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TREASURE ISLAND
SSIC NO. 5090.3.A

Department of Toxic Substances Control

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August 4, 1999

Commanding Officer
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Attn: Mr. Ernesto Galang
900 Commodore Drive
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DRAFT REMEDIAL INVESTIGATION REPORT SITE 12 OPERABLE UNIT, NAVAL STATION TREASURE ISLAND

Dear Mr. Galang:

The Department of Toxic Substances Control (DTSC) has reviewed the Draft Remedial Investigation Report Site 12 Operable Unit for the former Naval Station Treasure Island (NSTI) dated June 1, 1999. Enclosed with this letter please find comments from Mr. Brian Davis, Ph.D., Staff Toxicologist of the Human and Ecological Risk Division of the Department of Toxic Substances Control.

Specific Comments

1. Page 1-4, Section 1.1.3, Remedial Investigation and Feasibility Study Objectives

   This section indicates that a Feasibility Study (FS) will be prepared for all of the onshore sites at NSTI including Site 12. It is DTSC's understanding that a separate FS will be prepared for Site 12. Please clarify.

2. Page 3-5, Section 3.3.1.1, Potential Chemical-Specific ARARs

   The Navy has cited the Regional Water Quality Control Board's (RWQCB) Pilot Beneficial Use Designation Project for San Francisco and

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San Mateo counties report as justification for not evaluating groundwater against state and federal maximum contaminant levels (MCLs). This report is a draft report and as such, any conclusions reached in this report are not yet final.

DTSC recognizes that the final report may retain the same recommendations on the de-designation of groundwater. However, that recommendation would not alleviate the Navy from addressing Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) contaminants detected in groundwater at Site 12.

Therefore, the Navy needs to present a comprehensive approach to address all contaminants detected in groundwater at Site 12. At a minimum this should include a general discussion along with plume maps and tables showing contaminant concentrations in comparison to screening values and any conclusions and recommendations the Navy has developed.

3. Page 4-9, Section 4.3.2.2, Exposure Pathway

Please see specific comment number two.

4. Page 4-11, Section 4.3.3.1, Soil and Section 4.7.2.2, Estimation of Exposure Point Concentrations

These sections indicate that the ninety-fifth upper confidence level for copper is 2,250,000 milligrams per kilogram (mg/kg) at the former debris disposal area. Is this correct? Please clarify.

5. Page 6-1, Section 6.0, Nature and Extent of TPH and Chemical Risk Drivers

Since the lead removal action at the former burn pit did not accomplish the pre-established goal of removing all lead at concentrations above 400 mg/kg, the risks associated with the contaminants left in place needs to be evaluated and discussed in this section.

6. Page 8-4, Section 8.2, Groundwater

Please see specific comment number two.

7. Page 8-4, Section 8.3, Recommendations

The first recommendation in this section indicates that no further action will be required following the time-critical lead removal action. DTSC believes that the removal action did not accomplish the goal of removing all lead at levels above 400 mg/kg and that lead contaminated soil is still present that may warrant further action.

Please revise this recommendation to address the lead contaminated soil that has been left in place.

If you have any questions regarding this letter, please contact me at (510) 540-3769.

Sincerely,

David Rist

David Rist
Hazardous Substances Scientist
Office of Military Facilities

cc: See next page.

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MEMORANDUM

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FROM: Brian K. Davis, Ph.D. Brian K. Davis
Human and Ecological Risk Division

DATE: August 2, 1999

SUBJECT: Naval Station, Treasure Island, Site 12
PCA: 18040 Site: 201210-00

BACKGROUND

Document Reviewed: Draft Site 12 Operable Unit Remedial Investigation; Naval Station, Treasure Island, San Francisco, California. Dated 6/1/99.

Nature of the Facility: Naval Station, Treasure Island, is made up of two islands in San Francisco Bay, between San Francisco and Oakland. Treasure Island is an artificial island about 403 acres, constructed of dredged material from San Francisco Bay. Yerba Buena Island is a natural island of about 147 acres, of which the U.S. Coast Guard owns 30 acres. The U.S. Government has used Yerba Buena Island for military activities since 1866. Dredging and construction of Treasure Island was done in 1936-7.

Site 12 is a military housing section of about 90 acres at the northwestern end of Treasure Island. Before housing was constructed it was used for ammunition storage, debris and trash disposal, waste incineration, radionuclide liquid waste storage and disposal, oil storage, and aircraft landing. From the early 1940s until about 1968, 21 ammunition bunkers were located in Site 12. At least four distinct debris disposal areas are known.

Scope of Review: The document was reviewed for scientific content related to risk assessment issues. Minor grammatical or typographical errors that do not affect the interpretation have not been noted. We assume that regional personnel have evaluated the sampling of environmental media, analytical chemistry data, and quality assurance procedures. Any future changes or additions to the document should be clearly identified.

GENERAL COMMENTS

1. SAMPLE DATA SELECTION.

A. Risk assessment should be an iterative process, not a one-time evaluation. The remedial investigation risk assessment is a baseline risk assessment, reflecting potential risks and hazards under existing conditions. As further sample data become available or as remediation takes place, the risk assessment for Site 12 should be modified accordingly.

B. Section 4.2.1 states (page 4-5) that data from four samples (12-HP082, 12-HP083, 2-HP084, 12-HP193) were excluded "*because a remedial action is planned to remove lead in this area*". This is reiterated in Section 4.3.3. It is not acceptable to select sample data based on future actions. Remediation plans may change or further contamination may be found in confirmation sampling. The baseline risk assessment must evaluate existing conditions using all available sample data. As Section 4.1.1 makes the point, "*A BHHRA is typically prepared to evaluate potential risks associated with a site, **assuming no cleanup actions are conducted at the site.***" (emphasis added).

C. Section 4.2.1 contains other examples of selective use of sample data. For example, 15 samples collected by Geomatrix and 27 samples collected by the Navy were used for dioxins, but seven samples collected during the remedial investigation were not (page 4-4). Although it is true that different analytical methods may make it unacceptable to pool different sample data, a parallel evaluation is preferable to excluding the data. The document should present the results and determine the consequences of excluding the remedial investigation data.

D. Section 3.1 summarizes early investigations of Site 12, including soil sample analysis. The document should justify exclusion of these data and comment on the effect of that exclusion on the risk assessment.

E. Section 4.2.1 refers to planned additional sampling (page 4-4) to be included "*in the final BHHRA for Site 12*". Section 4.8 elaborates on this statement, referring to sampling "*scheduled for the summer of 1999*". Any additional sample data should be combined with the existing data for the revised risk assessment.

F. Consideration of sample data must include evaluation of possible hot spots. The evaluation has divided Site 12 into Areas 1 and 2 (Section 4.2.1, page 4-5), based on higher concentrations of dioxins in Area 1. However, there is no discussion of possible hot spots of dioxins within either of those areas or of possible hot spots for other contaminants. Since Site 12 is residential, activities of children or adults may be focused in a small area around their dwelling. If any given small area includes high concentrations of a contaminant, the potential for harm may be underestimated.

The issue of hot spots is mitigated in some instances because the highest concentration was used as the soil concentration estimate (Section 4.3.3.1). Nonetheless, the issue should be directly addressed.

2. SOURCES OF CONTAMINATION.

A. The sources of contamination at Site 12 are debris and trash disposal and waste incineration (Section 1.2.2). It is therefore impossible to anticipate the full range of chemical contaminants. Section 4.7.1 states that "*sources of contaminants (that is, specific industrial activities) were not identified and it is suspected that the contents of the disposal areas consist of materials and contaminants that were dispersed randomly...*" Section 4.7.1 argues that because of this characteristic, "*...single detections of higher concentrations are generally interpreted as isolated incidents*".

This characteristic also means that potential contaminants cannot be readily identified. Therefore, the statement (page 4-22) that hexavalent chromium "*was not expected based on the history of activities at Site 12...*" is not convincing.

B. The uncertainty of contaminant identification and the expected heterogeneity of contaminant distribution means that site characterization must be viewed with caution.

3. REPORTING RESULTS.

A. Sampling and analysis results in Section 4.2.1 should be presented as numbers, not just qualitative comparisons. Example 1: Page 4-3 reports that "*Concentrations of dioxins in samples Geomatrix collected in these areas were similar to levels observed during the RI.*" Please report the ranges of the Geomatrix concentrations and the remedial investigation concentrations and let the reader make an independent judgment of similarity. Example 2: Page 4-3 reports that "*Dioxins were detected in these samples at concentrations similar to or below the EPA-estimated background level for dioxins in soil of 8 pg/g...*" Please report the actual range of concentrations and let the reader make an independent judgment of similarity.

B. This applies to risk assessment results as well. Page 4-3 reports that "*The results of the 1997 assessment indicated that the risks associated with potential exposure to dioxins detected in soil samples collected during the RI were within the EPA target range and below levels that would warrant action...*" Please report the actual risk assessment results and let the reader judge whether they are of concern.

4. AMBIENT LEVELS OF INORGANIC CHEMICALS. Section 4.2.2.2 discusses the selection of chemicals of potential concern based on comparisons to ambient levels. The usual procedure is to include as chemicals of potential concern any inorganic chemical for which the maximum concentration exceeds the local ambient level. This is step 1 in Section 4.2.2.2. Step 2 is to eliminate inorganic chemicals if 10% or less of the samples exceed the local ambient

level. For Site 12, only thallium was eliminated in Step 1, while an additional ten chemicals were eliminated in Step 2.

These two steps were agreed to by U.S. EPA, the Department of Toxic Substances Control and the Navy. We accept that agreement, but we urge caution in interpreting the results.

As a safeguard for the two-step process, Section 4.2.2.2 lists five additional considerations. However, because the sources of contamination at Site 12 are debris disposal and debris burning, some of these additional considerations are not helpful. Number 3 is the co-location of inorganic chemicals with organic contaminants. However, the failure to find such co-location could simply represent disposal of inorganic chemicals unaccompanied by organic contaminants. Similarly, the failure to identify historical sources is less meaningful for disposal areas.

Two of the other considerations are comparison to the ambient range of concentrations and comparison to regional concentrations. The document provides no specific comparisons, but only general conclusions. We are concerned that Table 4-3 reports maximum concentrations of arsenic, cadmium, and mercury of 33.7 mg/kg, 9.2 mg/kg, and 2.4 mg/kg, respectively, each considerably higher than the maximum concentrations of 11.0 mg/kg, 1.7 mg/kg, and 0.9 mg/kg reported in California by Bradford et al. (1996). The document should provide better justification for the elimination of inorganic chemicals as chemicals of potential concern, with particular attention to arsenic, cadmium, and mercury.

5. PETROLEUM CONTAMINATION. Section 4.4.1 (page 4-23) discusses the risk assessment evaluation of petroleum contamination at Site 12. Since petroleum products are complex mixtures for which there is little information on toxicity, the toxic components are evaluated. Inorganic chemicals should be added to the Section 4.4.1 list of toxic components (benzene, toluene, ethylbenzene, xylene, and polycyclic aromatic hydrocarbons),

6. EXPOSURE PATHWAYS. Exposure to contaminants in ground water was excluded (Section 4.3.2.2), with the exception of volatile compounds which may migrate from ground water to air. The justification for excluding direct contact with ground water is the reclassification of ground water in the "*San Francisco and Northern San Mateo County Pilot Beneficial Use Designation Project*". Please reference the document which supports this conclusion in writing.

7. EXPOSURE ASSUMPTIONS.

A. Some exposure assumptions (exposure time, exposure frequency) differ in Table 4-9 and Table H-4, even though both tables are for construction workers. The document should explain that different construction activities are being evaluated. See also Comment 8 below.

B. Table 4-11 reports inhalation rates in units of m^3/day. This is ambiguous for receptors which are exposed at Site 12 for only part of the day. Table 4-11 shows the same inhalation rate (20

m^3/day) for an adult resident and a worker. However, the adult resident is assumed to be in residence at Site 12 all day, with an average inhalation rate of 0.8 m^3 per hour, while the worker is assumed to work an eight-hour day, with an average inhalation rate of 2.5 m^3 per hour.

Please clarify these inhalation rates in Table 4-11 and in the text (Section 4.3.4.3). Please explain the basis for the inhalation rates for recreational receptors. Neither Table 4-11 nor Section 4.3.4.3 provides sufficient information on the derivation of the inhalation rates (5.4, 6.7, 5.0, 5.0 m^3/day). Please explain what activities are assumed, how many hours are assumed, and what level of activity was used to derive the numbers.

C. Section 4.3.4.4 correctly reports a produce consumption rate of 122 grams per day, consisting of 42 grams of fruit and 80 grams of vegetables. Table 4-12 incorrectly reports produce consumption rate in **mg per day** (e.g., 122 mg per day). Table 4-12 also incorrectly reports a conversion factor for **kg/mg** of 10^{-3}. The appropriate conversion factor is **10^{-3} kg/g**. Please correct the units and confirm that the calculations were done correctly.

8. CONSTRUCTION WORKERS AND GROUND WATER CONTAMINANTS.

A. Instead of including potential exposure of construction workers to ground water contaminants in the risk assessment, the document (Section 4.3.2.2) attempts to dismiss this exposure pathway with a screening assessment (Appendix H). Unfortunately, the screening assessment is incomplete. It ignores cumulative exposure and risk from multiple exposure routes, multiple contaminants, and multiple contaminated media. These are discussed in parts B, C, and D which follow. The assessment also underestimates the potential for inhalation exposure in a confined space such as a trench (part E below).

B. For each contaminant, the Appendix H screening assessment calculates two risk-based screening levels, one for dermal contact and one for inhalation. These levels are analogous to preliminary remediation goals, but they are exposure route-specific. The screening assessment compares the contaminant concentrations to the lower of the two risk-based screening levels. The result of comparing to one or the other screening level is to assume either that a construction worker is never exposed to chemicals by both exposure routes, which is untenable, or that one of the exposure routes is always insignificant relative to the other exposure route, which could be true but hasn't been demonstrated. The evaluation must consider exposure from both routes.

C. Since each risk-based screening level is based on an excess cancer risk of 1E-6 or a hazard quotient of one, the Appendix H screening assessment ignores exposure to more than one contaminant. The evaluation must consider exposure from multiple contaminants.

D. Since Appendix H evaluates construction worker exposure only to ground water and the body of the risk assessment (Section 4.0) evaluates construction worker exposure only to soil, the assumption is either that a construction worker is never exposed to chemicals from both soil and

ground water, which is untenable, or that ground water exposure is always insignificant relative to soil exposure. The evaluation must consider cumulative exposure from all media.

E. Attachment H-1 to Appendix H presents the estimation of air concentrations of volatile contaminants from ground water. Although the document specifically assumes that the construction worker is in a trench (page H-1 in Appendix H and page H-1-1 in Attachment H-1), the use of the Box Model assumes a surface with unimpeded air movement. A confined space may have a much higher concentration of volatile contaminants. This evaluation is unacceptable for a trench worker.

F. The analysis concludes (Section 7.0 of Appendix H) that the maximum concentrations of all ground water contaminants are "*more than two orders of magnitude lower than their respective RBSLs* (risk-based screening levels)". It may be that construction worker exposure to ground water contaminants is insignificant. Until the issues discussed in parts A-E of this comment have been addressed, the question remains open.

9. AIR CONTAMINANTS.

A. Section 4.3.3.2 evaluates the potential for volatile organic chemicals to move from ground water through soil into the air by extrapolating from measurements at other sites. This is the same issue which is addressed by modeling in Attachment H-1 to Appendix H (see Comment 5E above). The two discussions belong together.

B. Section 4.3.3.2 dismisses the exposure pathway of inhalation of volatile organic chemicals which move from ground water through soil into the air by comparison to U.S. EPA Region IX air Preliminary Remediation Goals. Elimination of exposure pathways is not an acceptable application of Preliminary Remediation Goals (Department of Toxic Substances Control, 1994).

10. FISH CONSUMPTION.

A. The document discusses potential human health effects from the consumption of San Francisco Bay fish and the difficulty in associating contaminant levels in fish with a specific source such as Site 12. We agree that it is appropriate not to evaluate exposure through fish ingestion for Site 12.

B. The language used to describe the potential human health effects should be made more precise. Section 4.3.2.2 states "*Furthermore, a RWQCB study confirms that ingesting fish caught in the bay can result in adverse health effects.*" Similarly, Appendix I (page I-1) states "*It is documented that ingesting fish caught in San Francisco Bay can result in adverse health effects.*" These statements may be incorrectly interpreted to mean that an association between ingesting fish and adverse health effects has been found. What is intended is that the levels of contaminants in the fish **suggest the potential for adverse health effects.**

Similarly, the title of Appendix I is "*HEALTH EFFECTS ASSOCIATED WITH CONSUMPTION OF FISH*". This may also incorrectly imply that adverse effects have been demonstrated, rather than that risk assessment methods show a potential for harm.

11. SOIL CONCENTRATIONS.

A. We note that the central tendency evaluation uses 50th percentiles as estimates of soil concentrations (Section 4.3.3.1). U.S. EPA (1992) guidance requires the 95% Upper Confidence Limit on the arithmetic mean of the sample concentrations for central tendency exposure estimates as well as reasonable maximum exposure estimates. Because risk management decisions will be predicated on the reasonable maximum exposure estimates, we do not ask that the central tendency estimates in this risk assessment be recalculated.

B. Section 4.3.3.1 refers to the UCL_{95} without defining the term. Please include an explanation that this refers to the 95% Upper Confidence Limit on the arithmetic mean of the sample concentrations.

C. Section 4.3.3.1 is inconsistent in discussing the evaluation of copper and lead concentrations in soil. It states that the number of Area 1 samples is 23 and discusses the effect of small sample size. It then reports that the upper bound estimates are 2,250,000 mg/kg for copper and 1,440 mg/kg for lead.

Area 1 has 23 total soil samples, but only seven shallow soil samples. The upper bound estimate of 2,250,000 mg/kg for copper is based on the seven shallow soil samples, while the upper bound estimate of 1,440 mg/kg for lead is based on all 23 soil samples.

The argument being made in Section 4.3.3.1 about small sample size is correct, but the details are incorrect. The same errors are found in Section 4.7.2.2.

12. TOXICITY CRITERIA.

A. Section 4.4.1 states that cancer slope factors are derived for carcinogens in Groups A, B1, and B2. Group C carcinogens also have cancer slope factors and should be included in the cancer risk assessment. For example, Table 4-13 shows 1,4-dichlorobenzene as a Group C carcinogen with both oral and inhalation slope factors.

B. Section 4.4.1 discusses the reconsideration of beryllium carcinogenicity by U.S. EPA and the decision to classify beryllium as an inhalation carcinogen but not an oral carcinogen. Recently, the California Office of Environmental Health Hazard Assessment also dropped beryllium as an oral carcinogen. Therefore, revisions of this risk assessment and future risk assessments can use current classification of beryllium carcinogenicity.

13. RISK CHARACTERIZATION.

A. We do not object to the inclusion of alternative risk assessment evaluations as long as Department of Toxic Substances Control assumptions, methods, and results are presented clearly and in an unbiased manner. It is not acceptable to exclude the Department of Toxic Substances Control risk characterization from the discussion (Section 4.6) and relegate the results to the tables and Appendix H. The Department of Toxic Substances Control risk characterization must be presented in Section 4.6 and given equal weight.

B. For all receptors evaluated, the estimates of excess cancer risk and the hazard indices are somewhat higher using Department of Toxic Substances Control assumptions and methods, compared to the alternative assumptions and methods, as would be expected (Table 4-26). We note that both sets of results show all excess cancer risks between 1×10^{-6} and 1×10^{-4} and all hazard indices by target organ less than or equal to one for all receptors at both Site 1 and Site 2.

14. RISK ASSESSMENT FOR LEAD. Section 4.5.3 uses more current data on levels of lead in food to evaluate the potential for harm from lead in Site 12 soil. Results are presented (Table 4-17) using the current assumptions for the Department of Toxic Substances Control lead model as well as the current lead in food estimates. The approach used to estimate the lead in food is reasonable. Presentation of these results should be helpful for risk managers.

15. RISK MANAGEMENT COMMENTARY.

A. Section 4.5.1 states the Navy's risk management policy that remediation is not needed "*when risks associated with residential exposure at a site are below 10^{-4}.*" This is supported by reference to a U.S. EPA directive. We do not object to the statement of Navy policy, but Section 4.5.1 should be balanced by recognition that Department of Toxic Substances Control policy differs. Consistent with the federal National Contingency Plan, the Department of Toxic Substances Control uses a point of departure of 1×10^{-6} for cancer risk. As stated in 40 CFR 300.430, "*For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6} using information on the relationship between dose and response. The 10^{-6} risk level shall be used as the point of departure for determining remediation goals for alternatives when ARARs are not available or are not sufficiently protective because of the presence of multiple contaminants at a site or multiple pathways of exposure.*" The risk range of 10^{-4} and 10^{-6} is not intended to imply that any risk within this range is acceptable. The actual level of acceptable risk is a site-specific risk management decision, with 1×10^{-6} as the point of departure for making such decisions.

Section 4.8.1 restates the Navy policy and does recognize Department of Toxic Substances Control policy as well.

B. Section 4.0 is titled "*Human Health Risk Assessment*" and that is the topic. Whether remediation is necessary is not the responsibility of the risk assessor and should not be a conclusion in the risk assessment. Please remove the assertion in almost every subsection of Section 4.6 and in Section 4.8.2 that the carcinogenic risks "*are within the target risk range and below the level that warrants action (10^{-4}).*"

16. UNCERTAINTY

A. The discussion of the uncertainty of site characterization must acknowledge the difficulty of characterizing areas of debris and trash disposal and waste incineration, such as Site 12. It is impossible to anticipate all chemical contaminants. Further, the contaminants are expected to be heterogeneously distributed. This may have resulted in contaminants not being identified as chemicals of potential concern and it may have resulted in overlooking areas of contamination. Both of these factors may have led to underestimation of risks and hazards. See also Comment 2A above.

B. Section 4.7.2.2 points out that when the sample size is small, the upper bound estimate can be exaggerated. As discussed in Comment 11C above, there are errors in the numbers presented. More important, the fact that the sample size is small (seven in the example) calls into question the adequacy of the site characterization. This should be discussed as an uncertainty.

C. An uncertainty discussion is useful to risk managers only if it provides specific, unbiased information relevant to the risk assessment being discussed. A general list of risk assessment issues is not helpful. Page 4-22 points out that risk assessments usually assume no loss of contaminants by degradation or movement in the environment. Ironically, the "risk drivers" identified in Tables 4-18 through 4-25 are, without exception, polycyclic aromatic hydrocarbons and dioxins. These compounds are stable in the environment with limited degradation or movement (see Section 7.1).

D. Section 4.7.2.3 states that exposure parameters are mostly upper bound estimates, but "*there may be considerable variation in the activity patterns and physiological response of individuals.*" This misses the point of the reasonable maximum exposure policy. It is true that individuals vary in their activities and their physiology. The reasonable maximum exposure is based on upper bound estimates to protect not just the average individual but all individuals including those at the upper bounds of the distributions.

17. ECOLOGICAL RISK ASSESSMENT. We agree that the terrestrial habitat at Site 12 is so limited that a quantitative risk assessment is not needed (Sections 2.8.1, 2.8.2 and 5.0). We also accept the screening criteria for total petroleum hydrocarbons (Section 5.0), but we emphasize that the selected values of 447 mg/kg for soil and 1.4 mg/L for ground water were selected only for Site 12 of Treasure Island Naval Station and should not be applied elsewhere.

SPECIFIC COMMENTS

1. Table 4-4. Page 2 of Table 4-4 is mislabeled as Table 4-5.

2. Section 4.2.2.2, page 4-6. References to "*the RI report...*" are confusing because this document under review is titled "*Remedial Investigation Report*". Please identify the PRC (1997c) more specifically than as "*the RI report*". This ambiguous reference is made in several places throughout the document.

3. Section 4.5.2. Equation 4-3 needs to be reformatted to bring the denominator under the numerator.

CONCLUSIONS

The risk assessment in the Remedial Investigation will be revised, using additional sample data for Site 12. The comments in this memorandum should be used in that revision to produce a risk assessment which will be acceptable to the Department of Toxic Substances Control.

REFERENCES

Bradford, GR, AC Chang, AL Page, D Bakhtar, JA Frampton, and H Wright, 1996. Background Concentrations of Trace and Major Elements in California Soils. Kearney Foundation Special Report, Division of Agricultural and Natural Resources, University of California.

Department of Toxic Substances Control, Office of Scientific Affairs, 1994. Recommended Outline for Using U.S. Environmental Protection Agency Region IX Preliminary Remedial Goals in Screening Risk Assessments at Military Facilities. Memorandum from Michael J. Wade, Laura Valoppi and John Christopher to Kenneth Smith, dated October 28, 1994.

U.S. EPA, 1992. Supplemental Guidance to RAGS: Calculating the Concentration Term. May 1992.

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