemical of Concern	Noncancer Effects							Cancer Effects						
		Ingestion		Dermal Contact		Outdoor Inhalation			Ingestion		Dermal Contact		Outdoor Inhalation		
		IF_{oral} (mg/kg-day)	Reference Dose (mg/kg-day)	IF_{dermal} (mg/kg-day)	Reference Dose (mg/kg-day)	$EC_{inh,soil}$ (mg/m^3-mg/kg)	Reference Concentration (mg/m^3)	$SSCG_{soil-nc}$ (mg/kg)	IF_{oral} (mg/kg-day)	Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	IF_{dermal} (mg/kg-day)	Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	$EC_{inh,soil}$ (mg/m^3-mg/kg)	Inhalation Unit Risk $(\mu g/m^3)^{-1}$	$SSCG_{soil-c}$ (mg/kg)
5	Aromatic: C9-C16	1.3E-05	3.0E-02	4.7E-06	3.0E-02	5.3E-05	5.0E-02	6.0E+02	1.6E-06	NC	6.4E-07	NC	2.3E-05	NC	–
6	Aromatic: C17-C32	1.3E-05	3.0E-02	4.7E-06	3.0E-02	--	NA	1.7E+03	1.6E-06	NC	6.4E-07	NC	--	NC	–
	SVOCs														
121-14-2	2,4-Dinitrotoluene	1.3E-05	2.0E-03	3.7E-06	2.0E-03	3.4E-10	7.0E-03	1.2E+02	1.6E-06	3.1E-01	5.0E-07	3.1E-01	1.6E-10	8.9E-05	1.6E+00
117-81-7	Bis(2-Ethylhexyl) Phthalate	1.3E-05	2.0E-02	3.6E-06	2.0E-02	3.4E-10	7.0E-02	1.2E+03	1.6E-06	1.4E-02	4.9E-07	1.4E-02	1.5E-10	2.4E-06	3.5E+01
	VOCs														
79-34-5	1,1,2,2-Tetrachloroethane	1.3E-05	2.0E-02	–	2.0E-02	6.9E-05	7.0E-02	6.2E+02	1.6E-06	2.7E-01	–	2.7E-01	2.9E-05	5.8E-05	4.7E-01
96-18-4	1,2,3-Trichloropropane	1.3E-05	4.0E-03	–	4.0E-03	1.3E-04	3.0E-04	2.4E+00	1.6E-06	3.0E+01	–	3.0E+01	5.4E-06	NC	2.1E-02
95-63-6	1,2,4-Trimethylbenzene	1.3E-05	1.0E-02	–	1.0E-02	7.6E-05	7.0E-03	8.3E+01	1.6E-06	NC	–	NC	3.2E-05	NC	--
78-87-5	1,2-Dichloropropane	1.3E-05	9.0E-02	–	9.0E-02	2.7E-04	4.0E-03	1.5E+01	1.6E-06	3.6E-02	–	3.6E-02	1.2E-04	1.0E-05	8.3E-01
108-67-8	1,3,5-Trimethylbenzene	1.3E-05	1.0E-02	–	1.0E-02	7.4E-05	7.0E-03	8.5E+01	1.6E-06	NC	–	NC	3.2E-05	NC	–
106-46-7	1,4-Dichlorobenzene	1.3E-05	7.0E-02	--	7.0E-02	7.4E-05	8.0E-01	3.6E+03	1.6E-06	5.4E-03	–	5.4E-03	3.2E-05	1.1E-05	2.8E+00
71-43-2	Benzene	1.3E-05	4.0E-03	--	4.0E-03	3.5E-04	3.0E-02	6.7E+01	1.6E-06	1.0E-01	–	1.0E-01	1.5E-04	2.9E-05	2.2E-01
75-27-4	Bromodichloromethane	1.3E-05	2.0E-02	--	2.0E-02	1.2E-04	7.0E-02	4.3E+02	1.6E-06	1.3E-01	–	1.3E-01	5.0E-05	3.7E-05	4.9E-01
74-83-9	Bromomethane	1.3E-05	1.4E-03	–	1.4E-03	5.2E-04	5.0E-03	8.8E+00	1.6E-06	NC	–	NC	2.2E-04	NC	--
100-41-4	Ethylbenzene	1.3E-05	1.0E-01	–	1.0E-01	1.8E-04	1.0E+00	3.3E+03	1.6E-06	1.1E-02	–	1.1E-02	7.7E-05	2.5E-06	4.8E+00
75-09-2	Methylene chloride	1.3E-05	6.0E-03	–	6.0E-03	3.9E-04	6.0E-01	3.6E+02	1.6E-06	1.4E-02	–	1.4E-02	1.7E-04	1.0E-06	5.3E+00
127-18-4	Tetrachloroethene	1.3E-05	6.0E-03	–	6.0E-03	3.8E-04	4.0E-02	8.6E+01	1.6E-06	5.4E-01	–	5.4E-01	1.6E-04	5.9E-06	5.5E-01
79-01-6	Trichloroethene	1.3E-05	5.0E-04	–	6.0E-04	3.0E-04	2.0E-03	5.8E+00	1.6E-06	4.6E-02	–	4.6E-02	1.3E-04	4.1E-06	1.7E+00
75-01-4	Vinyl chloride	1.3E-05	3.0E-03	–	3.0E-03	9.3E-04	1.0E-01	7.4E+01	1.6E-06	2.7E-01	–	2.7E-01	4.0E-04	7.8E-05	3.2E-02

Note: " – " not applicable

Attachment A1, Table A1-2
Derivation of Site-Specific Cleanup Goals, Soil
Onsite Resident, Infrequent Exposure to Subsurface Soils
Former Kast Property
Carson, California

CAS Number	Chemical of Concern	Noncancer Effects							Cancer Effects						
		Ingestion		Dermal Contact		Outdoor Inhalation			Ingestion		Dermal Contact		Outdoor Inhalation		
		IF_{oral} (mg/kg-day)	Reference Dose (mg/kg-day)	IF_{dermal} (mg/kg-day)	Reference Dose (mg/kg-day)	$EC_{inh,soil}$ (mg/m^3-mg/kg)	Reference Concentration (mg/m^3)	$SSCG_{soil-nc}$ (mg/kg)	IF_{oral} (mg/kg-day)	Cancer Slope Factor (mg/kg-day)$^{-1}$	IF_{dermal} (mg/kg-day)	Cancer Slope Factor (mg/kg-day)$^{-1}$	$EC_{inh,soil}$ (mg/m^3-mg/kg)	Inhalation Unit Risk (µg/m^3)$^{-1}$	$SSCG_{soil-c}$ (mg/kg)
	Inorganics														
7440-36-0	Antimony	1.5E-07	4.0E-04	--	6.0E-05	3.9E-12	NA	2.7E+03	1.8E-08	NC	--	NC	1.7E-12	NC	--
7440-38-2	Arsenic	1.6E-07	3.0E-04	1.2E-08	3.0E-04	3.9E-12	1.5E-05	1.9E+03	1.8E-08	9.5E+00	1.7E-09	9.5E+00	1.7E-12	3.3E-03	5.4E+00
7440-43-9	Cadmium	1.5E-07	1.0E-03	4.1E-10	2.5E-05	3.9E-12	2.0E-05	6.1E+03	1.8E-08	NC	5.6E-11	NC	1.7E-12	4.2E-03	1.4E+05
18540-29-9	Chromium VI	1.6E-07	3.0E-03	--	7.5E-05	3.9E-12	1.0E-04	2.1E+04	1.8E-08	5.0E-01	--	NC	1.7E-12	1.5E-01	1.1E+02
7440-48-4	Cobalt	1.5E-07	3.0E-04	--	3.0E-04	3.9E-12	6.0E-06	2.1E+03	1.8E-08	NC	--	NC	1.7E-12	9.0E-03	6.7E+04
7440-50-8	Copper	1.5E-07	4.0E-02	--	4.0E-02	3.9E-12	NA	2.7E+05	1.8E-08	NC	--	NC	1.7E-12	NC	--
7439-92-1	Lead	1.5E-07	NA	--	NA	3.9E-12	NA	--	1.8E-08	NC	--	NC	1.7E-12	NC	--
7440-28-0	Thallium	1.5E-07	1.0E-05	--	1.0E-05	3.9E-12	NA	6.8E+01	1.8E-08	NC	--	NC	1.7E-12	NC	--
7440-62-2	Vanadium	1.5E-07	5.0E-03	--	5.0E-03	3.9E-12	NA	3.4E+04	1.8E-08	NC	--	NC	1.7E-12	NC	--
7440-66-6	Zinc	1.5E-07	3.0E-01	--	3.0E-01	3.9E-12	NA	2.1E+06	1.8E-08	NC	--	NC	1.7E-12	NC	--
	PAHs														
56-55-3	Benz[a]anthracene	1.5E-07	NA	5.3E-08	NA	3.9E-12	NA	--	1.8E-08	2.9E-01	7.3E-09	2.9E-01	1.7E-12	1.1E-04	1.4E+02
50-32-8	Benzo[a]pyrene	1.5E-07	NA	5.3E-08	NA	3.9E-12	NA	--	1.8E-08	2.9E+00	7.3E-09	2.9E+00	1.7E-12	1.1E-03	1.4E+01
205-99-2	Benzo[b]fluoranthene	1.5E-07	NA	5.3E-08	NA	3.9E-12	NA	--	1.8E-08	2.9E-01	7.3E-09	2.9E-01	1.7E-12	1.1E-04	1.4E+02
207-08-9	Benzo[k]fluoranthene	1.5E-07	NA	5.3E-08	NA	3.9E-12	NA	--	1.8E-08	2.9E-01	7.3E-09	2.9E-01	1.7E-12	1.1E-04	1.4E+02
218-01-9	Chrysene	1.5E-07	NA	5.3E-08	NA	3.9E-12	NA	--	1.8E-08	2.9E-02	7.3E-09	2.9E-02	1.7E-12	1.1E-05	1.4E+03
53-70-3	Dibenz[a,h]anthracene	1.5E-07	NA	5.3E-08	NA	3.9E-12	NA	--	1.8E-08	4.1E+00	7.3E-09	4.1E+00	1.7E-12	1.2E-03	9.7E+00
193-39-5	Indeno[1,2,3-cd]pyrene	1.5E-07	NA	5.3E-08	NA	3.9E-12	NA	--	1.8E-08	2.9E-01	7.3E-09	2.9E-01	1.7E-12	1.1E-04	1.4E+02
90-12-0	Methylnaphthalene, 1-	1.5E-07	7.0E-02	5.3E-08	7.0E-02	1.6E-07	NA	3.5E+05	1.8E-08	2.9E-02	7.3E-09	2.9E-02	6.7E-08	NC	1.4E+03
91-57-6	Methylnaphthalene, 2-	1.5E-07	4.0E-03	5.3E-08	4.0E-03	1.6E-07	NA	2.0E+04	1.8E-08	NC	7.3E-09	NC	7.0E-08	NC	--
91-20-3	Naphthalene	1.5E-07	2.0E-02	5.3E-08	2.0E-02	2.0E-07	3.0E-03	1.3E+04	1.8E-08	NC	7.3E-09	NC	8.5E-08	3.4E-05	3.5E+02
129-00-0	Pyrene	1.5E-07	3.0E-02	5.3E-08	3.0E-02	2.9E-09	1.1E-01	1.5E+05	1.8E-08	NC	7.3E-09	NC	1.2E-09	NC	--
	TPH														
1	Aliphatic: C5-C8	1.5E-07	4.0E-02	5.3E-08	4.0E-02	7.8E-06	7.0E-01	6.2E+04	1.8E-08	NC	7.3E-09	NC	3.3E-06	NC	--
2	Aliphatic: C9-C18	1.5E-07	1.0E-01	5.3E-08	1.0E-01	1.8E-06	3.0E-01	1.3E+06	1.8E-08	NC	7.3E-09	NC	7.6E-07	NC	--
3	Aliphatic: C19-C32	1.5E-07	2.0E+00	5.3E-08	2.0E+00	--	NA	1.0E+07	1.8E-08	NC	7.3E-09	NC	--	NC	--
4	Aromatic: C6-C8	1.5E-07	NA	5.3E-08	NA	2.6E-06	NA	--	1.8E-08	NC	7.3E-09	NC	1.1E-06	NC	--

Attachment A1, Table A1-2
Derivation of Site-Specific Cleanup Goals, Soil
Onsite Resident, Infrequent Exposure to Subsurface Soils
Former Kast Property
Carson, California

CAS Number	Chemical of Concern	Noncancer Effects							Cancer Effects						
		Ingestion		Dermal Contact		Outdoor Inhalation			Ingestion		Dermal Contact		Outdoor Inhalation		
		IF_{oral} (mg/kg-day)	Reference Dose (mg/kg-day)	IF_{dermal} (mg/kg-day)	Reference Dose (mg/kg-day)	$EC_{inh,soil}$ (mg/m^3-mg/kg)	Reference Concentration (mg/m^3)	$SSCG_{soil-nc}$ (mg/kg)	IF_{oral} (mg/kg-day)	Cancer Slope Factor (mg/kg-day)$^{-1}$	IF_{dermal} (mg/kg-day)	Cancer Slope Factor (mg/kg-day)$^{-1}$	$EC_{inh,soil}$ (mg/m^3-mg/kg)	Inhalation Unit Risk (µg/m^3)$^{-1}$	$SSCG_{soil-c}$ (mg/kg)
5	Aromatic: C9-C16	1.5E-07	3.0E-02	5.3E-08	3.0E-02	6.1E-07	5.0E-02	**5.3E+04**	1.8E-08	NC	7.3E-09	NC	2.6E-07	NC	--
6	Aromatic: C17-C32	1.5E-07	3.0E-02	5.3E-08	3.0E-02	--	NA	**1.5E+05**	1.8E-08	NC	7.3E-09	NC	--	NC	--
	SVOCs														
121-14-2	2,4-Dinitrotoluene	1.5E-07	2.0E-03	4.2E-08	2.0E-03	3.9E-12	7.0E-03	**1.1E+04**	1.8E-08	3.1E-01	6.8E-09	3.1E-01	1.7E-12	8.9E-05	**1.4E+02**
117-81-7	Bis(2-Ethylhexyl) Phthalate	1.5E-07	2.0E-02	4.1E-08	2.0E-02	3.9E-12	7.0E-02	**1.1E+05**	1.8E-08	1.4E-02	5.6E-09	1.4E-02	1.7E-12	2.4E-06	**3.0E+03**
	VOCs														
79-34-5	1,1,2,2-Tetrachloroethane	1.5E-07	2.0E-02	--	2.0E-02	7.8E-07	7.0E-02	**5.4E+04**	1.8E-08	2.7E-01	--	2.7E-01	3.4E-07	5.8E-05	**4.1E+01**
96-18-4	1,2,3-Trichloropropane	1.5E-07	4.0E-03	--	4.0E-03	1.4E-06	3.0E-04	**2.1E+02**	1.8E-08	3.0E+01	--	3.0E+01	6.1E-07	NC	**1.9E+00**
95-63-6	1,2,4-Trimethylbenzene	1.5E-07	1.0E-02	--	1.0E-02	8.7E-07	7.0E-03	**7.2E+03**	1.8E-08	NC	--	NC	3.7E-07	NC	--
78-87-5	1,2-Dichloropropane	1.5E-07	9.0E-02	--	9.0E-02	3.1E-06	4.0E-03	**1.3E+03**	1.8E-08	3.6E-02	--	3.6E-02	1.3E-06	1.0E-05	**7.2E+01**
108-67-8	1,3,5-Trimethylbenzene	1.5E-07	1.0E-02	--	1.0E-02	8.4E-07	7.0E-03	**7.4E+03**	1.8E-08	NC	--	NC	3.6E-07	NC	--
106-46-7	1,4-Dichlorobenzene	1.5E-07	7.0E-02	--	7.0E-02	8.5E-07	8.0E-01	**3.2E+05**	1.8E-08	5.4E-03	--	5.4E-03	3.6E-07	1.1E-05	**2.4E+02**
71-43-2	Benzene	1.5E-07	4.0E-03	--	4.0E-03	4.0E-06	3.0E-02	**5.8E+03**	1.8E-08	1.0E-01	--	1.0E-01	1.7E-06	2.9E-05	**1.9E+01**
75-27-4	Bromodichloromethane	1.5E-07	2.0E-02	--	2.0E-02	1.3E-06	7.0E-02	**3.8E+04**	1.8E-08	1.3E-01	--	1.3E-01	5.7E-07	3.7E-05	**4.2E+01**
74-83-9	Bromomethane	1.5E-07	1.4E-03	--	1.4E-03	6.0E-06	5.0E-03	**7.7E+02**	1.8E-08	NC	--	NC	2.6E-06	NC	--
100-41-4	Ethylbenzene	1.5E-07	1.0E-01	--	1.0E-01	2.0E-06	1.0E+00	**2.9E+05**	1.8E-08	1.1E-02	--	1.1E-02	8.8E-07	2.5E-06	**4.2E+02**
75-09-2	Methylene chloride	1.5E-07	6.0E-03	--	6.0E-03	4.4E-06	6.0E-01	**3.2E+04**	1.8E-08	1.4E-02	--	1.4E-02	1.9E-06	1.0E-06	**4.7E+02**
127-18-4	Tetrachloroethene	1.5E-07	6.0E-03	--	6.0E-03	4.3E-06	4.0E-02	**7.5E+03**	1.8E-08	5.4E-01	--	5.4E-01	1.9E-06	5.9E-06	**4.9E+01**
79-01-6	Trichloroethene	1.5E-07	5.0E-04	--	5.0E-04	3.4E-06	2.0E-03	**5.0E+02**	1.8E-08	4.6E-02	--	4.6E-02	1.5E-06	4.1E-06	**1.5E+02**
75-01-4	Vinyl chloride	1.5E-07	3.0E-03	--	3.0E-03	1.1E-05	1.0E-01	**6.4E+03**	1.8E-08	2.7E-01	--	2.7E-01	4.6E-06	7.8E-05	**2.8E+00**

Note: " -- " not applicable

Attachment A1, Table A1-3
Derivation of Site-Specific Cleanup Goal, Lead in Soil
Onsite Resident, Infrequent Exposure to Subsurface Soils
Former Kast Property
Carson, California

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 05/19/03

Exposure Variable	PRG Equation[1]		Description of Exposure Variable	Units	Values for Non-Residential Exposure Scenario			
					Using Equation 1		Using Equation 2	
	1*	2**			GSDi = Hom	GSDi = Het	GSDi = Hom	GSDi = Het
$PbB_{fetal, 0.95}$	X	X	95th percentile PbB in fetus	ug/dL	1	1	1	1
$R_{fetal/maternal}$	X	X	Fetal/maternal PbB ratio	--	0.9	0.9	0.9	0.9
BKSF	X	X	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4	0.4	0.4
GSD_i	X	X	Geometric standard deviation PbB	--	1.8	1.8	1.8	1.8
PbB_0	X	X	Baseline PbB	ug/dL	0.0	0.0	0.0	0.0
IR_S	X		Soil ingestion rate (including soil-derived indoor dust)	g/day	0.100	0.100	--	--
IR_{S+D}		X	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--	0.100	0.100
W_S		X	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--	--	1.0	1.0
K_{SD}		X	Mass fraction of soil in dust	--	--	--	0.7	0.7
$AF_{S, D}$	X	X	Absorption fraction (same for soil and dust)	--	0.12	0.12	0.12	0.12
$EF_{S, D}$	X	X	Exposure frequency (same for soil and dust)	days/yr	4	4	4	4
$AT_{S, D}$	X	X	Averaging time (same for soil and dust)	days/yr	365	365	365	365
SSCG			**Site-Specific Cleanup Goal**	ppm	**9.9E+03**	**9.9E+03**	**9.9E+03**	**9.9E+03**

[1] Equation 1 does not apportion exposure between soil and dust ingestion (excludes W_S, K_{SD}).
When $IR_S = IR_{S+D}$ and $W_S = 1.0$, the equations yield the same PRG.

Attachment A1, Table A1-4
Derivation of Site-Specific Cleanup Goals, Soil
Construction and Utility Maintenance Worker
Former Kast Property
Carson, California

CAS Number	Chemical of Concern	Noncancer Effects							Cancer Effects						
		Ingestion		Dermal Contact		Outdoor Inhalation			Ingestion		Dermal Contact		Outdoor Inhalation		
		IF_{oral} (mg/kg-day)	Reference Dose (mg/kg-day)	IF_{dermal} (mg/kg-day)	Reference Dose (mg/kg-day)	$EC_{inh,soil}$ (mg/m³-mg/kg)	Reference Concentration (mg/m³)	$SSCG_{soil-nc}$ (mg/kg)	IF_{oral} (mg/kg-day)	Cancer Slope Factor (mg/kg-day)⁻¹	IF_{dermal} (mg/kg-day)	Cancer Slope Factor (mg/kg-day)⁻¹	$EC_{inh,soil}$ (mg/m³-mg/kg)	Inhalation Unit Risk (µg/m³)⁻¹	$SSCG_{soil-c}$ (mg/kg)
	Inorganics														
7440-36-0	Antimony	1.3E-07	4.0E-04	–	6.0E-05	2.7E-08	NA	3.1E+03	4.6E-08	NC	--	NC	9.8E-09	NC	--
7440-38-2	Arsenic	1.3E-07	3.0E-04	5.4E-08	3.0E-04	2.7E-08	1.5E-05	4.1E+02	4.6E-08	9.5E+00	1.9E-08	9.5E+00	9.8E-09	3.3E-03	1.5E+01
7440-43-9	Cadmium	1.3E-07	1.0E-03	1.6E-09	2.5E-05	2.7E-08	2.0E-05	6.4E+02	4.6E-08	NC	6.4E-10	NC	9.8E-09	4.2E-03	2.4E+02
18540-29-9	Chromium VI	1.3E-07	3.0E-03	–	7.5E-05	2.7E-08	1.0E-04	3.2E+03	4.6E-08	5.0E-01	--	NC	9.8E-09	1.5E-01	6.7E+00
7440-48-4	Cobalt	1.3E-07	3.0E-04	–	3.0E-04	2.7E-08	6.0E-06	2.0E+02	4.6E-08	NC	--	NC	9.8E-09	9.0E-03	1.1E+02
7440-50-8	Copper	1.3E-07	4.0E-02	–	4.0E-02	2.7E-08	NA	3.1E+05	4.6E-08	NC	--	NC	9.8E-09	NC	--
7439-92-1	Lead	1.3E-07	NA	–	NA	2.7E-08	NA	–	4.6E-08	NC	--	NC	9.8E-09	NC	--
7440-28-0	Thallium	1.3E-07	1.0E-05	–	1.0E-05	2.7E-08	NA	7.7E+01	4.6E-08	NC	--	NC	9.8E-09	NC	--
7440-62-2	Vanadium	1.3E-07	5.0E-03	--	5.0E-03	2.7E-08	NA	3.9E+04	4.6E-08	NC	--	NC	9.8E-09	NC	--
7440-66-6	Zinc	1.3E-07	3.0E-01	–	3.0E-01	2.7E-08	NA	2.3E+06	4.6E-08	NC	--	NC	9.8E-09	NC	--
	PAHs														
56-55-3	Benz[a]anthracene	1.3E-07	NA	2.3E-07	NA	2.7E-08	NA	--	4.6E-08	2.9E-01	8.3E-08	2.9E-01	9.8E-09	1.1E-04	2.6E+02
50-32-8	Benzo[a]pyrene	1.3E-07	NA	2.3E-07	NA	2.7E-08	NA	--	4.6E-08	2.9E+00	8.3E-08	2.9E+00	9.8E-09	1.1E-03	2.6E+01
205-99-2	Benzo[b]fluoranthene	1.3E-07	NA	2.3E-07	NA	2.7E-08	NA	--	4.6E-08	2.9E-01	8.3E-08	2.9E-01	9.8E-09	1.1E-04	2.6E+02
207-08-9	Benzo[k]fluoranthene	1.3E-07	NA	2.3E-07	NA	2.7E-08	NA	--	4.6E-08	2.9E-01	8.3E-08	2.9E-01	9.8E-09	1.1E-04	2.6E+02
218-01-9	Chrysene	1.3E-07	NA	2.3E-07	NA	2.7E-08	NA	--	4.6E-08	2.9E-02	8.3E-08	2.9E-02	9.8E-09	1.1E-05	2.6E+03
53-70-3	Dibenz[a,h]anthracene	1.3E-07	NA	2.3E-07	NA	2.7E-08	NA	--	4.6E-08	4.1E+00	8.3E-08	4.1E+00	9.8E-09	1.2E-03	1.9E+01
193-39-5	Indeno[1,2,3-cd]pyrene	1.3E-07	NA	2.3E-07	NA	2.7E-08	NA	--	4.6E-08	2.9E-01	8.3E-08	2.9E-01	9.8E-09	1.1E-04	2.6E+02
90-12-0	Methylnaphthalene, 1-	1.3E-07	7.0E-02	2.3E-07	7.0E-02	1.7E-05	NA	1.9E+05	4.6E-08	2.9E-02	8.3E-08	2.9E-02	6.0E-06	NC	2.7E+03
91-57-6	Methylnaphthalene, 2-	1.3E-07	4.0E-03	2.3E-07	4.0E-03	1.7E-05	NA	1.1E+04	4.6E-08	NC	8.3E-08	NC	6.2E-06	NC	--
91-20-3	Naphthalene	1.3E-07	2.0E-02	2.3E-07	2.0E-02	2.1E-05	3.0E-03	1.4E+02	4.6E-08	NC	8.3E-08	NC	7.6E-06	3.4E-05	3.9E+01
129-00-0	Pyrene	1.3E-07	3.0E-02	2.3E-07	3.0E-02	3.1E-07	1.1E-01	6.7E+04	4.6E-08	NC	8.3E-08	NC	1.1E-07	NC	--
	TPH														
1	Aliphatic: C5-C8	1.3E-07	4.0E-02	2.3E-07	4.0E-02	8.4E-04	7.0E-01	8.3E+02	4.6E-08	NC	8.3E-08	NC	3.0E-04	NC	--
2	Aliphatic: C9-C18	1.3E-07	1.0E-01	2.3E-07	1.0E-01	1.9E-04	3.0E-01	1.6E+03	4.6E-08	NC	8.3E-08	NC	6.8E-05	NC	--
3	Aliphatic: C19-C32	1.3E-07	2.0E+00	2.3E-07	2.0E+00	--	NA	5.5E+06	4.6E-08	NC	8.3E-08	NC	--	NC	--
4	Aromatic: C6-C8	1.3E-07	NA	2.3E-07	NA	2.8E-04	NA	--	4.6E-08	NC	8.3E-08	NC	9.8E-05	NC	--
5	Aromatic: C9-C16	1.3E-07	3.0E-02	2.3E-07	3.0E-02	6.6E-05	5.0E-02	7.5E+02	4.6E-08	NC	8.3E-08	NC	2.3E-05	NC	--

Attachment A1, Table A1-4
Derivation of Site-Specific Cleanup Goals, Soil
Construction and Utility Maintenance Worker
Former Kast Property
Carson, California

CAS Number	Chemical of Concern	Noncancer Effects							Cancer Effects						
		Ingestion		Dermal Contact		Outdoor Inhalation			Ingestion		Dermal Contact		Outdoor Inhalation		
		IF_{oral} (mg/kg-day)	Reference Dose (mg/kg-day)	IF_{dermal} (mg/kg-day)	Reference Dose (mg/kg-day)	$EC_{inh,soil}$ (mg/m^3-mg/kg)	Reference Concentration (mg/m^3)	$SSCG_{soil-nc}$ (mg/kg)	IF_{oral} (mg/kg-day)	Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	IF_{dermal} (mg/kg-day)	Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	$EC_{inh,soil}$ (mg/m^3-mg/kg)	Inhalation Unit Risk $(\mu g/m^3)^{-1}$	$SSCG_{soil-c}$ (mg/kg)
6	Aromatic: C17-C32	1.3E-07	3.0E-02	2.3E-07	3.0E-02	--	NA	8.3E+04	4.6E-08	NC	8.3E-08	NC	--	NC	--
	SVOCs														
121-14-2	2.4-Dinitrotoluene	1.3E-07	2.0E-03	1.8E-07	2.0E-03	2.7E-08	7.0E-03	6.3E+03	4.6E-08	3.1E-01	6.5E-08	3.1E-01	9.8E-09	8.9E-05	2.8E+02
117-81-7	Bis(2-Ethylhexyl) Phthalate	1.3E-07	2.0E-02	1.8E-07	2.0E-02	2.7E-08	7.0E-02	6.3E+04	4.6E-08	1.4E-02	6.4E-08	1.4E-02	9.8E-09	2.4E-06	6.4E+03
	VOCs														
79-34-5	1,1,2,2-Tetrachloroethane	1.3E-07	2.0E-02	--	2.0E-02	8.4E-05	7.0E-02	8.3E+02	4.6E-08	2.7E-01	--	2.7E-01	3.0E-05	5.8E-05	6.7E+00
96-18-4	1,2,3-Trichloropropane	1.3E-07	4.0E-03	--	4.0E-03	1.5E-04	3.0E-04	2.0E+00	4.6E-08	3.0E+01	--	3.0E+01	5.5E-05	NC	7.2E+00
95-63-6	1,2,4-Trimethylbenzene	1.3E-07	1.0E-02	--	1.0E-02	9.3E-05	7.0E-03	7.5E+01	4.6E-08	NC	--	NC	3.3E-05	NC	--
78-87-5	1,2-Dichloropropane	1.3E-07	9.0E-02	--	9.0E-02	3.3E-04	4.0E-03	1.2E+01	4.6E-08	3.6E-02	--	3.6E-02	1.2E-04	1.0E-05	8.5E+00
108-67-8	1,3,5-Trimethylbenzene	1.3E-07	1.0E-02	--	1.0E-02	9.0E-05	7.0E-03	7.7E+01	4.6E-08	NC	--	NC	3.2E-05	NC	--
106-46-7	1,4-Dichlorobenzene	1.3E-07	7.0E-02	--	7.0E-02	9.1E-05	8.0E-01	8.7E+03	4.6E-08	5.4E-03	--	5.4E-03	3.2E-05	1.1E-05	2.8E+01
71-43-2	Benzene	1.3E-07	4.0E-03	--	4.0E-03	4.3E-04	3.0E-02	6.9E+01	4.6E-08	1.0E-01	--	1.0E-01	1.5E-04	2.9E-05	2.2E+00
75-27-4	Bromodichloromethane	1.3E-07	2.0E-02	--	2.0E-02	1.4E-04	7.0E-02	4.9E+02	4.6E-08	1.3E-01	--	1.3E-01	5.1E-05	3.7E-05	5.3E+00
74-83-9	Bromomethane	1.3E-07	1.4E-03	--	1.4E-03	6.4E-04	5.0E-03	7.8E+00	4.6E-08	NC	--	NC	2.3E-04	NC	--
100-41-4	Ethylbenzene	1.3E-07	1.0E-01	--	1.0E-01	2.2E-04	1.0E+00	4.5E+03	4.6E-08	1.1E-02	--	1.1E-02	7.8E-05	2.5E-06	5.1E+01
75-09-2	Methylene chloride	1.3E-07	6.0E-03	--	6.0E-03	4.7E-04	6.0E-01	1.2E+03	4.6E-08	1.4E-02	--	1.4E-02	1.7E-04	1.0E-06	6.9E+01
127-18-4	Tetrachloroethene	1.3E-07	6.0E-03	--	6.0E-03	4.6E-04	4.0E-02	6.6E+01	4.6E-08	5.4E-01	--	5.4E-01	1.7E-04	5.9E-06	1.0E+01
79-01-6	Trichloroethene	1.3E-07	5.0E-04	--	5.0E-04	3.6E-04	2.0E-03	5.5E+00	4.6E-08	4.6E-02	--	4.6E-02	1.3E-04	4.1E-06	1.9E+01
75-01-4	Vinyl chloride	1.3E-07	3.0E-03	--	3.0E-03	1.1E-03	1.0E-01	8.7E+01	4.6E-08	2.7E-01	--	2.7E-01	4.1E-04	7.8E-05	3.1E-01

Note: " -- " not applicable

Attachment A1, Table A1-5
Derivation of Site-Specific Cleanup Goals, Soil Vapor
Construction and Utility Maintenance Worker
Former Kast Property
Carson, California

CAS Number	Chemical of Concern	VF_{SV-OA} (µg/m³-µg/m³)	Noncancer Effects			Cancer Effects		
			Exposure Concentration (EC_{SV-OA}) (mg/m³)	Reference Concentration (mg/m³)	**Soil Vapor $SSCG_{nc}$ (µg/m³)**	Exposure Concentration (EC_{SV-OA}) (mg/m³)	Inhalation Unit Risk (µg/m³)⁻¹	**Soil Vapor $SSCG_{c}$ (µg/m³)**
	PAHs							
91-20-3	Naphthalene	2.1E+03	1.3E-08	3.0E-03	**2.3E+05**	4.6E-09	3.4E-05	**6.3E+04**
	VOCs							
71-55-6	1,1,1-Trichloroethane	4.0E+04	6.8E-10	5.0E+00	**7.4E+09**	2.4E-10	NC	--
79-34-5	1,1,2,2-Tetrachloroethane	7.0E+03	3.9E-09	7.0E-02	**1.8E+07**	1.4E-09	5.8E-05	**1.2E+05**
79-00-5	1,1,2-Trichloroethane	1.4E+04	2.0E-09	2.0E-04	**1.0E+05**	7.1E-10	1.6E-05	**8.6E+05**
75-34-3	1,1-Dichloroethane	3.9E+04	7.1E-10	7.0E-01	**9.9E+08**	2.5E-10	1.6E-06	**2.5E+07**
120-82-1	1,2,4-Trichlorobenzene	6.4E+03	5.1E-09	2.0E-03	**3.9E+05**	1.8E-09	NC	--
95-63-6	1,2,4-Trimethylbenzene	9.0E+03	3.0E-09	7.0E-03	**2.3E+06**	1.1E-09	NC	--
107-06-2	1,2-Dichloroethane	1.7E+04	1.6E-09	7.0E-03	**4.4E+06**	5.7E-10	2.1E-05	**8.5E+05**
78-87-5	1,2-Dichloropropane	2.5E+04	1.1E-09	4.0E-03	**3.6E+06**	3.9E-10	1.0E-05	**2.5E+06**
108-67-8	1,3,5-Trimethylbenzene	8.8E+03	3.1E-09	7.0E-03	**2.3E+06**	1.1E-09	NC	--
106-99-0	1,3-Butadiene	5.0E+04	5.5E-10	2.0E-03	**3.7E+06**	2.0E-10	1.7E-04	**3.0E+05**
106-46-7	1,4-Dichlorobenzene	7.8E+03	3.5E-09	8.0E-01	**2.3E+08**	1.3E-09	1.1E-05	**7.2E+05**
123-91-1	1,4-Dioxane	1.2E+03	2.3E-08	3.0E+00	**1.3E+08**	8.1E-09	7.7E-06	**1.6E+05**
540-84-1	2,2,4-Trimethylpentane	1.8E+04	1.5E-09	1.0E+00	**6.5E+08**	5.5E-10	NC	--
591-78-6	2-Hexanone	7.2E+03	3.8E-09	3.0E-02	**7.9E+06**	1.4E-09	NC	--
622-96-8	4-Ethyltoluene	6.7E+03	4.1E-09	1.0E-01	**2.5E+07**	1.5E-09	NC	--
71-43-2	Benzene	2.9E+04	9.5E-10	3.0E-02	**3.2E+07**	3.4E-10	2.9E-05	**1.0E+06**
75-27-4	Bromodichloromethane	2.8E+04	9.7E-10	7.0E-02	**7.2E+07**	3.5E-10	3.7E-05	**7.8E+05**
74-83-9	Bromomethane	5.2E+04	5.3E-10	5.0E-03	**9.5E+06**	1.9E-10	NC	--
75-15-0	Carbon disulfide	5.6E+04	4.9E-10	7.0E-01	**1.4E+09**	1.7E-10	NC	--
56-23-5	Carbon tetrachloride	4.3E+04	6.3E-10	1.0E-01	**1.6E+08**	2.3E-10	4.2E-05	**1.1E+06**
67-66-3	Chloroform	2.5E+04	1.1E-09	9.8E-02	**9.0E+07**	3.9E-10	5.3E-06	**4.9E+06**
74-87-3	Chloromethane	5.1E+04	5.4E-10	9.0E-02	**1.7E+08**	1.9E-10	NC	--
110-82-7	Cyclohexane	8.2E+04	3.3E-10	6.0E+00	**1.8E+10**	1.2E-10	NC	--
124-48-1	Dibromochloromethane	2.3E+04	1.2E-09	7.0E-02	**6.0E+07**	4.2E-10	2.7E-05	**8.8E+05**
156-59-2	Dichloroethene, cis-1,2-	3.3E+04	8.4E-10	7.0E-03	**8.3E+06**	3.0E-10	NC	--
156-60-5	Dichloroethene, trans-1,2-	4.2E+04	6.5E-10	6.0E-02	**9.3E+07**	2.3E-10	NC	--

Attachment A1, Table A1-5
Derivation of Site-Specific Cleanup Goals, Soil Vapor
Construction and Utility Maintenance Worker
Former Kast Property
Carson, California

CAS Number	Chemical of Concern	VF_{SV-OA} ($\mu g/m^3$-$\mu g/m^3$)	Noncancer Effects: Exposure Concentration (EC_{SV-OA}) (mg/m^3)	Noncancer Effects: Reference Concentration (mg/m^3)	Noncancer Effects: Soil Vapor $SSCG_{nc}$ ($\mu g/m^3$)	Cancer Effects: Exposure Concentration (EC_{SV-OA}) (mg/m^3)	Cancer Effects: Inhalation Unit Risk ($(\mu g/m^3)^{-1}$)	Cancer Effects: Soil Vapor $SSCG_c$ ($\mu g/m^3$)
10061-02-6	Dichloropropene, trans-1,3-	6.1E+04	4.5E-10	2.0E-02	**4.4E+07**	1.6E-10	1.6E-05	**3.9E+06**
64-17-5	Ethanol	1.3E+03	2.1E-08	4.0E+00	**1.9E+08**	7.4E-09	NC	--
100-41-4	Ethylbenzene	1.7E+04	1.6E-09	1.0E+00	**6.3E+08**	5.7E-10	2.5E-06	**7.0E+06**
142-82-5	Heptane	9.2E+04	3.0E-10	7.0E-01	**2.3E+09**	1.1E-10	NC	--
87-68-3	Hexachloro-1,3-butadiene	1.7E+03	1.6E-08	7.0E+00	**4.4E+08**	5.7E-09	2.2E-05	**8.0E+04**
110-54-3	Hexane	6.5E+04	4.2E-10	7.0E-01	**1.7E+09**	1.5E-10	NC	--
67-63-0	Isopropanol	2.2E+03	1.2E-08	7.0E+00	**5.7E+08**	4.4E-09	NC	--
98-82-8	Isopropylbenzene (cumene)	1.0E+05	2.8E-10	4.0E-01	**1.5E+09**	9.8E-11	NC	--
78-93-3	Methyl ethyl ketone (2-butanone)	6.3E+03	4.3E-09	5.0E+00	**1.1E+09**	1.6E-09	NC	--
75-09-2	Methylene chloride	2.8E+04	9.9E-10	6.0E-01	**6.1E+08**	3.5E-10	1.0E-06	**2.8E+07**
1634-04-4	Methyl-tert-butyl ether	1.6E+04	1.7E-09	3.0E+00	**1.8E+09**	5.9E-10	2.6E-07	**6.5E+07**
103-65-1	Propylbenzene	1.8E+04	1.5E-09	1.0E+00	**6.6E+08**	5.4E-10	NC	--
75-65-0	tert-Butyl Alcohol (TBA)	6.7E+03	4.1E-09	1.1E+00	**2.6E+08**	1.5E-09	NC	--
127-18-4	Tetrachloroethene	3.8E+04	7.2E-10	4.0E-02	**5.5E+07**	2.6E-10	5.9E-06	**6.6E+06**
109-99-9	Tetrahydrofuran	6.7E+03	4.1E-09	2.0E+00	**4.9E+08**	1.5E-09	NC	--
108-88-3	Toluene	2.0E+04	1.4E-09	5.0E+00	**3.7E+09**	4.9E-10	NC	--
79-01-6	Trichloroethene	2.7E+04	1.0E-09	2.0E-03	**2.0E+06**	3.6E-10	4.1E-06	**6.7E+06**
75-01-4	Vinyl chloride	6.3E+04	4.3E-10	1.0E-01	**2.3E+08**	1.5E-10	7.8E-05	**8.3E+05**
108-38-3	Xylene, m-	1.6E+04	1.7E-09	1.0E-01	**6.0E+07**	6.0E-10	NC	--
95-47-6	Xylene, o-	1.3E+04	2.1E-09	1.0E-01	**4.8E+07**	7.5E-10	NC	--
106-42-3	Xylene, p-	1.6E+04	1.7E-09	1.0E-01	**5.9E+07**	6.0E-10	NC	--

Note: " -- " not applicable or not available

Attachment A1, Table A1-6
Derivation of Site-Specific Cleanup Goal, Lead in Soil
Construction and Utility Maintenance Worker
Former Kast Property
Carson, California

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 05/19/03

Exposure Variable	PRG Equation[1]		Description of Exposure Variable	Units	Values for Non-Residential Exposure Scenario			
					Using Equation 1		Using Equation 2	
	1*	2**			GSDi = Hom	GSDi = Het	GSDi = Hom	GSDi = Het
$PbB_{fetal, 0.95}$	X	X	95th percentile PbB in fetus	ug/dL	1	1	1	1
$R_{fetal/maternal}$	X	X	Fetal/maternal PbB ratio	--	0.9	0.9	0.9	0.9
BKSF	X	X	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4	0.4	0.4
GSD_i	X	X	Geometric standard deviation PbB	--	1.8	1.8	1.8	1.8
PbB_0	X	X	Baseline PbB	ug/dL	0.0	0.0	0.0	0.0
IR_S	X		Soil ingestion rate (including soil-derived indoor dust)	g/day	0.330	0.330	--	--
IR_{S+D}		X	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--	0.330	0.330
W_S		X	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--	--	1.0	1.0
K_{SD}		X	Mass fraction of soil in dust	--	--	--	0.7	0.7
$AF_{S, D}$	X	X	Absorption fraction (same for soil and dust)	--	0.12	0.12	0.12	0.12
$EF_{S, D}$	X	X	Exposure frequency (same for soil and dust)	days/yr	10	10	10	10
$AT_{S, D}$	X	X	Averaging time (same for soil and dust)	days/yr	365	365	365	365
SSCG			**Site-Specific Cleanup Goal**	ppm	**1.2E+03**	**1.2E+03**	**1.2E+03**	**1.2E+03**

[1] Equation 1 does not apportion exposure between soil and dust ingestion (excludes W_S, K_{SD}).
When $IR_S = IR_{S+D}$ and $W_S = 1.0$, the equations yield the same PRG.

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ATTACHMENT A-2

Background Evaluation

Attachment A2
Detailed Background Evaluation
Former Kast Property
Carson, California

Introduction

This attachment presents the background evaluation methodology and results used to derive background-based Site-specific cleanup goals (SSCGs) for metals and carcinogenic polyaromatic hydrocarbons (cPAHs) detected in soil at the former Kast Property (Site) located in Carson, California. The evaluation builds upon the preliminary evaluation presented previously (Geosyntec, 2011) and includes samples from locations not anticipated to be affected by the Site and that represent local and regional background.

Purpose

The purpose of this report is to *i)* identify locally representative background data for metals and cPAHs from locations that are not affected by Site impacts; *ii)* evaluate the selected background datasets graphically and statistically including outlier analysis to develop a representative background dataset; *iii)* develop background threshold values for metals and cPAHs for use in background evaluation using local and regulatory approved regional background datasets; and *iv)* present the methodology that will be used to compare Site datasets with background thresholds to determine if metals or cPAHs are above or below background and should be carried forward for further risk evaluation.

Approach

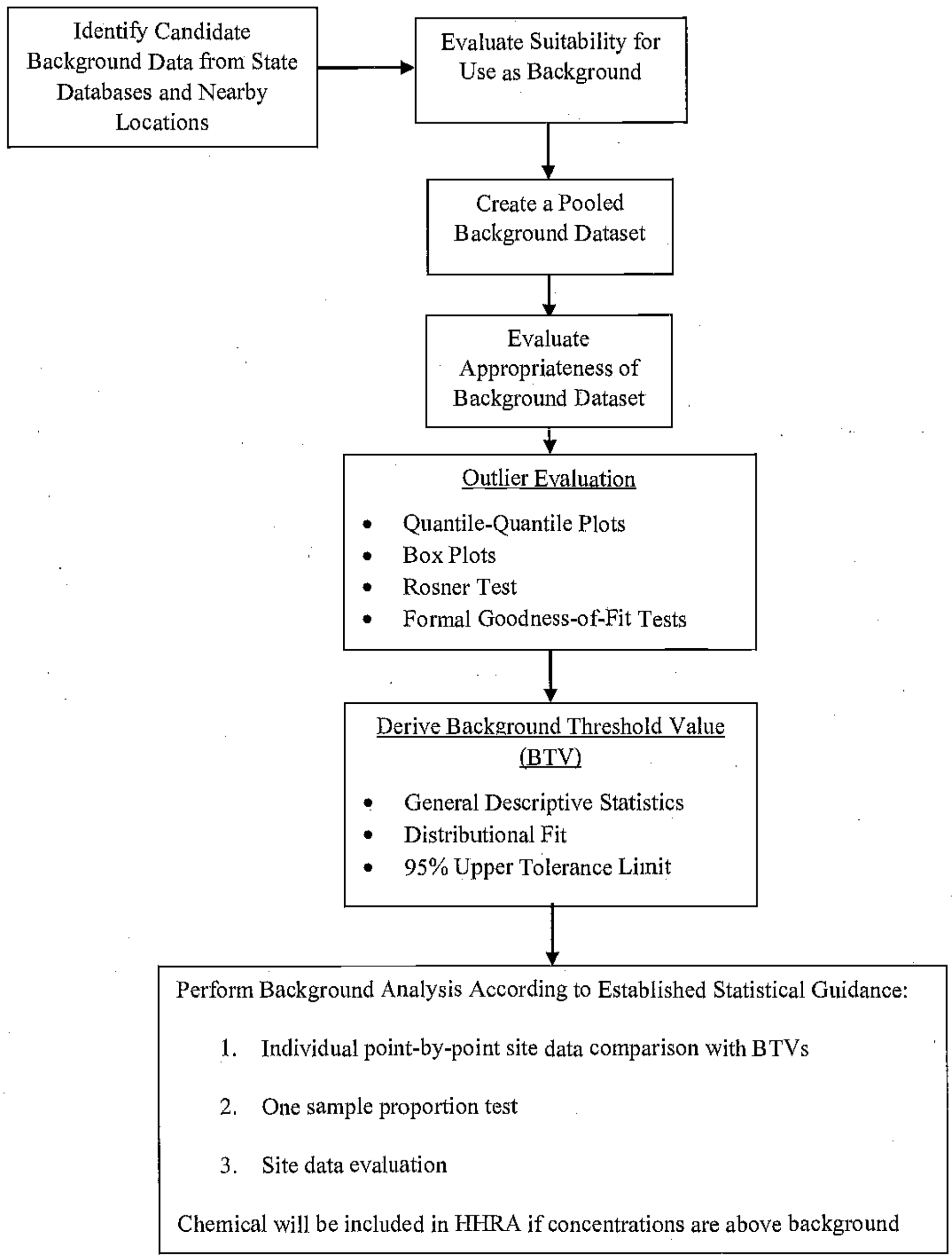
Metals may be naturally occurring in the environment. According to the California Department of Toxic Substances (DTSC) (Cal-EPA DTSC 2009a, 2009b, Cal-EPA, 1997) for naturally occurring materials such as metals, an evaluation of background concentrations is important to evaluate whether the metals concentrations on the property are consistent with naturally occurring levels in the area, and whether they should be included in the risk assessment. If concentrations of a metal are within background, the metal is not considered a Chemical of Concern (COC) and is not evaluated further.

In addition to metals, cPAHs can be naturally occurring or present at ambient levels not associated with former site activities. A background dataset and methodology has been developed by DTSC that can be used to evaluate the presence of cPAHs in soil (Cal-EPA DTSC, 2009c).

The background evaluation considered:

1. Offsite background data collected for the project;
2. Data collected from nearby locations that represent local background; and
3. Regulatory approved regional background concentrations for southern California soils.

The approach that was used to perform the background data evaluation is illustrated in the flow chart below.



Background Site Selection

The background locations used to create a local background database include:

- Banning Park,
- Banning Elementary School,
- Wilmington Middle School, and
- Wilmington Recreation Center.

These locations were previously identified in the Background Soil Evaluation Work Plan (Geosyntec 2010). The use of background datasets from nearby locations in the vicinity of the Site is consistent with the approaches and methodologies used by DTSC and other agencies to evaluate regional background datasets such as arsenic or cPAHs both for southern and northern California regions (DTSC, 2009a; DTSC, 2009c). The regional datasets show that background values can vary by location. The use of several background datasets is anticipated to capture these variabilities and provide a more representative background value.

Banning Park

Banning Park was selected as a potential background location as the site did not appear to have been developed for commercial or industrial use and according to the review of historical aerial photographs from the Los Angeles Regional Water Quality Control Board's (LARWQCB) Geotracker database (Geotracker); the site was not impacted by nearby historical operations. The park is developed with a museum situated on 20-acres of parkland. The museum was formerly a residence built in 1864. The residence and parkland were acquired by the City of Los Angeles in 1927. A total of 30 soil samples were collected from ten soil borings placed at 0.5, 2 and 5 feet (ft) below ground surface (bgs). The Banning Park background samples were analyzed for metals and cPAHs.

Banning Elementary School and Wilmington Middle School

Data previously collected to support site characterization at nearby school locations including Banning Elementary School and Wilmington Middle School were considered for inclusion in the background dataset. At Banning Elementary school, 63 soil samples were collected at depths 0, 0.5, 1 and 5 ft bgs and analyzed for metals; while at Wilmington Middle School five soil samples were collected at 0.5 and 5 ft bgs and analyzed for metals and cPAHs.

Wilmington Recreation Center

Eight background soil samples were collected at Wilmington Recreation Center as part of the environmental investigations performed for the LAUSD new schools construction program. These data are reported in the PEA for Banning Elementary School. The samples were collected at 0.5 and 2.5 to 3 ft bgs and analyzed for metals.

Evaluation of Background Datasets

Comparison of Background Samples by Depth

The background samples were obtained from several depths ranging from 0 to 5 ft bgs. To evaluate whether the samples could be combined into a single dataset, the samples were evaluated for significant difference by depth to determine if shallower samples were statistically different than surface samples. Samples between 0 to 2 ft bgs (surface) and >2 to 5 ft bgs (shallow), and with percent detection above 50%, were statistically compared using the non-parametric Mann-Whitney method at 0.05 significance level. The results show that the majority of metals concentrations (except cadmium, copper, lead and zinc) are not significantly different by depth. The Mann Whitney analysis was not suitable for comparison of equality for cPAHs as B(a)P-equivalents by depth, as samples >2 to 5 ft bgs have more than an 85% frequency of non-detect samples. A two-sample proportions test, applicable for comparing samples with high degree of non-detection, however indicates that cPAHs are statistically different by depth. This may be due to higher near surface ambient concentrations as a result of anthropogenic sources. While there were some differences by depth, datasets were combined to reflect the depth interval of interest for exposure potential and to provide for a larger dataset. The statistical analysis report (Minitab software output) is presented in Attachment A2-1.

Outlier Evaluation

Since two of the datasets were from investigations for school sites and were not specifically background sample datasets, an outlier analysis was conducted consistent with DTSC guidance for evaluating background (DTSC, 2009a). The background datasets were screened for suspect or potential outliers using *(i)* box plots, *(ii)* Q-Q plots, *(iii)* probability plots or underlying distributions (Goodness of fit test), *(iv)* Rosner outlier test, and *(v)* professional judgment based on established regional background thresholds and historical land use.

Samples higher than the three-interquartile range (3IR) on box plots were identified as suspect outliers and were further evaluated using the formal outlier test (Rosner test). Suspect outliers were also evaluated using Q-Q plots and goodness-of-fit tests on detected datasets. The Q-Q probability plots for the best fit distribution for each metal and cPAH (as benzo(a)pyrene equivalent) were examined for the presence of inflections and break-points, which could be used to identify multiple populations or outlier concentrations. A probability-plot (i.e., normal, lognormal, or gamma) partitioning was used to identify outliers as well as other patterns in the data that could signify the presence of multiple statistical populations. A weight of evidence approach based on the results of all the above methodologies was considered when determining whether a suspect outlier was eliminated or included in the background dataset. Suspect outliers that were persistently identified in all of these methods were further evaluated with respect to sample location, depth or correlation to known contaminated locations or other pertinent evidence. Outlier evaluation of each chemical, as part of a background metals evaluation is provided in Attachment A2-1.

Development of a Background Threshold Value

Background Threshold Values (BTVs) are single-point background thresholds that represent an upper plausible limit of the background distributions of individual compounds (EPA 2009a, 2009b; Helsel 2005). Threshold limits are most often based on an upper percentile of the background distribution (such as 90th, 95th, or 99th percentile), an upper confidence limit of an upper percentile (that is, an upper tolerance limit or UTL). Consistent with Cal-EPA guidance (Cal-EPA DTSC 2009a), the UTL was derived. Following EPA's guidance, a minimum of 8 to 10 or more samples are required to estimate BTVs. When detected observations are less than 4 to 6, the maximum detected sample could be used to estimate the BTV. When all the background samples are non-detects, the BTV will also be a non-detect. The smaller of the sample maximum and calculated BTV were used as the chemical BTV. Development of the BTV for each chemical is presented in Attachment A2-1.

Background Thresholds from State Regulatory Datasets

In addition to the BTVs derived from the data discussed above, well established regulatory approved regional background thresholds for arsenic and cPAHs in soil were considered. These thresholds have been used for many sites within the Los Angeles Area to identify chemicals of potential concern for risk assessments as well as used as remedial goals for site cleanups for unrestricted or residential land use. For arsenic, the DTSC background concentration for southern California sites of 12 mg/kg (Cal-EPA DTSC, 2007) will be used. In addition to metals, PAHs can be naturally occurring or present at ambient levels not associated with former site activities. A background dataset and methodology has been developed that can be used to evaluate the presence of PAHs in soil (Cal-EPA DTSC, 2009c). Consistent with agency-approved risk assessment practice in California, the DTSC-developed background concentration of 0.9 mg/kg benzo(a)pyrene equivalents (Bap-eq) will be used to evaluate cPAHs results. These values will be used as the BTVs for the Site.

Comparison of Site and Background Datasets

Due to the preponderance of Site data (over 10,000 samples and 285 individual study areas), a streamlined approach was developed to evaluate background at the Site. In the first step, Site samples will be compared to the BTVs to evaluate whether onsite metal or cPAH concentrations are above or below background concentrations. In the second step, for those areas where samples are above the BTV, a proportion test will be conducted to further evaluate whether observed concentrations are above background. If onsite concentrations are below background, the area will not be evaluated further in the risk assessment process. The background comparison will be conducted as part of the full Human Health Risk Assessment (HHRA) that will be conducted once the Phase II Site Characterization work is complete. It is anticipated that the HHRA will be included in the Remedial Action Plan (RAP).

As mentioned above, the approach used to compare Site datasets against background thresholds includes:

- Point by point comparison of Site datasets and BTV;
- One-sample hypothesis testing (Proportion test); and
- Site data evaluation

Point-by-Point Comparison

The point-by-point comparison method will initially be used as a conservative screen to identify chemicals that may be present at concentrations above background. If a chemical is found to be above background, the proportion test will be used to further evaluate the data.

One-sample proportion test

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. This is consistent with agency guidance that states that when BTVs and cleanup standards are known, one-sample hypotheses are used to compare site data with the known and pre-established threshold values (USEPA, 2010). The one-sample proportion test is a test for proportion and will be used to compare the proportion of Site data exceeding the BTV with a pre-specified allowable proportion of exceedance (5%). The proportion test is non-parametric and therefore can be used with censored datasets in which there is a large proportion on non-detect values. The proportion test is used to detect a significant difference or a shift in the upper tail of the site data distribution. A significant shift in the upper tail of the site dataset as compared to background may indicate that the site has been impacted for that particular chemical. A 5% level of significance ($p < 0.05$) will be used to evaluate all tests.

Site Data Evaluation

A more detailed analysis may be conducted to further evaluate if chemicals are present at the Site above background, especially for chemicals that do not have local or regional background datasets or were nondetect in the background datasets. Methods described in Cal-EPA guidance *Selecting Inorganic Constituents as Chemicals of Potential Concern at Risk Assessments at Hazardous Waste Sites and Permitted Facilities* (Cal-EPA, 1997) describe ways that the Site data can be evaluated to determine if observed concentrations are consistent with background. Natural metals distributions are widely observed to be normal or to have a low to moderate skewness that is well approximated by a lognormal distribution (Cal-EPA 1997). Cal-EPA also states that samples from such distributions generally range by no more than one order of magnitude and that the sample coefficients of variation (CV, standard deviation/mean) are also no greater than one. Substantial departures from these traits, referred to here as natural population indicators, will be used to indicate the presence of multiple populations in the sample, which may indicate the presence of chemical concentrations above background. As a part of the evaluation, visual observation of the data will be conducted using probability plots to determine if multiple populations are present.

If the concentrations of a chemical are found to be above background after these three steps the chemical will be included in the HHRA.

References

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Attachment A2-1
Detailed Background Evaluation

1. Background Metals Data Evaluation

The summary statistics of the metals and cPAH background databases are provided in Table A2-1. Background Threshold Values (BTVs) are presented in Tables A2-2 and A2-3. Box plots and probability plots of the background datasets are provided in Figures A2-1 through A2-3.

Box plots based on three times the interquartile range (3IR), Q-Q plots and probability plots for outlier evaluation are shown on Figures A2-4-1 through A2-4-18. ProUCL output of the Rosner outlier test is provided in Attachment A2-1.

Goodness of fit test of background samples before and after elimination of suspect outliers is shown in Attachment A2-1. Summary of the background threshold values (BTV) after elimination of suspect outliers is provided in Table A2-2. ProUCL output of the upper threshold analysis is shown in Attachment A2-1.

Antimony (N=106, ND=99.06%)
Antimony has 106 samples all obtained from 0 to 5 ft bgs. There is only one detected sample at 0.74 mg/kg (99% non-detection). Since the %ND is significantly large, there is no reliable statistical analysis that can be performed on antimony. No samples were eliminated as outliers. The detection levels were 0.306 and 0.5 mg/kg. The detected sample was obtained from Banning Park at 0.5 ft bgs.

Due to large %ND, no reliable 95% UTL can be estimated. The maximum value of 0.741 mg/kg is used as BTV for antimony.

Arsenic (N=106, ND=2.83%)

Outlier evaluation based on above 3IR box plot indicates that arsenic has three suspect outliers including 9, 11.9 and 127, while a test for one Rosner outlier at 1% significance level indicates that 127 may be a potential outlier. Graphic evaluation using a Q-Q plot indicates that the arsenic sample with a concentration of 127 mg/kg may be a suspect outlier. A goodness of fit test was performed, and arsenic does not fit normal or lognormal distribution. The GOF test however shows that the arsenic sample concentration of 127 mg/kg is considerably offset from the general linear trend indicating that the sample may be an outlier. The sample was obtained from the surface (at 0 ft bgs) at the Wilmington School, and may not represent background distribution. Moreover, the value is significantly above the Southern California arsenic background threshold of 12 mg/kg and above the background range reported of 2.2 mg/kg to 19 mg/kg reported in the regional study conducted by UC Riverside (1991) and the range of 0.15 mg/kg to 19.63 mg/kg that was observed in the Southern California background dataset presented by DTSC in its

Arsenic Strategies Document (DTSC, 2009a). The sample 127 mg/kg therefore was eliminated as an outlier.

After elimination of the outlier, detected arsenic follow an approximate gamma distribution, and therefore a Gamma distribution based UTL was selected from the ProUCL results to estimate the 95% UTL at 10.4 mg/kg.

The local threshold BTV, 10.41 mg/kg, is less than the well-established Southern California arsenic BTV of 12 mg/kg developed by DTSC. The maximum value in the local background dataset is 11.9, close to the value of 12 mg/kg. The Southern California background arsenic dataset is made up of a much larger database across several areas within the Los Angeles basin and as a result anticipated to be more representative of background within the Los Angeles area. In addition, this value has been commonly used for COC selection and as a cleanup level for unrestricted land use and residential sites. Therefore, the DTSC arsenic threshold value of 12 mg/kg is used as the BTV in this report.

Barium (N=106, ND=0%)
Barium has four suspect outliers including concentrations of 203, 267, 428 and 575 mg/kg based on above 3IR box plot evaluation. A test for one Rosner outlier at 1% significance level indicates that 575 may be a potential outlier while a graphic evaluation using a Q-Q plot indicates that 267, 428 and 575 may be potential outliers. A GOF test was performed and barium data does not fit normal nor lognormal distribution. The test based on lognormal distribution however shows that barium samples 428 and 575 mg/kg may be considered as deviating from the general linear trend indicating that they may be outliers. The weight of evidence presented suggests that 428 and 575 mg/kg may be outliers, and were removed from the background evaluation.

After elimination of the two suspect outliers, barium appears to fit lognormal distribution. Based on lognormal distribution after elimination of suspect outliers (N=105, %ND = 0%), the 95% UTL was 195.4 mg/kg.

Beryllium (N=106, ND=16.98%)
With 106 samples and 17% non-detection, 3IR based box plot indicates that concentrations of 0.6, 0.7, 0.7 and 0.8 may be suspect outliers while a one outlier Rosner test shows that 0.8 may be an outlier. Graphic evaluation using a Q-Q plot does not show an obvious or significant outlier. A GOF test shows that beryllium does not fit normal or lognormal distributions. There is however a general linear trend based on a lognormal distribution particularly among the detected datasets. In addition, these concentrations fall within the range of background concentrations of 0.1 to 0.9 mg/kg reported in the regional study conducted by UC Riverside (1991). There is no strong evidence to suggest that these are outliers, and therefore no beryllium samples are eliminated as outliers.

Since Beryllium samples do not fit a normal or lognormal distribution, a non-parametric 95% KM UTL with 99% coverage of 0.56 mg/kg was selected as the BTV for the background dataset.

Cadmium (N=106, ND=53.77%)

Based on above 3IR samples on a box plot, seven cadmium samples from 1.0 to 3.81 mg/kg are suspect outliers. A test for one Rosner outlier at 1% significance level indicates 3.81 as a potential outlier while a graphic evaluation using a Q-Q plot apparently shows two populations as indicated by the shift from linearity which may imply that the upper tail of the distribution may be impacted. However it has to be noted that cadmium has more than 50% non-detects that constitutes the lower tail of the population distribution while the detected samples make the upper distribution. So the Q-Q plot departure from linearity is more of a distinction between detected and non-detected samples rather than discrimination between background and impacted samples. The three highest suspect outliers 1.63, 1.8 and 3.81 mg/kg are obtained from Banning Park at 0.5 ft bgs. A GOF test on the detected samples indicates cadmium fits a lognormal distribution. Using the above weight of evidence, no cadmium sample was eliminated as an outlier.

A value of 3.81 mg/kg is selected as a BTV using a 95% Bootstrap (%) UTL with 99% coverage ProUCL output.

Chromium (N=106, ND=0%)

Chromium has three suspect outliers including 29.3, 36.5 and 38.6 mg/kg based on above 3IR box plot evaluation. A test for one Rosner outlier at 1% significance level indicates that 38.6 may be a potential outlier while a graphic evaluation using a Q-Q plot does not indicate a significant outlier. A GOF test was performed and indicates the data fit a lognormal distribution indicating there may be no outlier chromium samples. The samples 29.3, 36.5 were obtained from Banning Elementary School (at 0.5 ft bgs), while sample 38.6 was obtained from Wilmington Recreation Center (at 0.5 ft bgs). Based on the weight of evidence presented, no dataset was eliminated from chromium samples as outlier.

Since chromium is log-normally distributed, a 95% UTL of 32.54 mg/kg is selected from PROUCL output.

Cobalt (N=106, ND=3.77%)

Cobalt has three suspect outliers including 13.1, 13.5 and 15.7 mg/kg based on above 3IR box plot evaluation. A test for one Rosner outlier at 1% significance level indicates that 15.7 may be a potential outlier. A GOF test indicates that Cobalt samples are log-normally distributed. Though the Box plot and Rosner test indicate three suspect outliers (13.1, 13.5, 15.7), the GOF test and Q-Q plot did not show a significant break of these datasets from the body of samples. The suspect outliers 13.1, 13.5 and 15.7 were obtained from Banning Elementary School at 0.5 ft, 5 ft and 1 ft bgs respectively. Based on the above weight of evidence, no samples were eliminated as outlier.

A non-parametric based 95% KM UTL with 99% coverage at 10.91 mg/kg will be used as the sample BTV.

Copper (N=106, ND=0%)
Copper has one suspect outlier at 59 mg/kg based on above 3IR box plot evaluation. A test for one Rosner outlier at 1% significance level indicates that the sample 59 mg/kg may be a potential outlier while a graphic evaluation using a Q-Q plot does not indicate a significant outlier. A GOF test was performed and indicates copper fit a fairly strong lognormal distribution showing there may be no outliers. The sample 59 mg/kg was obtained from Banning Park (at 0.5 ft bgs). Based on the weight of evidence presented, no copper dataset was eliminated as outlier.

Based on lognormal distribution, a threshold value of 95% UTL is 64.62. However, since this value is higher than sample max at 59, the BTV will be taken as 59 mg/kg.

Lead (N=106, ND=5.66%)
Based on above 3IR samples on a box plot, twelve (12) lead samples from 43.3 to 112 mg/kg are suspect outliers. A test for one Rosner outlier at 1% significance level indicates 112 as a potential outlier while a graphic evaluation using a Q-Q plot apparently shows two populations which is partly a reflection of lead distribution by depth. A GOF test on the detected samples indicates lead does not follow a normal or lognormal distribution. The linear pattern of the probability plot using lognormal distribution at different depths (0 to 0.5 ft, and >0. 5 ft bgs) however indicates that lead may not have an outlier. Moreover, lead has been detected at background level concentrations ranging from 7.7 to 189.4 mg/kg in Southern California region. Using the above weight of evidence, no lead sample was eliminated as an outlier.

Since lead samples do not follow a discernible distribution, a non-parametric 95% KM UTL with 99% coverage BTV at 61.46 mg/kg is selected from PROUCL output.

Mercury (N=106, ND=71.7%)
Mercury has a large proportion of non-detects (ND=71.7%), and therefore outlier evaluation is performed using the detected datasets only. There is one suspect outlier (0.324) based on above 3IR box plot and one Rosner outlier test at 1% significance. The Q-Q plot however did not appear to indicate a significant departure or break of this sample from the body of the samples. A GOF tests shows that detected mercury samples do not follow a normal or lognormal distribution, though the shift from linearity was small. The suspect outlier was obtained from Banning Park at 0.5 ft bgs. Based on the above weight of evidence, no sample was eliminated as an outlier.

Since mercury does not follow a discernible distribution, a non-parametric BTV of 0.131 mg/kg based on 95% KM UTL with 99% coverage is selected from PROUCL output.

Molybdenum (N=106, ND=84.91%)
Molybdenum has a large proportion of non-detects (ND=84.9%), and therefore outlier evaluation is performed using the detected datasets only. There is no suspect outlier based on above 3IR box plot evaluation. The Rosner outlier test at 1% significance indicates no outlier either. The Q-Q plot indicates a slight departure from linearity. A GOF tests shows that detected molybdenum samples do not follow a normal or lognormal distribution, though the shift from linearity was not significant. Based on the above weight of evidence, no sample was eliminated as an outlier.

Since molybdenum does not follow a discernible distribution, a non-parametric BTV of 0.409 mg/kg based on 95% KM UTL with 99% coverageis selected from PROUCL output.

Nickel (N=106, ND=10.38%)
Based on above 3IR samples on a box plot, two nickel samples 25.3 and 27.2 mg/kg are suspect outliers. A test for one Rosner outlier at 1% significance level indicates 27.2 as a potential outlier while a graphic evaluation using a Q-Q plot apparently shows no suspect outlier. A GOF test indicates nickel fits a lognormal distribution. Both suspect outliers (25.3 and 27.2) were obtained from Banning Elementary School at 5 and 1 ft bgs respectively. Using the above weight of evidence, no samples were eliminated as outliers.

A BTV of 20.17 mg/kg based on a non-parametric approach of 95% KM UTL with 99% Coverage is selected from PROUCL output.

Selenium (N=106, ND=99.06%)
Selenium has 106 samples all obtained from 0 to 5 ft bgs. There is only one detected sample at 0.78 mg/kg (99% non-detection). No reliable statistics can be performed on Selenium as the %ND is significantly large. No samples were eliminated as outliers.

Due to large %ND, no reliable 95% UTL can be estimated. The maximum value of 0.78 mg/kg is used as BTV for selenium.

Silver (N=106, ND=91.51%)
Silver has 91.5% non-detects. Statistical evaluation was performed only on detected samples (9 samples). The outlier tests show no indication of suspect outliers, and therefore no sample was eliminated.

Silver data appear log-normally distributed. Since the corresponding potential BTV (6.87) was greater than the sample max of 1.29, the BTV selected was 1.29 mg/kg.

Thallium (N=106, ND=100%)
All 106 thallium data were non-detects. No statistical analysis was performed on thallium. At 100% non-detection, the BTV of thallium was also a non-detect and assessed at 0.23 mg/kg.

Vanadium (N=106, ND=0%)
Vanadium has no suspect outlier based on above 3IR box plot evaluation. A test for one Rosner outlier at 1% significance level indicates no suspect outlier either. The Q-Q plot shows a fairly linear trend indicating no potential outlier. A GOF test shows that vanadium follows a strong lognormal distribution. Based on the above weight of evidence, no suspect outliers were identified for vanadium.

Based on lognormal distribution, BTV at 95% UTL is 50.07 mg/kg. However, since this value is higher than sample maximum (47.01), BTV was assessed at 47.01 mg/kg.

Zinc(N=106, ND=0%)
Zinc has four suspect outliers including 151, 172, 291and 525 mg/kg based on above 3IR box plot evaluation. A test for one Rosner outlier at 1% significance level indicates that 525 may be a potential outlier while a graphic evaluation using a Q-Q plot also indicates that 525 may be a potential outlier. A GOF test was performed and zinc data does not fit normal nor lognormal distributions though the deviation of the probability plot from linear trend is only slight. The sample 525 was obtained from Wilmington Recreation Center at 0 ft bgs. The weight of evidence presented suggests that 525 mg/kg may be an outlier and was eliminated from further background evaluation.

Zinc samples did not follow a discernible distribution even after the elimination of the outlier. Therefore a non-parametric 95% Percentile Bootstrap UTL BTV of 291 mg/kg was used from ProUCL output.

2. **Background cPAH Evaluation**

cPAH (N=35, ND=37.14%)
cPAH samples were obtained from Banning Park (N=30) and Wilmington Middle School (N= 5). Using a weight-of-evidence of above 3IR based box plot evaluation and Rosner test, the value of 0.179 mg/kg appears to be a suspect outlier. The Q-Q plot and GOF test suggests that the concentration of 0.179 mg/kg may be an outlier. The sample was collected at 0.5 feet bgs at Wilmington Middle School. A review of the sample data indicate that low levels of total petroleum hydrocarbons (< 60 mg/kg) were detected which may have contributed to the cPAH concentrations. However, since the value of 0.179 mg/kg is well within the range of background reported for Southern California (Cal-EPA, 2009c), and the concentrations of TPH are considered negligible (<60 mg/kg) and not from a known onsite source, the sample was included in the analysis as what may be represented in the soils from anthropogenic non site-related sources.

To further evaluate background cPAH, these local background datasets were evaluated against the backdrop of 22 background sites in Southern California (N=185) used in developing the regional cPAH BTV (Cal-EPA DTSC, 2009c). Side by side graphical evaluation including box plots and probability plots were used to compare local and Southern California representative datasets (Figure A2-5). The evaluation indicates that, Banning Park and Wilmington Middle School datasets are in the low end/tail distribution of Southern California Background datasets.

The Southern California analysis used a much larger pool of background sites, and a relatively larger number of samples. As a result, the Southern California evaluation is anticipated to be more robust and more representative of the true background condition of the region. The local background dataset is consistent with a selection of subsamples from the broader regional dataset where some samples are expected to be higher and some lower than the regional mean. Moreover, the Southern California statistical analysis benefits from a higher statistical power due to higher number of samples than Banning Park and WMS background samples collected as part of a site investigation.

Therefore, considering the above and the common use of the regional dataset for remedial decision making at sites, the cPAH BTV of 0.9 mg/kg, derived from the southern California cPAH background analysis is selected at the cPAH BTV for use at the Site. This value has been used as a remedial goal at unrestricted land use and residential sites throughout southern California. The BTV of 0.9 mg/kg will be used along with the comparison methodology outlined in the main document to determine if Site concentrations are above background. Additional evaluation as discussed in guidance (Cal-EPA, 2009c) may be conducted if warranted

Tables

Table A2-1
Summary Statistics of Background Metals and cPAHs
Former Kast Property
Carson, California

Site ID	Analyte	Variable	Depth (ft bgs)	# of Samples	% NDs	Minimum[1]	Maximum[1]	Mean[1]	Median[1]	SD[1]	CV[1]
Banning Park	cPAH	BaP-TEQ	0.5 - 5	30	30%	0.00106	0.0163	0.0042	0.0026	0.0048	1.1310
	Metals	Antimony	0.5 - 5	30	96.67%	0.741	0.741	0.741	0.741	--	--
		Arsenic	0.5 - 5	30	0%	1.11	11.9	2.36	1.69	1.97	0.84
		Barium	0.5 - 5	30	0%	38.3	267	73.83	71.50	39.08	0.53
		Beryllium	0.5 - 5	30	0%	0.18	0.30	0.23	0.22	0.03	0.13
		Cadmium	0.5 - 5	30	43.33%	0.11	3.81	0.83	0.61	0.93	1.12
		Chromium	0.5 - 5	30	0%	6.76	28.2	11.64	9.60	4.55	0.39
		Cobalt	0.5 - 5	30	0%	3.66	6.53	4.77	4.72	0.54	0.11
		Copper	0.5 - 5	30	0%	2.69	59	10.77	6.57	11.09	1.03
		Lead	0.5 - 5	30	0%	2.3	68.1	13.40	6.46	17.07	1.27
		Mercury	0.5 - 5	30	0%	0.02	0.32	0.05	0.03	0.06	1.22
		Molybdenum	0.5 - 5	30	50%	0.10	0.40	0.16	0.14	0.07	0.46
		Nickel	0.5 - 5	30	0%	3.68	20.8	6.6	5.7	3.0	0.5
		Selenium	0.5 - 5	30	100%	--	--	--	--	--	--
		Silver	0.5 - 5	30	70%	0.132	1.29	0.58	0.29	0.47	0.81
		Thallium	0.5 - 5	30	100%	--	--	--	--	--	--
		Vanadium	0.5 - 5	30	0%	12.6	22.8	16.28	16.25	1.92	0.12
		Zinc	0.5 - 5	30	0%	11.5	86.3	29.03	18.96	19.95	0.69
Banning Elementary School	Metals	Antimony	0 - 5	63	100%	--	--	--	--	--	--
		Arsenic	0 - 5	63	4.76%	0.4	9	1.91	1.7	1.27	0.67
		Barium	0 - 5	63	0%	17.7	575	69.04	47.8	86.41	1.25
		Beryllium	0 - 5	63	25.4%	0.2	0.8	0.306	0.3	0.15	0.48
		Cadmium	0 - 5	63	61.9%	0.2	0.7	0.375	0.35	0.15	0.39
		Chromium	0 - 5	63	0%	4.4	36.6	11.24	10.6	5.95	0.53
		Cobalt	0 - 5	63	6.35%	2.5	15.7	5.52	5	2.70	0.49
		Copper	0 - 5	63	0%	3.5	44.1	15.51	14.1	8.99	0.58
		Lead	0 - 5	63	6.35%	2.6	112	13.06	6	18.57	1.42
		Mercury	0 - 5	63	100%	--	--	--	--	--	--
		Molybdenum	0 - 5	63	100%	--	--	--	--	--	--
		Nickel	0 - 5	63	17.46%	3	27.2	8.92	7.35	5.46	0.61
		Selenium	0 - 5	63	100%	--	--	--	--	--	--
		Silver	0 - 5	63	100%	--	--	--	--	--	--
		Thallium	0 - 5	63	100%	--	--	--	--	--	--
		Vanadium	0 - 5	63	0%	6.2	47.1	20.07	19.7	9.58	0.48
		Zinc	0 - 5	63	0%	9.7	291	44.93	30.6	44.02	0.98

Table A2-1
Summary Statistics of Background Metals and cPAHs
Former Kast Property
Carson, California

Site ID	Analyte	Variable	Depth (ft bgs)	# of Samples	% NDs	Minimum[1]	Maximum[1]	Mean[1]	Median[1]	SD[1]	CV[1]
Wilmington Middle School	cPAH	BaP-TEQ	0.5 - 5	5	80%	0.179	0.179	0.179	0.179	--	--
	Metals	Antimony	0.5 - 5	5	100%	--	--	--	--	--	--
		Arsenic	0.5 - 5	5	0%	1.52	127	27.86	3.41	55.43	1.99
		Barium	0.5 - 5	5	0%	66.30	92.2	76.42	72	10.2	0.14
		Beryllium	0.5 - 5	5	20%	0.30	0.48	0.37	0.34	0.06	0.22
		Cadmium	0.5 - 5	5	100%	--	--	--	--	--	--
		Chromium	0.5 - 5	5	0%	9.04	17.4	12.6	13	3.5	0.28
		Cobalt	0.5 - 5	5	0%	5.18	6.92	6.33	6.57	0.7	0.11
		Copper	0.5 - 5	5	0%	5.34	14.70	9.21	7.07	4.06	0.44
		Lead	0.5 - 5	5	0%	3.48	57.60	14.96	4.11	23.8	1.59
		Mercury	0.5 - 5	5	100%	--	--	--	--	--	--
		Molybdenum	0.5 - 5	5	80%	0.625	0.625	0.625	0.625	--	--
		Nickel	0.5 - 5	5	0%	6.19	12.00	8.22	7.16	2.44	0.30
		Selenium	0.5 - 5	5	80%	0.78	0.78	0.78	0.78	--	--
		Silver	0.5 - 5	5	100%	--	--	--	--	--	--
		Thallium	0.5 - 5	5	100%	--	--	--	--	--	--
		Vanadium	0.5 - 5	5	0%	15.8	29.1	22.9	24	4.8	0.2
		Zinc	0.5 - 5	5	0%	20.1	161	52.2	27.8	56.6	1.1
Wilmington Recreation Center	Metals	Antimony	0 - 2.5	8	100%	--	--	--	--	--	--
		Arsenic	0 - 2.5	8	0%	0.3	2.1	1.35	1.35	0.64	0.47
		Barium	0 - 2.5	8	0%	31.9	91	58.24	56.00	16.58	0.29
		Beryllium	0 - 2.5	8	12.5%	0.2	0.3	0.23	0.20	0.05	0.21
		Cadmium	0 - 2.5	8	0%	0.2	1.0	0.49	0.30	0.36	0.73
		Chromium	0 - 2.5	8	0%	6.2	38.6	13.34	10.05	10.40	0.78
		Cobalt	0 - 2.5	8	0%	2.5	5.6	3.96	3.90	1.02	0.26
		Copper	0 - 2.5	8	0%	6.9	32.5	16.41	15.20	7.89	0.48
		Lead	0 - 2.5	8	25%	3.3	57.0	20.5	5.8	24.9	1.22
		Mercury	0 - 2.5	8	100%	--	--	--	--	--	--
		Molybdenum	0 - 2.5	8	100%	--	--	--	--	--	--
		Nickel	0 - 2.5	8	0%	4.10	18.40	9.60	8.85	4.46	0.47
		Selenium	0 - 2.5	8	100%	--	--	--	--	--	--
		Silver	0 - 2.5	8	100%	--	--	--	--	--	--
		Thallium	0 - 2.5	8	100%	--	--	--	--	--	--
		Vanadium	0 - 2.5	8	0%	10.50	28.80	18.19	17.80	5.72	0.32
		Zinc	0 - 2.5	8	0%	29.80	525.00	122.50	41.20	169.50	1.38

Notes:
[1]Summary statistics based on detected samples
- Summary statistics shown before outlier analysis

Table A2-2
Summary Outlier Evaluation based on Weight of Evidence Approach for Metals and cPAHs
Former Kast Property
Carson, California

Analyte	% NDs	3IR	Rosner Test	Q-Q Plot	GOF Test	Suspect Outlier	Sample Location	Sample Depth (ft, bgs)	WOE Outlier
Antimony	99.06%	NA	NA	NA	NA	0.741	Banning Park	0.5	None
Arsenic	2.86%	>9	127	127	No Discernible Distribution	127	Wilmington School	0	127
Barium	0.00%	>203	576	>267	No Discernible Distribution	>428	Banning Elementary School	0 and 0.5	428 and 526
Beryllium	16.98%	>0.6	0.8	None	No Discernible Distribution, close to LN	0.7 and 0.8	Banning Elementary School	0.5, 1 and 5	None
Cadmium	53.77%	>1	3.81	3.81	Lognormal	1.63, 1.8 and 3.81	Banning Park	0.5	None
Chromium	0.00%	>29.3	36.6	None	Lognormal	29.3, 36.5	Banning Elementary School	0.6	None
Cobalt	3.77%	>13.1	16.7	None	Lognormal	13.1, 13.5 and 16.7	Banning Elementary School	0.5, 5 and 1	None
Copper	0.00%	59	59	None	Lognormal or Gamma	59	Banning Park	0.5	None
Lead	6.66%	>43.3	112	112	No Discernible Distribution	None	NA	NA	None
Mercury	71.70%	0.324	None	None	No Discernible Distribution, close to LN	0.324	Banning Park	0.5	None
Molybdenum	84.91%	None	None	None	No Discernible Distribution, close to LN	None	NA	NA	None
Nickel	10.38%	>25.3	27.2	None	Lognormal	25.3 and 27.2	Banning Elementary School	5 and 1	None
Selenium	99.06%	NA	NA	NA	NA	NA	NA	NA	None
Silver	91.51%	NA	NA	NA	NA	NA	NA	NA	None
Thallium	100.00%	NA	NA	NA	NA	NA	NA	NA	None
Vanadium	0.00%	None	None	None	Lognormal	None	NA	NA	None
Zinc	0.00%	>151	525	525	No Discernible Distribution, close to LN	525	Wilmington Reacreation Center	0	525
BaP TEQ	37.14%	0.179	0.179	0.179	No Discernible Distribution	0.179	Wilmington Middle School	0.5	None

Notes:
NA - Not applicable
3IR - Three Interquartile Range
WOE - Weight of Evidence
GOF - Goodness of fit test
LN - Lognormal

Table A2-3
Summary Background Threshold Values of Metals and cPAHs
Former Kast Property
Carson, California

Analyte	# Samples	% NDs	Maximum	95%-tile 99% UTL	BTV	SoCal BTV	Selected BTV
Antimony	106	99.06%	0.741	0.74	0.74	--	0.74
Arsenic	105	2.86%	11.9	10.41	10.41	12	12
Barium	104	0.00%	267	267.00	267.00	--	267.00
Beryllium	106	16.98%	0.8	0.562	0.56	--	0.56
Cadmium	106	53.77%	3.81	3.81	3.81	--	3.81
Chromium	106	0.00%	38.6	32.54	32.54	--	32.54
Cobalt	106	3.77%	15.7	10.91	10.91	--	10.91
Copper	106	0.00%	59	64.62	59.00	--	59.00
Lead	106	5.66%	112	61.46	61.46	--	61.46
Mercury	106	71.70%	0.324	0.13	0.13	--	0.13
Molybdenum	106	84.91%	0.625	0.41	0.41	--	0.41
Nickel	106	10.38%	27.2	20.17	20.17	--	20.17
Selenium	106	99.06%	0.78	0.78	0.78	--	0.78
Silver	106	91.51%	1.29	2.32	1.29	--	1.29
Thallium	106	100.00%	N/A	0.23	0.23	--	0.23
Vanadium	106	0.00%	47.1	45.66	45.66	--	45.66
Zinc	105	0.00%	291	291.00	291.00	--	291.00
BaP TEQ	35	37.14%	0.179	0.10	0.10	0.9	0.9

Notes:
Values shown are based on background datasets after elimination of outliers
ND: Non detects
UTL: Upper Tolerance Limit
BTV: Background Threshold Value

Figures

Figure A2-1: Box Plots of Metals Background Datasets

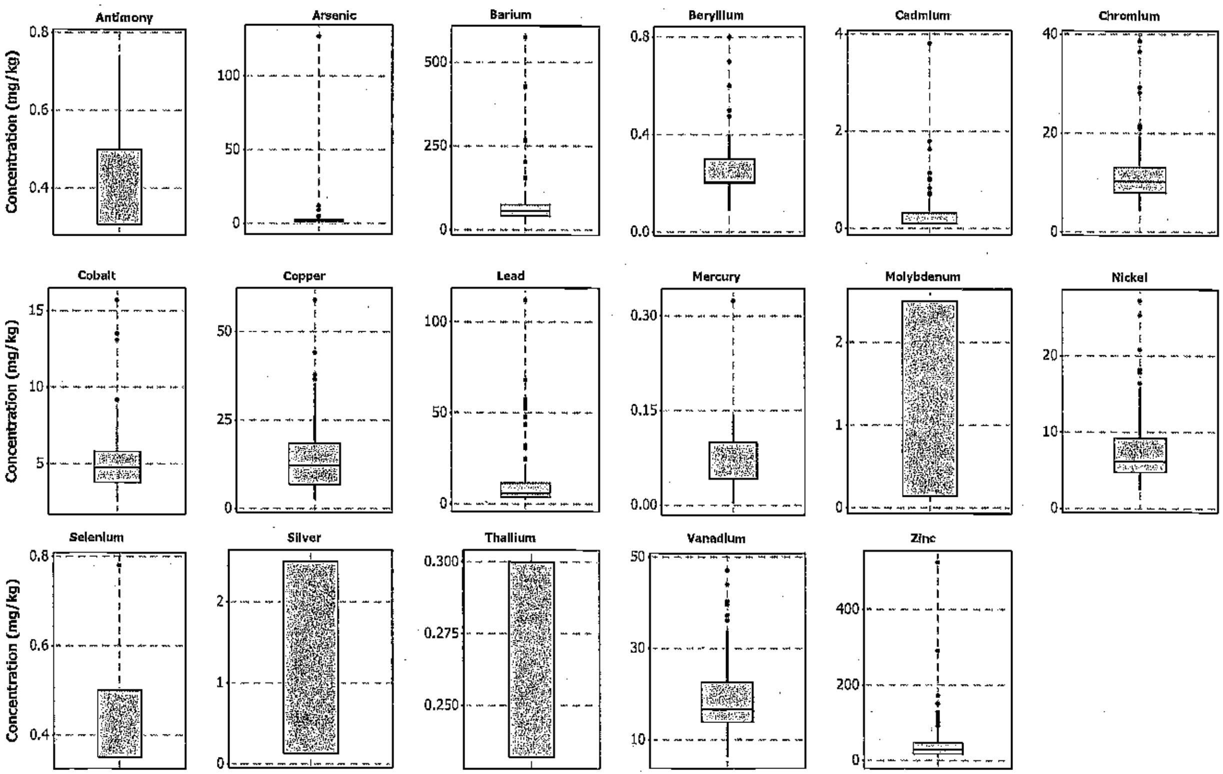


Figure A2-2: Probability Plots of Metals Background Datasets

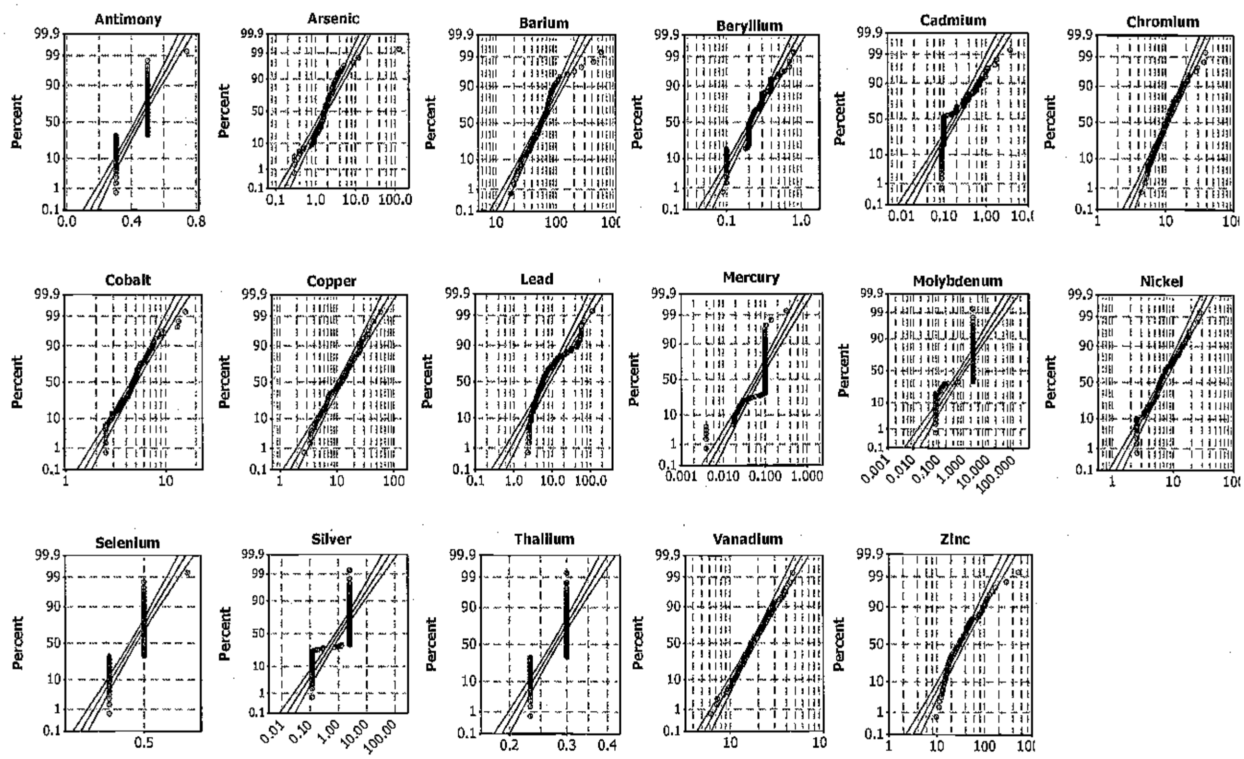
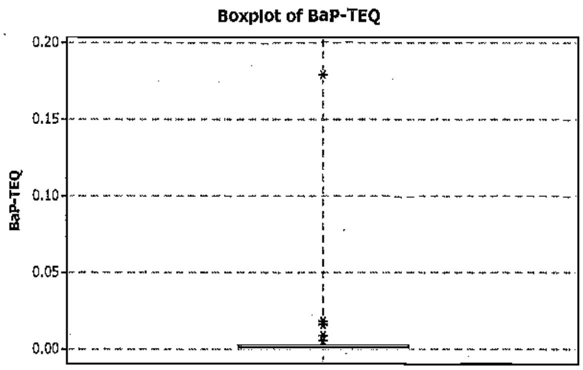
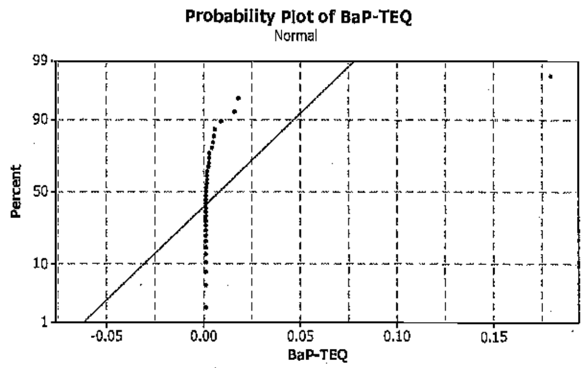


Figure A2-3: Box Plot and Probability Plots of cPAH Background Datasets





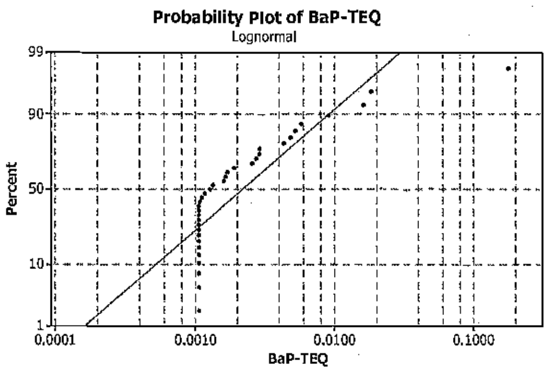
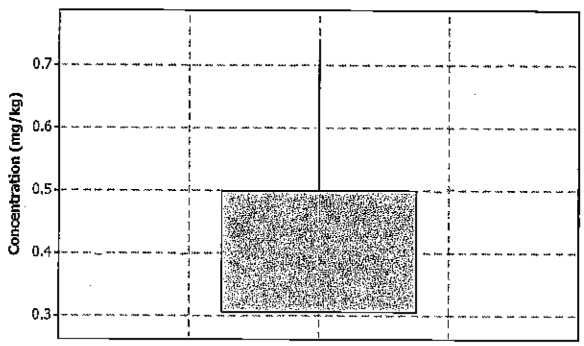
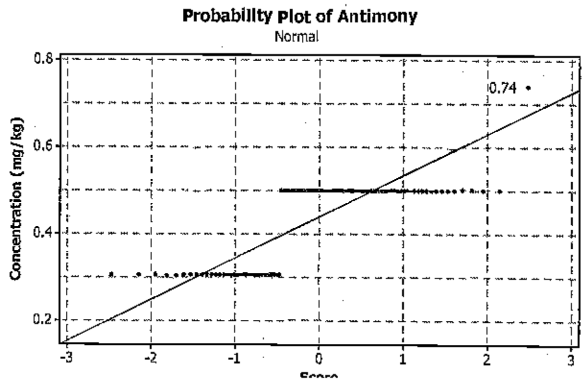
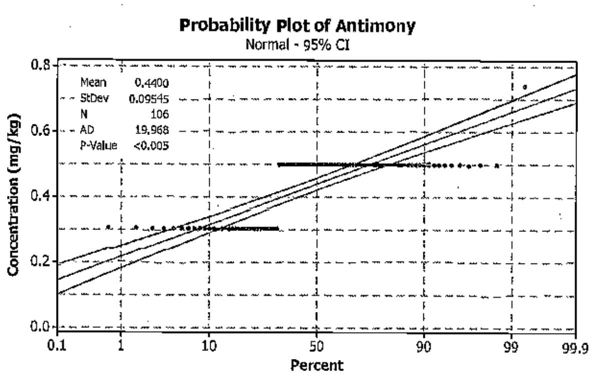


Figure A2-4-1: Antimony Outlier Evaluation





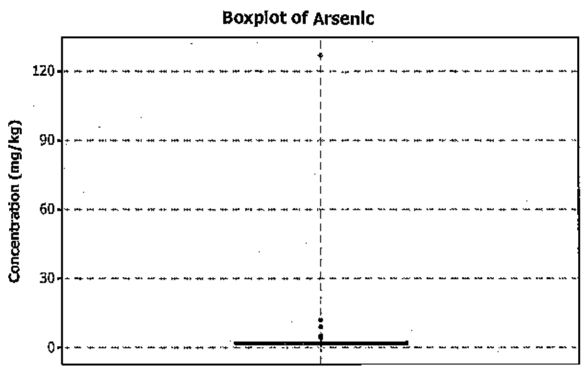


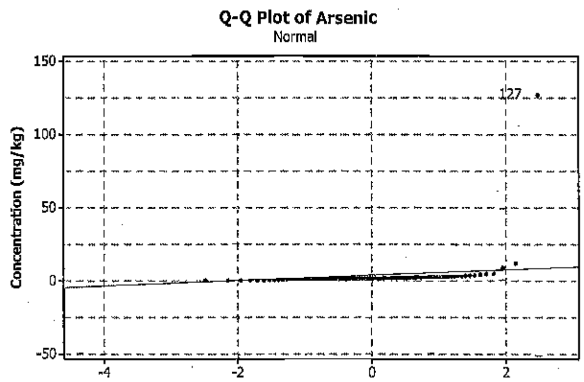
Note: Samples 99% ND (only 1 sample detected)

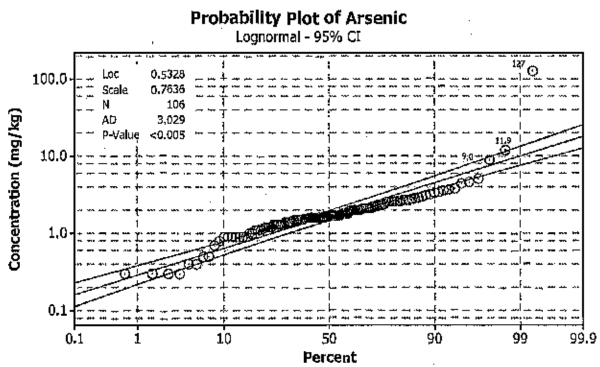
- No reliable statistical tests

- No samples were eliminated as outliers

Figure A2-4-2: Arsenic Outlier Evaluation

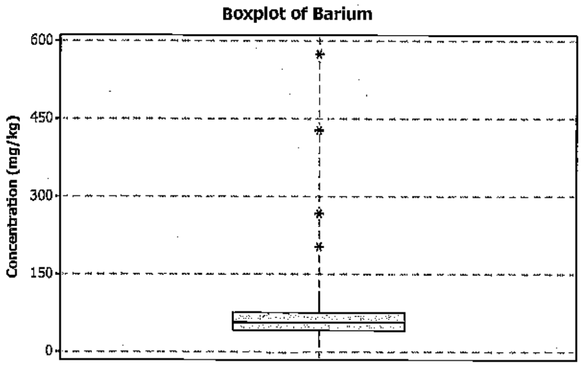


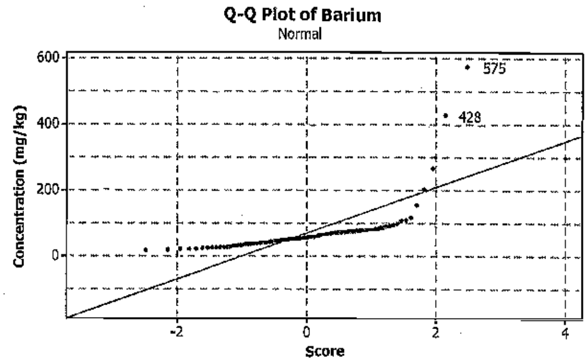


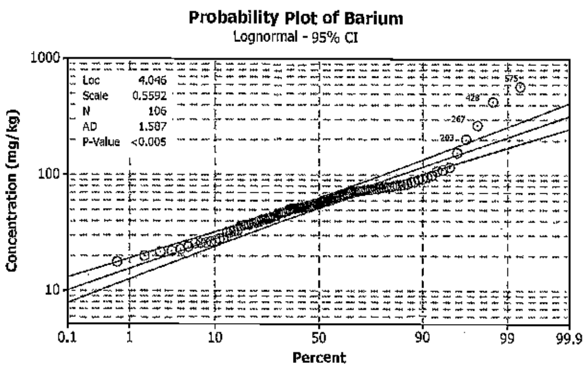


- 3IR box plot Tests indicate outliers: 9, 11.9 and 127.
- Rosner Test indicates outlier 127.
- Q-Q plot indicates one suspected outlier 127.
- GOF test: not normal or lognormal distribution, But the Lognormal fit shows strong linearity except one point: 127 may be considered an outlier.

Figure A2-4-3: Barium Outlier Evaluation

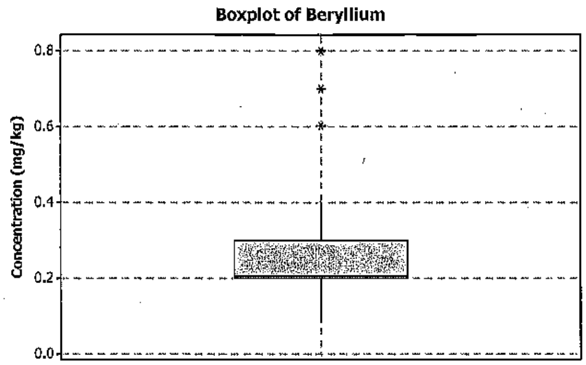


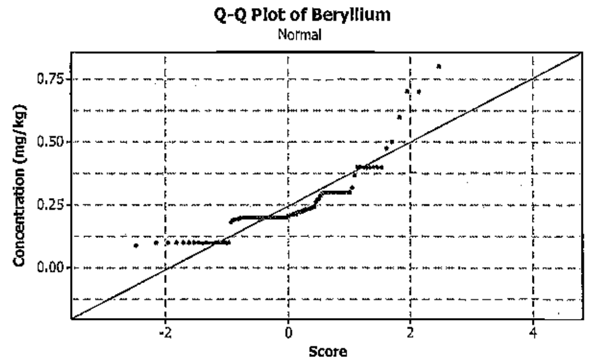


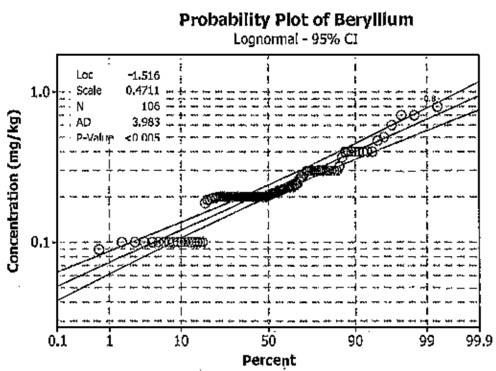


- 3IR suspected outliers - 203, 267, 428 and 575
- Rosner test suspect outlier: 575
- Q-Q plot based suspected outliers - 428 and 575
- Goodness of fit test: data does not fit normal, lognormal or gamma
-

Figure A2-4-4: Beryllium Outlier Evaluation

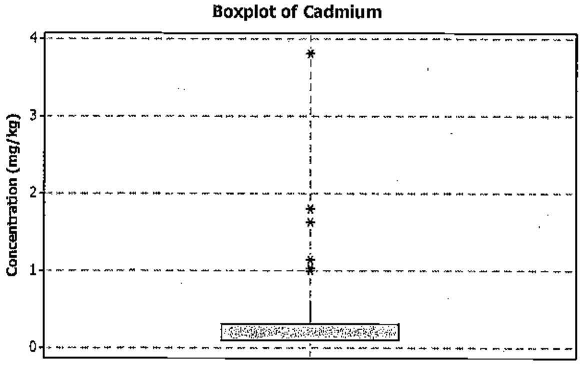


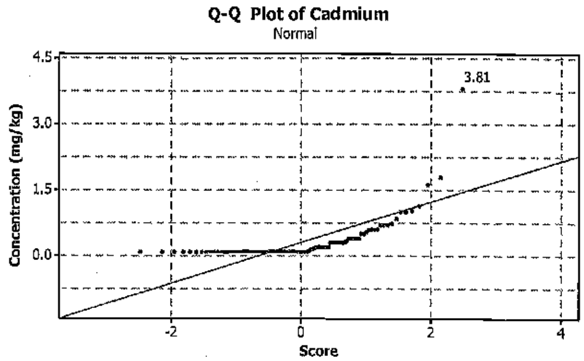


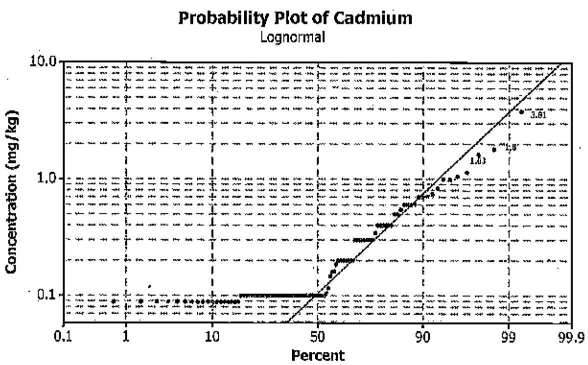


- 3IR suspect outliers - 0.6, 0.7, 0.7 and 0.8
- Rosner test suspect outlier - 0.8
- Q-Q plot based suspected outliers - None
- GOF test: not N, LN, GM (close to LN)
- No outlier

Figure A2-4-5: Cadmium Outlier Evaluation

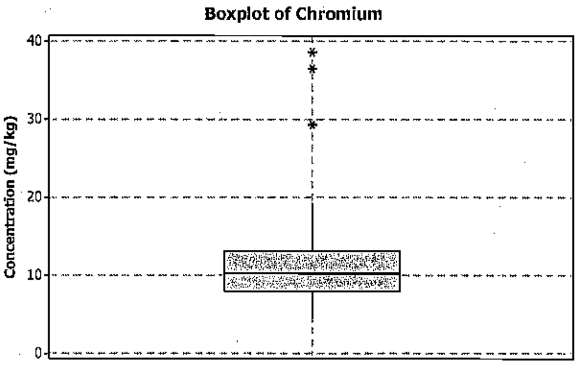


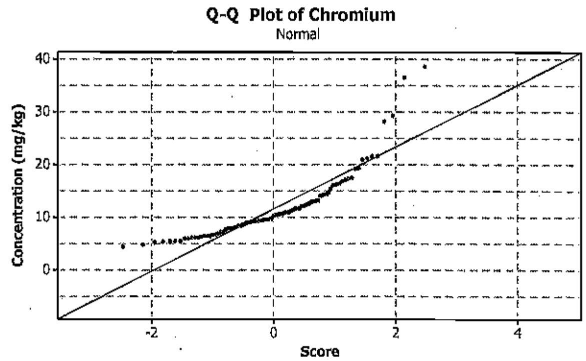


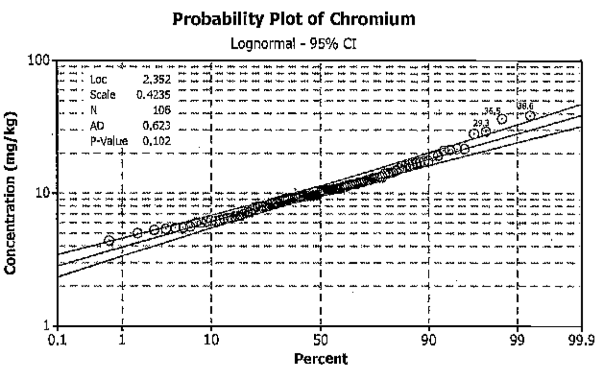


- 3IR suspected outliers - 1.0 to 3.81
- Rosner test outlier - 3.81
- Q-Q plot based suspected outliers - 3.81
- GOF test: Data appear LN
- No outlier

Figure A2-4-6: Chromium Outlier Evaluation

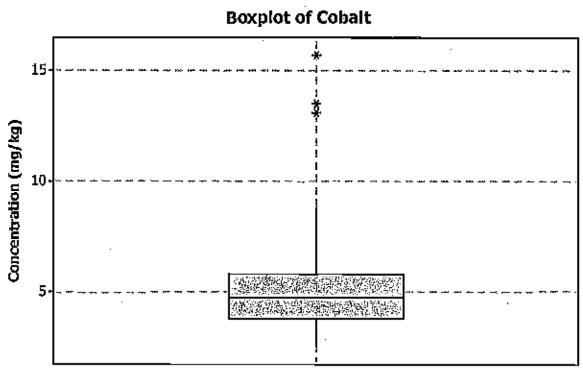


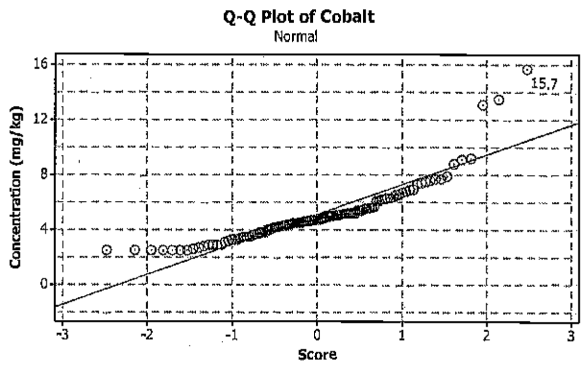


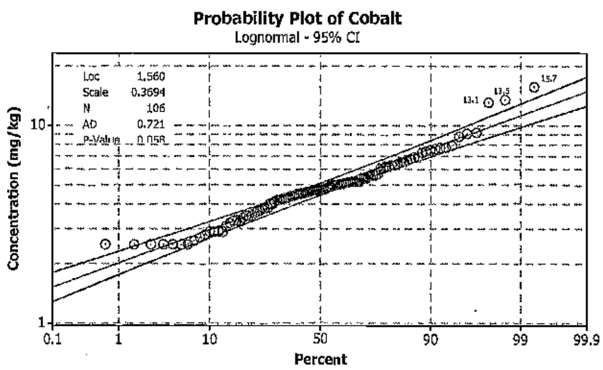


- 3IR suspected outliers -29.3, 36.5 and 38.6
- Rosner test: 38.6
- Q-Q plot based suspected outliers - None
- GOF: Data appear LN
- No outlier

Figure A2-4-7: Cobalt Outlier Evaluation

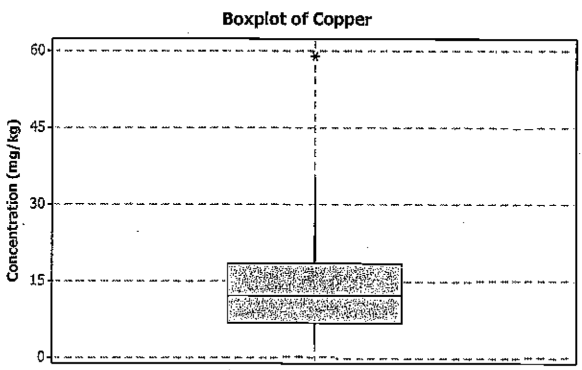


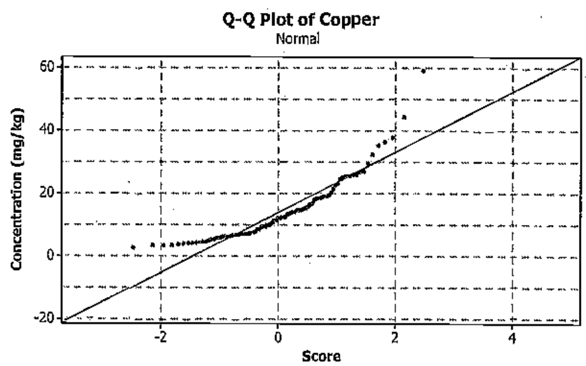


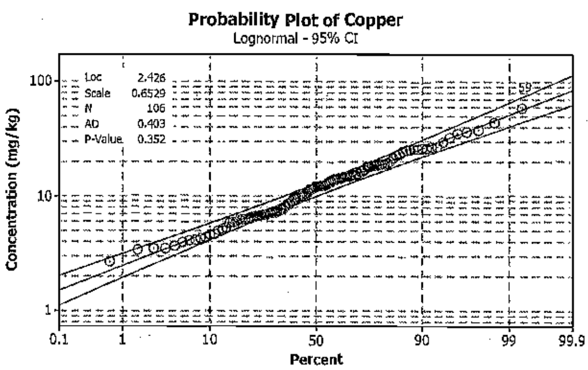


- 3IR suspected outliers - 13.1, 13.5, 15.7
- Rosner test: 15.7
- Q-Q plot based suspected outliers - None
- GOF test: Lognormal
- No outlier

Figure A2-4-8: Copper Outlier Evaluation

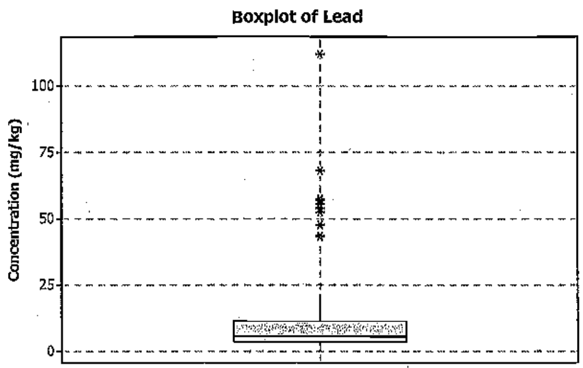


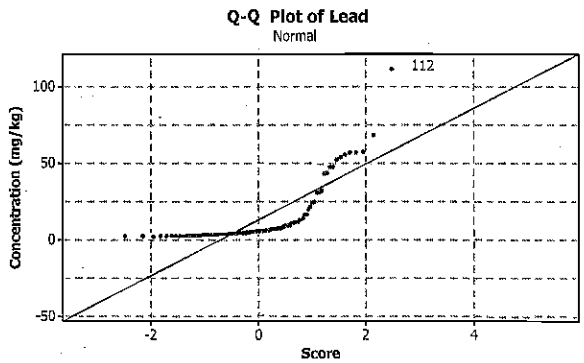


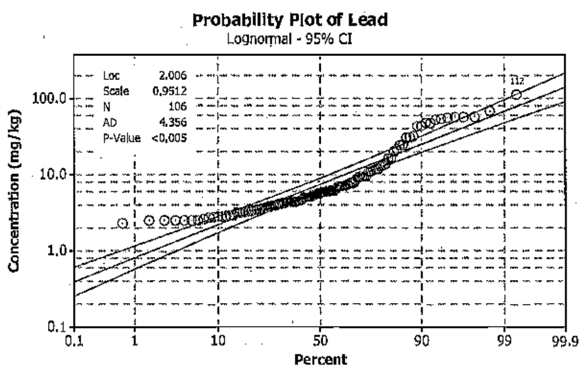


- 3IR suspected outliers - 59
- Rosner test = 59
- Q-Q plot based suspected outliers - None
- GOF test: Lognormal or gamma
- No outlier

Figure A2-4-9: Lead Outlier Evaluation

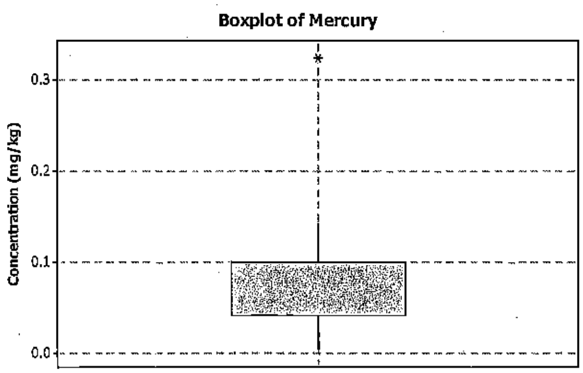


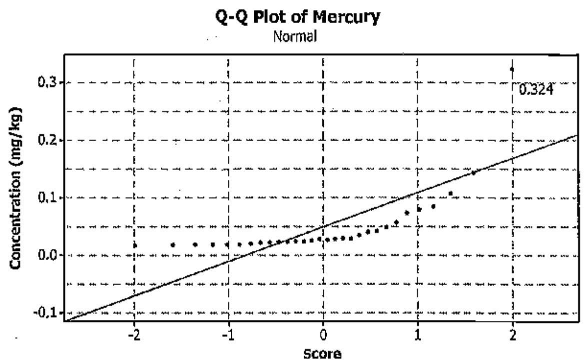


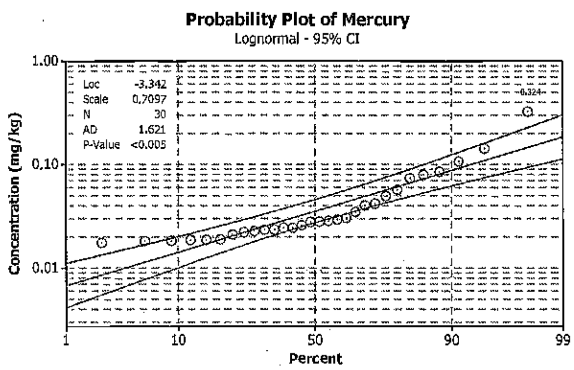


- 3IR suspected outliers - 43.3 to 112
- Rosner test outlier = 112
- Q-Q plot based suspected outliers - 112
- GOF test: not N, LN or GM
- Suspected outlier 112 does not appear to be significantly elevated than rest of data
- No outlier

Figure A2-4-10: Mercury Outlier Evaluation







- Rosner test and 3IR suspected outliers - 0.324

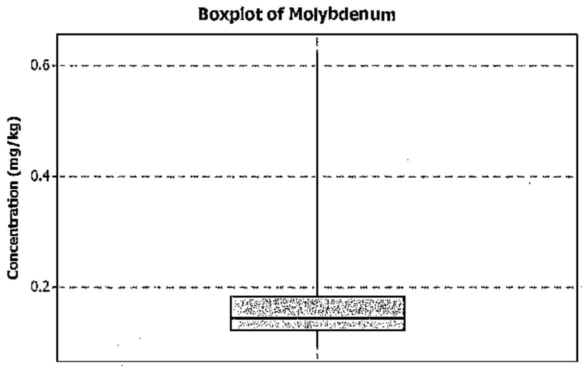
- Q-Q plot based suspected outliers - none

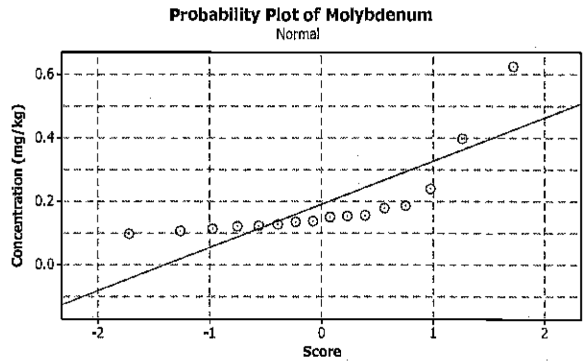
- GOF: not N or LN. Data appears fairly linear under LN.

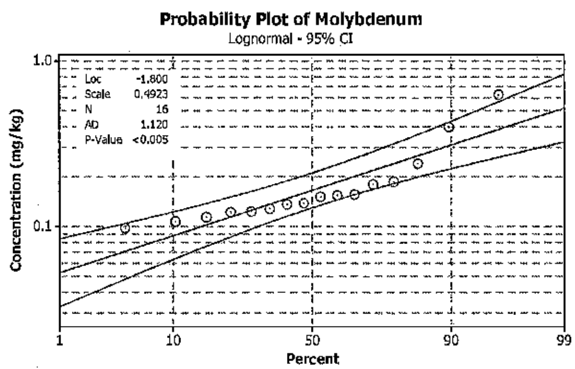
Note: %ND = 71.7%.
- Only detected values used in probability plot

- No outlier

Figure A2-4-11: Molybdenum Outlier Evaluation





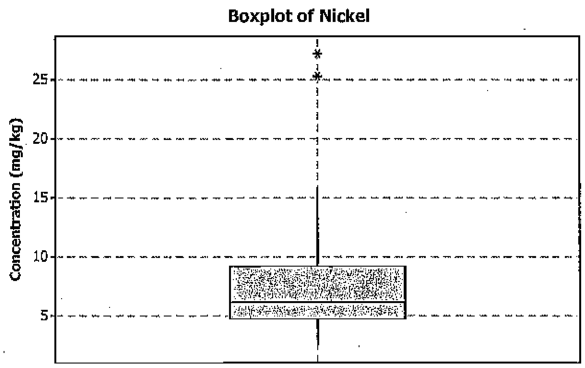


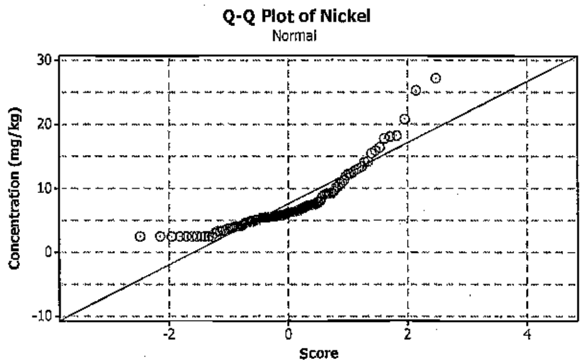
- Rosner test and 3IR suspected outliers - none

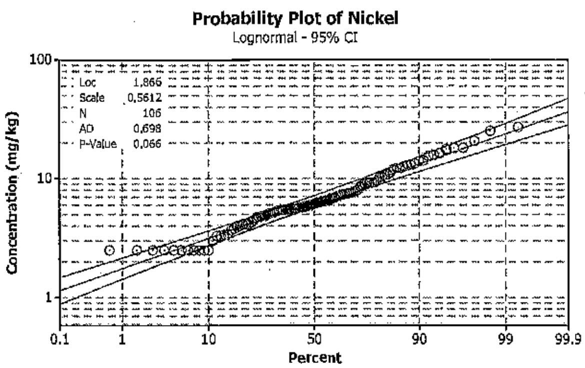
- Probability plot based suspected outliers - none

Note: %ND = 84.9%.
- Only detected values used in probability plot

Figure A2-4-12: Nickel Outlier Evaluation

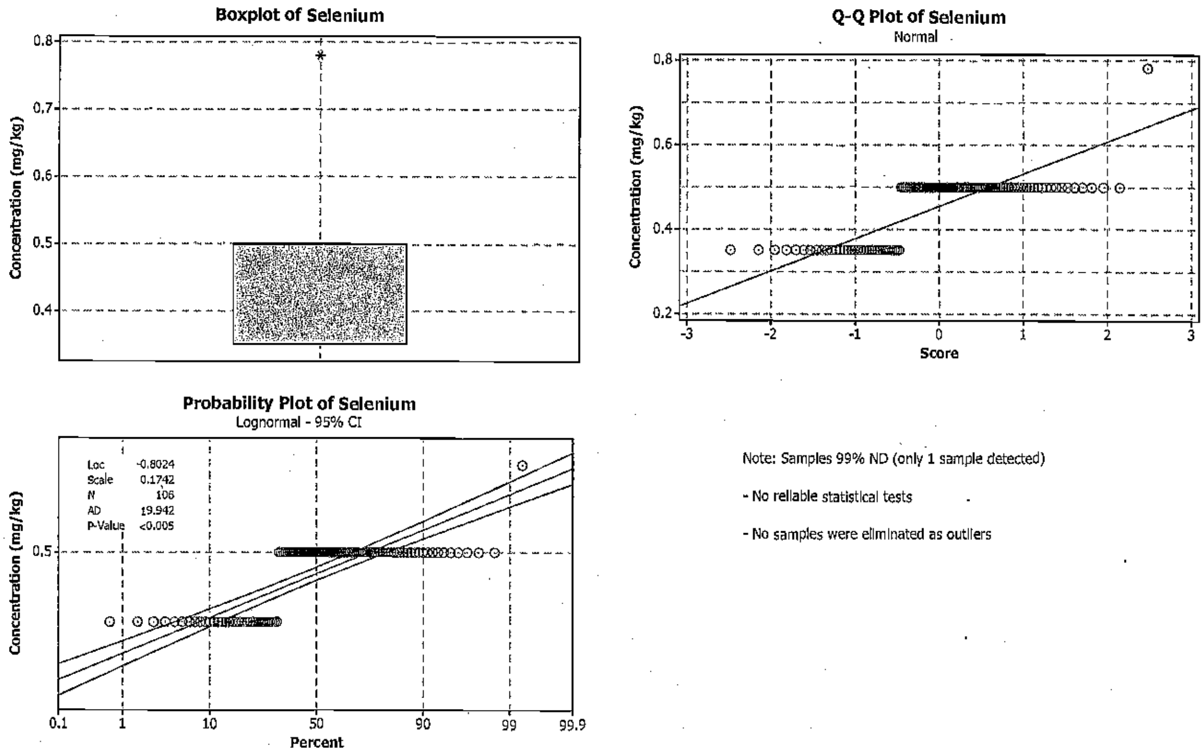






- 3IR suspected outliers -25.3, 27.2
- Rosner test 27.2
- Q-Q plot based suspected outliers - none
- GOF test: Lognormal
- No outlier

Figure A2-4-13: Selenium Outlier Evaluation

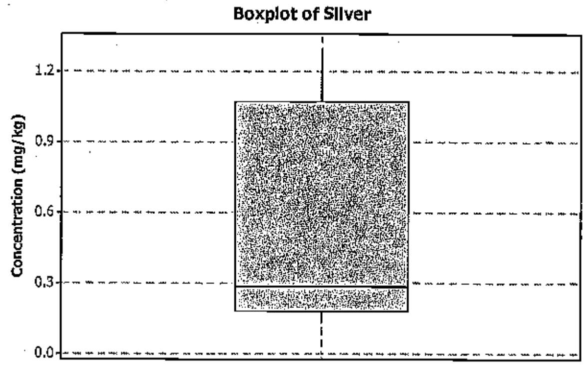


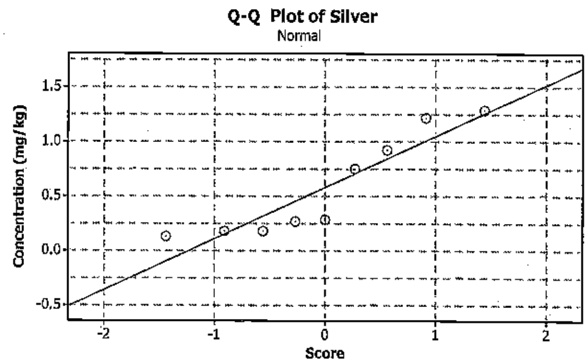
Note: Samples 99% ND (only 1 sample detected)

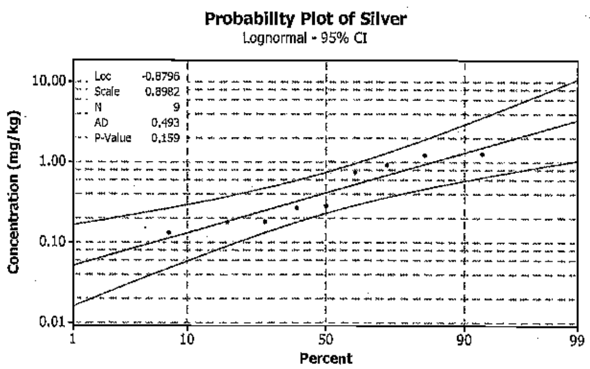
- No reliable statistical tests

- No samples were eliminated as outliers

Figure A2-4-14: Silver Outlier Evaluation







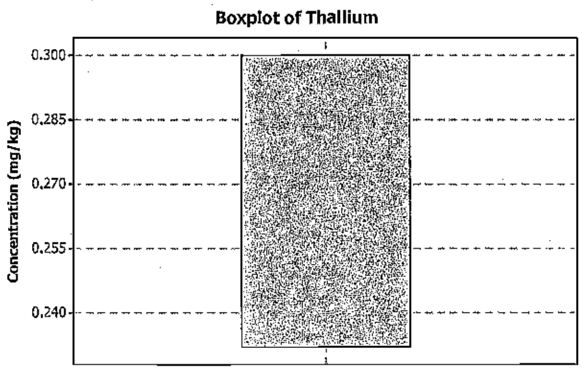
- Rosner test and 3IR suspected outliers - none

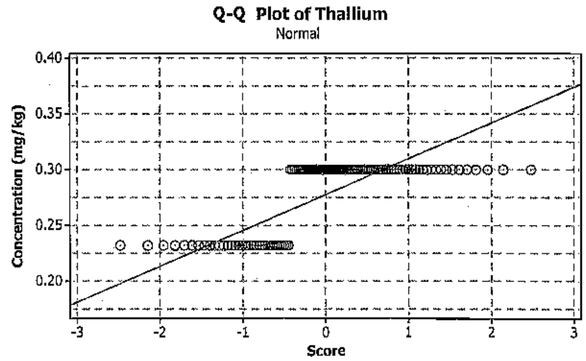
- Q-Q plot based suspected outliers - none

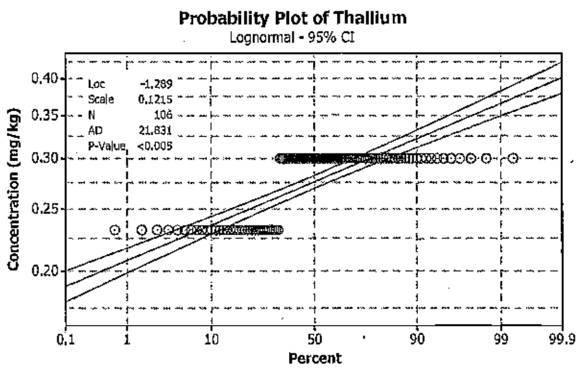
Note: %ND = 91.5%.
- Only detected values used in probability plot

- No outlier

Figure A2-4-15: Thallium Outlier Evaluation

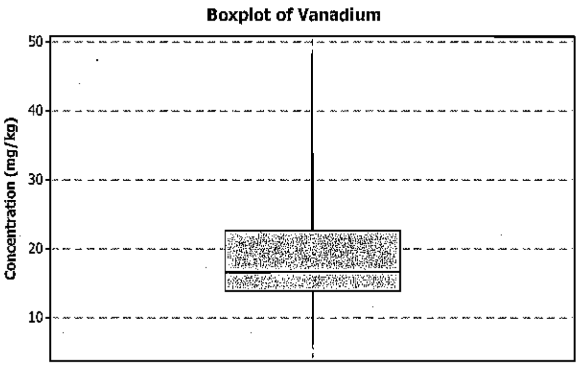


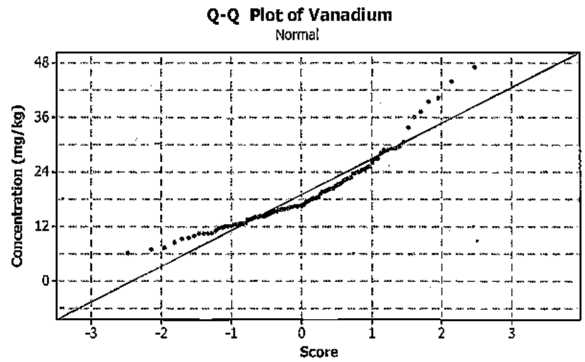


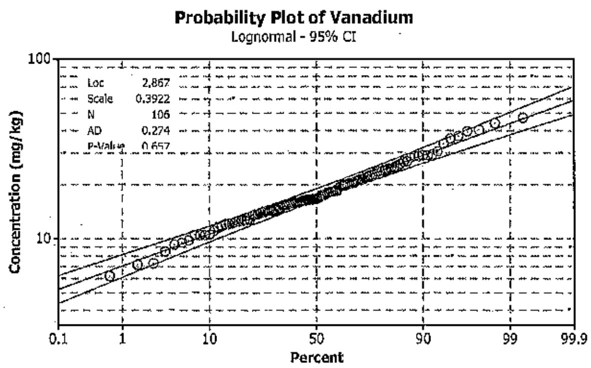


%ND = 100%

Figure A2-4-16: Vanadium Outlier Evaluation

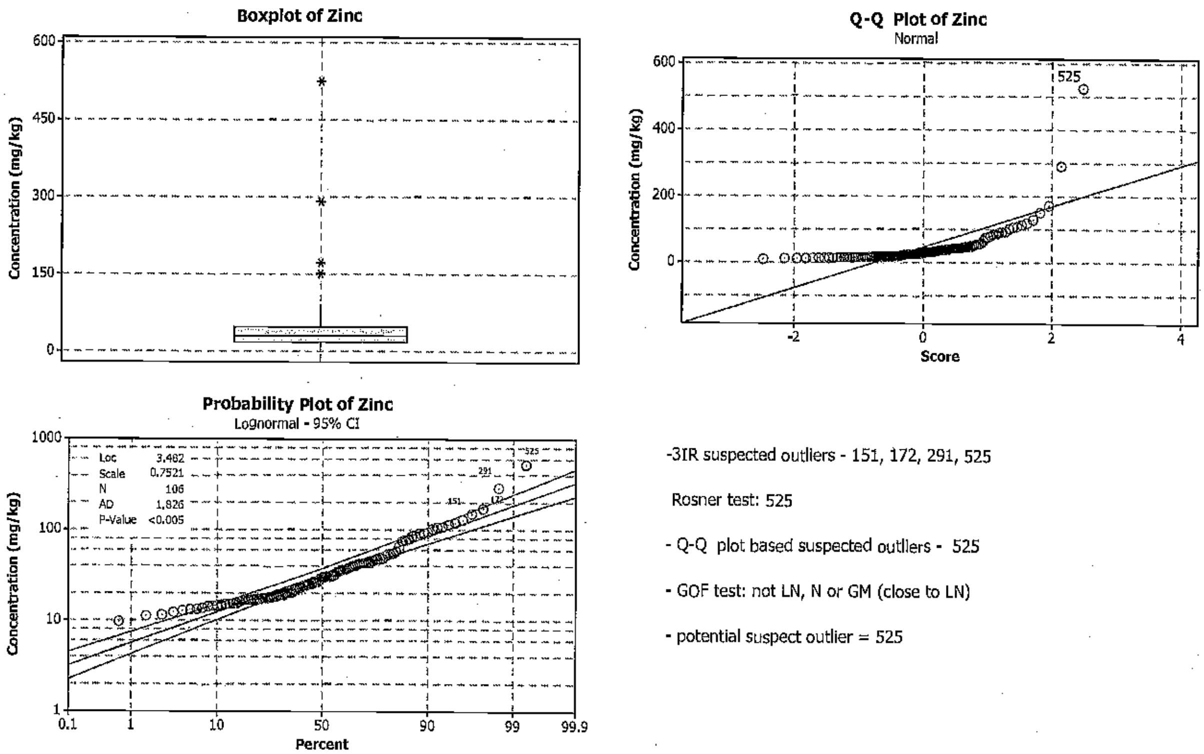






- Rosner test and 3IR suspected outliers - none
- Q-Q plot based suspected outliers - None
- GOF Test : Lognormal
- No outlier

Figure A2-4-17: Zinc Outlier Evaluation



-3IR suspected outliers - 151, 172, 291, 525

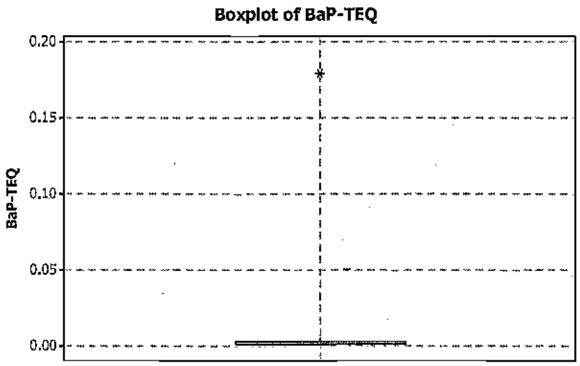
Rosner test: 525

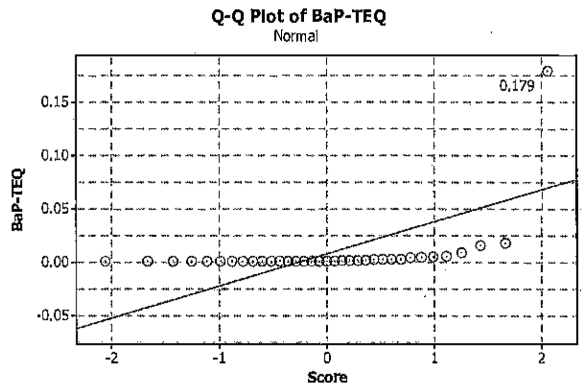
- Q-Q plot based suspected outliers - 525

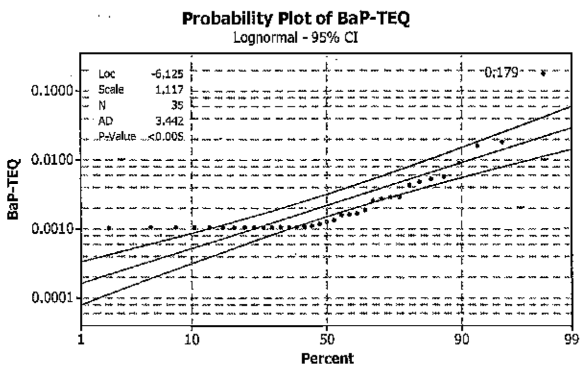
- GOF test: not LN, N or GM (close to LN)

- potential suspect outlier = 525

Figure A2-4-18: cPAH Outlier Evaluation

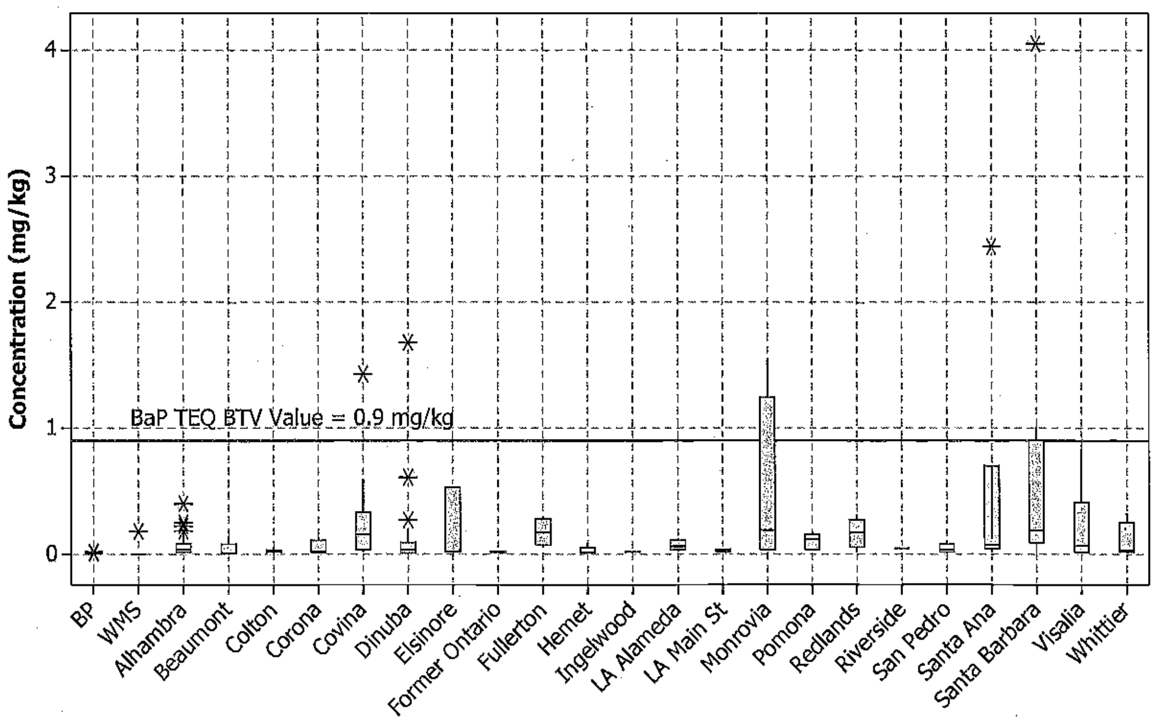






- 3IR suspected outliers - 0.179
- Rosner test = 0.179
- Q-Q plot based suspected outliers - 0.179
- GOF test: No discernible distribution (not N, LN or GM)
- No outlier

Figure A2-5: Boxplots of Local Background and Southern California Background cPAH Datasets



ProUCL Output

	A	B	C	D	E	F	G	H	I	J	K	L
1				General Background Statistics for Data Sets with Non-Detects								
2	User Selected Options											
3	From File			WorkSheet.wst								
4	Full Precision			OFF								
5	Confidence Coefficient			95%								
6	Coverage			99%								
7	Different or Future K Values			1								
8	Number of Bootstrap Operations			2000								
9												
10												
11	Antimony											
12												
13	General Statistics											
14	Number of Valid Data					106	Number of Detected Data					1
15	Number of Distinct Detected Data					1	Number of Non-Detect Data					105
16												
17	Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!											
18	It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).											
19												
20	The data set for variable Antimony was not processed!											
21												
22												
23												
24	Arsenic											
25												
26	General Statistics											
27	Number of Valid Data					105	Number of Detected Data					102
28	Number of Distinct Detected Data					61	Number of Non-Detect Data					3
29	Tolerance Factor					2.671	Percent Non-Detects					2.86%
30	Number of Missing Values					1						
31												
32	Raw Statistics						Log-transformed Statistics					
33	Minimum Detected					0.3	Minimum Detected					-1.204
34	Maximum Detected					11.9	Maximum Detected					2.477
35	Mean of Detected					2.041	Mean of Detected					0.542
36	SD of Detected					1.511	SD of Detected					0.577
37	Minimum Non-Detect					0.3	Minimum Non-Detect					-1.204
38	Maximum Non-Detect					0.3	Maximum Non-Detect					-1.204
39												
40												
41	Background Statistics											
42	Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only					
43	Lilliefors Test Statistic					0.181	Lilliefors Test Statistic					0.0886
44	5% Lilliefors Critical Value					0.0877	5% Lilliefors Critical Value					0.0877
45	Data not Normal at 5% Significance Level						Data not Lognormal at 5% Significance Level					
46												
47	Assuming Normal Distribution						Assuming Lognormal Distribution					
48	DL/2 Substitution Method						DL/2 Substitution Method					
49	Mean					1.987	Mean (Log Scale)					0.472
50	SD					1.522	SD (Log Scale)					0.7
51	95% UTL 99% Coverage					6.053	95% UTL 99% Coverage					10.38
52	95% UPL (t)					4.526	95% UPL (t)					5.148
53	90% Percentile (z)					3.938	90% Percentile (z)					3.929

	A–E	F	G–K	L
54	95% Percentile (z)	4.491	95% Percentile (z)	5.067
55	99% Percentile (z)	5.529	99% Percentile (z)	8.162
56				
57	Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
58	Mean	1.969	Mean in Original Scale	1.995
59	SD	1.545	SD in Original Scale	1.513
60	95% UTL with 99% Coverage	6.095	95% UTL with 99% Coverage	8.536
61			95% BCA UTL with 99% Coverage	11.9
62			95% Bootstrap (%) UTL with 99% Coverage	11.9
63	95% UPL (t)	4.545	95% UPL (t)	4.605
64	90% Percentile (z)	3.949	90% Percentile (z)	3.632
65	95% Percentile (z)	4.51	95% Percentile (z)	4.542
66	99% Percentile (z)	5.563	99% Percentile (z)	6.907
67				
68	**Gamma Distribution Test with Detected Values Only**		**Data Distribution Test with Detected Values Only**	
69	k star (bias corrected)	2.978	Data do not follow a Discernable Distribution (0.05)	
70	Theta Star	0.685		
71	nu star	607.6		
72				
73	A-D Test Statistic	1.627	**Nonparametric Statistics**	
74	5% A-D Critical Value	0.758	Kaplan-Meier (KM) Method	
75	K-S Test Statistic	0.101	Mean	1.992
76	5% K-S Critical Value	0.0895	SD	1.51
77	**Data not Gamma Distributed at 5% Significance Level**		SE of Mean	0.148
78			95% KM UTL with 99% Coverage	6.025
79	**Assuming Gamma Distribution**		95% KM Chebyshev UPL	8.605
80	Gamma ROS Statistics with Extrapolated Data		95% KM UPL (t)	4.51
81	Mean	1.983	90% Percentile (z)	3.927
82	Median	1.66	95% Percentile (z)	4.476
83	SD	1.528	99% Percentile (z)	5.505
84	k star	1.015		
85	Theta star	1.953	**Gamma ROS Limits with Extrapolated Data**	
86	Nu star	213.2	95% Wilson Hilferty (WH) Approx. Gamma UPL	4.962
87	95% Percentile of Chisquare (2k)	6.051	95% Hawkins Wixley (HW) Approx. Gamma UPL	5.684
88			95% WH Approx. Gamma UTL with 99% Coverage	8.224
89	90% Percentile	4.549	95% HW Approx. Gamma UTL with 99% Coverage	10.41
90	95% Percentile	5.909		
91	99% Percentile	9.063		
92				
93	**Note: DL/2 is not a recommended method.**			
94				
95				
96	**Barium**			
97				
98	**General Statistics**			
99	Total Number of Observations	104	Number of Distinct Observations	95
100	Tolerance Factor	2.672	Number of Missing Values	2
101				
102	**Raw Statistics**		**Log-Transformed Statistics**	
103	Minimum	17.7	Minimum	2.874
104	Maximum	267	Maximum	5.587
105	Second Largest	203	Second Largest	5.313
106	First Quartile	41.25	First Quartile	3.72

	A–E	F	G–K	L
107	Median	56	Median	4.025
108	Third Quartile	74.85	Third Quartile	4.315
109	Mean	61.58	Mean	4.005
110	SD	34.25	SD	0.475
111	Coefficient of Variation	0.556		
112	Skewness	2.953		
113				
114	**Background Statistics**			
115	**Normal Distribution Test**		**Lognormal Distribution Test**	
116	Lilliefors Test Statistic	0.15	Lilliefors Test Statistic	0.0764
117	Lilliefors Critical Value	0.0869	Lilliefors Critical Value	0.0869
118	**Data not Normal at 5% Significance Level**		**Data appear Lognormal at 5% Significance Level**	
119				
120	**Assuming Normal Distribution**		**Assuming Lognormal Distribution**	
121	95% UTL with 99% Coverage	153.1	95% UTL with 99% Coverage	195.4
122	95% UPL (t)	118.7	95% UPL (t)	121.2
123	90% Percentile (z)	105.5	90% Percentile (z)	100.9
124	95% Percentile (z)	117.9	95% Percentile (z)	119.9
125	99% Percentile (z)	141.3	99% Percentile (z)	165.8
126				
127	**Gamma Distribution Test**		**Data Distribution Test**	
128	k star	4.356	**Data appear Lognormal at 5% Significance Level**	
129	Theta Star	14.14		
130	MLE of Mean	61.58		
131	MLE of Standard Deviation	29.51		
132	nu star	906		
133				
134	A-D Test Statistic	0.826	**Nonparametric Statistics**	
135	5% A-D Critical Value	0.755	90% Percentile	87.05
136	K-S Test Statistic	0.091	95% Percentile	106.7
137	5% K-S Critical Value	0.0887	99% Percentile	201.6
138	**Data not Gamma Distributed at 5% Significance Level**			
139				
140	**Assuming Gamma Distribution**		95% UTL with 99% Coverage	267
141	90% Percentile	101.1	95% Percentile Bootstrap UTL with 99% Coverage	267
142	95% Percentile	116.7	95% BCA Bootstrap UTL with 99% Coverage	267
143	99% Percentile	150	95% UPL	109.5
144			95% Chebyshev UPL	211.6
145	95% WH Approx. Gamma UPL	116.6	Upper Threshold Limit Based upon IQR	125.3
146	95% HW Approx. Gamma UPL	117.3		
147	95% WH Approx. Gamma UTL with 99% Coverage	167.4		
148	95% HW Approx. Gamma UTL with 99% Coverage	172.2		
149				
150				
151				
152	**Beryllium**			
153				
154	**General Statistics**			
155	Number of Valid Data	106	Number of Detected Data	88
156	Number of Distinct Detected Data	38	Number of Non-Detect Data	18
157	Tolerance Factor	2.669	Percent Non-Detects	16.98%
158				
159	**Raw Statistics**		**Log-transformed Statistics**	

	A–E	F	G–K	L
160	Minimum Detected	0.182	Minimum Detected	-1.704
161	Maximum Detected	0.8	Maximum Detected	-0.223
162	Mean of Detected	0.276	Mean of Detected	-1.353
163	SD of Detected	0.119	SD of Detected	0.333
164	Minimum Non-Detect	0.0894	Minimum Non-Detect	-2.415
165	Maximum Non-Detect	0.1	Maximum Non-Detect	-2.303
166				
167	**Data with Multiple Detection Limits**		**Single Detection Limit Scenario**	
168	Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect with Single DL	18
169	For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected with Single DL	88
170	Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	16.98%
171				
172			**Background Statistics**	
173	**Normal Distribution Test with Detected Values Only**		**Lognormal Distribution Test with Detected Values Only**	
174	Lilliefors Test Statistic	0.237	Lilliefors Test Statistic	0.19
175	5% Lilliefors Critical Value	0.0944	5% Lilliefors Critical Value	0.0944
176	**Data not Normal at 5% Significance Level**		**Data not Lognormal at 5% Significance Level**	
177				
178	**Assuming Normal Distribution**		**Assuming Lognormal Distribution**	
179	DL/2 Substitution Method		DL/2 Substitution Method	
180	Mean	0.237	Mean (Log Scale)	-1.633
181	SD	0.138	SD (Log Scale)	0.692
182	95% UTL 99% Coverage	0.605	95% UTL 99% Coverage	1.238
183	95% UPL (t)	0.467	95% UPL (t)	0.619
184	90% Percentile (z)	0.414	90% Percentile (z)	0.474
185	95% Percentile (z)	0.464	95% Percentile (z)	0.609
186	99% Percentile (z)	0.558	99% Percentile (z)	0.977
187				
188	Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
189	Mean	0.232	Mean in Original Scale	0.25
190	SD	0.147	SD in Original Scale	0.122
191	95% UTL with 99% Coverage	0.624	95% UTL with 99% Coverage	0.687
192			95% BCA UTL with 99% Coverage	0.795
193			95% Bootstrap (%) UTL with 99% Coverage	0.8
194	95% UPL (t)	0.477	95% UPL (t)	0.455
195	90% Percentile (z)	0.42	90% Percentile (z)	0.388
196	95% Percentile (z)	0.474	95% Percentile (z)	0.451
197	99% Percentile (z)	0.574	99% Percentile (z)	0.597
198				
199	**Gamma Distribution Test with Detected Values Only**		**Data Distribution Test with Detected Values Only**	
200	k star (bias corrected)	7.677	Data do not follow a Discernable Distribution (0.05)	
201	Theta Star	0.0359		
202	nu star	1351		
203				
204	A-D Test Statistic	6.767	**Nonparametric Statistics**	
205	5% A-D Critical Value	0.753	Kaplan-Meier (KM) Method	
206	K-S Test Statistic	0.201	Mean	0.26
207	5% K-S Critical Value	0.0954	SD	0.113
208	**Data not Gamma Distributed at 5% Significance Level**		SE of Mean	0.0111
209			95% KM UTL with 99% Coverage	0.562
210	**Assuming Gamma Distribution**		95% KM Chebyshev UPL	0.756
211	Gamma ROS Statistics with Extrapolated Data		95% KM UPL (t)	0.449
212	Mean	0.232	90% Percentile (z)	0.405

	A–E	F	G–K	L
213	Median	0.206	95% Percentile (z)	0.446
214	SD	0.145	99% Percentile (z)	0.523
215	k star	0.512		
216	Theta star	0.453	**Gamma ROS Limits with Extrapolated Data**	
217	Nu star	108.6	95% Wilson Hilferty (WH) Approx. Gamma UPL	0.742
218	95% Percentile of Chisquare (2k)	3.903	95% Hawkins Wixley (HW) Approx. Gamma UPL	0.961
219			95% WH Approx. Gamma UTL with 99% Coverage	1.379
220	90% Percentile	0.625	95% HW Approx. Gamma UTL with 99% Coverage	2.113
221	95% Percentile	0.884		
222	99% Percentile	1.52		
223				
224	**Note: DL/2 is not a recommended method.**			
225				
226				
227	Cadmium			
228				
229	**General Statistics**			
230	Number of Valid Data	106	Number of Detected Data	49
231	Number of Distinct Detected Data	24	Number of Non-Detect Data	57
232	Tolerance Factor	2.669	Percent Non-Detects	53.77%
233				
234	**Raw Statistics**		**Log-transformed Statistics**	
235	Minimum Detected	0.105	Minimum Detected	-2.254
236	Maximum Detected	3.81	Maximum Detected	1.338
237	Mean of Detected	0.551	Mean of Detected	-0.917
238	SD of Detected	0.599	SD of Detected	0.749
239	Minimum Non-Detect	0.0883	Minimum Non-Detect	-2.427
240	Maximum Non-Detect	0.1	Maximum Non-Detect	-2.303
241				
242	**Data with Multiple Detection Limits**		**Single Detection Limit Scenario**	
243	Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect with Single DL	57
244	For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected with Single DL	49
245	Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	53.77%
246				
247	**Background Statistics**			
248	**Normal Distribution Test with Detected Values Only**		**Lognormal Distribution Test with Detected Values Only**	
249	Shapiro Wilk Test Statistic	0.623	Shapiro Wilk Test Statistic	0.962
250	5% Shapiro Wilk Critical Value	0.947	5% Shapiro Wilk Critical Value	0.947
251	**Data not Normal at 5% Significance Level**		**Data appear Lognormal at 5% Significance Level**	
252				
253	**Assuming Normal Distribution**		**Assuming Lognormal Distribution**	
254	DL/2 Substitution Method		DL/2 Substitution Method	
255	Mean	0.28	Mean (Log Scale)	-2.056
256	SD	0.477	SD (Log Scale)	1.177
257	95% UTL 99% Coverage	1.554	95% UTL 99% Coverage	2.958
258	95% UPL (t)	1.076	95% UPL (t)	0.91
259	90% Percentile (z)	0.892	90% Percentile (z)	0.578
260	95% Percentile (z)	1.065	95% Percentile (z)	0.887
261	99% Percentile (z)	1.39	99% Percentile (z)	1.977
262				
263	Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
264	Mean	-0.0672	Mean in Original Scale	0.288
265	SD	0.794	SD in Original Scale	0.474

	A–E	F	G–K	L
266	95% UTL with 99% Coverage	2.052	95% UTL with 99% Coverage	4.055
267			95% BCA UTL with 99% Coverage	3.81
268			95% Bootstrap (%) UTL with 99% Coverage	3.81
269	95% UPL (t)	1.257	95% UPL (t)	1.114
270	90% Percentile (z)	0.95	90% Percentile (z)	0.677
271	95% Percentile (z)	1.239	95% Percentile (z)	1.082
272	99% Percentile (z)	1.78	99% Percentile (z)	2.607
273				
274	**Gamma Distribution Test with Detected Values Only**		**Data Distribution Test with Detected Values Only**	
275	k star (bias corrected)	1.62	Data appear Lognormal at 5% Significance Level	
276	Theta Star	0.34		
277	nu star	158.7		
278				
279	A-D Test Statistic	1.429	**Nonparametric Statistics**	
280	5% A-D Critical Value	0.765	Kaplan-Meier (KM) Method	
281	K-S Test Statistic	0.165	Mean	0.311
282	5% K-S Critical Value	0.129	SD	0.461
283	**Data not Gamma Distributed at 5% Significance Level**		SE of Mean	0.0452
284			95% KM UTL with 99% Coverage	1.54
285	**Assuming Gamma Distribution**		95% KM Chebyshev UPL	2.328
286	Gamma ROS Statistics with Extrapolated Data		95% KM UPL (t)	1.079
287	Mean	0.254	90% Percentile (z)	0.901
288	Median	0.000001	95% Percentile (z)	1.068
289	SD	0.49	99% Percentile (z)	1.382
290	k star	0.125		
291	Theta star	2.038	**Gamma ROS Limits with Extrapolated Data**	
292	Nu star	26.47	95% Wilson Hilferty (WH) Approx. Gamma UPL	1.083
293	95% Percentile of Chisquare (2k)	1.417	95% Hawkins Wixley (HW) Approx. Gamma UPL	1.292
294			95% WH Approx. Gamma UTL with 99% Coverage	2.919
295	90% Percentile	0.729	95% HW Approx. Gamma UTL with 99% Coverage	4.69
296	95% Percentile	1.445		
297	99% Percentile	3.609		
298				
299	**Note: DL/2 is not a recommended method.**			
300				
301				
302	**Chromium**			
303				
304	**General Statistics**			
305	Total Number of Observations	106	Number of Distinct Observations	86
306	Tolerance Factor	2.669		
307				
308	**Raw Statistics**		**Log-Transformed Statistics**	
309	Minimum	4.4	Minimum	1.482
310	Maximum	38.6	Maximum	3.653
311	Second Largest	36.5	Second Largest	3.597
312	First Quartile	8.013	First Quartile	2.081
313	Median	10.25	Median	2.327
314	Third Quartile	13.08	Third Quartile	2.571
315	Mean	11.58	Mean	2.352
316	SD	5.884	SD	0.424
317	Coefficient of Variation	0.508		
318	Skewness	2.235		

	A–E	F	G–K	L
319				
320	**Background Statistics**			
321	**Normal Distribution Test**		**Lognormal Distribution Test**	
322	Lilliefors Test Statistic	0.165	Lilliefors Test Statistic	0.0696
323	Lilliefors Critical Value	0.0861	Lilliefors Critical Value	0.0861
324	**Data not Normal at 5% Significance Level**		**Data appear Lognormal at 5% Significance Level**	
325				
326	**Assuming Normal Distribution**		**Assuming Lognormal Distribution**	
327	95% UTL with 99% Coverage	27.28	95% UTL with 99% Coverage	32.54
328	95% UPL (t)	21.39	95% UPL (t)	21.29
329	90% Percentile (z)	19.12	90% Percentile (z)	18.08
330	95% Percentile (z)	21.25	95% Percentile (z)	21.09
331	99% Percentile (z)	25.26	99% Percentile (z)	28.14
332				
333	**Gamma Distribution Test**		**Data Distribution Test**	
334	k star	5.177	**Data appear Lognormal at 5% Significance Level**	
335	Theta Star	2.236		
336	MLE of Mean	11.58		
337	MLE of Standard Deviation	5.088		
338	nu star	1098		
339				
340	A-D Test Statistic	1.551	**Nonparametric Statistics**	
341	5% A-D Critical Value	0.754	90% Percentile	17.5
342	K-S Test Statistic	0.103	95% Percentile	21.5
343	5% K-S Critical Value	0.088	99% Percentile	36.14
344	**Data not Gamma Distributed at 5% Significance Level**			
345				
346	**Assuming Gamma Distribution**		95% UTL with 99% Coverage	38.6
347	90% Percentile	18.39	95% Percentile Bootstrap UTL with 99% Coverage	38.6
348	95% Percentile	21.01	95% BCA Bootstrap UTL with 99% Coverage	38.6
349	99% Percentile	26.55	95% UPL	21.6
350			95% Chebyshev UPL	37.34
351	95% WH Approx. Gamma UPL	21.01	Upper Threshold Limit Based upon IQR	20.67
352	95% HW Approx. Gamma UPL	21.04		
353	95% WH Approx. Gamma UTL with 99% Coverage	29.43		
354	95% HW Approx. Gamma UTL with 99% Coverage	30.01		
355				
356				
357				
358	**Cobalt**			
359				
360	**General Statistics**			
361	Number of Valid Data	106	Number of Detected Data	102
362	Number of Distinct Detected Data	74	Number of Non-Detect Data	4
363	Tolerance Factor	2.669	Percent Non-Detects	3.77%
364				
365	**Raw Statistics**		**Log-transformed Statistics**	
366	Minimum Detected	2.5	Minimum Detected	0.916
367	Maximum Detected	15.7	Maximum Detected	2.754
368	Mean of Detected	5.215	Mean of Detected	1.585
369	SD of Detected	2.16	SD of Detected	0.353
370	Minimum Non-Detect	2.5	Minimum Non-Detect	0.916
371	Maximum Non-Detect	2.5	Maximum Non-Detect	0.916

	A–E	F	G–K	L
372				
373				
374	Background Statistics			
375	**Normal Distribution Test with Detected Values Only**		**Lognormal Distribution Test with Detected Values Only**	
376	Lilliefors Test Statistic	0.17	Lilliefors Test Statistic	0.0953
377	5% Lilliefors Critical Value	0.0877	5% Lilliefors Critical Value	0.0877
378	**Data not Normal at 5% Significance Level**		**Data not Lognormal at 5% Significance Level**	
379				
380	**Assuming Normal Distribution**		**Assuming Lognormal Distribution**	
381	DL/2 Substitution Method		DL/2 Substitution Method	
382	Mean	5.066	Mean (Log Scale)	1.534
383	SD	2.25	SD (Log Scale)	0.434
384	95% UTL 99% Coverage	11.07	95% UTL 99% Coverage	14.75
385	95% UPL (t)	8.818	95% UPL (t)	9.552
386	90% Percentile (z)	7.95	90% Percentile (z)	8.081
387	95% Percentile (z)	8.767	95% Percentile (z)	9.46
388	99% Percentile (z)	10.3	99% Percentile (z)	12.71
389				
390	Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
391	Mean	5.071	Mean in Original Scale	5.097
392	SD	2.239	SD in Original Scale	2.202
393	95% UTL with 99% Coverage	11.05	95% UTL with 99% Coverage	13.15
394			95% BCA UTL with 99% Coverage	15.7
395			95% Bootstrap (%) UTL with 99% Coverage	15.7
396	95% UPL (t)	8.803	95% UPL (t)	8.957
397	90% Percentile (z)	7.94	90% Percentile (z)	7.725
398	95% Percentile (z)	8.753	95% Percentile (z)	8.88
399	99% Percentile (z)	10.28	99% Percentile (z)	11.53
400				
401	**Gamma Distribution Test with Detected Values Only**		**Data Distribution Test with Detected Values Only**	
402	k star (bias corrected)	7.461	Data do not follow a Discernable Distribution (0.05)	
403	Theta Star	0.699		
404	nu star	1522		
405				
406	A-D Test Statistic	1.318	**Nonparametric Statistics**	
407	5% A-D Critical Value	0.753	Kaplan-Meier (KM) Method	
408	K-S Test Statistic	0.122	Mean	5.113
409	5% K-S Critical Value	0.089	SD	2.171
410	**Data not Gamma Distributed at 5% Significance Level**		SE of Mean	0.212
411			95% KM UTL with 99% Coverage	10.91
412	**Assuming Gamma Distribution**		95% KM Chebyshev UPL	14.62
413	Gamma ROS Statistics with Extrapolated Data		95% KM UPL (t)	8.732
414	Mean	5.021	90% Percentile (z)	7.895
415	Median	4.74	95% Percentile (z)	8.684
416	SD	2.337	99% Percentile (z)	10.16
417	k star	1.125		
418	Theta star	4.464	**Gamma ROS Limits with Extrapolated Data**	
419	Nu star	238.4	95% Wilson Hilferty (WH) Approx. Gamma UPL	11.5
420	95% Percentile of Chisquare (2k)	6.466	95% Hawkins Wixley (HW) Approx. Gamma UPL	13.64
421			95% WH Approx. Gamma UTL with 99% Coverage	18.02
422	90% Percentile	11.23	95% HW Approx. Gamma UTL with 99% Coverage	23.83
423	95% Percentile	14.43		
424	99% Percentile	21.81		

Note: DL/2 Is not a recommended method.

Copper

General Statistics

Total Number of Observations	106	Number of Distinct Observations	89
Tolerance Factor	2.669		

Raw Statistics		Log-Transformed Statistics	
Minimum	2.69	Minimum	0.99
Maximum	59	Maximum	4.078
Second Largest	44.1	Second Largest	3.786
First Quartile	6.818	First Quartile	1.919
Median	12.15	Median	2.497
Third Quartile	18.35	Third Quartile	2.91
Mean	13.94	Mean	2.426
SD	9.607	SD	0.653
Coefficient of Variation	0.689		
Skewness	1.735		

Background Statistics

Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.132	Lilliefors Test Statistic	0.0712
Lilliefors Critical Value	0.0861	Lilliefors Critical Value	0.0861
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% UTL with 99% Coverage	39.58	95% UTL with 99% Coverage	64.62
95% UPL (t)	29.96	95% UPL (t)	33.6
90% Percentile (z)	26.25	90% Percentile (z)	26.12
95% Percentile (z)	29.74	95% Percentile (z)	33.11
99% Percentile (z)	36.29	99% Percentile (z)	51.67

Gamma Distribution Test		Data Distribution Test	
k star	2.482	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	5.618		
MLE of Mean	13.94		
MLE of Standard Deviation	8.85		
nu star	526.1		
A-D Test Statistic	0.689	**Nonparametric Statistics**	
5% A-D Critical Value	0.762	90% Percentile	25.8
K-S Test Statistic	0.0891	95% Percentile	31.78
5% K-S Critical Value	0.0888	99% Percentile	43.79
Data follow Appx. Gamma Distribution at 5% Significance Level			
Assuming Gamma Distribution		95% UTL with 99% Coverage	59
90% Percentile	25.8	95% Percentile Bootstrap UTL with 99% Coverage	59
95% Percentile	30.94	95% BCA Bootstrap UTL with 99% Coverage	59
99% Percentile	42.2	95% UPL	34.32
		95% Chebyshev UPL	56.02

95% WH Approx. Gamma UPL	30.94	Upper Threshold Limit Based upon IQR	35.65
95% HW Approx. Gamma UPL	31.39		
95% WH Approx. Gamma UTL with 99% Coverage	48.4		
95% HW Approx. Gamma UTL with 99% Coverage	51.01		
Lead			
General Statistics			
Number of Valid Data	106	Number of Detected Data	100
Number of Distinct Detected Data	82	Number of Non-Detect Data	6
Tolerance Factor	2.669	Percent Non-Detects	5.66%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	2.3	Minimum Detected	0.833
Maximum Detected	112	Maximum Detected	4.718
Mean of Detected	13.7	Mean of Detected	2.071
SD of Detected	18.57	SD of Detected	0.94
Minimum Non-Detect	2.5	Minimum Non-Detect	0.916
Maximum Non-Detect	2.5	Maximum Non-Detect	0.916
Background Statistics			
Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Lilliefors Test Statistic	0.299	Lilliefors Test Statistic	0.161
5% Lilliefors Critical Value	0.0886	5% Lilliefors Critical Value	0.0886
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	13	Mean (Log Scale)	1.966
SD	18.26	SD (Log Scale)	1.008
95% UTL 99% Coverage	61.73	95% UTL 99% Coverage	105.4
95% UPL (t)	43.44	95% UPL (t)	38.39
90% Percentile (z)	36.4	90% Percentile (z)	26.02
95% Percentile (z)	43.03	95% Percentile (z)	37.54
99% Percentile (z)	55.47	99% Percentile (z)	74.63
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	12.27	Mean in Original Scale	12.99
SD	19	SD in Original Scale	18.27
95% UTL with 99% Coverage	62.97	95% UTL with 99% Coverage	111.1
		95% BCA UTL with 99% Coverage	112
		95% Bootstrap (%) UTL with 99% Coverage	112
95% UPL (t)	43.95	95% UPL (t)	39.49
90% Percentile (z)	36.62	90% Percentile (z)	26.51
95% Percentile (z)	43.52	95% Percentile (z)	38.58
99% Percentile (z)	56.47	99% Percentile (z)	77.98
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	1.025	Data do not follow a Discernable Distribution (0.05)	
Theta Star	13.36		

	A–E	F	G–K	L
531	nu star	205.1		
532				
533	A-D Test Statistic	7.995	**Nonparametric Statistics**	
534	5% A-D Critical Value	0.782	Kaplan-Meier (KM) Method	
535	K-S Test Statistic	0.227	Mean	13.06
536	5% K-S Critical Value	0.092	SD	18.14
537	**Data not Gamma Distributed at 5% Significance Level**		SE of Mean	1.77
538			95% KM UTL with 99% Coverage	61.46
539	**Assuming Gamma Distribution**		95% KM Chebyshev UPL	92.48
540	Gamma ROS Statistics with Extrapolated Data		95% KM UPL (t)	43.29
541	Mean	12.93	90% Percentile (z)	36.3
542	Median	5.7	95% Percentile (z)	42.89
543	SD	18.31	99% Percentile (z)	55.25
544	k star	0.456		
545	Theta star	28.32	**Gamma ROS Limits with Extrapolated Data**	
546	Nu star	96.77	95% Wilson Hilferty (WH) Approx. Gamma UPL	41.9
547	95% Percentile of Chisquare (2k)	3.622	95% Hawkins Wixley (HW) Approx. Gamma UPL	47.27
548			95% WH Approx. Gamma UTL with 99% Coverage	83.28
549	90% Percentile	35.62	95% HW Approx. Gamma UTL with 99% Coverage	107
550	95% Percentile	51.29		
551	99% Percentile	90.15		
552				
553	**Note: DL/2 is not a recommended method.**			
554				
555				
556	**Mercury**			
557				
558	**General Statistics**			
559	Number of Valid Data	106	Number of Detected Data	30
560	Number of Distinct Detected Data	28	Number of Non-Detect Data	76
561	Tolerance Factor	2.669	Percent Non-Detects	71.70%
562				
563	**Raw Statistics**		**Log-transformed Statistics**	
564	Minimum Detected	0.0175	Minimum Detected	-4.046
565	Maximum Detected	0.324	Maximum Detected	-1.127
566	Mean of Detected	0.0493	Mean of Detected	-3.342
567	SD of Detected	0.0599	SD of Detected	0.71
568	Minimum Non-Detect	0.0039	Minimum Non-Detect	-5.547
569	Maximum Non-Detect	0.1	Maximum Non-Detect	-2.303
570				
571	**Data with Multiple Detection Limits**		**Single Detection Limit Scenario**	
572	Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect with Single DL	103
573	For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected with Single DL	3
574	Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	97.17%
575				
576	**Background Statistics**			
577	**Normal Distribution Test with Detected Values Only**		**Lognormal Distribution Test with Detected Values Only**	
578	Shapiro Wilk Test Statistic	0.54	Shapiro Wilk Test Statistic	0.84
579	5% Shapiro Wilk Critical Value	0.927	5% Shapiro Wilk Critical Value	0.927
580	**Data not Normal at 5% Significance Level**		**Data not Lognormal at 5% Significance Level**	
581				
582	**Assuming Normal Distribution**		**Assuming Lognormal Distribution**	
583	DL/2 Substitution Method		DL/2 Substitution Method	

	A–E	F	G–K	L
584	Mean	0.0475	Mean (Log Scale)	-3.247
585	SD	0.0331	SD (Log Scale)	0.782
586	95% UTL 99% Coverage	0.136	95% UTL 99% Coverage	0.313
587	95% UPL (t)	0.103	95% UPL (t)	0.143
588	90% Percentile (z)	0.0899	90% Percentile (z)	0.106
589	95% Percentile (z)	0.102	95% Percentile (z)	0.141
590	99% Percentile (z)	0.124	99% Percentile (z)	0.24
591				
592	Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
593	Mean	-0.368	Mean in Original Scale	0.0351
594	SD	0.245	SD in Original Scale	0.0371
595	95% UTL with 99% Coverage	0.286	95% UTL with 99% Coverage	0.187
596			95% BCA UTL with 99% Coverage	0.324
597			95% Bootstrap (%) UTL with 99% Coverage	0.324
598	95% UPL (t)	0.0409	95% UPL (t)	0.0893
599	90% Percentile (z)	-0.0537	90% Percentile (z)	0.0672
600	95% Percentile (z)	0.0354	95% Percentile (z)	0.0878
601	99% Percentile (z)	0.202	99% Percentile (z)	0.145
602				
603	**Gamma Distribution Test with Detected Values Only**		**Data Distribution Test with Detected Values Only**	
604	k star (bias corrected)	1.511	Data do not follow a Discernable Distribution (0.05)	
605	Theta Star	0.0326		
606	nu star	90.69		
607				
608	A-D Test Statistic	2.521	**Nonparametric Statistics**	
609	5% A-D Critical Value	0.762	Kaplan-Meier (KM) Method	
610	K-S Test Statistic	0.25	Mean	0.0355
611	5% K-S Critical Value	0.163	SD	0.0359
612	**Data not Gamma Distributed at 5% Significance Level**		SE of Mean	0.00443
613			95% KM UTL with 99% Coverage	0.131
614	**Assuming Gamma Distribution**		95% KM Chebyshev UPL	0.193
615	Gamma ROS Statistics with Extrapolated Data		95% KM UPL (t)	0.0953
616	Mean	0.0393	90% Percentile (z)	0.0815
617	Median	0.0284	95% Percentile (z)	0.0945
618	SD	0.0429	99% Percentile (z)	0.119
619	k star	0.283		
620	Theta star	0.139	**Gamma ROS Limits with Extrapolated Data**	
621	Nu star	59.92	95% Wilson Hilferty (WH) Approx. Gamma UPL	0.16
622	95% Percentile of Chisquare (2k)	2.635	95% Hawkins Wixley (HW) Approx. Gamma UPL	0.21
623			95% WH Approx. Gamma UTL with 99% Coverage	0.354
624	90% Percentile	0.117	95% HW Approx. Gamma UTL with 99% Coverage	0.575
625	95% Percentile	0.183		
626	99% Percentile	0.357		
627				
628	**Note: DL/2 is not a recommended method.**			
629				
630				
631	**Molybdenum**			
632				
633	**General Statistics**			
634	Number of Valid Data	106	Number of Detected Data	16
635	Number of Distinct Detected Data	16	Number of Non-Detect Data	90
636	Tolerance Factor	2.669	Percent Non-Detects	84.91%

	A–E	F	G–K	L
637				
638	**Raw Statistics**		**Log-transformed Statistics**	
639	Minimum Detected	0.0978	Minimum Detected	-2.325
640	Maximum Detected	0.625	Maximum Detected	-0.47
641	Mean of Detected	0.191	Mean of Detected	-1.8
642	SD of Detected	0.136	SD of Detected	0.492
643	Minimum Non-Detect	0.0777	Minimum Non-Detect	-2.555
644	Maximum Non-Detect	2.5	Maximum Non-Detect	0.916
645				
646	**Data with Multiple Detection Limits**		**Single Detection Limit Scenario**	
647	Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect with Single DL	106
648	For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected with Single DL	0
649	Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	100.00%
650				
651	**Background Statistics**			
652	**Normal Distribution Test with Detected Values Only**		**Lognormal Distribution Test with Detected Values Only**	
653	Shapiro Wilk Test Statistic	0.629	Shapiro Wilk Test Statistic	0.816
654	5% Shapiro Wilk Critical Value	0.887	5% Shapiro Wilk Critical Value	0.887
655	**Data not Normal at 5% Significance Level**		**Data not Lognormal at 5% Significance Level**	
656				
657	**Assuming Normal Distribution**		**Assuming Lognormal Distribution**	
658	DL/2 Substitution Method		DL/2 Substitution Method	
659	Mean	0.873	Mean (Log Scale)	-0.704
660	SD	0.544	SD (Log Scale)	1.404
661	95% UTL 99% Coverage	2.324	95% UTL 99% Coverage	20.94
662	95% UPL (t)	1.779	95% UPL (t)	5.134
663	90% Percentile (z)	1.57	90% Percentile (z)	2.987
664	95% Percentile (z)	1.767	95% Percentile (z)	4.974
665	99% Percentile (z)	2.138	99% Percentile (z)	12.95
666				
667	Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
668			Mean in Original Scale	0.111
669			SD in Original Scale	0.109
670			Mean in Log Scale	-2.564
671			SD in Log Scale	0.867
672			95% UTL 99% Coverage	0.778
673			95% UPL (t)	0.327
674			90% Percentile (z)	0.234
675			95% Percentile (z)	0.32
676			99% Percentile (z)	0.578
677				
678	**Gamma Distribution Test with Detected Values Only**		**Data Distribution Test with Detected Values Only**	
679	k star (bias corrected)	2.987	Data do not follow a Discernable Distribution (0.05)	
680	Theta Star	0.0639		
681	nu star	95.57		
682				
683	A-D Test Statistic	1.555	**Nonparametric Statistics**	
684	5% A-D Critical Value	0.743	Kaplan-Meier (KM) Method	
685	K-S Test Statistic	0.264	Mean	0.14
686	5% K-S Critical Value	0.216	SD	0.101
687	**Data not Gamma Distributed at 5% Significance Level**		SE of Mean	0.0176
688			95% KM UTL with 99% Coverage	0.409
689	**Assuming Gamma Distribution**		95% KM Chebyshev UPL	0.581

Gamma ROS Statistics with Extrapolated Data		95% KM UPL (t)	0.308
Mean	0.0863	90% Percentile (z)	0.269
Median	0.000001	95% Percentile (z)	0.306
SD	0.121	99% Percentile (z)	0.374
k star	0.136		
Theta star	0.635	**Gamma ROS Limits with Extrapolated Data**	
Nu star	28.79	95% Wilson Hilferty (WH) Approx. Gamma UPL	0.384
95% Percentile of Chisquare (2k)	1.522	95% Hawkins Wixley (HW) Approx. Gamma UPL	0.465
		95% WH Approx. Gamma UTL with 99% Coverage	1.026
90% Percentile	0.252	95% HW Approx. Gamma UTL with 99% Coverage	1.667
95% Percentile	0.483		
99% Percentile	1.17		

Note: DL/2 is not a recommended method.

Nickel

General Statistics

Number of Valid Data	106	Number of Detected Data	95
Number of Distinct Detected Data	84	Number of Non-Detect Data	11
Tolerance Factor	2.669	Percent Non-Detects	10.38%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	3	Minimum Detected	1.099
Maximum Detected	27.2	Maximum Detected	3.303
Mean of Detected	8.186	Mean of Detected	1.976
SD of Detected	4.689	SD of Detected	0.484
Minimum Non-Detect	2.5	Minimum Non-Detect	0.916
Maximum Non-Detect	2.5	Maximum Non-Detect	0.916

Background Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Lilliefors Test Statistic	0.194	Lilliefors Test Statistic	0.105
5% Lilliefors Critical Value	0.0909	5% Lilliefors Critical Value	0.0909
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	7.466	Mean (Log Scale)	1.794
SD	4.919	SD (Log Scale)	0.706
95% UTL 99% Coverage	20.6	95% UTL 99% Coverage	39.54
95% UPL (t)	15.67	95% UPL (t)	19.5
90% Percentile (z)	13.77	90% Percentile (z)	14.86
95% Percentile (z)	15.56	95% Percentile (z)	19.2
99% Percentile (z)	18.91	99% Percentile (z)	31.05
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	7.306	Mean in Original Scale	7.586
SD	5.173	SD in Original Scale	4.779
95% UTL with 99% Coverage	21.11	95% UTL with 99% Coverage	29.75
		95% BCA UTL with 99% Coverage	27.2

		95% Bootstrap (%) UTL with 99% Coverage	27.2
95% UPL (t)	15.93	95% UPL (t)	16.74
90% Percentile (z)	13.94	90% Percentile (z)	13.41
95% Percentile (z)	15.81	95% Percentile (z)	16.52
99% Percentile (z)	19.34	99% Percentile (z)	24.44
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	3.991	Data do not follow a Discernable Distribution (0.05)	
Theta Star	2.051		
nu star	758.3		
A-D Test Statistic	2.313	**Nonparametric Statistics**	
5% A-D Critical Value	0.756	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.135	Mean	7.648
5% K-S Critical Value	0.0921	SD	4.69
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.458
		95% KM UTL with 99% Coverage	20.17
Assuming Gamma Distribution		95% KM Chebyshev UPL	28.19
Gamma ROS Statistics with Extrapolated Data		95% KM UPL (t)	15.47
Mean	7.336	90% Percentile (z)	13.66
Median	6.145	95% Percentile (z)	15.36
SD	5.097	99% Percentile (z)	18.56
k star	0.393		
Theta star	18.68	**Gamma ROS Limits with Extrapolated Data**	
Nu star	83.28	95% Wilson Hilferty (WH) Approx. Gamma UPL	23.91
95% Percentile of Chisquare (2k)	3.285	95% Hawkins Wixley (HW) Approx. Gamma UPL	31.7
		95% WH Approx. Gamma UTL with 99% Coverage	45
90% Percentile	20.79	95% HW Approx. Gamma UTL with 99% Coverage	71.44
95% Percentile	30.67		
99% Percentile	55.58		

Note: DL/2 is not a recommended method.

Selenium

General Statistics

Number of Valid Data	106	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	105

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Selenium was not processed!

Silver

General Statistics

Number of Valid Data	106	Number of Detected Data	9
Number of Distinct Detected Data	8	Number of Non-Detect Data	97
Tolerance Factor	2.669	Percent Non-Detects	91.51%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.132	Minimum Detected	-2.025
Maximum Detected	1.29	Maximum Detected	0.255
Mean of Detected	0.582	Mean of Detected	-0.88
SD of Detected	0.469	SD of Detected	0.898
Minimum Non-Detect	0.117	Minimum Non-Detect	-2.146
Maximum Non-Detect	2.5	Maximum Non-Detect	0.916

Data with Multiple Detection Limits	Single Detection Limit Scenario	
Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect with Single DL	106
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected with Single DL	0
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	100.00%

Warning: There are only 9 Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set

the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

Background Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.832	Shapiro Wilk Test Statistic	0.878
5% Shapiro Wilk Critical Value	0.829	5% Shapiro Wilk Critical Value	0.829
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.901	Mean (Log Scale)	-0.622
SD	0.533	SD (Log Scale)	1.329
95% UTL 99% Coverage	2.322	95% UTL 99% Coverage	18.65
95% UPL (t)	1.789	95% UPL (t)	4.927
90% Percentile (z)	1.584	90% Percentile (z)	2.951
95% Percentile (z)	1.777	95% Percentile (z)	4.782
99% Percentile (z)	2.14	99% Percentile (z)	11.83
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
		Mean in Original Scale	0.184
		SD in Original Scale	0.445
		Mean in Log Scale	-3.451
		SD in Log Scale	2.015
		95% UTL 99% Coverage	6.87
		95% UPL (t)	0.913
		90% Percentile (z)	0.42
		95% Percentile (z)	0.873
		99% Percentile (z)	3.445

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	1.159	Data appear Normal at 5% Significance Level
Theta Star	0.502	
nu star	20.86	

A-D Test Statistic	0.606	**Nonparametric Statistics**	
5% A-D Critical Value	0.733	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.259	Mean	0.248
5% K-S Critical Value	0.284	SD	0.298
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.0535
		95% KM UTL with 99% Coverage	1.044
Assuming Gamma Distribution		95% KM Chebyshev UPL	1.554
Gamma ROS Statistics with Extrapolated Data		95% KM UPL (t)	0.745
Mean	0.147	90% Percentile (z)	0.63
Median	0.000001	95% Percentile (z)	0.738
SD	0.335	99% Percentile (z)	0.942
k star	0.0956		
Theta star	1.541	**Gamma ROS Limits with Extrapolated Data**	
Nu star	20.26	95% Wilson Hilferty (WH) Approx. Gamma UPL	0.481
95% Percentile of Chisquare (2k)	1.112	95% Hawkins Wixley (HW) Approx. Gamma UPL	0.432
		95% WH Approx. Gamma UTL with 99% Coverage	1.475
90% Percentile	0.384	95% HW Approx. Gamma UTL with 99% Coverage	1.851
95% Percentile	0.857		
99% Percentile	2.393		
Note: DL/2 is not a recommended method.			
Thallium			
General Statistics			
Number of Valid Data	106	Number of Detected Data	0
Number of Distinct Detected Data	0	Number of Non-Detect Data	106
Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!			
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!			
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).			
The data set for variable Thallium was not processed!			
Vanadium			
General Statistics			
Total Number of Observations	106	Number of Distinct Observations	86
Tolerance Factor	2.669		
Raw Statistics		**Log-Transformed Statistics**	
Minimum	6.2	Minimum	1.825
Maximum	47.1	Maximum	3.852
Second Largest	44	Second Largest	3.784
First Quartile	14.03	First Quartile	2.641
Median	16.65	Median	2.812
Third Quartile	22.58	Third Quartile	3.117
Mean	18.99	Mean	2.867
SD	7.863	SD	0.392
Coefficient of Variation	0.414		

902	Skewness	1.276		
903				
904	**Background Statistics**			
905	**Normal Distribution Test**		**Lognormal Distribution Test**	
906	Lilliefors Test Statistic	0.129	Lilliefors Test Statistic	0.0615
907	Lilliefors Critical Value	0.0861	Lilliefors Critical Value	0.0861
908	**Data not Normal at 5% Significance Level**		**Data appear Lognormal at 5% Significance Level**	
909				
910	**Assuming Normal Distribution**		**Assuming Lognormal Distribution**	
911	95% UTL with 99% Coverage	39.97	95% UTL with 99% Coverage	50.07
912	95% UPL (t)	32.1	95% UPL (t)	33.81
913	90% Percentile (z)	29.07	90% Percentile (z)	29.06
914	95% Percentile (z)	31.92	95% Percentile (z)	33.51
915	99% Percentile (z)	37.28	99% Percentile (z)	43.78
916				
917	**Gamma Distribution Test**		**Data Distribution Test**	
918	k star	6.467	**Data appear Gamma Distributed at 5% Significance Level**	
919	Theta Star	2.936		
920	MLE of Mean	18.99		
921	MLE of Standard Deviation	7.467		
922	nu star	1371		
923				
924	A-D Test Statistic	0.684	**Nonparametric Statistics**	
925	5% A-D Critical Value	0.754	90% Percentile	28.95
926	K-S Test Statistic	0.086	95% Percentile	35.55
927	5% K-S Critical Value	0.088	99% Percentile	43.82
928	**Data appear Gamma Distributed at 5% Significance Level**			
929				
930	**Assuming Gamma Distribution**		95% UTL with 99% Coverage	47.1
931	90% Percentile	28.96	95% Percentile Bootstrap UTL with 99% Coverage	47.1
932	95% Percentile	32.7	95% BCA Bootstrap UTL with 99% Coverage	47.1
933	99% Percentile	40.51	95% UPL	36.88
934			95% Chebyshev UPL	53.42
935	95% WH Approx. Gamma UPL	32.76	Upper Threshold Limit Based upon IQR	35.4
936	95% HW Approx. Gamma UPL	32.96		
937	95% WH Approx. Gamma UTL with 99% Coverage	44.61		
938	95% HW Approx. Gamma UTL with 99% Coverage	45.66		
939				
940				
941				
942	**Zinc**			
943				
944	**General Statistics**			
945	Total Number of Observations	105	Number of Distinct Observations	98
946	Tolerance Factor	2.671	Number of Missing Values	1
947				
948	**Raw Statistics**		**Log-Transformed Statistics**	
949	Minimum	9.7	Minimum	2.272
950	Maximum	291	Maximum	5.673
951	Second Largest	172	Second Largest	5.147
952	First Quartile	17.7	First Quartile	2.874
953	Median	29.8	Median	3.395
954	Third Quartile	46.4	Third Quartile	3.837

		F		L
955	Mean	42.07	Mean	3.455
956	SD	40.39	SD	0.704
957	Coefficient of Variation	0.96		
958	Skewness	3.14		
959				
960	**Background Statistics**			
961	**Normal Distribution Test**		**Lognormal Distribution Test**	
962	Lilliefors Test Statistic	0.224	Lilliefors Test Statistic	0.1
963	Lilliefors Critical Value	0.0865	Lilliefors Critical Value	0.0865
964	**Data not Normal at 5% Significance Level**		**Data not Lognormal at 5% Significance Level**	
965				
966	**Assuming Normal Distribution**		**Assuming Lognormal Distribution**	
967	95% UTL with 99% Coverage	149.9	95% UTL with 99% Coverage	207.6
968	95% UPL (t)	109.4	95% UPL (t)	102.5
969	90% Percentile (z)	93.83	90% Percentile (z)	78.07
970	95% Percentile (z)	108.5	95% Percentile (z)	100.8
971	99% Percentile (z)	136	99% Percentile (z)	162.9
972				
973	**Gamma Distribution Test**		**Data Distribution Test**	
974	k star	1.862	**Data do not follow a Discernable Distribution (0.05)**	
975	Theta Star	22.6		
976	MLE of Mean	42.07		
977	MLE of Standard Deviation	30.83		
978	nu star	390.9		
979				
980	A-D Test Statistic	3.522	**Nonparametric Statistics**	
981	5% A-D Critical Value	0.766	90% Percentile	92.1
982	K-S Test Statistic	0.124	95% Percentile	112.8
983	5% K-S Critical Value	0.0894	99% Percentile	171.2
984	**Data not Gamma Distributed at 5% Significance Level**			
985				
986	**Assuming Gamma Distribution**		95% UTL with 99% Coverage	291
987	90% Percentile	83.21	95% Percentile Bootstrap UTL with 99% Coverage	291
988	95% Percentile	102.1	95% BCA Bootstrap UTL with 99% Coverage	291
989	99% Percentile	144.1	95% UPL	117.5
990			95% Chebyshev UPL	219
991	95% WH Approx. Gamma UPL	100.7	Upper Threshold Limit Based upon IQR	89.45
992	95% HW Approx. Gamma UPL	100.6		
993	95% WH Approx. Gamma UTL with 99% Coverage	165.7		
994	95% HW Approx. Gamma UTL with 99% Coverage	172.2		
995				
996				

1		General Background Statistics for Data Sets with Non-Detects		
2	User Selected Options			
3	From File	C:\Users\atesfamichael\Desktop\SB0484 KAST\Feb 2012 Analysis\July 2012 Reporting\PAH 0 to 5 wo outliers.\		
4	Full Precision	OFF		
5	Confidence Coefficient	95%		
6	Coverage	99%		
7	Different or Future K Values	1		
8	Number of Bootstrap Operations	2000		
9				
10				
11	BaP-TEQ			
12				
13	General Statistics			
14	Number of Valid Data	35	Number of Detected Data	22
15	Number of Distinct Detected Data	22	Number of Non-Detect Data	13
16	Tolerance Factor	2.983	Percent Non-Detects	37.14%
17				
18	Raw Statistics		Log-transformed Statistics	
19	Minimum Detected	0.00106	Minimum Detected	-6.849
20	Maximum Detected	0.179	Maximum Detected	-1.718
21	Mean of Detected	0.0122	Mean of Detected	-5.696
22	SD of Detected	0.0376	SD of Detected	1.226
23	Minimum Non-Detect	0.00106	Minimum Non-Detect	-6.849
24	Maximum Non-Detect	0.00106	Maximum Non-Detect	-6.849
25				
26				
27	Background Statistics			
28	Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
29	Shapiro Wilk Test Statistic	0.303	Shapiro Wilk Test Statistic	0.823
30	5% Shapiro Wilk Critical Value	0.911	5% Shapiro Wilk Critical Value	0.911
31	Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
32				
33	Assuming Normal Distribution		Assuming Lognormal Distribution	
34	DL/2 Substitution Method		DL/2 Substitution Method	
35	Mean	0.00785	Mean (Log Scale)	-6.382
36	SD	0.0301	SD (Log Scale)	1.322
37	95% UTL 99% Coverage	0.0977	95% UTL 99% Coverage	0.0874
38	95% UPL (t)	0.0595	95% UPL (t)	0.0163
39	90% Percentile (z)	0.0464	90% Percentile (z)	0.00921
40	95% Percentile (z)	0.0574	95% Percentile (z)	0.0149
41	99% Percentile (z)	0.0779	99% Percentile (z)	0.0367
42				
43	Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
44	Mean	-0.00432	Mean in Original Scale	0.00774
45	SD	0.0392	SD in Original Scale	0.0301
46	95% UTL with 99% Coverage	0.113	95% UTL with 99% Coverage	0.267
47			95% BCA UTL with 99% Coverage	0.179
48			95% Bootstrap (%) UTL with 99% Coverage	0.179
49	95% UPL (t)	0.0629	95% UPL (t)	0.0258
50	90% Percentile (z)	0.0459	90% Percentile (z)	0.0116
51	95% Percentile (z)	0.0601	95% Percentile (z)	0.0227
52	99% Percentile (z)	0.0868	99% Percentile (z)	0.0796

	A–E	F	G–K	L
53				
54	**Gamma Distribution Test with Detected Values Only**		**Data Distribution Test with Detected Values Only**	
55	k star (bias corrected)	0.457	Data do not follow a Discernable Distribution (0.05)	
56	Theta Star	0.0266		
57	nu star	20.11		
58				
59	A-D Test Statistic	3.184	**Nonparametric Statistics**	
60	5% A-D Critical Value	0.806	Kaplan-Meier (KM) Method	
61	K-S Test Statistic	0.307	Mean	0.00805
62	5% K-S Critical Value	0.196	SD	0.0296
63	**Data not Gamma Distributed at 5% Significance Level**		SE of Mean	0.00513
64			95% KM UTL with 99% Coverage	0.0965
65	**Assuming Gamma Distribution**		95% KM Chebyshev UPL	0.139
66	Gamma ROS Statistics with Extrapolated Data		95% KM UPL (t)	0.0589
67	Mean	0.00765	90% Percentile (z)	0.046
68	Median	0.00127	95% Percentile (z)	0.0568
69	SD	0.0302	99% Percentile (z)	0.077
70	k star	0.195		
71	Theta star	0.0392	**Gamma ROS Limits with Extrapolated Data**	
72	Nu star	13.67	95% Wilson Hilferty (WH) Approx. Gamma UPL	0.0259
73	95% Percentile of Chisquare (2k)	2.025	95% Hawkins Wixley (HW) Approx. Gamma UPL	0.0269
74			95% WH Approx. Gamma UTL with 99% Coverage	0.0823
75	90% Percentile	0.0231	95% HW Approx. Gamma UTL with 99% Coverage	0.111
76	95% Percentile	0.0397		
77	99% Percentile	0.0854		
78				
79	**Note: DL/2 is not a recommended method.**			
80				

APPENDIX B

VAPOR INTRUSION PATHWAY EVALUATION

APPENDIX B
Vapor Intrusion Evaluation

1. INTRODUCTION

This appendix provides a detailed assessment of the vapor intrusion pathway at the former Kast property (Site). A multiple-lines-of-evidence evaluation was conducted to assess whether volatile organic compounds (VOCs) detected in soil and soil vapor at the Site are resulting in a measureable effect on indoor air. The results of this evaluation will be used to develop site-specific cleanup goals and assist in making corrective action decisions regarding this pathway.

There are various potential sources of VOCs in indoor air, and background sources can make the interpretation of indoor air difficult. Background sources may consist of VOCs in outdoor air or emissions from household building materials (e.g. rugs, paints), household products, or materials brought into the home. The contribution of background sources to indoor air concentrations is an important element in an evaluation of the role of soil vapor to the indoor air pathway. Indoor and outdoor air concentrations measured during the Phase II Site Characterization at the Site were compared to literature values of "typical" concentrations found in indoor and outdoor air.

The Phase II Site Characterization data were further evaluated to assess the correlation between soil vapor and indoor air data. Correlation, or the lack thereof, can be used to establish if sub-surface soil vapor is contributing to indoor air concentrations. Furthermore, this analysis can be used to evaluate whether Site data support the development of a site-specific vapor intrusion attenuation factor (i.e., empirical relationship between sub-slab soil and indoor air).

2. DATA SUMMARY

Through December 31, 2012, indoor and sub-slab soil vapor data have been collected at 190 properties[1]. The addresses and sampling dates for these properties are listed in **Table B-1**. This section summarizes the sub-slab soil vapor and indoor air data sets and describes how they are used in this evaluation.

2.1 Sub-Slab Soil Vapor

In general, sub-slab soil vapor samples are collected from three locations on each residential property: one from beneath the home and two beneath pavement outside the building footprint. However, the specific locations of the sub-slab soil vapor samples may differ due to the property layout and access (e.g., at some properties a sub-slab probe was installed in the garage rather

[1] Sub-slab soil vapor samples were collected at an additional 72 properties, but indoor air samples were not collected at these properties as of December 31, 2012. Consequently data from these properties could not be included in this evaluation.

than a front yard hardscape location). Sub-slab soil vapor analytical results for the properties considered in this vapor intrusion evaluation are summarized on **Table B-2.**

Sub-slab soil vapor analytical results were compared to conservative risk-based screening levels (RBSLs) used in the human health screening risk evaluations (HHSRE) presented in the interim reports for the individual properties. A summary of COCs exceeding sub-slab soil vapor RBSLs is provided in **Table B-3**. **Figures B-1 and B-2** show the sub-slab soil vapor analytical results for benzene and naphthalene[2] along with a comparison of the results to RBSLs. Note that in many cases, exceedances were infrequently or inconsistently observed at each specific property (**Figures B-1 and B-2**). Temporal variability is also evident in the analytical results presented in **Table B-2.**

2.2 Indoor/Outdoor Air Sampling

The indoor air sampling typically consists of two to three indoor air samples (two primary indoor air samples and periodically a duplicate sample from one of the locations), an air sample from the garage, and two outdoor air samples. Of the 190 houses sampled through December 31, 2012; two rounds of indoor air sampling were conducted at 12 properties. Indoor, garage, and outdoor air analytical results for the samples considered in this evaluation are summarized in **Table B-4**. A statistical summary of the analytical results of the air samples collected for the vapor intrusion evaluation is provided in **Table B-5.**

As reported in the Interim and Follow-up Phase II Site Characterization reports, indoor, garage, and outdoor air concentrations for several constituents exceed RBSLs. However, as discussed below, background concentrations of these compounds commonly exceed these screening levels, and the measured air concentrations for samples collected at the site are reflective of background levels. These conclusions were discussed in the Interim and Follow-up Phase II Site Characterization reports which have been reviewed by the California Regional Water Quality Control Board – Los Angeles Region and California Environmental Protection Agency Office of Environmental Health Hazard Assessment. The regulatory agency reviews of the Interim and Follow-up Phase II Site Characterization reports have concurred that the VOCs detected in indoor air appear to be due to background sources.

Figures B-3 and B-4 show the indoor air analytical results for benzene and naphthalene. The figures highlight the distribution of concentrations of these constituents in indoor air. Spatial variability of indoor air concentrations is observed across the Site; however, less spatial variability was observed for air samples collected within a specific home on the same date (i.e., air concentrations collected in a residential property kitchen and bedroom on a specific date are

[2] Only benzene and naphthalene are shown in these figures, because they are key Site-related COCs for the vapor intrusion pathway analysis.

generally similar). However, temporal variability was evident in indoor, outdoor, and garage air samples (**Table B-4**).

3. BACKGROUND CONCENTRATION EVALUATION

In order to evaluate the significance of concentrations of VOCs detected in indoor air, a literature review of background levels of VOCs and other petroleum compounds was conducted. For vapor intrusion evaluations, background is defined as sources that are not due to sub-surface impacts (e.g., contributions due to outdoor air or indoor sources). This section presents a review of background sources and concentrations and compares Site data to literature values.

3.1 Background Sources

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

- Environmental tobacco smoke is known to contain VOCs including benzene, toluene, xylenes, naphthalene, and styrene (Offermann et al., 1991; CARB, 2005; Jia and Batterman, 2010).

- Gasoline- and diesel-powered equipment including automobiles and lawn mowers, etc. emit VOCs typical of petroleum products including benzene, toluene, ethylbenzene, and xylenes (BTEX), heptane, hexane, naphthalene, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene (CARB, 2005).

- Paints, glues, solvents, cleaners, and deodorizers contain a wide variety of VOCs and are commonly found and used in residential households. VOCs associated with these products include (but are not limited to) BTEX, naphthalene, carbon tetrachloride, tetrachloroethene (PCE), and 1,4-dichlorobenzene (CARB, 2005).

- Natural gas contains low concentrations of low molecular weight hydrocarbons (e.g., benzene) and leaking natural gas lines/connections can be a source of VOCs to indoor air.

Table B-6 summarizes potential background sources and concentrations of VOCs detected in indoor air.

3.2 Indoor vs. Outdoor Concentrations

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

3.3 Indoor Air Background Evaluation

Six studies were reviewed to evaluate VOC background concentrations in indoor air. These studies included original investigations (Van Winkle and Scheff, 2001; Sexton et al., 2004) and data compilations (Hodgson and Levin, 2003; CARB, 2005; Jia and Batterman, 2010; USEPA, 2011). A summary of the documents reviewed and the background concentrations reported is presented below.

- Van Winkle and Scheff (2001) monitored ten homes at regular intervals for just under a year to evaluate background VOC and PAH concentrations in indoor air. The study excluded homes with smokers. Background concentrations in this study were attributed to mothball storage, air freshener use, and cooking activities.

- Sexton et al. (2004) conducted a study to evaluate personal, indoor, and outdoor air exposures in three different neighborhoods during spring, summer, and fall of 1999. The study excluded homes with smokers and found that concentrations in indoor air were greater than concentrations in outdoor air, and that concentrations in personal air (breathing zone) were greater than concentrations in indoor air. Background concentrations in this study were attributed to outdoor sources, including industry and automotive exhaust, and indoor sources including consumer products and cooking emissions.

- Hodgson and Levin (2003) conducted a review of VOC concentrations measured in North America since 1990. Data collected from studies in which environmental tobacco smoke specific compounds were reported were excluded from this assessment.

- In 2005, the California Air Resources Board (CARB) prepared a report on indoor air pollution in California. The report was extensive and documented the health effects, costs, sources, and concentrations of indoor air pollutants.

- Jia and Batterman (2010) conducted a review of naphthalene sources and exposures relevant to indoor and outdoor air. This study found that average naphthalene concentrations ranged from 0.02 $\mu g/m^3$ to 0.31 $\mu g/m^3$ in non-smoker's homes. Naphthalene emission sources include industry, open burning, combustion and tailpipe emissions. The second largest source is off-gassing from products including deodorizers, repellants (including moth balls), and fumigants.

- In June 2011, the USEPA published a compilation of background indoor air VOC concentrations for North American residences from 1990 through 2005. Studies evaluated in this report were limited to those in which no known or suspected contamination was present below the ground surface unless a proven and effective vapor intrusion mitigation system was in place. The study also excluded data in which smokers were present. This technical report compiled summary statistics (e.g., 25th, 50th, 75th, 90th, and 95th percentiles, number of samples, percent detection, and reporting limits) for the distribution of indoor air concentrations in thousands of residences that are not expected or known to be at risk of vapor intrusion. The study found that background VOC concentrations in indoor air are highly variable and that the VOCs most commonly detected in indoor air due to background sources include BTEX and chlorinated solvents.

The impact of smoking was specifically excluded in the studies selected to represent background. However, smoking can greatly affect the quality of indoor air and contribute to concentrations of several petroleum related compounds (Jenkins, et al., 2000). Exclusion of smoking related background may bias the background indoor air data low.

Median indoor air background concentrations for petroleum hydrocarbons are summarized in the table below, and indoor air background concentrations reported in the USEPA study (USEPA, 2011) are shown in **Table B-7**.

Median Indoor Air Background Concentrations for Petroleum Hydrocarbons from Literature Studies
(Concentrations reported in $\mu g/m^3$)

Compounds	Van Winkle (2001)	Sexton (2004)	Hodgson and Levin (2003)	USEPA (2011)
Benzene	2.9	1.9	2.78	<RL - 4.7
Ethylbenzene	9.1	1.4	2.3	1 - 3.7

Compounds	Van Winkle (2001)	Sexton (2004)	Hodgson and Levin (2003)	USEPA (2011)
Toluene	3.2	12.3	12.4	4.8 - 24
m,p-Xylene	13.5	4.8	6.1	1.5 - 14
o-Xylene	3.6	1.6	2.3	1.1 - 3.6
Naphthalene	0.47	NR	0.47	<RL - 0.4

NR – Not reported
< RL – Median concentration below method reporting limit

The indoor air concentrations measured at the Site were compared to the literature values summarized by USEPA (USEPA, 2011). The USEPA study did not include raw data for the background data sets, but robust summary statistics were provided. The percentiles calculated from the onsite indoor air concentrations were compared to the background percentile ranges provided in the EPA report.

Table B-7 provides the summary statistics (e.g., 50th, 75th, 90th, and 95th percentiles), sample sizes, the reporting limits, and percent detections of the background indoor air concentrations from the USEPA report. **Table B-8** summarizes the summary statistics (e.g., 25th, 50th, mean, 75th, 90th, and 95th percentiles), the sample sizes, and percent detections for concentrations for indoor air samples collected at the Site[3]. These summary statistics show that indoor air concentrations from both data sets are highly variable (range spans an order of magnitude or more).

A comparison of the two data sets (USEPA, 2011 and Site data) is shown on **Figure B-5**. The box and whisker plot for each chemical shows the indoor air concentration distributions for ten compounds that were frequently detected in the indoor air samples (detection frequencies greater than 95%). The box in these figures shows the interquartile range (i.e., 25th to 75th percentile) and the bar in the middle of the box is the median value. The whiskers of the plots show the 10th and 90th percentile concentrations and outlier results are plotted to illustrate the range of detected concentrations. The colored symbols on this plot show the ranges of median, 90th percentile and maximum indoor air concentrations reported in the USEPA report (USEPA, 2011). Open and closed symbols show the lower and upper end of the ranges for these statistics, respectively.

With the exception of 1,2-dichloroethane (1,2-DCA), the Site concentrations were within the background range reported by USEPA. Although 1,2-DCA was outside of the background range

[3] Table B-7 include only constituents that are listed in the USEPA (2011) summary and that were detected in indoor air samples collected at the Site.

reported in the USEPA study, more current studies (Doucette, et al., 2010 and Kurtz et al., 2010) conclude that this compound has been detected in increasing frequency and higher concentrations since 2004 (i.e., the data considered in the USEPA study [1990 – 2005] did not reflect this more recent increase in indoor air concentrations).

The results of the comparison of Site data with literature background values indicates that VOCs detected in indoor air are reflective of background concentrations and not related to sub-slab soil vapor concentrations. As a result, the data cannot be used to calculate an empirical vapor intrusion attenuation factor. The vapor intrusion attenuation factor is the ratio of indoor and subsurface vapor concentrations for constituents measured in both media assuming that the contributions from background sources are insignificant. Limiting development of empirical attenuation factors is consistent with implementation of USEPA guidance for sites across the United States (USEPA, 2012).

3.4 Outdoor Air Background Evaluation

Two studies were identified that report regional background concentrations of VOCs in outdoor air (SCAQMD, 2008; DRI, 2009). Results from these studies were considered for the outdoor air background evaluation.

- The South Coast Air Quality Management District (SCAQMD) conducted a multi-year monitoring and evaluation study for the South Coast Air Basin. Sample collection and analysis for the Multiple Air Toxics Exposure Study III (MATES III) was performed between April 2004 through March 2006. Samples were collected from ten fixed monitoring stations every three days over the course of the study. Two of the monitoring stations (West Long Beach and North Long Beach) were located in the general area of the Site. The study provided statistics of the concentrations of detected VOCs for the individual monitoring stations.

- CARB conducted the Harbor Community Monitoring Study (HCMS) to characterize the concentrations of VOCs in the area near the Site. There were 23 monitoring locations in this study; one of these locations was located just south of the Site. Samples were collected in 2007 over four consecutive weeks during each season. The study provided statistics of the concentrations of detected VOCs for the individual monitoring stations.

Average outdoor air background concentrations for petroleum hydrocarbons are summarized in the table below, and outdoor air background concentrations for all VOCs reported in these studies are shown in **Table B-9**.

Average Outdoor Air Background Concentrations for Petroleum Hydrocarbons from Literature Studies
(Concentrations reported in μg/m³)

Compounds	MATES III North Long Beach		MATES III West Long Beach		HCMS
	Apr. 2004 – Mar. 2005	Apr. 2005 – Mar. 2006	Apr. 2004 – Mar. 2005	Apr. 2005 – Mar. 2006	2007
Benzene	1.79 ± 0.19	1.53 ± 0.19	1.82 ± 0.26	1.60 ± 0.22	1.50 ± 0.26
Ethylbenzene	0.95 ± 0.13	0.87 ± 0.13	1.17 ± 0.17	0.95 ± 0.13	1.65 ± 0.56
Toluene	6.03 ± 0.75	5.28 ± 0.75	7.46 ± 1.17	5.88 ± 0.87	6.03 ± 0.98
m,p-Xylene	3.69 ± 0.48	2.95 ± 0.43	4.04 ± 0.65	3.12 ± 0.48	5.25 ± 0.65†
o-Xylene	0.82 ± 0.13	0.74 ± 0.17	0.95 ± 0.17	0.82 ± 0.17	
Naphthalene	NR	0.18 ± 0.03	NR	NR	NR

NR – Not reported
† HCMS presented results for Total Xylenes (m,p-Xylene + o-Xylene)

The outdoor air concentrations measured at the Site were compared to the literature values for studies conducted in the region (SCAQMD, 2008; DRI, 2009). **Table B-10** lists the summary statistics (e.g., 25th, 50th, mean, 75th, 90th, and 95th percentiles), the sample sizes, and percent detections for concentrations for outdoor air samples collected at the Site[4]. These summary statistics show that outdoor air concentrations from both data sets are highly variable (range spans an order of magnitude or more).

A comparison of the two data sets is shown on **Figure B-6**. The box and whisker plot for each chemical shows the outdoor air concentration distributions for eleven compounds reported in the regional studies. The box in these figures shows the interquartile range (i.e., 25th to 75th percentile) and the bar in the middle of the box is the median value. The whiskers of the plots show the 10th and 90th percentile concentrations and outlier results are plotted to illustrate the range of detected concentrations. The colored symbols on this plot show the ranges of mean and maximum outdoor air concentrations reported in the regional studies (SCAQMD, 2008; DRI,

[4] Table B-10 include only constituents that are listed in the regional studies summary and that were detected in outdoor air samples collected at the Site.

2009). Open and closed symbols show the lower and upper end of the ranges for these statistics, respectively.

The concentrations of these constituents detected in samples collected from the Site are within the reported background ranges. The results of the comparison of Site data with literature background values indicates that VOCs detected in outdoor air are reflective of background concentrations.

4. MULTIPLE LINEAR REGRESSION ANALYSIS

Both indoor air and outdoor air concentrations appear consistent with relevant background comparison concentrations. A more rigorous statistically analysis was performed to further investigate the relationship. Multiple linear regression is used to model the relationship between a variable of interest or response variable (i.e., indoor air concentration), and other explanatory variables (i.e., sub-slab soil vapor, garage, and outdoor air concentrations). The relationship between the response and explanatory variables is fit to a linear equation using the observed data. Implicit in this approach is that the response variable is assumed to be linearly related to the explanatory variables.

4.1 Multiple Linear Regression Approach

As illustrated on **Figure B-7**, indoor air concentrations are potentially affected by (i) emissions from indoor sources (a property specific factor), (ii) transport from the garage air (i.e., linear relationship with garage air concentrations), (iii) transport from outdoor air (linear relationship with outdoor air concentrations), and (iv) vapor intrusion (linear relationship with soil vapor concentrations). Therefore, indoor air concentration is the response variable and soil vapor, garage air, and outdoor air are considered the explanatory variables. An additional term is included in the multiple linear regression equation to account for indoor air sources. More formally, the multiple linear regression equation for each COPC is:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \epsilon,$$

where

Y is the log-transformed indoor air concentration;

X_1 is the log-transformed garage concentration;

X_2 is the log-transformed outdoor air concentration;

X_3 is the log-transformed sub-slab soil vapor concentration;

β_0 is the intercept term, or the mean value of indoor air concentration when all explanatory variables are set to zero and is representative of indoor sources;

β_1 represents the effect of a one percent increase in garage concentration on the mean indoor air concentration, while holding outdoor air and soil gas concentrations fixed;

β_2 represents the effect of a one percent increase in outdoor air concentration on the mean indoor air concentration, while holding garage and soil gas concentrations fixed;

β_3 represents the effect of a one percent increase in soil gas concentration on the mean indoor air concentration, while holding garage and outdoor air concentrations fixed; and

ϵ represents the residual or error term which quantifies the deviations of the observed value from the predicted value obtained from the linear regression equation.

Note that ϵ is assumed to be independent and identically distributed with mean zero and constant variance.

Since the regression coefficients (β parameters) associated with each explanatory variable are unknown, they are estimated using a method of least squares. Statistical tests, known as hypothesis tests, are then conducted to determine whether these estimates are statistically different from zero. If the estimate is statistically significant (i.e., the estimate is statistically different from zero), then the value and sign of the estimate represent the magnitude and direction of the effect of that explanatory variable on the mean indoor air concentration.

Additionally, the coefficient of determination (R^2 value) is a measure of the linear association between the response variable and the explanatory variables and is used to assess the model fit. Essentially, the R^2 value quantifies the overall proportion of variability in indoor air concentrations that can be explained by garage, outdoor air and soil gas concentrations. The greater the R^2 value, the stronger the association between the indoor air concentration and the garage, outdoor air and soil gas concentrations and the better the linear regression model fit.

Based on review of the data sets, log-transformation was warranted to address the underlying distribution of the data. The log-transformation improves the statistical properties of the hypothesis testing since the variables themselves will exhibit normality, and will ensure that the other model assumptions (i.e., errors are normally distributed and have constant variance) are better met. Log transforms of environmental data are frequently required because environmental data are often log-normally distributed (Gilbert, 1987).

4.2 Data for Statistical Analysis

This statistical analysis was conducted for 10 compounds selected to consider a range of detection frequencies in indoor air, outdoor air, and sub-slab soil vapor samples collected at the

Site. The selected compounds include petroleum hydrocarbons (BTEX [m,p-xylene was evaluated separately from o-xylene], and naphthalene), chlorinated hydrocarbons (1,2-DCA, carbon tetrachloride, and PCE) and a trihalomethane (chloroform). Seven of these compounds were detected at the Site at concentrations that exceed indoor air risk-based screening levels (toluene, m,p-xylene, and o-xylene were not detected in indoor air at concentrations exceeding risk-based screening levels). Four of these constituents (naphthalene, chloroform, benzene, and PCE) had the highest detection frequency in sub-slab soil vapor for these COCs at the Site. Statistical evaluation of these 10 compounds is a representative sub-set to evaluate the potential vapor intrusion pathway at the Site.

The data sets used in the analysis met the following criteria:

- Analytical results for both air and sub-slab soil vapor samples collected from October 2010 through December 2012.

- Samples where sub-slab soil vapor and indoor air data were collected on consecutive days (typically, sub-slab soil vapor samples were collected following the completion of the 24-hour indoor air sampling event).

- For a given property and sample date, the maximum detected concentrations for (i) indoor air, (ii) garage air, (iii) outdoor air, and (iv) soil vapor were used in the statistical analysis.

An analysis was conducted for each of the 10 representative COCs identified above. **Table B-11** contains the analytical data used in the analyses and **Table B-12** contains summary statistics (sample size, detection frequency, minimum and maximum concentration) by COC for each variable. Note that high detection frequencies for these compounds are reported for indoor air (99% - 100%), garage air (95% to 100%), and outdoor air (74% to 100%). However, lower detection frequencies were observed for the sub-slab soil vapor results. To limit the impact of non-detect sub-slab soil vapor results on the statistical analysis, the data sets for the multiple linear regression analysis was limited to those with detected sub-slab soil vapor concentrations. However, for several of the compounds with low sub-slab soil vapor detection frequencies (i.e., 1,2-DCA, benzene, carbon tetrachloride, ethylbenzene, m,p-xylene, and o-xylene), the complete data set was used in the statistical analysis. If a constituent was not detected in any of the samples for a specific medium on a given sample date, the minimum analytical reporting limit was used in the analysis. The observed trends discussed below persisted for both the full and detect only data sets, therefore, non-detect data handling options did not impact the overall conclusions of the analysis.

4.3 Multiple Linear Regression Results

For each compound, a multiple linear regression was performed on the log-transformed data sets. **Attachment A** contains the correlation plots for the log-transformed data sets for each compound. The top row of these figures show the correlation plots of indoor air concentrations to (i) garage air concentrations, (ii) outdoor air concentrations, and (iii) sub-slab soil vapor concentrations. These data were statistically evaluated to calculate coefficient estimates which characterize the linear relationship between the paired concentrations (e.g., if increases in outdoor air concentrations result in an increase in indoor air concentrations).

Table B-13 shows the multiple linear regression results. The coefficient estimates for β_1 (garage air to indoor air) and β_2 (outdoor air to indoor air) were statistically significant indicating that the indoor air concentrations are related to the garage and outdoor air concentrations[5]. The magnitude of the coefficient estimate indicates the relative contribution to indoor air concentrations from the different explanatory variables. For example, for carbon tetrachloride, the outdoor air coefficient was higher than that for garage air; which indicates that carbon tetrachloride detected in indoor air was better explained by the outdoor air than by the garage air concentrations. Conversely, 1,2-DCA has a higher coefficient for garage air and no significant correlation for outdoor air, which indicates that 1,2-DCA detected in indoor air was better explained by the garage concentrations than by the outdoor air concentrations.

Hypothesis tests for the contribution different sources have in indoor air indicated that contributions from sub-slab soil vapor concentrations (β_3) are not statistically different from zero. In other words, sub-slab soil vapor concentrations do not explain the variability in indoor air concentrations for any of the representative COCs, which suggests that there is no association between the two variables. Also note that VOCs frequently detected in indoor air, were infrequently detected or not detected in sub-slab soil vapor samples. Overall, there is not a correlation between sub-slab soil vapor concentrations and the resultant indoor air concentration. As a result, the data cannot be used to calculate an empirical vapor intrusion attenuation factor.

The amount of variability (R^2) in indoor air concentrations explained by garage, outdoor air and soil vapor concentrations ranged from 23% (1,2-DCA) to 79% (carbon tetrachloride) (**Table B-13**). The regressions for benzene, carbon tetrachloride, ethylbenzene, m,p-xylene, and o-xylene showed the highest R^2 values, from 53% to 79%. Therefore, a majority (i.e., at least 53%) of the variability of indoor air concentrations for these compounds is explained by the garage air and outdoor air concentrations. The regressions performed for the remaining five compounds included in the multiple linear regression analysis (1,2-DCA, chloroform, naphthalene, PCE, and toluene) ranged from 23% to 40%; which suggests that indoor sources have a larger effect on the variability of indoor air concentrations for these constituents.

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

Finally, model selection methods were used to evaluate the appropriateness of the selected linear regression model. Because the soil vapor variables were not statistically significant, the data were re-fit using a reduced model which excludes the soil gas term (i.e., indoor air concentrations were modeled as a function of garage and outdoor air only or $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \epsilon$). In order to evaluate the effect of the removal of this variable, a statistical test (an F-test) was conducted to compare the multiple linear regression analysis results using the full and reduced models.

Table B-14 provides a summary of the full and reduced model fits and the results of the F-test for the comparison of the two models. The regression coefficients and R^2 values for the reduced models are almost identical to those of the full model. Additionally, the results of the F-tests indicate that the reduced model (i.e., excluding sub-slab soil vapor concentrations as an explanatory variable) provide the same fit as the full model. This provides further evidence that the indoor air concentrations are not correlated to soil vapor concentrations.

The results of this statistical evaluation indicate that the data cannot be used to calculate an empirical vapor intrusion attenuation factor, because there is no statistically significant relationship between the sub-slab soil vapor and indoor air concentrations.

4.4 SUMMARY

The results of this multiple-lines-of-evidence evaluation of the vapor intrusion pathway at the former Kast property indicate:

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

- The multiple linear regression analyses show that the variability in indoor air concentrations are correlated with the garage air and outdoor air concentrations, but are not correlated with the sub-slab soil vapor concentrations.

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

- The regressions for benzene, carbon tetrachloride, ethylbenzene, m/p-xylene, and o-xylene showed the highest correlation values indicating that a large proportion of the variability in indoor air concentrations for those constituents can be explained by garage and outdoor air concentrations. However, regressions for 1,2-DCA, chloroform, naphthalene, PCE, and toluene showed lowest correlation values, and, therefore, weaker linear relationships with garage and outdoor air concentrations; which suggests that the variability in indoor air concentrations is predominantly due to indoor sources.

- Evaluation of the reduced model further supports the conclusion that indoor air concentrations are not correlated with sub-slab soil vapor concentrations.

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

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Tables

Figures

Attachments

Attachment A – Correlation Plots for Log-Transformed Data

TABLES

Table B-1
Indoor Air Sample Locations Through December 31, 2012
Former Kast Property
Carson, California

Address	Sample Date	
24401 MARBELLA AVE	3/28/2012	
24402 NEPTUNE AVE	10/3/2012	
24402 PANAMA AVE	12/20/2012	
24402 RAVENNA AVE	12/8/2010	5/24/2012
24403 NEPTUNE AVE	11/8/2012	
24405 MARBELLA AVE	3/21/2012	
24406 MARBELLA AVE	3/8/2012	
24406 NEPTUNE AVE	11/12/2010	1/25/2012
24406 PANAMA AVE	8/15/2012	
24409 NEPTUNE AVE	5/3/2012	
24410 PANAMA AVE	7/18/2012	
24411 MARBELLA AVE	4/26/2012	
24411 PANAMA AVE	12/13/2012	
24413 NEPTUNE AVE	10/10/2012	
24413 RAVENNA AVE	9/19/2012	
24416 NEPTUNE AVE	7/12/2012	
24416 PANAMA AVE	5/17/2012	
24419 NEPTUNE AVE	8/2/2012	
24419 RAVENNA AVE	6/14/2012	
24420 PANAMA AVE	12/6/2012	
24422 MARBELLA AVE	7/11/2012	
24422 NEPTUNE AVE	1/19/2011	
24422 RAVENNA AVE	12/19/2012	
24423 MARBELLA AVE	6/20/2012	
24423 NEPTUNE AVE	10/11/2012	
24423 RAVENNA AVE	10/25/2012	
24426 MARBELLA AVE	2/23/2012	
24426 NEPTUNE AVE	10/29/2010	
24426 PANAMA AVE	12/5/2012	
24427 MARBELLA AVE	4/5/2012	
24429 NEPTUNE AVE	1/13/2011	
24430 PANAMA AVE	11/29/2012	
24432 MARBELLA AVE	3/15/2012	
24433 MARBELLA AVE	3/1/2012	
24436 PANAMA AVE	6/27/2012	
24502 MARBELLA AVE	5/3/2012	
24502 RAVENNA AVE	10/6/2010	7/25/2012
24503 MARBELLA AVE	3/29/2012	
24503 NEPTUNE AVE	4/12/2012	
24503 PANAMA AVE	8/9/2012	
24503 RAVENNA AVE	11/7/2012	
24506 MARBELLA AVE	3/14/2012	
24508 NEPTUNE AVE	1/27/2011	

Table B-1
Indoor Air Sample Locations Through December 31, 2012
Former Kast Property
Carson, California

Address	Sample Date	
24508 PANAMA AVE	4/25/2012	
24509 NEPTUNE AVE	7/5/2012	
24509 RAVENNA AVE	4/11/2012	
24512 MARBELLA AVE	1/19/2012	
24512 PANAMA AVE	11/14/2012	
24513 NEPTUNE AVE	8/1/2012	
24513 RAVENNA AVE	5/24/2012	
24516 MARBELLA AVE	5/23/2012	
24517 MARBELLA AVE	3/23/2012	
24518 RAVENNA AVE	7/11/2012	
24519 NEPTUNE AVE	6/28/2012	
24522 MARBELLA AVE	4/19/2012	
24522 NEPTUNE AVE	4/4/2012	
24522 RAVENNA AVE	8/22/2012	
24523 MARBELLA AVE	4/26/2012	
24523 NEPTUNE AVE	10/3/2012	
24523 RAVENNA AVE	8/23/2010	3/24/2011
24526 MARBELLA AVE	4/18/2012	
24528 NEPTUNE AVE	3/7/2012	
24529 NEPTUNE AVE	3/1/2012	
24529 PANAMA AVE	5/16/2012	
24529 RAVENNA AVE	8/17/2011	
24532 MARBELLA AVE	4/4/2012	
24532 PANAMA AVE	5/9/2012	
24532 RAVENNA AVE	11/15/2012	
24533 PANAMA AVE	9/19/2012	
24533 RAVENNA AVE	9/26/2012	
24602 MARBELLA AVE	5/31/2012	
24602 NEPTUNE AVE	3/3/2011	6/28/2012
24602 RAVENNA AVE	10/4/2012	
24603 MARBELLA AVE	1/14/2010	10/14/2010
24603 PANAMA AVE	10/18/2012	
24603 RAVENNA AVE	5/31/2012	
24606 MARBELLA AVE	1/12/2012	
24608 NEPTUNE AVE	5/17/2012	
24608 PANAMA AVE	4/5/2012	
24608 RAVENNA AVE	5/16/2012	
24609 NEPTUNE AVE	12/9/2010	
24609 PANAMA AVE	2/17/2011	
24609 RAVENNA AVE	9/20/2012	
24612 MARBELLA AVE	5/9/2012	
24612 NEPTUNE AVE	3/10/2011	
24612 RAVENNA AVE	10/31/2012	

Table B-1
Indoor Air Sample Locations Through December 31, 2012
Former Kast Property
Carson, California

Address	Sample Date	
24613 MARBELLA AVE	10/10/2012	
24613 NEPTUNE AVE	5/10/2012	
24613 PANAMA AVE	2/9/2011	9/12/2012
24613 RAVENNA AVE	5/19/2011	
24616 MARBELLA AVE	3/17/2011	
24617 MARBELLA AVE	5/2/2012	
24618 NEPTUNE AVE	1/26/2011	7/26/2012
24618 PANAMA AVE	4/18/2012	
24619 NEPTUNE AVE	7/12/2012	
24619 PANAMA AVE	2/10/2011	12/7/2011
24622 MARBELLA AVE	11/15/2012	
24622 NEPTUNE AVE	3/29/2012	
24623 MARBELLA AVE	1/27/2011	
24623 NEPTUNE AVE	3/30/2011	
24627 MARBELLA AVE	5/10/2012	
24628 MARBELLA AVE	6/22/2011	10/26/2011
24629 NEPTUNE AVE	2/2/2011	
24702 PANAMA AVE	2/23/2011	
24703 MARBELLA AVE	4/19/2012	
24707 MARBELLA AVE	9/6/2012	
24708 PANAMA AVE	8/15/2012	
24709 NEPTUNE AVE	8/9/2012	
24709 PANAMA AVE	3/7/2012	
24710 MARBELLA AVE	5/2/2012	
24712 PANAMA AVE	2/24/2011	
24712 RAVENNA AVE	6/9/2011	
24715 NEPTUNE AVE	2/17/2011	
24716 MARBELLA AVE	5/23/2012	
24716 RAVENNA AVE	2/29/2012	
24717 MARBELLA AVE	7/25/2012	
24718 NEPTUNE AVE	2/23/2012	
24718 PANAMA AVE	10/17/2012	
24719 NEPTUNE AVE	7/18/2012	
24719 PANAMA AVE	9/27/2012	
24719 RAVENNA AVE	11/28/2012	
24722 MARBELLA AVE	6/6/2012	
24722 NEPTUNE AVE	4/12/2012	
24722 PANAMA AVE	4/25/2012	
24722 RAVENNA AVE	11/8/2012	
24723 MARBELLA AVE	6/20/2012	
24723 RAVENNA AVE	11/7/2012	
24725 NEPTUNE AVE	6/21/2012	
24726 MARBELLA AVE	12/13/2012	

Table B-1
Indoor Air Sample Locations Through December 31, 2012
Former Kast Property
Carson, California

Address	Sample Date	
24726 RAVENNA AVE	12/19/2012	
24728 PANAMA AVE	11/1/2012	
24729 NEPTUNE AVE	10/18/2012	
24729 RAVENNA AVE	8/23/2012	
24732 NEPTUNE AVE	3/9/2011	
24732 PANAMA AVE	6/13/2012	
24732 RAVENNA AVE	6/21/2012	
24733 MARBELLA AVE	6/7/2012	
24733 RAVENNA AVE	7/26/2012	
24735 NEPTUNE AVE	11/14/2012	
24737 MARBELLA AVE	12/6/2012	
24738 NEPTUNE AVE	2/22/2012	
24738 PANAMA AVE	9/6/2012	
24739 NEPTUNE AVE	9/20/2012	
24739 PANAMA AVE	10/25/2012	
24739 RAVENNA AVE	3/2/2011	
24741 MARBELLA AVE	6/14/2012	
24744 MARBELLA AVE	3/14/2012	
24748 RAVENNA AVE	9/13/2012	
24749 RAVENNA AVE	12/16/2010	
24752 RAVENNA AVE	7/19/2012	
24809 NEPTUNE AVE	7/19/2012	
24809 PANAMA AVE	3/23/2012	
24812 PANAMA AVE	12/5/2012	
24813 PANAMA AVE	8/22/2012	
24815 NEPTUNE AVE	3/28/2012	
24818 PANAMA AVE	6/7/2012	
24819 PANAMA AVE	4/20/2011	
24828 PANAMA AVE	9/12/2012	
24832 PANAMA AVE	9/27/2012	
24833 PANAMA AVE	11/28/2012	
24904 NEPTUNE AVE	9/13/2012	
24912 NEPTUNE AVE	3/15/2012	
305 244TH ST	10/17/2012	
317 244TH ST	3/23/2011	
331 244TH ST	8/29/2012	
337 244TH ST	11/11/2010	
341 244TH ST	8/1/2012	
345 249TH ST	11/1/2012	
347 244TH ST	12/20/2012	
348 248TH ST	8/25/2010	1/12/2011
348 249TH ST	8/16/2012	
351 244TH ST	10/22/2010	

Table B-1
Indoor Air Sample Locations Through December 31, 2012
Former Kast Property
Carson, California

Address	Sample Date	
352 249TH ST	2/9/2011	
353 249TH ST	2/3/2011	
354 248TH ST	6/13/2012	
357 244TH ST	11/29/2012	
357 249TH ST	8/2/2012	
358 249TH ST	3/8/2012	
360 248TH ST	7/5/2012	
361 244TH ST	11/11/2010	
367 249TH ST	10/24/2012	
368 249TH ST	8/8/2012	
373 249TH ST	4/11/2012	
374 248TH ST	10/4/2012	
377 244TH ST	6/27/2012	
377 249TH ST	8/23/2012	
378 249TH ST	5/11/2011	2/23/2012
383 249TH ST	6/6/2012	
402 249TH ST	3/21/2012	
412 249TH ST	9/26/2012	

Table B-2
Sub-Slab Soil Vapor Results
Former Kast Property
Carson, California

Sample ID	Address	Sample Date	Sample Time	Location	Oxygen	Oxygen/ Argon	Carbon Dioxide	Acetone	Naphthalene	Ethanol	2-Butanone (Methyl Ethyl Ketone)	Chloroform	Benzene	Tetrachloro-ethene	Freon 12	Toluene	Methane	Carbon Disulfide	Isopropanol
				Analyte Units	MOL %	MOL %	MOL %	UG/M3	UG/M3	UG/M3	UG/M3	UG/M3	UG/M3	UG/M3	UG/M3	UG/M3	MOL %	UG/M3	UG/M3
				Frequency of Detection	100.00%	100.00%	91.79%	56.43%	46.54%	23.34%	22.50%	15.84%	9.95%	9.57%	8.60%	8.40%	7.50%	6.40%	5.49%
M24401 SVH	24401 MARBELLA AVE	2010-07-29	09:17	House	21		0.09	25	< 6	15	4	< 5.6	< 3.6	170	< 5.6	< 4.3	< 0.00023	< 3.6	< 11
M24401 SVG	24401 MARBELLA AVE	2010-07-29	10:15	Garage	20		0.085	34	< 6.2	14	3.9	< 5.7	5.9	< 7.9	< 5.8	< 4.4	< 0.00023	< 3.6	< 11
M24401 SVB	24401 MARBELLA AVE	2010-07-29	10:52	Back	21		0.076	29	< 7.2	< 10	14	< 6.7	< 4.4	< 9.2	< 6.8	< 5.1	< 0.00027	< 4.2	< 13
M24401SVH	24401 MARBELLA AVE	2012-03-29	14:46	House	21		0.085	21	0.65 J, b	< 6.1	< 9.6	< 4	< 2.6	17	< 4	5.4	< 0.00016	< 10	< 8
M24401SVB	24401 MARBELLA AVE	2012-03-29	15:03	Back	21		0.15	30	0.45 J, b	< 5.7	< 9	< 3.7	< 2.4	< 5.2	5.5	< 2.9	< 0.00015	< 9.5	< 7.5
M24401SVG	24401 MARBELLA AVE	2012-03-29	15:14	Garage	20		1.1	23	0.91 J, b	< 6.2	< 9.7	< 4	< 2.6	< 5.6	< 4.1	< 3.1	< 0.00016	< 10	< 8.1
M24401SVGD	24401 MARBELLA AVE	2012-03-29	15:14	Garage	20		1.1	38	1.3 J, b	< 6.2	< 9.7	4.2	< 2.6	9	< 4.1	< 3.1	< 0.00016	< 10	< 8.1
N24402SVH	24402 NEPTUNE AVE	2010-07-01	14:03	House	20		0.48	110	< 2.3	15	16	< 5.7	< 3.7	< 7.9	< 5.8	4.4	< 0.00023	< 3.6	< 11
N24402SVB	24402 NEPTUNE AVE	2010-07-01	14:47	Back	20		< 0.022	25	2.3 J	8.6	< 3.3	< 5.5	< 3.6	< 7.6	< 5.5	14	< 0.00022	< 3.5	< 11
N24402SVG	24402 NEPTUNE AVE	2010-07-01	15:31	Garage	20		0.23	30	< 2.3	10	4.2	< 5.6	5.1	< 7.8	< 5.7	< 4.3	< 0.00023	< 3.6	< 11
N24402SVB	24402 NEPTUNE AVE	2012-10-04	15:08	Back	20		0.46	< 33	< 0.7	< 11	< 17	< 6.9	< 4.5	< 9.6	< 7	< 5.3	< 0.00028	< 18	< 14
N24402SVH	24402 NEPTUNE AVE	2012-10-04	15:13	House	20		0.85	< 28	< 0.59	< 9	< 14	< 5.8	< 3.8	< 8.1	< 5.9	< 4.5	< 0.00024	< 15	< 12
N24402SVG	24402 NEPTUNE AVE	2012-10-04	16:03	Garage	20		0.52	< 29	2.7 J, b	< 9.3	< 14	< 6	< 3.9	< 8.4	< 6.1	< 4.6	< 0.00025	< 15	< 12
N24402SVGD	24402 NEPTUNE AVE	2012-10-04	16:03	Garage	20		0.54	< 29	< 0.61	< 9.3	< 14	< 6	< 3.9	< 8.4	< 6.1	< 4.6	< 0.00025	< 15	< 12
P24402SVB	24402 PANAMA AVE	2010-11-16	09:03	Back	19		< 0.022	48	1.1 J, b	< 8.4	< 3.3	< 5.5	< 3.6	< 7.6	< 5.5	< 4.2	< 0.00022	< 3.5	< 11
P24402SVG	24402 PANAMA AVE	2010-11-16	09:36	Garage	21		< 0.022	15	0.73 J, b	< 8.4	< 3.3	< 5.5	< 3.6	< 7.6	< 5.5	< 4.2	< 0.00022	< 3.5	< 11
P24402SVH	24402 PANAMA AVE	2010-11-16	10:18	House	18		0.46	16	< 0.34	< 9	< 3.5	< 5.8	< 3.8	< 8.1	< 5.9	< 4.5	< 0.00024	< 3.7	< 12
P24402SVH	24402 PANAMA AVE	2012-12-21	09:47	House	18		2.4	< 29	3.5 J, b	< 9.3	< 14	< 6	< 3.9	< 8.4	< 6.1	< 4.6	< 0.00025	< 15	< 12
P24402SVG	24402 PANAMA AVE	2012-12-21	10:08	Garage	21		0.21	< 28	1.1 J, b	< 9	< 14	< 5.8	< 3.8	< 8.1	< 5.9	< 4.5	< 0.00024	< 15	< 12
P24402SVB	24402 PANAMA AVE	2012-12-21	10:14	Back	18		0.048	< 28	2.1 J, b	< 9	< 14	< 5.8	< 3.8	< 8.1	< 5.9	< 4.5	< 0.00024	< 15	< 12
R24402SVB	24402 RAVENNA AVE	2009-10-02	15:36	Back	18		2.1	17	< 2.9	< 8.7	< 3.4	240	< 3.7	< 7.8	< 5.7	< 4.3	< 0.00023	< 3.6	< 11
R24402SVF	24402 RAVENNA AVE	2009-10-02	16:44	Front	18		1.6	32	< 3	< 9	< 3.5	< 5.8	< 3.8	< 8.1	< 5.9	< 4.5	< 0.00024	< 3.7	1700 E
R24402SVB	24402 RAVENNA AVE	2010-12-09	11:14	Back	20		1.2	15	0.55 J, b	< 8.9	< 3.5	17	< 3.8	< 8	< 5.9	< 4.5	< 0.00024	< 3.7	< 12
R24402SVF	24402 RAVENNA AVE	2010-12-09	11:54	Front	20		1.1	< 11	0.44 J, b	< 8.7	< 3.4	< 5.6	< 3.7	< 7.8	< 5.7	< 4.4	< 0.00023	< 3.6	< 11
R24402SVFS	24402 RAVENNA AVE	2010-12-09	11:54	Front		20.6	1.11	< 17	< 1.3	< 17	< 17	1.7	< 1.7	< 1.7	2.6	3	< 0.15	< 17	< 3.4
R24402SVH	24402 RAVENNA AVE	2010-12-13	13:44	House	21		0.48	52	1 J, b	< 8.4	6.6	< 5.5	< 3.6	< 7.6	< 5.5	< 4.2	0.00024	< 3.5	< 11
R24402SVB	24402 RAVENNA AVE	2012-05-25	09:55	Back	21		0.99	< 20	< 0.33	< 6.2	< 9.8	16	< 2.6	< 5.6	< 4.1	< 3.1	< 0.00017	< 10	10
R24402SVBD	24402 RAVENNA AVE	2012-05-25	09:55	Back	21		1.1	< 20	< 0.33	< 6.2	< 9.8	16	< 2.6	< 5.6	< 4.1	< 3.1	< 0.00017	< 10	< 8.2
R24402SVF	24402 RAVENNA AVE	2012-05-25	10:28	Front	20		1.8	< 18	< 0.3	< 5.7	< 8.9	4.2	< 2.4	< 5.1	< 3.7	< 2.8	< 0.00015	< 9.4	< 7.4
R24402SVH	24402 RAVENNA AVE	2012-05-25	10:54	House	22		0.62	31	0.32 J, b	11	< 9.5	< 3.9	< 2.6	< 5.5	< 4	< 3	< 0.00016	< 10	< 7.9
N24403SVF	24403 NEPTUNE AVE	2010-06-25	09:26	Front	18		1.9	33	< 2.3 UJ	11	< 3.4	7.1	< 3.7	< 7.9	< 5.8	< 4.4	< 0.00023	< 3.6	< 11
N24403SVH	24403 NEPTUNE AVE	2010-06-25	10:04	House	20		0.095	26	< 2.4 UJ	16	4.6	< 5.8	< 3.8	< 8	< 5.9	< 4.5	< 0.00024	21	< 12
N24403SVB	24403 NEPTUNE AVE	2010-06-25	11:12	Back	20		0.096	58	< 2.2 UJ	18	21	< 5.5	< 3.6	< 7.7	< 5.6	< 4.2	< 0.00023	< 3.5	< 11
N24403SVH	24403 NEPTUNE AVE	2012-11-09	09:48	House	21		0.19	< 28	1.3 J, b	< 8.8	< 14	< 5.7	< 3.7	< 7.9	< 5.8	< 4.4	< 0.00023	< 14	< 11
N24403SVB	24403 NEPTUNE AVE	2012-11-09	10:18	Back	22		0.23	< 28	< 0.59	< 9	< 14	< 5.8	< 3.8	< 8.1	< 5.9	< 4.5	< 0.00024	< 15	< 12
N24403SVBD	24403 NEPTUNE AVE	2012-11-09	10:18	Back	21		0.22	< 28	3.9 J, b	< 8.8	< 14	< 5.7	< 3.7	< 7.9	< 5.8	< 4.4	< 0.00023	< 14	< 11
N24403SVF	24403 NEPTUNE AVE	2012-11-09	10:31	Front	19		1.5	< 28	< 0.58	< 8.8	< 14	< 5.7	< 3.7	< 7.9	< 5.8	< 4.4	< 0.00023	< 14	< 11
M24405SVF	24405 MARBELLA AVE	2010-11-10	12:36	Front	21		< 0.025	24	0.91 J, b	< 9.3	< 3.6	< 6	< 3.9	< 8.3	< 6.1	< 4.6	< 0.00025	< 3.8	< 12
M24405SVH	24405 MARBELLA AVE	2010-11-10	14:10	House	21		0.024	21	0.43 J, b	< 8.8	< 3.5	< 5.7	< 3.8	120	< 5.8	< 4.4	< 0.00024	< 3.6	< 12
M24405 SVF	24405 MARBELLA AVE	2012-03-22	15:21	Front	21		0.09	22	0.87 J, b	< 6.3	< 9.9	< 4.1	< 2.7	< 5.7	< 4.2	< 3.2	< 0.00017	< 10	11
M24405 SVH	24405 MARBELLA AVE	2012-03-22	15:27	House	21		0.1	< 17	6.3 J, b	< 5.5	< 8.6	< 3.6	< 2.3	19	3.8	< 2.8	< 0.00015	< 9.1	< 7.2
M24406SVB	24406 MARBELLA AVE	2010-09-17	08:58	Back	18		1.2	25	1.4 J, b	< 8.9	3.9	< 5.8	< 3.8	< 8	< 5.9	< 4.5	< 0.00024	< 3.7	< 12
M24406SVG	24406 MARBELLA AVE	2010-09-17	09:39	Garage	20		< 0.023	89	1.6 J, b	11	5.2	< 5.7	< 3.7	< 7.9	< 5.8	< 4.4	< 0.00023	< 3.6	< 11
M24406SVGD	24406 MARBELLA AVE	2010-09-17	09:39	Garage	20		< 0.023	140	1.7 J, b	20	11	< 5.7	< 3.7	< 7.9	< 5.8	< 4.4	< 0.00023	< 3.6	< 11
M24406SVH	24406 MARBELLA AVE	2010-09-17	10:22	House	18		1.1	20	1.4 J, b	< 8.8	< 3.4	< 5.7	8.7	< 7.9	< 5.8	< 4.4	< 0.00023	< 3.6	< 11
M24406SVG	24406 MARBELLA AVE	2012-03-09	15:13	Garage	21		0.24	< 19	1.8 J, b	< 6.1	< 9.5	4	< 2.6	< 5.5	< 4	< 3	< 0.00021	< 10	< 7.9
M24406SVH	24406 MARBELLA AVE	2012-03-09	15:40	House	21		0.44	< 19	1.4 J, b	< 6.2	< 9.7	< 4	< 2.6	< 5.6	< 4	< 3.1	< 0.00021	< 10	< 8.1
M24406SVB	24406 MARBELLA AVE	2012-03-09	16:07	Back	21		1	27	1.6 J, b	12	< 8.8	< 3.6	< 2.4	< 5	< 3.7	22 J	< 0.00021	< 9.3	29
M24406SVBD	24406 MARBELLA AVE	2012-03-09	16:07	Back	20		1.2	< 19	1.6 J, b	< 6	< 9.3	< 3.8	< 2.5	< 5.4	< 3.9	< 3	< 0.00022	< 9.8	< 7.8
N24406SVH	24406 NEPTUNE AVE	2010-04-29	13:45	House	21		0.11	16	< 6.2	27 b	< 3.4	< 5.7	< 3.7	< 7.9	< 5.8	< 4.4	< 0.00023	7	< 11
N24406SVF	24406 NEPTUNE AVE	2010-04-29	14:31	Front	21		0.045	22	< 6.4	33 b	4.4	< 5.9	< 3.8	< 8.2	< 6	< 4.5	< 0.00024	< 3.8	< 12
N24406SVFD	24406 NEPTUNE AVE	2010-04-29	14:31	Front	21		0.042	89	6.7 J	1200 E, b	210	< 5.9	< 3.8	< 8.2	< 6	9.4	< 0.00024	18	200

Table B-2
Sub-Slab Soil Vapor Results
Former Kast Property
Carson, California

Sample ID	Address	Sample Date	Sample Time	Location	Oxygen	Oxygen/ Argon	Carbon Dioxide	Acetone	Naphthalene	Ethanol	2-Butanone (Methyl Ethyl Ketone)	Chloroform	Benzene	Tetrachloro-ethane	Freon 12	Toluene	Methane	Carbon Disulfide	Isopropanol
			Units		MOL %	MOL %	MOL %	UG/M3	UG/M3	UG/M3	UG/M3	UG/M3	UG/M3	UG/M3	UG/M3	UG/M3	MOL %	UG/M3	UG/M3
			Frequency of Detection		100.00%	100.00%	91.79%	56.43%	46.54%	23.34%	22.50%	15.84%	9.95%	9.57%	8.60%	8.40%	7.50%	6.40%	5.49%
N24406SVB	24406 NEPTUNE AVE	2010-04-29	15:22	Back	21		< 0.024	98	80 J	25 b	< 3.6	42	7.6	< 8.2	< 6	6.4	< 0.00024	< 3.8	< 12
N24406SVH	24406 NEPTUNE AVE	2010-11-12	11:08	House	21		0.21	< 11	0.71 J, b	< 8.6	< 3.4	< 5.6	< 3.6	< 7.8	< 5.7	< 4.3	< 0.00023	< 3.6	< 11
N24406SVB	24406 NEPTUNE AVE	2010-11-12	12:22	Back	21		0.099	< 14	0.73 J, b	< 11	< 4.3	< 7	< 4.6	< 9.8	< 7.1	< 5.4	< 0.00029	< 4.5	< 14
N24406SVBS	24406 NEPTUNE AVE	2010-11-12	12:22	Back		21.7	< 0.2	< 21	< 1.6	< 21	< 21	< 2.1	< 2.1	< 2.1	2.8	2.2	< 0.2	< 21	< 4.2
N24406SVH	24406 NEPTUNE AVE	2012-01-26	11:02	House	22		0.17	30	0.71 J, b	6.5	< 9.5	< 3.9	< 2.6	< 5.5	< 4	< 3	0.00017	< 10	< 7.9
N24406SVG	24406 NEPTUNE AVE	2012-01-26	11:44	Garage	23		0.08	38	< 0.41	15	< 12	< 5.1	< 3.3	< 7	< 5.1	< 3.9	0.00021	< 13	< 10
N24406SVB	24406 NEPTUNE AVE	2012-01-26	11:59	Back	22		0.087	19	< 0.32	< 6.2	< 9.7	< 4	< 2.6	< 5.6	< 4	< 3.1	0.00017	< 10	< 8.1
N24406SVBS	24406 NEPTUNE AVE	2012-01-26	11:59	Back		21.6	< 0.17 U	23	< 1 U	< 18 U	< 18 U	< 1.8 U	< 1.8 U	< 1.8 U	3.3	< 1.8 U	< 0.17 U	< 18 U	< 3.6 U
P24406SVB	24406 PANAMA AVE	2009-09-17	11:47	Back	18		0.2	42	< 3.2	< 9.7	5.1	< 6.3	< 4.1	< 8.7	< 6.4	< 4.8	< 0.00026	< 4	< 13
P24406SVB-D	24406 PANAMA AVE	2009-09-17	11:47	Back	18		0.2	38	6 J	< 9.9	4.1	< 6.4	< 4.2	< 9	< 6.5	< 5	< 0.00026	< 4.1	< 13
P24406SVF	24406 PANAMA AVE	2009-09-17	13:22	Front	19		0.74	130	< 2.9	< 8.7	11	< 5.6	< 3.7	< 7.8	< 5.7	< 4.3	< 0.00023	< 3.6	20
P24406SVB	24406 PANAMA AVE	2010-07-21	09:22	Back	19		2.2	25	< 6	< 8.6	7.8	< 5.6	< 3.6	< 7.8	< 5.7	4.4 b	< 0.00023	< 3.6	< 11
P24406SVH	24406 PANAMA AVE	2010-07-21	10:50	House	20		0.7	18	< 6.2	9	< 3.4	6.4	< 3.7	< 7.9	< 5.8	< 4.4	< 0.00023	4.5	< 11
P24406SVB	24406 PANAMA AVE	2011-02-14	10:31	Back	20		1.4	38	< 0.32	< 8.5	7.6	< 5.5	< 3.6	< 7.7	< 5.6	< 4.2	< 0.00023	< 3.5	< 11
P24406SVH	24406 PANAMA AVE	2011-02-14	11:14	House	21		1	< 11	< 0.34	< 8.9	< 3.5	< 5.8	< 3.8	< 8	10	< 4.5	< 0.00024	< 3.7	< 12
P24406SVH	24406 PANAMA AVE	2012-08-16	15:05	House	19		1.2	< 19	3.9 J, b	< 6	< 9.3	< 3.8	< 2.5	< 5.4	4.9	< 3	< 0.00016	< 9.8	< 7.8
P24406SVF2	24406 PANAMA AVE	2012-08-16	15:24	Front 2	20		0.45	43	2.2 J, b	420	< 10	< 4.3	< 2.8	< 5.9	< 4.3	6.6	< 0.00018	< 11	24
P24406SVB	24406 PANAMA AVE	2012-08-16	15:48	Back	18		2.8	23	1.4 J, b	11	< 9.3	< 3.8	< 2.5	< 5.4	< 3.9	< 3	< 0.00016	< 9.8	< 7.8
P24406SVB D	24406 PANAMA AVE	2012-08-16	15:48	Back	18		2.8	22	1.5 J, b	< 6	< 9.3	< 3.8	< 2.5	< 5.4	< 3.9	< 3	< 0.00016	< 9.8	< 7.8
N24409SVG	24409 NEPTUNE AVE	2010-07-16	09:09	Garage	20		0.17	41	< 6	16	9.9	< 5.6	< 3.6	< 7.8	< 5.7	< 4.3	< 0.00023	< 3.6	< 11
N24409SVB	24409 NEPTUNE AVE	2010-07-16	10:03	Back	18		0.26	34	< 6.4	14	5	< 5.9	< 3.9	< 8.2	< 6	< 4.6	< 0.00024	5.7	< 12
N24409SVBD	24409 NEPTUNE AVE	2010-07-16	10:03	Back	18		0.26	50	< 6.4	18	17	< 5.9	< 3.9	< 8.2	< 6	< 4.6	< 0.00024	< 3.8	< 12
N24409SVH	24409 NEPTUNE AVE	2012-05-04	09:58	House	21		< 0.016	36	4.7 J, b	19	< 9.3	< 3.8	< 2.5	< 5.4	< 3.9	< 3	< 0.00016	< 9.8	< 7.8
N24409SVG	24409 NEPTUNE AVE	2012-05-04	10:05	Garage	21		0.61	< 18	0.78 J, b	< 5.8	< 9.1	< 3.8	< 2.5	< 5.2	< 3.8	< 2.9	< 0.00016	< 9.6	< 7.6
N24409SVGS	24409 NEPTUNE AVE	2012-05-04	10:05	Garage		21.1	0.595	< 17 U	< 0.73 U	< 17 U	< 17 U	< 1.7 U	< 1.7 U	< 1.7 U	2.2	< 1.7 U	< 0.16 U	< 17 U	< 3.5 U
N24409SVB	24409 NEPTUNE AVE	2012-05-04	10:39	Back	20		0.75	< 18	0.58 J, b	< 5.6	< 8.8	< 3.6	< 2.4	< 5	< 3.7	< 2.8	< 0.00015	< 9.3	< 7.3
N24409SVBS	24409 NEPTUNE AVE	2012-05-04	10:39	Back		20	0.773	< 16 U	< 0.69 U	< 16 U	< 16 U	1.7	< 1.6 U	< 1.6 U	2.2	< 1.6 U	< 0.15 U	< 16 U	< 3.3 U
P24410SVH	24410 PANAMA AVE	2010-07-30	14:06	House	20		1	18 b	< 6.2	< 8.8	< 3.4	< 5.7	< 3.7	< 7.9	< 5.8	< 4.4	< 0.00023	< 3.6	< 11
P24410SVB	24410 PANAMA AVE	2010-07-30	14:58	Back	19		1.1	18 b	< 6.4	< 9.1	< 3.6	< 5.9	< 3.9	< 8.2	< 6	< 4.6	< 0.00024	< 3.8	< 12
P24410SVG	24410 PANAMA AVE	2010-07-30	15:02	Garage	19		1.8	20 b	< 6.2	17	< 3.4	< 5.7	< 3.7	< 7.9	< 5.8	< 4.4	< 0.00023	< 3.6	< 11
P24410SVGS	24410 PANAMA AVE	2010-07-30	15:02	Garage		21.2	1.23	< 17	< 1.4	< 17	< 17	< 1.7	< 1.7	1.9	2.2	< 1.7	< 0.16	< 17	< 3.5
P24410SVH	24410 PANAMA AVE	2012-07-19	09:52	House	20		0.89	< 19	< 3 PF	< 6.1	< 9.6	< 4	< 2.6	< 5.5	< 4	< 3.1	< 0.00016	< 10	< 8
P24410SVG	24410 PANAMA AVE	2012-07-19	09:53	Garage	17		2.7	< 20	< 3.1 PF	< 6.2	< 9.8	< 4	< 2.6	< 5.6	< 4.1	< 3.1	< 0.00017	< 10	< 8.2
P24410SVGD	24410 PANAMA AVE	2012-07-19	09:53	Garage	18		2.8	< 20	< 3.1 PF	< 6.2	< 9.8	< 4	< 2.6	< 5.6	< 4.1	< 3.1	< 0.00017	< 10	< 8.2
P24410SVB	24410 PANAMA AVE	2012-07-19	10:25	Back	19		1.8	< 18	< 2.8 PF	< 5.6	< 8.8	4.2	< 2.4	< 5.1	< 3.7	< 2.8	< 0.00015	< 9.3	< 7.4
M24411SVH	24411 MARBELLA AVE	2010-09-13	13:36	House	21		0.044	44	2.2 J	23	11	< 5.8	< 3.8	19	< 5.9	< 4.5	< 0.00024	5.1	27
M24411SVF	24411 MARBELLA AVE	2010-09-13	14:19	Front	21		< 0.025	69	2.8 J	22	6.8	< 6.2	< 4	< 8.5	< 6.2	< 4.7	< 0.00025	6.4	< 12
M 24411 SVB2	24411 MARBELLA AVE	2011-02-03	13:41	Back 2	21		< 0.024	13	25 b	< 8.9	< 3.5	< 5.8	8.4	< 8	< 5.9	48	< 0.00024	< 3.7	< 12
M24411SVF	24411 MARBELLA AVE	2012-04-27	13:58	Front	21		< 0.02	24	1.4 J, b	< 5.9	< 9.2	< 3.8	< 2.5	< 5.3	< 3.8	< 2.9	< 0.0002	< 9.7	< 7.7
M24411SVFD	24411 MARBELLA AVE	2012-04-27	13:58	Front	22		< 0.02	< 18	0.91 J, b	< 5.9	< 9.2	< 3.8	< 2.5	< 5.3	< 3.8	< 2.9	< 0.0002	< 9.7	< 7.7
M24411SVB2	24411 MARBELLA AVE	2012-04-27	14:24	Back 2	21		0.041	21	2 J, b	< 5.5	< 8.6	< 3.6	< 2.3	< 5	< 3.6	< 2.8	< 0.0002	< 9.1	< 7.2
P24411SVH	24411 PANAMA AVE	2010-07-06	09:31	House	17		2.7	56	< 2.3 Q	11	5	< 5.6	< 3.7	< 7.8	< 5.7	< 4.3	< 0.00023	66	< 11
P24411SVG	24411 PANAMA AVE	2010-07-06	10:24	Garage	19		1.9	16	2.7 J, Q, b	< 8.8	< 3.4	< 5.7	34	74	< 5.8	190	< 0.00023	< 3.6	< 11
P24411SVB	24411 PANAMA AVE	2010-07-06	11:08	Back	19		1.2	21	< 2.3 Q	< 8.8	< 3.4	< 5.7	< 3.7	8.5	< 5.8	< 4.4	< 0.00023	< 3.6	< 11
P24411SVH	24411 PANAMA AVE	2012-12-14	10:07	House	18		3.6	< 27	1 J, b	< 8.4	< 13	< 5.5	< 3.6	< 7.6	< 5.5	< 4.2	< 0.00022	< 14	< 11
P24411SVB	24411 PANAMA AVE	2012-12-14	10:13	Back	17		3.3	< 29	1.6 J, b	< 9.3	< 15	< 6	< 4	< 8.4	< 6.1	< 4.7	< 0.00025	< 15	< 12
P24411SVBD	24411 PANAMA AVE	2012-12-14	10:13	Back	18		3.1	< 28	1.1 J, b	< 8.9	< 14	< 5.8	< 3.8	< 9	< 5.9	6.5	< 0.00024	< 15	< 12
P24411SVG	24411 PANAMA AVE	2012-12-14	10:50	Garage	20		1.7	< 27	1.9 J, b	< 8.5	< 13	< 5.5	< 3.6	48	< 5.6	< 4.2	< 0.00023	< 14	< 11
N24413SVH	24413 NEPTUNE AVE	2010-11-01	09:20	House	19		2.5	20	< 1.4	11	< 3.5	< 5.8	< 3.8	< 8.1	< 5.9	< 4.5	< 0.00024	< 3.7	< 12
N24413SVHD	24413 NEPTUNE AVE	2010-11-01	09:20	House	19		2.5	15	< 1.4	< 9	< 3.5	< 5.8	< 3.8	< 8.1	< 5.9	< 4.5	< 0.00024	< 3.7	< 12
N24413SVF	24413 NEPTUNE AVE	2010-11-01	10:01	Front	20		0.18	120	< 1.4	< 9	< 3.5	< 5.8	< 3.8	< 8.1	< 5.9	4.5	< 0.00024	< 3.7	< 12
N24413SVB	24413 NEPTUNE AVE	2010-11-01	10:34	Back	20		0.89	< 11	< 1.4	12	< 3.6	< 5.9	< 3.9	< 8.2	< 6	< 4.6	< 0.00024	< 3.8	< 12