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18 July 2001
C6-BRC-T-01-013

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
Los Angeles Region
320 W. 4th Street, Suite 200
Los Angeles, CA 90013

BOEING

Attention: John Geroch

Subject: **RISK ASSESSMENT WORKPLAN ADDENDUM 1 FOR BOEING REALTY CORPORATION, FORMER C-6 FACILITY, 19503 SOUTH NORMANDIE AVENUE, LOS ANGELES, CA**

Dear Mr. Geroch:

Please find enclosed for your review, two copies of the subject document prepared by Haley & Aldrich, Inc. for Boeing Realty Corporation.

If you have any questions concerning this document, please contact the undersigned at 562-593-8623.

Sincerely,

Stephanie Sibbett

Stephanie Sibbett
Boeing Realty Corporation

Cc: Mario Stavale, Boeing Realty Corporation
Scott Lattimore, Long Beach Division

enclosure

HALEY & ALDRICH

ENGLAND GEOSYSTEM
ENVIRONMENTAL ENGINEERING

BOEING REALTY CORPORATION
FORMER C-6 FACILITY
LOS ANGELES, CALIFORNIA

TECHNICAL MEMORANDUM

RISK ASSESSMENT WORK PLAN ADDENDUM NO. 1

To: **Mr. Brian Mossman**
Boeing Realty Corporation
3855 Lakewood Blvd.
Building 1A MC D001-0097
Long Beach, CA 90846

From: **Haley & Aldrich, Inc.**

Date: **July 11, 2001**

Re: **Response to April 12, 2001 Office of Environmental Health Hazard Assessment (OEHHA) Comments to November 29, 2000 Risk Assessment Work Plan for the Boeing Realty Corporation, Former C-6 Facility, Los Angeles, California**

This technical memorandum has been prepared by Haley & Aldrich, Inc., on behalf of the Boeing Realty Corporation (BRC), in response to the April 12, 2001 Office of Environmental Health Hazard Assessment (OEHHA) comments on the November 29, 2001 Risk Assessment Work Plan (RAWP) for the BRC Former C-6 Facility in Los Angeles, California (subject property). This addendum documents a complete response to the OEHHA comments and, along with the RAWP, comprises the work plan for the proposed risk assessment activities at the subject property. A copy of the April 12, 2001 OEHHA comments is presented as Appendix A. OEHHA's comments were discussed between Dr. Julio Salinas of OEHHA and Dr. Michael Sullivan of The Boeing Company in April, 2001. Our response to each comment is presented below.

Section 1 – Introduction

Response to Comment No. 1: In this comment, OEHHA requests that the Los Angeles Regional Water Quality Control Board (LARWQCB) provide an opinion regarding whether the groundwater within the Bellflower aquitard is or is not suitable for water supply purposes and whether this potential exposure pathway should or should not be included in the risk assessment. It is our understanding that the LARWQCB concurs that the Bellflower aquitard is not suitable for water supply purposes and this potential exposure pathway should not be included in the risk assessment (Personal communication, John Geroch, LARWQCB, June 2001).

Response to Comment No. 2a: In this comment, OEHHA provides clarification of the exposure pathway evaluation process by presenting definitions for "migration pathway", and "exposure pathway". We agree with OEHHA's definition of migration pathway and exposure pathway and each of their roles in exposure pathway evaluation. The risk assessment will include a more detailed

exposure pathway analysis that includes an analysis of current and future chemical migration and migration mechanisms within each environmental medium.

Response to Comment No. 2b: OEHHA requests that the exposure pathway evaluation include an assessment of the concept of spatial and temporal analysis. See response to Section 1 Comment No. 2a.

Response to Comment No. 3: OEHHA indicates that the presentation of the proposed tiered risk assessment approach is not clear. We agree that the RAWP may not be optimally organized. Although, the tiered process is not explicitly described, the process proposed for the subject property is consistent with the tiered approach described in the figure provided with the OEHHA comments and entitled *Overall Risk Assessment Process for a Contaminated Problem.* The initial steps of the proposed risk assessment process include conducting a complete chemical characterization of the subject property and identifying analytical procedures that will provide comprehensive and valid chemical results for use in the risk assessment. These steps are described in the following LARWQCB-approved documents:

- Sampling and Analysis Plan (SAP), prepared by Kennedy/Jenks Consultants (K/J). The SAP describes the overall investigative approach, explains how environmental features were identified, provides rationale for determining the scope of the investigation, describes sample handling and documentation procedures, identifies the analytical tests to be performed, and describes the analytical method quality control procedures.

- Addendum A, Sampling and Analysis Plan (SAP Addendum), prepared by K/J. The SAP Addendum provides the investigation and analytical approach for Buildings 2 and 66 which were not included in the SAP.

- Sampling and Analysis Plan Supplement (SAP Supplement No. 1), prepared by Haley & Aldrich, Inc. (H&A). This SAP supplement identifies additional sampling and analysis in suspected volatile organic compound (VOC) source areas, proposed for possible interim remediation by soil vapor extraction (SVE), and in other portions of the property to obtain additional information for human health risk assessment purposes. During the preparation of this SAP supplement, an exposure pathway evaluation including an evaluation of migration pathways was considered to ensure that appropriate media and site locations were sampled and tested. Other risk assessment requirements (e.g., physical soil parameters, and analytical methods, chemical detection limits) were also evaluated during the preparation of this SAP supplement.

- Sampling and Analysis Plan Supplement No. 2, Former Chromic Acid Tank Location, Parcel C, prepared by H&A. This SAP supplement describes the proposed sampling and analysis plan for delineation of impacts associated with a former chromic acid tank on Parcel C.

- Sampling and Analysis Plan Supplement No. 3, Additional Soil Gas Samples, Parcel C, prepared by H&A. This SAP supplement describes additional soil gas sampling activities to be conducted in proximity to previous sampling locations where isolated VOC concentrations were reported within Parcel C.

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- Sampling and Analysis Plan Supplement No. 4, Soil Gas Screening Concentrations (SGSCs), prepared by H&A. This SAP supplement describes the derivation of the SGSCs for an assumed light industrial/commercial setting. The SGSCs were used as a tool to assist with the assessment of soil gas impact delineation, and were derived for VOCs using conservative health-based assumptions for the vapor phase migration pathway.

- Sampling and Analysis Plan Supplement No. 5, Field Action Levels for Soil, Parcel C, prepared by H&A. This SAP supplement describes the derivation of field action levels (FALs), developed for chemical delineation purposes to ensure that the data obtained are complete for conducting an exposure pathway evaluation, estimating exposure point concentrations, and assessing potential threat to groundwater from chemical migration.

A conservative screening risk assessment (SRA), or Tier 1 risk assessment, will be conducted. When few samples have detected concentrations, the maximum reported concentrations instead of the reasonable maximum exposure (RME) concentration (which in many cases is the 95 percent upper confidence limit concentration [95%UCL]) will be used to estimate exposure point concentrations. This is more conservative; since, when few samples have detected concentrations, calculated 95%UCL concentrations may end up being close to the laboratory detection limits for organic chemicals, and within background concentrations for metals. Should the results of SRA indicate that target risk levels are not exceeded, no further risk assessment, additional investigations, or remedial actions will be recommended. Should a target risk level(s) be exceeded in the SRA, either remedial decisions will be made from the SRA results or a detailed deterministic, or Tier 2 risk assessment will be conducted. The detailed deterministic risk assessment will include site-specific, realistic human exposure models and may include more detailed fate and transport modeling. Should a target risk level(s) be exceeded in the detailed deterministic risk assessment, a detailed probabilistic risk assessment or Tier 3 risk assessment may be proposed. Additional information specific to a detailed probabilistic risk assessment will provided to OEHHA, as requested in their April 12, 2001 comments, prior to initiation of a probabilistic risk assessment. Each risk assessment tier will address the same site conceptual evaluation model, and will utilize the same values identified in the toxicity assessment.

Section 2 – Data Requirements and Objectives

Response to Comment No. 1: The information presented in Tables 2-1, 2-2, and 2-3 was obtained from the laboratory scope of work requirements developed for the subject project. The information presented in these tables is in general conformance with the EPA's 1994 *Contract Laboratory Program National Functional Guidelines for Organic Data Review*, and EPA's 1994 *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*). References will be provided for tables presented in the risk assessment and throughout the risk assessment text, as appropriate.

Section 3 – Hazard Identification

Response to Comment No. 1: In this comment, OEHHA indicates that less than a 5% detection frequency is a necessary condition for elimination of a chemical as a COPC in a risk assessment but is not, in and of itself, sufficient justification for not identifying the chemical as a COPC. We agree that a chemical should not be eliminated as a chemical of potential concern (COPC) in the risk assessment

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solely based on detection frequency. The analytical results for samples obtained from each medium and the use history of the facility will also be reviewed. We agree with the flowchart presented in the figure provided with the OEHHA comments and entitled *COPC Evaluation Process*, with the following exception: metals concentrations will also be compared to site-specific background levels in the COPC selection process. Should the results for a particular metal be within the background concentration range, that metal will not be considered a COPC in the risk assessment.

Response to Comment No. 1(a): OEHHA further comments that a low detection frequency may indicate inappropriate or insufficient sampling and testing. The risk assessment will be conducted only after site characterization activities are considered to be complete.

Response to Comment No. 1(b): OEHHA indicates that a spatial and temporal analysis must be considered when selecting COPCs in groundwater. Worst-case chemical concentration assumptions considering both spatial and temporal analyses of chemical concentrations in groundwater will be evaluated, should groundwater results be used in the evaluation of potential migration of VOCs into buildings.

Thus, Item 2 of Section 3.1 has been revised to address the above-noted detection frequency concerns: "2. A chemical with relatively low detection frequency may not be selected as a COPC, only after further evaluation of sampling and testing strategy for that chemical, site characterization completeness, possible laboratory contamination, spatial and temporal analysis of the analytical data, and historical chemical usage. If the results of the above-note evaluations indicated that it is unlikely that the chemical is present at the site, only then will the chemical not be selected as a COPC for the risk assessment."

Response to Comment No. 2: OEHHA requests that they be informed of the proposed elimination of tentatively identified compounds (TICs) as COPCs in the risk assessment. If TICs are identified, we will notify OEHHA and request concurrence to our proposed decision in the selection of TICs as COPCs in the risk assessment.

Response to Comment No. 3: In this comment, OEHHA indicates their concern that careless laboratory contamination could lead to erroneous elimination of COPCs. We have the same concern. It is not our intent to eliminate typical laboratory contaminants as COPCs; since, in some cases these chemicals may also be site-related chemicals. Should typical laboratory contaminants be routinely detected in laboratory method blanks, the laboratory will be notified of our concern regarding sample contamination and potential "sloppy" sample preparation or analytical practices. Only established and reputable California-certified laboratories are being used for this project.

Response to Comment No. 4a: In this comment, OEHHA provides clarification regarding the use of the Wilcoxon Rank Sum Test and identifies other statistical tests that may be used to evaluate background data. In the first sentence of Section 3.2.1, "populations" is substituted for "distributions". In addition, the last paragraph of Section 3.2.1, is revised to:

> "The Wilcoxon Rank Sum Test, a non-parametric statistical method, tests the null hypothesis (h_o) that background and site data are within the same population (i.e., the presence of a chemical at the site is due to background and is not site-related). The hypothesis is tested by analyzing the "location" of the site data within two independent data populations. The data of both populations are placed in rank order and, if the site data tend to be located toward the

upper extreme of ranked data, there is a decreasing probability that this data are from the same population as the background data. At some specified probability level, the site data are declared to be inconsistent with background and an alternative hypothesis (h_a) is accepted that the site data suggest site-related contamination."

Response to Comment No. 4b: In this comment, OEHHA indicates that the purpose of using ½ SQL is to replace the datum reported as "trace", "not detected", "zero", or "less than limit of detection" for a non-zero value when the contaminant concentration is very near or below the measurement limit of detection, to compensate for this uncertainty. We agree with the rationale for using ½ SQL, as provided by OEHHA. To avoid confusion, the last paragraph in Section 3.2.1.3 has been deleted.

Response to Comment No. 4c: OEHHA indicates that the RAWP does not specify that chemicals that are greater than background levels will be selected as COPCs in the risk assessment. This will be done, as shown in the flowchart presented in the RAWP as Figure 3-1.

Response to Comment No. 5: In this comment, OEHHA indicates that they do not believe that the COPC selection flowchart presented in Figure 3-1 is consistent with the flowchart provided with the OEHHA comments and entitled *COPC Evaluation Process.* We have reviewed and agree with the flowchart presented in the figure provided with the OEHHA comments, with the following exception: metals concentrations will also be compared to site-specific background levels in the COPC selection process. Should the results for a particular metal be within the background concentration range, that metal will not be considered a COPC in the risk assessment. In addition, in the step "Determine detection status, considering blank contamination", the blank contamination review process presented in December 1989 EPA document entitled *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Part A, Interim Final (*RAGs) will be used.

Response to Comment No. 6: OEHHA indicates the RAWP should specify that all site-related TICs with a EPA weight-of-evidence type A, B1, and B2, should be included as COPCs. We agree. The EPA cancer weight-of-evidence classification will be reviewed for each TIC and the TIC will be included as a COPC should the classification be A, B1, or B2, as requested. In addition, chemicals with an EPA cancer weight-of-evidence classification type C (e.g., 1,1-dichloroethylene) will only be evaluated for potential noncancer effects due to limited evidence of carcinogenicity in animals in the absence of human data for classification as a carcinogen.

Response to Comment No. 7: OEHHA presents a figure developed by EPA Region 6 entitled *COPC Evaluation Process* for review. See response to Section 3 Comment No. 5.

Section 4 – Conceptual Site Model

Response to Comment No. 1: In this comment, OEHHA indicates that a temporal and spatial analysis should be included in the evaluation of current and/or future exposure scenarios. We agree. See response to Section 1 Comment Nos. 2a and 2b.

Response to Comment No. 2: In this comment, OEHHA indicates that the inhalation pathway should be considered complete for onsite construction workers and offsite children during property development activities, and for onsite gardeners after redevelopment. We agree. The inhalation pathway is considered complete, as noted in Sections 4.2.2.1 and 4.2.2.2 of the RAWP, for the onsite construction worker and offsite child during property redevelopment activities and for the onsite

gardener after site redevelopment. Inhalation of fugitive particulates is considered complete and will be quantified in the risk assessment. However, inhalation of vapors in buildings is considered to be insignificant for all three receptors and thus will not be quantified in the risk assessment. Clarification regarding this evaluation and the associated conclusions will be provided in the risk assessment.

Response to Comment No. 3: OEHHA requests that consideration of groundwater as a potential point of contact with contaminated environmental media be discussed with the LARWQCB. See response to Section 1 Comment No. 1.

Section 5 – Exposure Point Concentrations

Response to Comment No. 1: In this comment, OEHHA indicates that characterization of the point of contact between a receptor and a COPC should include the location, concentration, and temporal likelihood, to reflect the topics mentioned in the conceptual site mode. We agree. See response to Section 1 Comment No. 2a.

Response to Comment No. 2: OEHHA indicates that Section 5.3 appears to refer only to volatile organic compounds (VOCs), and potential inorganic chemicals are not considered. See response to Section 1 Comment No. 1. At this time, the only complete groundwater exposure pathway to be considered in the risk assessment is inhalation due to the potential migration of VOC vapors into buildings from VOC-impacted groundwater.

Response to Comment No. 3: OEHHA indicates that the power for Ci should be omitted in Table 5-1. The expression of Pi x Ci^2 is correct as presented in Table 5-1, and is used in equation 5-4 of the RAWP to calculate the variance of the distribution of the area-weighted sample.

Response to Comment No. 4: OEHHA requests that the migration and fate models to be used in the risk assessment be explicitly identified. The following fate and transport models/assumptions are proposed for use in the Tier 1 (screening) and the Tier 2 (detailed deterministic) risk assessment:

- Migration of VOC vapors into buildings: County of San Diego Department of Environmental Health (DEH) model (use verbally approved by Dr. Julio Salinas of OEHHA)

- Groundwater concentrations due to chemical leaching and migration from vadose zone soil: A tiered approach will be used. A Tier 1 (screening level) estimate of soil leachate concentrations will be derived using either the conservative leachate concentration assumptions inherent in the EPA synthetic precipitation leaching procedure (SPLP) or attenuation factors described in the LARWQCB May 1996 *Interim Site Assessment & Cleanup Guidebook*. A Tier 2 estimate of soil leachate concentrations will be derived using the EPA VLEACH model.

Exposure to fugitive dust emissions in the Tier 1 risk assessment will be estimated using the assumptions inherent in the EPA Region IX preliminary remediation goals (PRGs). For the Tier 2 risk assessment:

- Fugitive dust emission factors after site redevelopment will be estimated using the EPA particulate emission factor described in EPA 1996 *Soil Screening Guidance: Technical Background Document* to account for wind erosion, and

- Fugitive dust emission factors during site redevelopment will be estimated using the emission factors for construction activity operations presented in the January 1995 EPA document entitled *Compilation of Air Pollution Emission Factors, Volume I: Stationary Point and Area Sources, Fifth Edition* (AP-42) and the January 1989 EPA document entitled *Air/Superfund National Technical Guidance Study Series, Volume III – Estimation of Air Emissions from Cleanup Activities at Superfund Sites, Interim Final.*

Section 6 – Screening Level Risk Assessment

Response to Comment No. 1: In this comment, OEHHA recommends that the definition provided in page 6-2 be clarified. As suggested by OEHHA, the first sentence of the third paragraph on page 6-2 is revised to read as follows: "By definition, soil PRG values represent the soil concentrations below which no significant adverse health effects or risks are likely to occur from the assumed direct contact pathways (soil ingestion, dermal contact with soil, inhalation of fugitive particulates, and inhalation of VOCs from soil) for the assumed exposure pathway scenario and receptor."

Response to Comment No. 2: In this comment, OEHHA disagrees with the second sentence of the third paragraph on page 6-2, as stated. This sentence is deleted, and substituted with the following sentence as suggested by OEHHA: "Industrial and residential PRG values developed by EPA Region IX include surface soil, groundwater, and surface water PRGs."

Response to Comment No. 3: OEHHA indicates that the PRG values presented in Table 6-1 will be verified by OEHHA during review of the risk assessment. Comment noted.

Section 7 – Human Exposure Models

Response to Comment No. 1: In this comment, OEHHA requests clarification regarding when detailed deterministic (Tier 2) and detailed probabilistic (Tier 3) risk assessments are proposed. See response to Section 1 Comment No. 3. We will prepare a SRA (Tier 1) risk assessment. Should risk estimates exceed target risk levels, either remedial decisions will be made from the SRA results or a detailed deterministic risk assessment will be prepared. We are not currently proposing that a detailed probabilistic risk assessment be conducted. Should we later propose that a detailed probabilistic risk assessment be prepared, OEHHA will be contacted prior to conducting the detailed probabilistic risk assessment, and an addendum to the RAWP will be prepared to respond to the OEHHA comments related to the detailed probabilistic risk assessment.

Response to Comment Nos. 2, 3, 4a through 4l (see additional responses below for Comment Nos. 4e, f, j, and k, as they relate to a Tier 2 risk assessment): In these comments, OEHHA recommends revisions to exposure factors presented for the proposed detailed probabilistic risk assessment. As indicated above in the Section 7 Response to Comment No. 1, we are not currently proposing that a detailed probabilistic risk assessment be conducted. Should we later propose that a detailed probabilistic risk assessment be prepared, OEHHA will be contacted prior to conducting the detailed

probabilistic risk assessment, and an addendum to the RAWP will be prepared to respond to the OEHHA comments related to the detailed probabilistic risk assessment.

Response to Comment No. 4e: This response addresses similar issues for the detailed deterministic risk assessment, as those identified by OEHHA for the detailed probabilistic risk assessment. OEEHA indicates that the central tendency exposure (CTE) and reasonable maximum exposure (RME) exposure durations of 6 months and 1 year, respectively, for the onsite construction worker during site redevelopment and the offsite residential receptors before or after site redevelopment appear short. A review of Tables 7-1 and 7-2 of the RAWP indicates that the exposure duration of the onsite construction worker and offsite child during site redevelopment activities is 6 months for the CTE and 1 year for the RME. The CTE estimate is based on information received by BRC regarding the duration of grading/earth moving activities at the subject property. BRC indicated that these activities would be completed within 3 months. This information will be verified with BRC prior to conducting a detailed deterministic risk assessment. The CTE and RME exposure durations for the offsite residential child after site redevelopment (Table 7-5), ages 0 to 6 years, should be 6 years. The revised Table 7-5 is presented in Appendix B.

Response to Comment No. 4f: This response addresses similar issues for the detailed deterministic risk assessment, as those identified by OEHHA for the detailed probabilistic risk assessment. OEHHA indicates that the current life span estimate for the U.S. population is about 74 to 76 years. It is understood that a 75-year life span is appropriate for the detailed deterministic risk assessment. This value is based on the average overall life expectancy in the United States of approximately 75 years since 1982 as presented in the EPA August 1997 document entitled *Exposure Factors Handbook, Volume I, General Factors.*

Response to Comment No. 4j: This response addresses similar issues for the detailed deterministic risk assessment, as those identified by OEHHA for the detailed probabilistic risk assessment. OEHHA indicates that breathing rate for children and the breathing rate of 0.43 or 0.55 m^3/hour for adults are underestimated. OEHHA recommends the use of the EPA default breathing rate of 15 m^3/day for children and 20 m^3/day for the adult residential receptors. As recommended by OEHHA, the breathing rate is adjusted to 15 m^3/day for the residential child both during and after site redevelopment and 20 m^3/day for the residential adult after site redevelopment. The revised Tables 7-2, 7-5, and 7-6 are presented in Appendix B.

Response to Comment No. 4k: This response addresses similar issues for the detailed deterministic risk assessment, as those identified by OEHHA for the detailed probabilistic risk assessment. OEHHA requests justification for the use of the same values for CTE and RME scenarios for several exposure factors. Exposure factors are the same for some of the CTE and RME values, where an upper end value was considered most appropriate. For instance, an exposure duration of 350 days/year for a residential child is assumed to be appropriate; since, it is likely that a child between 0 and 6 years of age will be at home for up to 50 weeks per year. The CTE and RME value for hours of the day spent in or near the home for the same receptor is 24 hours/day; since, it is assumed that a relatively large portion of the population of small preschool children do not spend large amounts of time away from home and/or will not attend a day care away from the same neighborhood.

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Section 8 – Human Health Toxicity Assessment

Response to Comment No. 1: In this comment, OEHHA requests that a statement be revised on page 8-2. As requested by OEHHA, the fourth sentence of the second paragraph in Section 8.2 is revised to read as follows: "The SF represents the upper bound on the probability of a carcinogenic response (per unit dose) and is usually expressed as the reciprocal of dose in milligrams per kilogram per day [$(mg/kg\text{-}day)^{-1}$]."

Response to Comment No. 2: OEHHA indicates that oral potency slopes shall be used as a surrogate for potency slopes for the dermal route. We agree and will use oral toxicity values for both oral and dermal exposures in the risk assessment.

Response to Comment No. 3: OEHHA indicates that the toxicity values shown in Tables 8-1 and 8-2 will be verified by OEHHA during review of the risk assessment. Comment noted.

Section 9 – Risk Decision Criteria

Response to Comment No. 1: In this comment, OEHHA requests that the RAWP include clarification regarding the use of the term "acceptable risk". Thus, as recommended by OEHHA, the following sentence is added after the first sentence of the last paragraph on page 9-1: "An "acceptable risk" is one that is not considered to be of biological significance and which is known to the potential receptor." In addition, the following sentence is added after the existing second sentence in the same paragraph: "However, it should be noted that even a *de minimus* risk level may not be considered acceptable if the public has not been appropriately and sufficiently informed of all the issues related to this risk."

Response to Comment No. 2: OEHHA request clarification that the range of lifetime excess cancer risk (LECR) of 10^{-6} to 10^{-4} corresponds to the range of risk decision making, as defined by the National Contingency Plan (NCP). The following sentence is added at the end of the first paragraph on page 9-2: "The range of lifetime excess cancer risk (LECR) of 10^{-6} to 10^{-4} corresponds to the range of risk decision making, as defined by the National Contingency Plan (NCP)."

Response to Comment No. 3: OEHHA identified a typographical error. To correct this error, "3.000001 to 3.0001" is substituted with "0.300001 to 0.3001" in the first paragraph on page 9-3.

Response to Comment No. 4: In this comment, OEHHA recommends clarification regarding the proposed target risk level for the detailed probabilistic risk assessment. See response to Section 7 Comment No. 1.

Response to Comment No. 5: In this comment, OEHHA requests that a distinction be made between high exposure receptors and hypersusceptible receptors, and the segregation of COPCs according to health effects of concern, in case the hazard index exceeds a value of one. We recognize the distinction between high exposure receptors and hypersusceptible receptors. High exposure receptors are addressed by the RME, and hypersusceptible receptors are addressed in the derivation of the reference dose (RfD). As indicated in the comment, we will segregate COPCs according to health effects of concern should the hazard index for the summation of hazard indices for each COPC, with the exception of lead, be greater than 1.0. The hazard indices for the segregated COPCs will be summed by health effect of concern, and will be presented separately. Health risk from potential

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exposure to lead will be evaluated using the Department of Toxic Substances (DTSC) LEADSPREAD model.

Response to Comment No. 6: OEHHA indicates that the results of the lead risk assessment should be analyzed and interpreted together with the rest of the hazard index contributors. As indicated in the response to Section 9 Comment No. 5, health risk from potential exposure to lead will be evaluated using the DTSC LEADSPREAD model. The blood lead level results from this model will be presented along with the hazard index/hazard indices for the other COPCs.

Section 10 – Human Risk Characterization

Response to Comment No. 1: This OEHHA comment appears to be a repeat of Comment No. 6 for Section 9. In this comment, OEHHA indicates that the results of the lead risk assessment should be analyzed and interpreted together with the rest of the hazard index contributors. See response to Section 9 Comment No. 6.

Response to Comment No. 2: In this comment, OEHHA requests clarification regarding the proposed interpretation of the results of the detailed probabilistic risk assessment. See response to Section 7 Comment No. 1.

Response to Comment No. 3: In this comment, OEHHA recommends clarification regarding the analysis of uncertainty and variability in the detailed probabilistic risk assessment. See response to Section 7 Comment No. 1.

Response to Comment No. 4: OEHHA recommends clarification regarding the presentation of sensitivity analysis in the detailed deterministic and the detailed probabilistic risk assessment. See response to Section 7 Comment No. 7 for the detailed probabilistic risk assessment. A sensitivity analysis will not be conducted for the detailed deterministic risk assessment. A qualitative uncertainty analysis will be presented for the detailed deterministic risk assessment, based on those parameters that may contribute most significantly to risk.

Section 11 – References

Response to Comment Nos. 1 and 2: OEHHA requests that instead of CalEPA (1997) that the OEHHA Website database be referenced, and that instead of Anderson et al (1985) that the EPA Exposure Factors Handbook (1997) be referenced. We agree, and will utilize the above-noted sources identified by OEHHA.

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Appendix A. Risk Assessment Report Templates

Response to Comment No. 1: In this comment, OEHHA indicates that the Appendix A report templates are very well organized. Comment noted.

Should you have any questions concerning the contents of this RAWP addendum, please contact the undersigned at (619) 405-5436.

Sincerely yours,
HALEY & ALDRICH, INC.

Anita Broughton, REA, CIH
Risk Assessment Task Manager

THE AMERICAN BOARD OF INDUSTRIAL HYGIENE
INCORPORATED
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PENNSYLVANIA - 1960
ANITA BRENCE BROUGHTON, CIH

for
Scott Zachary
Project Manager

Attachment: **Appendix A** - April 12, 2001 OEHHA Comments to RAWP
Appendix B – Revised RAWP Section 7 Tables

BOE-C6-0048671

Appendix A

Appendix A

April 12, 2001 OEHHA Comments to RAWP

BOE-C6-0048673

MEMORANDUM
DRAFT

TO: John Geroch
California Regional Water Quality Control Board
Los Angeles Region
320 W. 4th Street, Suite 200
Los Angeles, California 90013

VIA: David M. Siegel, Ph.D., Chief
Hazardous Waste Toxicology Section

FROM: Julio A. Salinas, Ph.D., Biochem.D.
Hazardous Waste Toxicology Section

DATE: 4/12/2001 2:22 PM

SUBJECT: REVIEW OF THE RISK ASSESSMENT WORKPLAN FOR BOEING REALTY CORPORATION FORMER C-6 FACILITY, LOS ANGELES, CALIFORNIA

Upon request from the Los Angeles California Regional Water Quality Control Board (LA-RWQCB), I reviewed the document entitled "Risk Assessment Workplan for Boeing Realty Corporation, Former C-6 Facility, Los Angeles, California" (the "Workplan"). The Workplan was prepared by Ogden Environmental and Energy Services Co., Inc., and is dated November 29, 2000.

In the comments below, I am focusing on the scientific and technical merits that could affect the validity of the risk assessment being proposed.

Section 1 – Introduction

1. Groundwater quality. Groundwater table within the Bellflower Aquitard has been encountered on site to depths of 70 feet bgs. The authors acknowledge that "The LARWQCB has designated groundwater at and in the vicinity of the subject properety as having existing beneficial uses for municipal and domestic supply, agricultural supply, industrial service supply, and industrial process supply." However, the Workplan proposes to exclude groundwater from the risk assessment, because (a) water bearing zones frequently do not meet water quality objectives for domestic use, and, (b) the Bellflower Aquitard has relatively low hydraulic conductivity. It is recommended that the RWQCB-LA determine whether the groundwater within the Bellflower Aquitard is not suitable for water supply purposes and whether this potential exposure pathway should or not be included in the risk assessment. From the exposure assessment point of view, groundwater is a carrier for contaminants, and it represents an contaminated environmental medium of concern.

2. Definitions:

2a. Migration pathway vs. exposure pathway. A "*migration pathway*" consists of all environmental physical and chemical processes that take place during the movement of contaminants along the source→release→environmental media→point of contact. The "*exposure pathway*" includes those processes between contact of receptor to contaminated media and intake, that is, contaminated media→route of exposure→receptor. In this way, the *migration* pathway is a receptor-independent process, and the exposure pathway only relates to dose intake.

2b. Spatial and temporal analysis. In determining whether migration pathways are complete or incomplete, please include the concept of spatial and temporal analysis. This means that the elements of a migration pathway should be analyzed in terms of likelihood of changes over time and space. Contaminants migrate in the subsurface soil and groundwater, and therefore concentrations may increase or decrease depending on location and time. Sound characterization of contamination should include evidence on migration as a function of time, distance and depth.

3. **Risk assessment flowchart** (Fig. 1-5). The Workplan proposes a strategy that may not be optimal for the Former C-6 Site. For example, the Conceptual Site Model is introduced after the contamination characterization, some of risk assessment components are located above (pathways, receptors, exposure point concentration) but others below (human exposure models, toxicity assessment, risk characterization) the screening risk assessment. A decision point indicates whether "toxicity model has been refined." A number of decisions and components are not mentioned, such as migration and fate, uncertainty analysis, and the decision on a detailed deterministic or detailed probabilistic risk assessment. Another decision point asks whether "Is there a potential significant risk?" (the expression "potential risk" is redundant; both are probabilities). It is suggested instead to ask: "Risk estimates exceed target risk levels." More importantly yet, the overall description does not really describe the three levels of complexity of a tier risk assessment process. A flowchart diagram is enclosed with this review, suggesting a simple process in which risk managers and risk assessors may interact and proceed more efficiently in achieving the project goals.

Section 2 – Data Requirements and Objectives

1. Provide references for Tables 2-1, 2-2, and 2-3.

Section 3 – Hazard Identification

1. COPC selection criteria based on detection frequency. The use of a 5% detection frequency of chemicals among all analyzed samples is a *necessary but not sufficient* condition for elimination of a contaminant in a risk assessment. The USEPA RAGS is not correct on this topic, since a **low detection frequency is normally expected to result** in situations such as:

(a) A soil surface area that has not been fully characterized for contamination as a result of an *inappropriate or insufficient* sampling strategy. For example, if a grid with cells too large is selected for the sampling plan, this would decrease the probability of locating or generating "hits" for a hot spot, resulting in a false negative presence of hot spot. This source of potential error is recognized in Section 5.2.2., Spatial Distribution Considerations (pages 5-7 and 5-8).

(b) Groundwater samples collected from various monitoring wells (MW) and the results pooled. If, for example, few positives resulted from one MW, although the contamination is real, according to the "low frequency criteria" the results would be wrongly eliminated. This is an unsupported decision, and a spatial analysis is recommended instead. Also, if contamination levels are monitored over time, it is possible that the levels may change over time. If a particular MW shows decreasing or increasing levels over time, elimination of this information would be a serious error. In situations such as these, a temporal trend analysis is warranted to determine whether contamination is increasing or decreasing as a function of time.

Section 3.1 should be revised to clarify this error.

2. The Project Manager should be informed on the proposed elimination of TICS. The list of selected COPCs to be evaluated in the risk assessment should be approved by the PM. This is the case, for example, of TICs without toxicity data, for which the PM may decide for adopting a surrogate toxicity value.

3. Blank contamination. This topic is presented in Section 3.1.2.3. It is clear that if analytical laboratory practices cannot be sustained with test samples, then the entire analytical effort may be useless. The original intent of the USEPA RAGS approach regarding blank contamination is not eliminating results that are common to reagents commonly used in analytical laboratories, but to outline a process for acceptance of results. If a given laboratory produces results in which reagents are either cross-contaminated at the laboratory, or if they use reagents that do not have appropriate purity for quantitative analysis, then a different analytical laboratory is warranted. Otherwise, careless laboratory contamination could lead to erroneous elimination of COPCs.

4. Statistical analysis of background data (Section 3.2).

4a. The Wilcoxon Rank Sum Test is a non-parametric statistical method that is – by definition – distribution-free. It is used to compare two independent populations, not "data distributions" as stated in section 3.2.1. An important assumption is that the distributions of the two populations are identical in shape (i.e., variance). Two other statistical methods for censored data are the Winsorized mean and standard deviation, and the Maximum Likelihood Estimator for a two-parameter lognormally distributed data, described in Sections 14.2.4 and 14.3.2, respectively in Statistical Methods for Environmental Pollution Monitoring, R.O. Gilbert, Van Nostrand Reinhold, New York, 1987.

4b. Subsections 3.2.1.2 and 3.2.1.3 describe the "Plotting...at ½ SQL... mak[es] the distribution appear less variant. This is an unsupported statement. The purpose of using ½ SQL is to replace the datum reported as "trace", "not detected", "zero", or "less than limit of detection" for a non-zero value when the contaminant concentration is very near or below the measurement limit of detection limit, to compensate this uncertainty. Data sets containing these type of data are said to be censored on the left and are the basis for the statistical method using *censored data with replacement.*

4c. Comparison to background levels. The Workplan does not specify that contaminants that are above background levels will be used as COPCs in the risk assessment.

5. Human Health Risk Assessment Identification of COPCs (Figure 3-1). This flowchart is complex and lacks consistency. It starts with a QA/QC/DQO statement, "validated and usable concentration data from each media" but if evidence on presence of the contaminant has been validated and declared usable, then what follows may be unnecessary. Another central box asks whether "are blanks contaminated?" but this is an unacceptable QA/QC/DQO standard. Frequency of detection is also used as a decision point, but this has been discussed above in comment 3.1, and shown to be unsupported. In benefit of the project, I would like to suggest that the authors work with the Project Manager at their earliest convenience in developing a process for the selection of COPCs in support of the exposure assessment.

6. The Workplan should specify that all site-related TIC contaminants with a USEPA Weight-of-Evidence type A, B1, and B2, should be included as COPCs.

7. A scheme for COPC evaluation, developed by USEPA Region 6 (1998) is enclosed for consideration in resolving this issue.

Section 4 – Conceptual Site Model

1. Exposure pathways analysis. Although complete or incomplete exposure pathways (actually, migration pathways) are relatively easy to define, that is not the case for "potentially complete" pathways, which the authors define as "exposure may occur if site conditions change." Elements of an environmental chemical migration pathway include source, release mechanism, environmental media (soil, water, air, food), fate, point of contact, receptor, route of exposure, and spatial and temporal likelihood. As discussed before, a temporal and spatial analysis should be included in support of current and/or future exposure scenarios.

2. The <u>inhalation pathway</u> should be considered <u>complete</u> for onsite construction workers and for off-site children during property development activities, and for on-site gardener after redevelopment. This is not described in section 4.2.1.1 nor shown in the CSM, figure 4-1. The Workplan does not explain the basis for not including the inhalation pathway, although the fugitive dust pathway for these receptors is considered complete.

3. The proposed approach of not considering groundwater as a potential point of contact with contaminated environmental medium (last paragraph, page 4-5) should be discussed with the RWQCB.

Section 5 – Exposure Point Concentrations

1. Characterization of the point of contact between receptor and contaminant should include the <u>location</u> (spatial analysis, migration modeling), the <u>concentration</u>, and the <u>temporal</u> likelihood, to reflect these topics mentioned in the conceptual site model.

2. Section 5.3 appears to refer only to VOCs but potential inorganic contaminants are not considered.

3. Table 5-1, Example 1 of Area-Weighted Statistics, shows an expression "Pi x Ci^2" the correct expression is "Pi x Ci". Omit the square power for Ci, since the sum of the concentrations is expressed in mg/kg.

4. The migration and fate models to be used in the risk assessment should be explicitly identified. For example, Johnson and Ettinger.

Section 6 – Screening Level Risk Assessment

1. The definition provided in page 6-2 should be clarified, to read (suggested changes indicated) that "soil PRG values represent the soil concentrations below which no significant adverse health effects risks are likely to occur from the assumed direct contact pathways (soil ingestion, dermal contact with soil, and inhalation of fugitive dust, and inhalation of VOCs from soil) for the assumed exposure scenario and receptor. PRGs are not intended for use across different receptors and exposure scenarios.

2. PRG values. Industrial and residential PRG values developed by USEPA Region IX include the surface soil, and the groundwater and surface water. PRGs are not "typically applicable only to surface soil" as stated in page 6-2.

3. PRG values are presented in Table 6-1. Values were not verified at this time, but they will at the completion of the risk assessment.

Section 7 – Human Exposure Models

1. A probabilistic approach to risk assessment is for the first time explicitly mentioned in this section. This is not appropriate. For example, the Risk Assessment Flowchart in Figure 1-5 only shows a "Screening Level" risk assessment, but it does not provide alternative detailed deterministic or detailed probabilistic risk assessment level whether the screening fails or not.

2. It is recommended that the USEPA Exposure Factors Handbook (1997) be used to identify and characterize the probability density functions (PDFs) for these variables. As published, the CalTOX documentation is not appropriate, since exposure factors were erroneously adjusted by body weight resulting in PDFs that cannot be verified.

3. It is suggested that exposure factor PDFs be identified and statistically characterized prior to conducting a probabilistic risk assessment, and be submitted for approval to the project Manager.

4. Exposure factors (Table 7-1 through 7-9) for the probabilistic approach.

   4a. The descriptors used for a "**child**" appear to be for a 0-6 years of age. This seems limited, and is suggested to include up to about 12 years of age.

   4b. It is recommended that for **children**, the **exposure factors** be segregated into e.g., 0-1, 1-6, and 6-12 years old. The reason is because exposure factors rapidly change with age in this range.

   4c. It is not sufficient with stating that an "**Empirical Distribution**" will be used. Define exactly (type, mean, dispersion, truncation) as for other PDFs. This applies for example, to soil adherence factor, skin surface area.

4d. **Exposure frequency** is a variable, not a "constant" as proposed. Please propose PDFs if a probabilistic approach is used.

4e. **Exposure duration**. Values for the exposure duration, whether CTE, RME or probabilistic, should be consistent. For the construction worker, a CTE=6 mo. and a RME=1 year seem both unrealistic short duration (only dismantling of the buildings has taken already over 6 months). Among off-site residential children, during redevelopment is assumed to be CTE=6 months (rather short) and RME=1 year (also short); after redevelopment, it is assumed CTE=6 months (too short for a resident child) and for RME=1 year (too short).

4f. **Averaging time** (AT) for carcinogenic effects is considered a *constant*, but for non-carcinogenic effects is considered a *variable*. This is a contradiction and is partially incorrect. The 70 years life span for human species (not 75 as shown in the Workplan) is not constant, but is only approximate and reflects a number of factors. The current estimate for the U.S. population is about 74-76 years. The reason for including AT in the algorithm is because of the need to express the intake dose normalized to time (days). So, it would be acceptable to use it as a discrete value or as a PDF, as long as the same approach is used for both endpoints.

4g. The PDFs proposed for the probabilistic risk assessment are not appropriate. For example, all **body weights** are described as mean and standard deviation, but they are assumed to be a non-truncated lognormal PDF. Body weight PDFs should be truncated, since zero and $\rightarrow\infty$ are biologically not plausible.

4h. **Body surface area** covary simultaneously with body weight and with height. Instead of using a complex mathematical expression, it is suggested the use of a truncated PDF for the potentially exposed dermal area.

4i. A mean **soil ingestion** of 9.94 mg/day for on-site construction worker seems underestimated. Please proposed a value using USEPA EFH (1997). Please use values with at most two significant figures multiplied by a power of ten (e.g., 19.9 = 2E+1)

4j. **Breathing rate.** Children: please propose a PDF identifiable in USEPA EFH (1997). Use of a child-to-adult constant ratio throughout the PDF does not have physiological basis. Adults: Please assume about 5 m^3 air intake while sleeping (8 h at rest), which leaves 15 m^3 for the rest of the day. BR of 0.43 or 0.55 m^3/hour for an adult are underestimated, since for the 16 hours awake time, these are equivalent to 6.9 and 8.8m^3/16 h, or a total of 11.9 and 13.8 m^3/d, respectively, or about 60-70% of the default 20 m^3/day.

4k. Several of the exposure factors show the same value for a **CTE and RME** values. Please justify in these cases.

4l. **Relative absorption factor**. It is assumed to be "constant" for the probabilistic approach, which is incorrect. Either propose chemical-in-matrix-specific PDFs or assume 100%.

Section 8 – Human Health Toxicity Assessment

1. Please correct the statement in page 8-2 (correction shown underlined): "The SF represents the upper bound on the probability of a carcinogenic response (per unit dose) and is usually expressed as the reciprocal of dose in milligrams per kilogram per day [(mg/kg·day)$^{-1}$]. "

2. Please explain that for the dermal route, oral potency slopes will be used as surrogate.

3. Toxicity values shown in Table 8-1 and 8-2 were not verified this time, and are assumed to be correct.

Section 9 – Risk Decision Criteria

1. Please explain that in health risk assessment, an "**acceptable risk**" is one that is not considered to be of biological significance and which is known to the potential human receptor. Even a *de minimis* risk level may not be considered acceptable if the public has not been appropriately and sufficiently informed of all the issues related to this risk.

2. Please clarify that the range of lifetime extra cancer risk (LECR) of 10^{-6} to 10^{-4} corresponds to the range of risk decision-making, as defined by the National Contingency Plan.

3. If the normal background cancer risk is 3 in 10 persons (=0.3), and the *de minimis* is $1x10^{-6}$ (=0.000 001), then the total cancer risk would be **0.300 001**, not 3.000 001, as shown in page 9-3.

4. The authors of the Workplan propose a site-specific target risk level of LECR=$1x10^{-5}$ for the deterministic approach. In the probabilistic risk assessment the output is a LECR PDF, not exposure RME. If, for example, the LECR PDF exceeds the target risk level, what percentile of the PDF would be accepted as "at risk population" (area under the PDF that exceeds the target risk level)? Reporting of LECR in a graphical form and complete statistical description (mean, standard deviation, type of function, skewness, kurtosis, 50th, 90th, 95th, 99th percentiles, as a minimum) is critical.

5. Section Hazard Index should make a distinction between *higher exposure* receptors and *hypersusceptible* receptors. Also, explain the segregation of contaminants according to health effects of concern, when the total Hazard Index exceeds a value one.

6. Results of the lead risk assessment should be analyzed and interpreted altogether with the rest of hazard index contributors.

Section 10 – Human Risk Characterization

1. Results of the lead risk assessment should be analyzed and interpreted altogether with the rest of hazard index contributors. In particular, if the overall Hazard Index for lead and/or all other contaminants approach a value of one.
2. The rationale shown in page 10-5, that "since deterministic risk estimates do not provide any information regarding the distribution of risk, results of probabilistic risk assessments will be used in the interpretation of deterministic risk estimates" seems incomplete. It may be argued that "since the probabilistic risk estimates contain associated uncertainty and variability, results of deterministic risk assessments will be used in the interpretation of probabilistic risk estimates." These two would be a circular unsupported analysis. Each

approach should be analyzed and interpreted separately, and later in the context of what each means.

3. The Workplan does not explain whether uncertainty and variability will be analyzed separately in a probabilistic risk assessment.
4. The Workplan describes sensitivity analysis for the deterministic risk assessment approach. Please be reminded that this analysis is distribution-independent, and it does not provide the intended information as with the sensitivity analysis for probabilistic analysis. Please provide Tornado graphic results if probabilistic analysis is conducted; pie chart would only be appropriate for deterministic analysis.

Section 11 – References

1. CalEPA (1997). Please refer to the OEHHA Website database, that is found at http://oehha.ca.gov
2. Anderson et al (1985). Use instead USEPA EFH (1997).

Appendix A. Risk Assessment Report Templates

Very well organized.

SUMMARY OF REVIEW

The Workplan prepared by Ogden EES, Inc. describes the proposed approach for a health risk assessment to be conducted for the Former C-6 Facility in Los Angeles, California.

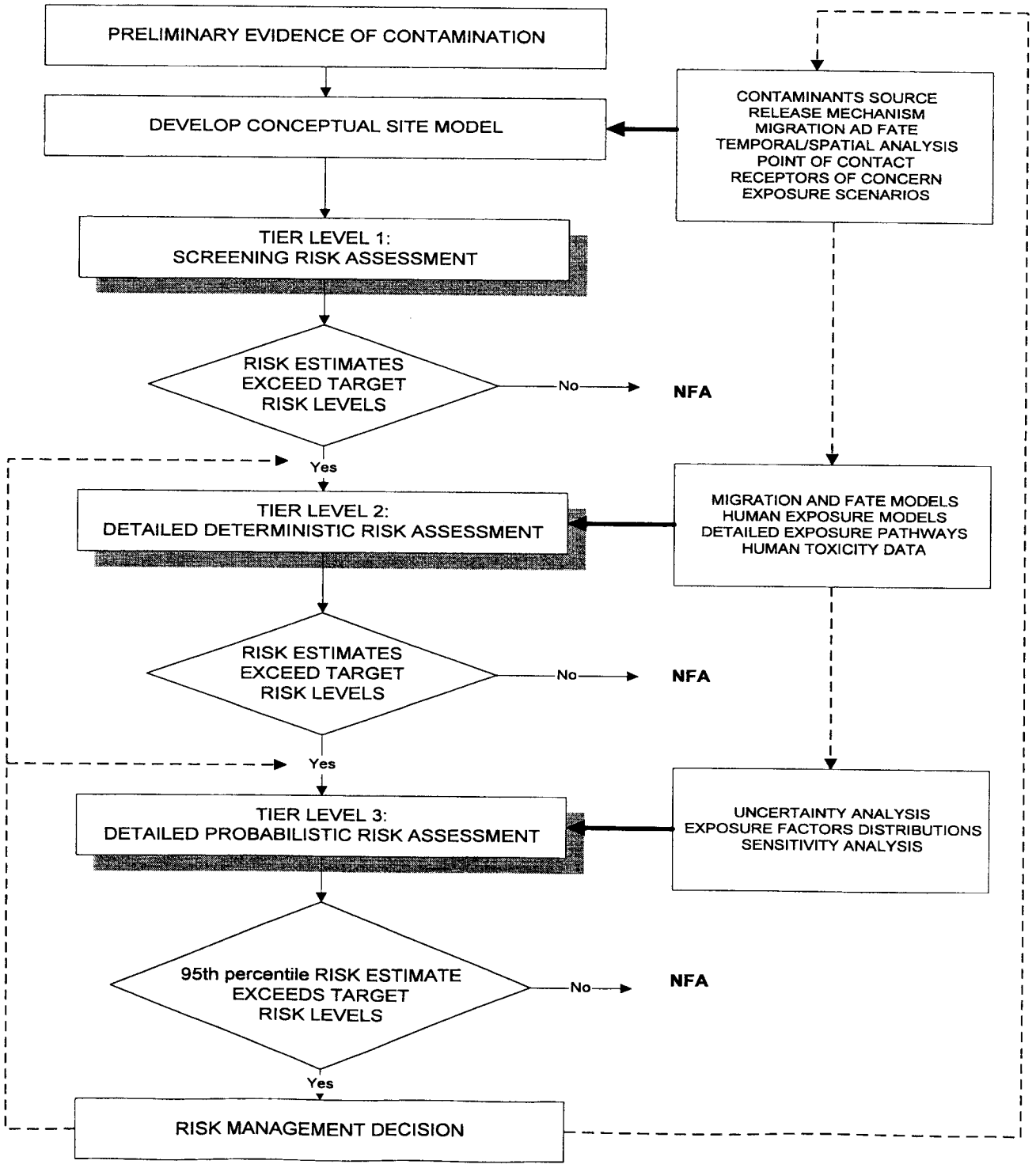
This is a complex project for which this Workplan is in general, reasonably documented. The proposed methods and procedures are expected to provide a basis for the characterization of the contamination and the health risks associated with these. The comments above are submitted for consideration, so that topics of critical importance may be clarified, such as:

(a) The current exception of groundwater as a potential migration and exposure pathway, issue that requires further sampling and analysis, and a decision by the RWQCB-LA whether this is an exposure pathway of concern;
(b) Revision of the overall risk assessment approach and for the selection of contaminants of potential concern, for which I present some suggestions;
(c) Complete and incomplete migration pathways should include a temporal and spatial analysis;
(d) Correction of certain values and assumptions used for the exposure factors;
(e) A formal description of the tier approach with three levels of complexity for the risk assessment. The criteria for proceeding to a higher level of complexity should be explained.

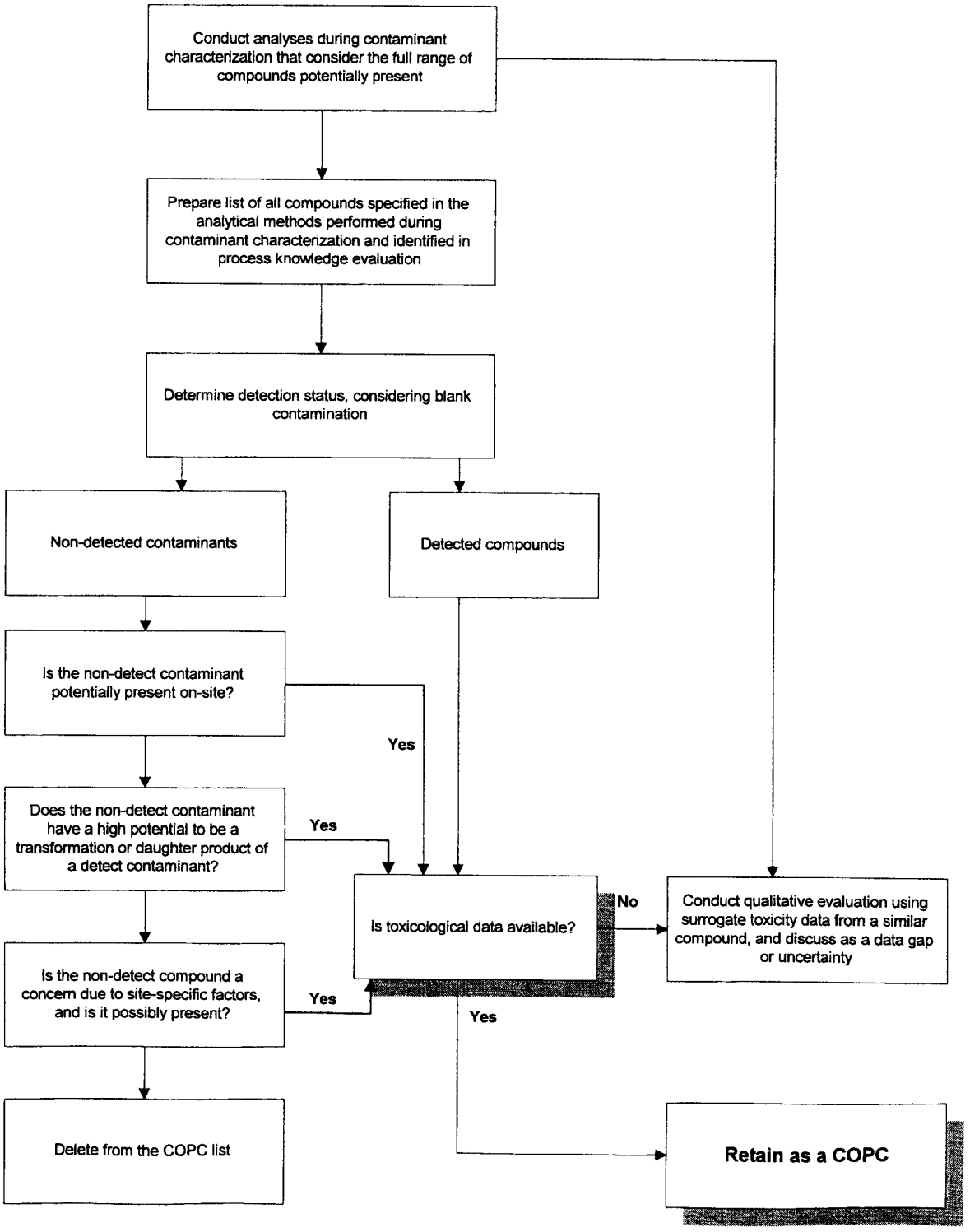
I would like to suggest that in the benefit of the process, it is not necessary for Boeing/Ogden to resubmit a revised Workplan, as long as they acknowledge and agree with the comments above. I am available for a continued assistance to the RWQCB and would like to suggest a discussion of the comments above at the Project Team earliest convenience. .

Respectfully submitted.

OVERALL RISK ASSESSMENT PROCESS FOR A CONTAMINATION PROBLEM



COPC EVALUATION PROCESS



Source: Risk Management Strategy. USEPA Region 6. Multimedia Planning and Permitting Division, December 1998.

Appendix B

Revised RAWP Section 7 Tables

BOE-C6-0048685

Table 7-2 (Page 1 of 2)

EXPOSURE ASSESSMENT PARAMETERS FOR AN OFFSITE RESIDENTIAL CHILD – DURING PROPERTY REDEVELOPMENT

Parameter	Central Tendency Exposure (CTE) Deterministic Risk Estimate	Exposure Distribution for Probabilistic Risk Estimation	Reasonable Maximum Exposure (RME) Deterministic Risk Estimate
General Parameters:			
Body Weight (BW)	Value: 15 kg Rationale: Average body weight (at midpoint of 1- to 6-year-olds), USEPA 1997; DTSC 1992	Normal mean: 15.6 kg standard deviation: 2 kg Rationale: Fit of reported percentiles of body weight for 3- to 4-year-olds (mid-point of 1- to 6-year-old receptor) as reported in Anderson et al. 1985	Value: 15 kg Rationale: Average body weight (at midpoint of 1- to 6-year-olds); USEPA 1997; DTSC 1992
Exposure Frequency (EF)	Value: 350 days/year Rationale: USEPA 1997; DTSC 1992	Constant	Value: 350 days/year Rationale: USEPA 1997; DTSC 1992
Exposure Duration (ED)	Value: 6 months Rationale: Estimated average time required for construction	Continuous variable between CTE value of 6 months and RME value of 1 year Rationale: Professional judgment	Value: 1 year Rationale: Estimated maximum time for construction
Averaging Time (AT)	Value: Carcinogenic Effects: 75 years (27,375 days) Noncarcinogenic Effects: AT = Exposure duration Rationale: Average lifetime, USEPA 1997; Exposure duration, DTSC 1992	Carcinogenic Effects: Constant at 75 years Noncarcinogenic Effects: Co-vary with exposure duration	Value: Carcinogenic Effects: 75 years (27,375 days) Noncarcinogenic Effects: AT = Exposure duration Rationale: Average lifetime, USEPA 1997; Exposure duration, DTSC 1992

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Table 7-2 (Page 2 of 2)

EXPOSURE ASSESSMENT PARAMETERS FOR AN OFFSITE RESIDENTIAL CHILD – DURING PROPERTY REDEVELOPMENT

Parameter	Central Tendency Exposure (CTE) Deterministic Risk Estimate	Exposure Distribution for Probabilistic Risk Estimation	Reasonable Maximum Exposure (RME) Deterministic Risk Estimate
Inhalation of Particulates:			
Breathing Rate (BR)	Value: 15 m^3/day Rationale: USEPA 1989, 1997	Lognormal mean: 1.08 m^3/hour standard deviation: 0.32 m^3/hour Source: Active inhalation rate in adults times 0.86 (ratio of child to adult recommended rates in USEPA 1997); CalTOX 1994[1]	Value: 15 m^3/day Rationale: USEPA 1989, 1997

[1] CalTOX computer model version 1994.
Crystal Ball (Decisioneering, Inc., Denver, CO)

Table 7-5 (Page 1 of 2)

EXPOSURE ASSESSMENT PARAMETERS FOR AN OFFSITE RESIDENTIAL CHILD – AFTER PROPERTY REDEVELOPMENT

Parameter	Central Tendency Exposure (CTE) Deterministic Risk Estimate	Exposure Distribution for Probabilistic Risk Estimation	Reasonable Maximum Exposure (RME) Deterministic Risk Estimate
General Parameters:			
Body Weight (BW)	Value: 15 kg Rationale: Average body weight (at midpoint of 1- to 6-year-olds), USEPA 1997; DTSC 1992	Normal mean: 15.6 kg standard deviation: 2 kg Rationale: Fit of reported percentiles of body weight for 3- to 4-year-olds (mid-point of 1- to 6-year-old receptor) as reported in Anderson et al. 1985	Value: 15 kg Rationale: Average body weight (at midpoint of 1- to 6-year-olds); USEPA 1997; DTSC 1992
Exposure Frequency (EF)	Value: 350 days/year Rationale: USEPA 1997; DTSC 1992	Constant	Value: 350 days/year Rationale: USEPA 1997; DTSC 1992
Exposure Duration (ED)	Value: 6 years Rationale: RME, USEPA 1997; DTSC 1992	Continuous variable between CTE value of 6 months and RME value of 1 year Rationale: Professional judgment	Value: 6 years Rationale: RME, USEPA 1997; DTSC 1992
Averaging Time (AT)	Value: Carcinogenic Effects: 75 years (27,375 days) Noncarcinogenic Effects: AT = Exposure duration Rationale: Average lifetime, USEPA 1997; Exposure duration, DTSC 1992	Carcinogenic Effects: Constant at 75 years Noncarcinogenic Effects: Co-vary with exposure duration	Value: Carcinogenic Effects: 75 years (27,375 days) Noncarcinogenic Effects: AT = Exposure duration Rationale: Average lifetime, USEPA 1997; Exposure duration, DTSC 1992

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Table 7-5 (Page 2 of 2)

EXPOSURE ASSESSMENT PARAMETERS FOR AN OFFSITE RESIDENTIAL CHILD – AFTER PROPERTY REDEVELOPMENT

Parameter	Central Tendency Exposure (CTE) Deterministic Risk Estimate	Exposure Distribution for Probabilistic Risk Estimation	Reasonable Maximum Exposure (RME) Deterministic Risk Estimate
Inhalation of Particulates:			
Breathing Rate (BR)	Value: 15 m^3/day Rationale: USEPA 1989, 1997	Lognormal mean: 1.08 m^3/hour standard deviation: 0.32 m^3/hour Source: Active inhalation rate in adults times 0.86 (ratio of child to adult recommended rates in USEPA 1997); CalTOX 1994[1]	Value: 15 m^3/day Rationale: USEPA 1989, 1997
Hours of day spent in or near home (Ef_f)	Value: 24 h/d Rationale: Small preschool child not anticipated to spend large amounts of time away from home	Constant	24 h/d Rationale: Small preschool child not anticipated to spend large amounts of time away from home

[1] CalTOX computer model version 1994.
Crystal Ball (Decisioneering, Inc., Denver, CO)

Table 7-6 (Page 1 of 2)

EXPOSURE ASSESSMENT PARAMETERS FOR AN OFFSITE RESIDENTIAL ADULT – AFTER PROPERTY REDEVELOPMENT

Parameter	Central Tendency Exposure (CTE) Deterministic Risk Estimate	Exposure Distribution for Probabilistic Risk Estimation	Reasonable Maximum Exposure (RME) Deterministic Risk Estimate
General Parameters:			
Body Weight (BW)	Value: 70 kg Rationale: Average body weight, USEPA 1997	Lognormal mean: 71 kg standard deviation: 14.2 Source: CalTOX 1994[1]	Value: 70 kg Rationale: Average body weight, USEPA 1997
Exposure Frequency (EF)	Value: 350 days/year Rationale: USEPA 1997; DTSC 1992	Constant	Value: 350 days/year Rationale: USEPA 1997; DTSC 1992
Exposure Duration (ED)	Value: 9 years Rationale: Average residence time, USEPA 1997	Selected exposure duration from distribution given below, less 6 years for child exposure (truncated at 0 years) Lognormal mean: 9.37 years standard deviation: 2.52 years Source: CalTOX 1994[1]	Value: 24 years (30-year lifetime minus 6 years as child) Rationale: 95th percentile value for residence time, USEPA 1997
Averaging Time (AT)	Value: Carcinogenic Effects: 75 years (27,375 days) Noncarcinogenic Effects: AT = Exposure duration or 9 years (3,285 days) Rationale: USEPA 1997	Carcinogenic Effects: Constant at 75 years Noncarcinogenic Effects: Co-vary with exposure duration	Value: Carcinogenic Effects: 75 years (27,375 days) Noncarcinogenic Effects: AT = Exposure duration or 24 years (8,760 days) Rationale: USEPA 1997

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Table 7-6 (Page 2 of 2)

EXPOSURE ASSESSMENT PARAMETERS FOR AN OFFSITE RESIDENTIAL ADULT – AFTER PROPERTY REDEVELOPMENT

Parameter	Central Tendency Exposure (CTE) Deterministic Risk Estimate	Exposure Distribution for Probabilistic Risk Estimation	Reasonable Maximum Exposure (RME) Deterministic Risk Estimate
Inhalation of Vapors:			
Breathing Rate (BR)	Value: 20 m^3/day Rationale: USEPA 1989, 1997	Lognormal mean: 0.43 m^3/hr standard deviation: 0.09 m^3/hr Source: Resting inhalation rate; CalTOX 1994[1]	Value: 20 m^3/day Rationale: USEPA 1989, 1997
Hours of day spent in or near home (EF_f)	16.3 hours/day Rationale: CalTOX average	Lognormal mean: 16.3 hours/day standard deviation: 2.24 hours/day Source: CalTOX 1994[1]	24 hours./day Rationale: Maximum hours in a day

[1] CalTOX computer model version 1994.
Crystal Ball (Decisioneering, Inc., Denver, CO)

Table 7-7 (Page 1 of 1)

EXPOSURE ASSESSMENT PARAMETERS FOR AN OFFSITE LIGHT INDUSTRIAL/COMMERCIAL WORKER – AFTER PROPERTY REDEVELOPMENT

Parameter	Central Tendency Exposure (CTE) Deterministic Risk Estimate	Exposure Distribution for Probabilistic Risk Estimation	Reasonable Maximum Exposure (RME) Deterministic Risk Estimate
General Parameters:			
Body Weight (BW)	Value: 70 kg Rationale: Average body weight, USEPA 1997	Lognormal mean: 71 kg standard deviation: 14.2 Source: CalTOX 1994[1]	Value: 70 kg Rationale: Average body weight, USEPA 1997
Exposure Frequency (EF)	Value: 8 hrs/d, 219 d/yr Rationale: DTSC 1999	Constant	Value: 8 hrs/d, 250 d/yr Rationale: USEPA 1997
Exposure Duration (ED)	Value: 9 years Rationale: DTSC 1999	Continuous variable across age-specific occupational tenure reported by Carey (1988) as presented by USEPA (1997)	Value: 25 years Rationale: DTSC 1999
Averaging Time (AT)	Value: Carcinogenic Effects: 75 years (27,375 days) Noncarcinogenic Effects: AT = Exposure duration Rationale: USEPA 1997	Carcinogenic Effects: Constant at 75 years Noncarcinogenic Effects: Co-vary with exposure duration	Value: Carcinogenic Effects: 75 years (27,375 days) Noncarcinogenic Effects: AT = Exposure duration Rationale: USEPA 1997
Inhalation of Indoor Vapors or Outdoor Particulates:			
Breathing Rate (BR)	Value: 20 m^3/day Rationale: USEPA 1989, 1997	Lognormal mean: 1.44 m^3/hr standard deviation: 0.66 m^3/hr Rationale: General construction workers and laborers reported by Linn et al. (1993) as presented by USEPA (1997)	Value: 20 m^3/day Rationale: USEPA 1989, 1997

[1] CalTOX computer model version 1994.
Crystal Ball (Decisioneering, Inc., Denver, CO

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