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TREASURE ISLAND
SSIC NO. 5090.3.A

STATE OF CALIFORNIA — ENVIRONMENTAL PROTECTION AGENCY

PETE WILSON, Governor

DEPARTMENT OF TOXIC SUBSTANCES CONTROL

REGION 2
0 HEINZ AVE., SUITE 200
ERKELEY, CA 94710-2737
(510) 540-3809

February 4, 1994

Commanding Officer
Western Division
Attn: Mr. Ernesto Galang, Code 1813
Naval Facilities Engineering Command
900 Commodore Drive
San Bruno, California 94066-0720

Dear Mr. Galang:

DRAFT REMEDIAL INVESTIGATION REPORT, PHASE I, NAVAL STATION TREASURE ISLAND

The California Environmental Protection Agency (Cal/EPA), Department of Toxic Substances Control (DTSC) and San Francisco Regional Water Quality Control Board (RWQCB) has reviewed the draft Remedial Investigation Report and the draft Ecological Risk Assessment. The DTSC has also reviewed the draft Human Health Risk Assessment. The following are the DTSC's comments on the draft Remedial Investigation Report, draft Ecological Risk Assessment, and Human Health Risk Assessment. The comments of the RWQCB on the draft RI Report and draft Ecological Risk Assessment are attached to this letter. A list of potential State ARARs from the RWQCB are also attached to this letter.

Critical Comments of Cal/EPA, DTSC and RWQCB on the draft Remedial Investigation Report, draft Preliminary Risk Assessment and draft Ecological Risk Assessment

1. All data used to characterize the extent of contamination at NAVSTA Treasure Island should be included in the draft Remedial Investigation (RI) Report. Pertinent data from past investigations should be presented on the figures.

2. A discussion on the useability of past data in site characterization and risk assessment needs to be included in the RI Report. If the past data is of a quality that does not allow its application for risk assessment or site characterization, those data points may require resampling.

3. The Navy has concluded that several Installation Restoration sites do not require further investigation. The Cal/EPA does not agree with that conclusions for sites 4/19, 7, 12, 14, 15, 16, 20, 22, and 24. The nature and extent of contamination for these sites has not been satisfactorily identified.

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4. For several sites the Navy concluded that there is no habitat currently available for ecological receptors. This conclusion fails to recognize the habitat of the adjacent San Francisco Bay.

5. The Navy concludes that there is no beneficial use for the groundwater at NAVSTA TI. Potential beneficial uses have been identified for the groundwater. They are: (1) potential drinking water source (SWRCB Resolution No. 88-63) and (2) surface water replenishment (San Francisco Bay Basin Plan).

6. The USGS survey used to establish soil ambient levels was insufficient. Comparison of on-site to off-site reference concentrations should rely on local documented background data for the San Francisco Bay Area. Attached to this letter are two documents that provide a local discussion on background levels.

7. The attenuation factor of 100 applied to Aquatic Water Quality Criteria was incorrectly derived.

8. Quarterly groundwater monitoring is needed as for all sites. Prior to initiating groundwater monitoring, a groundwater monitoring plan must be submitted and approved.

9. Site-specific data is needed to complete the qualitative phase of the NAVSTA TI Ecological Risk Assessment. This can be accomplished by performing a site walk.

10. Burrowing animals should be considered when conducting the ecological risk assessment.

11. The rare and endangered species associated with NAVSTA TI were not adequately addressed in the draft Ecological Risk Assessment.

Comments on the draft Remedial Investigation Report by the Department of Toxic Substances Control

1. <u>Section 1.2.4, Prior Assessments, page 1-10, third paragraph</u>

   In discussing Site 2 the document states that the FFSRA did not consider the site a potential risk. This statement is inaccurate in that the FFSRA does not consider risk at all. The FFSRA is an agreement between the State DTSC and RWQCB and the Department of Defense, U.S. Navy.

2. <u>Section 1.3.5, Fire Training School (Site 06), page 1-14, second paragraph</u>

A summary of the data collected by ERM-West should be included as a table in the RI Report.

3. Section 1.3.5, Fire Training School (Site 06), page 1-14

The HLA and ERM West data is important for site characterization. The HLA and ERM West data should be represented on Figure 9 and 10.

4. Section 1.3.5, Fire Training School (Site 06), page 1-14, third paragraph

Significant amounts of TPH-diesel was detected in soil and groundwater during the HLA and ERM-West investigations. The amounts of associated Polycyclic Aromatic Hydrocarbons in the soil must be known in order to calculate risk at Site 6. This data will have to be collected during the second phase of the RI investigation.

5. Section 1.3.5, Fire Training School (Site 06), Table 3

High concentrations of Mercury (Hg) are reported in Table 3 for Borings 2 (4220 ppm), 6 (3750 ppm), 7 (775 ppm), 9 (1700 ppm), and 10 (9300 ppm) in soil. Mercury concentration in groundwater from Boring 2 was reported at 27.1 mg/L and 33.7 mg/L. These levels are significant and should be discussed in Section 1.3.5.

6. Section 1.3.5, Fire Training School (Site 06), page 1-15, first paragraph

Please explain the significance of detecting TPH-gasoline in monitoring wells 1 and 11 which were adjacent to UST 240B. USTs 240A and B are described as two 1,500 gallon steel diesel fuel storage tanks.

7. Section 1.3.6, Pesticide Storage Area (Site 07), page 1-16, first paragraph

Please identify the area where pesticides and herbicides were mixed and prepared. Also, identify the location of pier 11.

8. Section 1.3.6, Pesticide Storage Area (Site 07), page 1-16, third paragraph

Please explain why the RI activities at Site 07 were restricted to an area where wastewater treatment plant sludge and other liquids were disposed when excess pesticides and paint fluids were known to have been disposed of east of building 62. The Phase II RI should investigate potential contamination east of building 62.

9. Section 1.3.6, Old Bunker Area (Site 12), page 1-18

Is there any information available from the trenching and borings performed in 1968 that may help identify where the disposal cells are located?

10. Section 1.3.6, Old Bunker Area (Site 12), page 1-19, third paragraph

Were the 1968 trenches and borings considered in determining areas of potential waste burial and where the twelve soil borings would be located?

11. Section 1.3.6, Old Bunker Area (Site 12), page 1-19, third paragraph

Was any debris identified in boring logs of the 12 soil borings placed where contamination was thought to most likely exist?

12. Section 1.3.6, Old Bunker Area (Site 12), page 1-19, third paragraph

Please include a figure showing the locations of the sixty-four surface samples collected in a grid and the twenty-two surface soil samples collected at the sandy play areas. The figure should show the concentrations of antimony, cadmium and lead.

13. Section 1.3.6, Old Bunker Area (Site 12), page 1-19, third paragraph

An air photo of Treasure Island was discovered during the Environmental Baseline Survey. This photo showed what could potentially be a trench in the bunker area. Is there any information on what this feature may actually be? If this photo does show the disposal area, the locations of soil borings and monitoring well would not characterize the potential for contamination at Site 12.

14. Section 1.3.14, Old Fuel Farm (Site 15), page 1-22, first paragraph

The report states that the location of the two above ground 210,000 gallon fuel storage tanks is unknown because their relocation to the new fuel farm predates the earliest air photos (dated 1947) and plans available for review. Were any earlier photos or plans discovered during the Environmental Baseline Survey?

15. Section 1.3.14, Old Fuel Farm (Site 15), page 1-22, first paragraph

Please identify where the excavations at the commissary and the new pier facility revealed areas with soil suspected of containing oil or petroleum hydrocarbons?

16. Section 1.3.14, Old Fuel Farm (Site 15), page 1-22, first paragraph

Please identify the location of the abandoned fuel lines.

17. Section 1.3.17, Refuse Transfer Area (Site 19), page 1-23, third and fourth paragraphs

The PA/SI activities conducted by Dames and Moore (1988) identified the presence of oil and grease, and total petroleum hydrocarbons at maximum concentrations of 77,300 mg/kg and 53,000 mg/kg respectively. Then PRC conducted subsequent work to the PA/SI and collected ten more soil samples from five soil borings. That investigation found TPH-gasoline, but "the concentration were much lower than the concentrations found during the PA/SI". This is correct; however, PRC did not analyze for the same contaminants found during the PA/SI. PRC analyzed for the lighter petroleum hydrocarbon, gasoline. Subsequent work at Site 4/19 should include analysis for TPH-diesel. This will identify the heavier petroleum hydrocarbons.

18. Section 1.3.18, Auto Hobby Shop and Transportation Center (Site 20), page 1-24, first paragraph

Please identify in a figure the locations of buildings 194, 224, 225, and 267.

19. Section 1.3.18, Auto Hobby Shop and Transportation Center (Site 20), page 1-25, third paragraph

Is there any information on the soil stock pile which was located west of building 258, the post office?

20. Section 1.3.21, 5th Street Fuel Releases/Dry Cleaning Facility (Site 24), page 1-28, fourth paragraph

Please identify the location where 125 cubic feet of soil were excavated from the vicinity of the leaking pipeline in 1986 and 1987.

21. Section 1.3.22, Seaplane Maintenance Area (Site 25), page 1-29, third paragraph

Please reference Table 4 in the discussion of sample results from the UST removals.

22. Section 2.3.2.1, Treasure Island Geology, page 2-3, second paragraph

Is there any information on where the fill was taken from for constructing Treasure Island?

23. Section 2.5.1, Regional Hydrogeology, page 2-5, last paragraph

The groundwater at Treasure Island is interconnected with the San Francisco Bay. According to EPA's "Guidance on Remedial Actions for Contaminated Groundwater at Superfund Sites", a Class IIIB designation is for groundwater that has no interconnection to surface water or adjacent aquifers. Therefore, this is an inappropriate designation for TI groundwater.

24. Section 2.6.2, Surface Drainage, page 2-8, second and third paragraph

Please reference Figure 21 which shows the drainage boundaries for Treasure Island.

The discussion of surface drainage of Yerba Buena Island is inadequate for understanding the movement of surface water on the island. Please include on Figure 22 the drainage boundaries for Yerba Buena Island.

25. Section 3.3.2, Sediment Sampling, page 3-4, second paragraph

Was there any sediment in the field blank collected on October 14, 1992?

26. Section 4.1, POTENTIALLY APPLICABLE LAWS AND REGULATIONS, page 4-1, second paragraph

The Comprehensive Environmental Response and Liability Act should be included as a major federal law governing environmental cleanup activities at NAVSTA Treasure Island.

27. Section 4.2, Applicable or Relevant and Appropriate Requirements, page 4-4

The application of Applicable or Relevant and Appropriate Requirements (ARARs) by a federal lead agency applies to sites on the National Priority List. Sites not on the National Priority List (e.g. Treasure Island) must fallow all State laws and regulations. The exercise in identifying ARARs for Treasure Island is useful and should be continued; however, the distinction between NPL and non-NPL sites needs to be understood.

28. Section 4.3.1.2, Potential State of California TBCs, page 4-7

The Department of Toxic Substances Control, Office of Scientific Affairs will soon publish Technical Directive # 94-OSA-2, titled Health-Based Soil Screening Levels. This document is currently in draft form; however, it should be included as a TBCs for Treasure Island.

29. Section 4.3.1.2, Other TBCs, page 4-9, last paragraph

The RI Report states that the groundwater at NAVSTA Treasure Island has no beneficial use. The ultimate receptor of groundwater at Treasure Island is the San Francisco Bay, therefore, beneficial uses of the San Francisco Bay may be the same beneficial uses for NAVSTA Treasure Island groundwater. (see SFRWQCB comments for details)

30. Section 4.3.1.2, Other TBCs, page 4-9, last paragraph

The RI Report incorrectly states that the groundwater has no beneficial use. The groundwater discharges to a surface water, the San Francisco Bay. Because the potential impact on Bay water the groundwater is considered having the same beneficial use as the Bay. (see SFRWQCB comments for details)

31. Section 4.3.1.2, Other TBCs, page 4-10, first paragraph

A 1000 ppm TPH-diesel and TPH-gasoline TBCs criteria for soil was calculated for the RI Report. The Navy's calculation incorrectly applies the 100-fold attenuation factor to assess the dilution of contaminants. (see SFRWQCB comments for details)

32. Section 4.3.2.2, Potential State of California ARARSs, page 4-12, last paragraph

The State office that administers the State of California Safe Drinking Water Act is the Department of Health, Office of Drinking Water Standards.

33. Section 4.3.2.2 Potential State of California ARARs, page 4-13, first paragraph

Who classified Treasure Island's groundwater classified as a Class III B nonpotable water source and how was this done?

34. Section 4.3.2.5, Other Potential TBCs, page 4-16, first paragraph

Please see SFRWQCB comments on Marshack's "Designated Level Methodology for Waste Classification and Cleanup Level Determination."

35. Section 4.3.4.1, Potential Federal ARARs, Ambient Water Quality Criteria, page 4-19

Please include as a table NAVSTA Treasure Islands NPDES discharge requirements.

36. Section 4.3.4.1, Potential Federal ARARs, Ambient Water Quality Criteria, page 4-19

The RI Report states that Ambient Water Quality Criteria may apply to NAVSTA Treasure Island because of the several stormwater outfalls that discharge into the San Francisco Bay. Because of the connection between groundwater and the San Francisco Bay, Ambient Water Quality Criteria may also apply as a TBCs for groundwater.

37. Chapter 5, Nature and Extent of Contamination, page 5-2, first paragraph

A decision was made not to do a background study for Treasure Island during the initial RI because of a lack of resources. A background or ambient study is planned for the second phase of the RI. More detailed comments on the present ambient study are provided in the comments on the Preliminary Human Health Risk Assessment.

38. Section 5.3.1, Contaminated Sources, page 5-7 last paragraph

What types of hydraulic equipment is used at the Training school? Are there any other potential sources of contamination?

39. Section 5.3.1, Contaminated Sources, page 5-7 last paragraph

Please show the stained area in Figures 6 and 7.

40. Section 5.3.1, Contaminated Sources, page 5-8 second paragraph

Please show the location of the storm drain mentioned in the RI Report in figures 6 and 7.

41. Section 5.3.6, HYDRAULIC TRAINING SCHOOL (Site 4) AND REFUSE TRANSFER AREA (Site 19), Recommendations, page 5-11, first paragraph

The DTSC does not agree with the Navy's conclusion that the nature and extent of contamination has been acceptably

defined, and no further investigation is required for the following reasons:

- The RI Report states that the primary contaminants at the site are PAHs and that there is no indication of petroleum products is given by the TPH extractables analysis. The recommendation section fails to mention the oil and grease, and TPH-diesel detected in soil borings 1, 2, and 4, which were drilled by Dames and Moore in 1988. Concentrations of oil and grease, and TPH-diesel concentrations in SB-2 were 77,300 ppm and 53,000 ppm respectively. Only a limited analysis were conducted on these borings (oil/grease, TPH-diesel, and PCB). A complete analysis of the soil is required. The concentration of soil contamination in the area of these borings must be confirmed and the extent of contamination better defined.

- During the 1991 investigation by PRC soil was analyzed for TPH-gasoline and not oil and grease or TPH-diesel. The detection limits for SVOCs were very high. What SVOCs, other than Butylbenzylphthalate and bis(2-ethylhexyl)phthalate, were analyzed for during the 1991 investigation? Did the analysis include PAHs?

- There is too little information on the contamination at MW03 to calculate the extent of contamination. The source of the contamination has not be identified.

42. <u>Section 5.4.5, OLD BOILER PLANT (Site 5), Contaminant Sources, page 5-11</u>

    Is there any more information on the debris, for example: How much debris is buried? How deep is the debris?

43. <u>Section 5.4.5, OLD BOILER PLANT (Site 5), Field Geology and Hydrogeology Findings, page 5-13</u>

    Was any debris uncovered during the test pit excavation?

44. <u>Section 5.4.5, OLD BOILER PLANT (Site 5), Geophysical Results, page 5-13</u>

    The GPR data indicate two areas having anomalous amounts of debris within the shallow subsurface. These two areas, however, were not in the area of the test pit or where borings were placed. Therefore, very little can be said about the type and extent of contamination at this site.

45. <u>Section 5.4.5, OLD BOILER PLANT (Site 5), Recommendations, page 5-13</u>

Because no asbestos was detected in the soil does not mean asbestos is not buried at Site 5. The Navy recommends No Further Action for Site 5. The Navy should consider reuse scenarios for Site 5 before making a final recommendation for this site.

46. Section 5.5.1, FIRE TRAINING SCHOOL, (Site 06), Contaminant Sources, page 5-14, second paragraph

Is there information on the location and condition of fuel lines at Site 06?

47. Section 5.5.2, FIRE TRAINING SCHOOL, (Site 06), Sampling Objectives, page 5-15

During the RI investigation, soil was not analyzed for TPH-gasoline. Gasoline has been identified in soil and groundwater at Site 06. The follow-on investigation when earlier investigations indicated high levels of TPH-gasoline near USTs 240A and B?

48. Section 5.5.2, FIRE TRAINING SCHOOL, (Site 06), Sampling Objectives, page 5-15

Defining the nature and extent of contamination at Site 06 seems to rely on data collected in previous investigations. For example, no groundwater samples were collected during the RI. What is the quality of the previously collected data? Does the old data meet data quality objectives for Treasure Island? Can the old data be used in a risk assessment?

49. Section 5.5.5, FIRE TRAINING SCHOOL, (Site 06), TPH-Gasoline, page 5-17

Past data is very important in characterizing the contamination at a site. When discussing the extent of contamination all previous investigations should be included in the discussion. The past data should be also included on the figures. TPH-gasoline was also detected in soil in boring 1 at 4,800,000 μg/kg during the investigation conducted by HLA in 1987.

50. Section 5.5.5, FIRE TRAINING SCHOOL, (Site 06), Metals, page 5-17

When discussing the extent of contamination all previous investigations should be included in the discussion. The past data should be also included on the figures. High levels of Mercury were detected in soil in borings 2, 6, 7, 9, and 10 and in groundwater in boring 2. This information

is critical in understanding the type of contamination at Site 06.

51. Section 5.5.5, FIRE TRAINING SCHOOL, (Site 06), Recommendations, page 5-19, second paragraph

The RI Report states that there are no ecological receptors at the site and that no ecological risk is apparent. Site 06 is located on the parameter of the island and contaminated groundwater may be affecting the San Francisco Bay. Aquatic receptors should be considered when discussing ecological risks.

52. Section 5.5.5, FIRE TRAINING SCHOOL, (Site 06), Recommendations, page 5-19, last paragraph

Extensive site characterization is required for Site 06. The extent of soil and groundwater contamination has not been defined. There was no groundwater investigation during the RI. The condition of monitoring wells at Site 06 is questionable. Several monitoring wells appeared to be damaged during an October 1993 site visit. The groundwater data currently available is over six year old and is unacceptable for current site characterization and risk assessment purposes. The source and extent of mercury contamination must also be investigated. The location and condition of pipelines needs to be determined.

53. Section 5.6.2 PESTICIDE STORAGE AREA (Site 07), Recommendations, page 5-22

The DTSC does not agree with the Navy's conclusion that the nature and extent of contamination has been acceptably defined, and no further investigation is required for the following reason:

- The area of investigation at Site 07 included the location where sludge from the wastewater treatment plant was disposed to land. Section 1.3.6 of the RI Report states, "Excess pesticide and paint fluids were disposed of by pouring directly onto the ground or into stormwater drains east of Building 62 that eventually discharge into San Francisco Bay." This area has not been investigated and must be included in the second phase of the RI.

54. Section 5.8.1 FOUNDRY (Site 09), Contaminant Sources, page 5-25, last paragraph

Building 41 included an operating paint booth from 1953 to 1968. Where was this paint booth located? Are there any floor drains located in the building?

55. Section 5.8.5 FOUNDRY (Site 09), Recommendations, page 5-27, last paragraph

More information is needed on the painting operations at Site 09. The source of the acetone, toluene, and lead needs to be identified. No information on the groundwater is available for Site 09. A groundwater well needs to be installed to determine the impact of the soil contamination on groundwater. More investigation is necessary to determine the extent of contamination during the second phase of the RI.

56. Section 5.9.1 BUS PAINTING SHOP (Site 10), Contaminant Sources, page 5-28

The RI Report states that waste paints, thinners, and solvents may have been released onto the ground near Building 335. The waste may have been spread on the adjacent riprap, or discharged to the bay. The RI, however, was limited to three portable above ground tanks east of building 335. These tanks are not discussed in the Contaminant source section. What type of solvents are contained in these tanks.

57. Section 5.9.1 BUS PAINTING SHOP (Site 10), Recommendations, page 5-30

If the solvent and antifreeze tanks at Site 10 are not suspected sources of contamination, why did the investigation focus on the area surrounding the tanks?

58. Section 5.9.1 BUS PAINTING SHOP (Site 10), Recommendations, page 5-30

Further investigation is needed at Site 10. The initial investigation was inadequate in assessing the potential for contamination due to operations at Site 10. Groundwater wells should be installed at Site 10 to determine if groundwater has been impacted by soil contamination.

59. Section 5.10.4 YBI LANDFILL (Site 11), Field Geology and Hydrogeology Findings, page 5-32

Please clarify whether the color of the sand changed to black and was saturated with oil for both 11-MW02 and 11-MW04.

60. Section 5.11.1 OLD BUNKER AREA (Site 12), Contaminant Sources, page 5-36

The locations of trenches dug in 1968 should be shown on Figure 19.

61. Section 5.11.1 OLD BUNKER AREA (Site 12), Contaminant Sources, page 5-39

The DTSC does not agree with the Navy's conclusion that the nature and extent of contamination has been acceptably defined, and no further investigation is required for the following reason:

- Without knowing where the debris was buried an accurate assessment of the contamination is impossible. Therefore, the DTSC does not agree that the RI and other investigations have provided enough information to characterize Site 12.

62. Section 5.12.4.1 STORMWATER OUTFALLS (Site 13,13A), page 4-43 and page 4-44

Please spell out the acronyms SFBB, AET, ER-L, and ER-M.

63. Section 5.12.4.1 STORMWATER OUTFALLS (Site 13,13A), Evaluation of Stormwater Contamination, page 4-47

Figure 23 should be referenced in the discussion section. The sample identification numbers should be included in Figure 23.

64. Section 5.13.1 NEW FUEL FARM (Site 14), Contaminant Sources, page 5-50, second paragraph

Will results of previous investigations be used in site characterization or risk assessment? If so, does the data meet the data quality objectives for Treasure Island?

65. Section 5.13.4 NEW FUEL FARM (Site 14), Soil and Vadose Zone Contamination, page 5-51, third paragraph

The soil and groundwater results from the Characterization Well installation should be included in Figure 25.

66. Section 5.13.6 NEW FUEL FARM (Site 14), Recommendations, page 5-53, fifth paragraph

The DTSC does not agree that the current RI sampling in conjunction with previous investigations provides enough information to characterize Site 14 for the following reasons:

- The usefulness of data from previous investigations is questionable.

- Monitoring wells installed in previous investigations may not be useable for continued groundwater

monitoring.

- The area around soil boring M1 through M6 will require resampling and analysis because the original analysis only included TPH-gasoline and TPH-diesel.

- The extent of soil and groundwater contamination has not been determined for Site 14.

67. Section 5.14.1 OLD FUEL FARM (Site 15), Contaminant Sources, page 5-54

Please provide the locations where excavations in 1985 revealed soil suspected of containing oil and petroleum hydrocarbons on Figure 27.

68. Section 5.14.1 OLD FUEL FARM (Site 15), Contaminant Sources, page 5-56

The Navy concludes that enough information is available to characterize Site 15. The DTSC does not agree with this recommendation for the following reasons:

- The source location of the contamination is not known.

- No groundwater data is available for the site.

- The full extent of the PAH contamination is unknown.

- The areas of petroleum hydrocarbon contamination discovered in 1985 is unknown.

69. Section 5.15.6 CLIPPER COVE TANK FARM (Site 16), Recommendations, page 5-58

The Navy concludes that enough information is available to characterize Site 16. The DTSC does not agree with this recommendation for the following reason:

- The soil is known to be contaminated at Site 16. No information is available on the condition of groundwater at Site 16.

70. Section 5.18.1 AUTO HOBBY SHOP AND TRANSPORTATION CENTER (Site 20), Contaminant Sources, page 5-62

Hydraulic lifts located in the Auto Hobby Shop should be investigated as a potential source for contamination.

71. Section 5.18.4 AUTO HOBBY SHOP AND TRANSPORTATION CENTER (Site 20), Soil and Vadose Zone Contamination, page 5-64

Please provide information on the amount of contaminants present in soil in the landfarm area. Also, please summarize the results of the other investigations. Particularly, what levels were found in soil borings 1, 2, and 3 drilled by Dames and Moore in 1988.

72. Section 5.18.4 AUTO HOBBY SHOP AND TRANSPORTATION CENTER (Site 20), Recommendations, page 5-65

The Navy concludes that enough information is available to characterize Site 16. The DTSC does not agree with this recommendation for the following reason:

- Hydraulic lifts located in the Auto Hobby Shop should be investigated.
- The extent of TPH contamination around MW03 has not been defined.

73. Section 5.19.5 VESSEL WASTE OIL RECOVERY (Site 21), Recommendations, page 5-67

The Navy has recommended this site for No further Action because the concentration of TPH-diesel did not exceed the TBC criteria. The TBC criteria for TPH-diesel was miscalculated, therefore, the DTSC cannot concur with the Navy's recommendation.

74. Section 5.20.7 NAVY EXCHANGE SERVICE STATION (Site 22), Recommendations, page 5-72

The Navy concludes that enough information is available to characterize Site 22. The DTSC does not agree with this recommendation for the following reason:

- The extent of soil and groundwater contamination has not been characterized.
- The source of diesel and gasoline near UST 330C must be determined. UST 330C supposedly contained waste oil and no constituents were detected in the soil samples taken from the excavation when the UST was removed.
- The RI Report incorrectly states that there are no Ecological Receptors at the site. The San Francisco Bay is habitat for dozens of ecological receptors. These receptors must be considered in the RI. Therefore, down gradient wells are required to assess the extent of the ground water plum between the source of contamination and the San Francisco Bay.

75. Section 5.21.2 FIFTH STREET FUEL RELEASES/DRY CLEANING FACILITY (Site 24), page 5-73

The location of the soil boring, monitoring wells, and geophysical survey area appear in Figure 30. Where is the fuel pipeline? What direction does the fuel line go once it reaches Avenue N? Where does the pipeline ultimately go to?

76. Section 5.21.2 FIFTH STREET FUEL RELEASES/DRY CLEANING FACILITY (Site 24), page 5-73

The RI Report states that the current RI sampling in conjunction with previous investigations provide enough information to characterize Site 24. The DTSC does not agree with that statement for the following reasons:

- Additional investigation is needed to characterize the extent of soil and groundwater contamination. Additional soil and groundwater information is needed to conduct human health and ecological risk assessments.

- Chlorinates solvents 1,2-dichloroethene, trichloroethene, and tetrachloroethene were detected in the groundwater sample 24-MW04W. Nothing else is know about the contamination in 24-MW04 except the potential source is Building 99. The extent of the solvent plume must be determined.

- The pipeline under investigation runs from Tanks 103 and 104 to Avenue N. The location of the fuel spill has not been identified. Only two borings are located along the length of the fuel pipe line. There are no groundwater wells in the vicinity where soil contamination was located.

- No information is available on the condition of the fuel line after the pipe line reaches Avenue N. As part of the Base Closure Process the entire fuel line will need some type of investigation.

The recommendation provided in this section differs for the recommendation given on page 8-6.

77. Section 5.22.5 SEAPLANE MAINTENANCE AREA (Site 25), Groundwater Contamination, page 5-79

TPH-gasoline was not included in the groundwater analysis. However, BTEX, a constituent of gasoline, was found in the groundwater. Additional groundwater sampling events should include TPH-gasoline.

78. Section 5.22.5 SEAPLANE MAINTENANCE AREA (Site 25), Geophysical Results, page 5-79

The location of Anomaly I should be shown on Figure 5. Also, Figure D-18 should be referenced in the text.

79. Section 5.22.5 SEAPLANE MAINTENANCE AREA (Site 25), Recommendation, page 5-80, third paragraph

The RI Report incorrectly states that they are no ecological receptors at this site and the site does not pose an ecological risk. Site 25 borders the San Francisco Bay. There are several ecological receptors in the San Francisco Bay.

80. Section 5.22.5 SEAPLANE MAINTENANCE AREA (Site 25), Recommendation, page 5-80, last paragraph

The statement that the concentrations of the organic and inorganic compounds in groundwater were below the potential ARARs and TBC values is incorrect. The TBC values for groundwater were incorrectly calculated. (See RWQCB comments)

81. Section 5.22.5 SEAPLANE MAINTENANCE AREA (Site 25), Recommendation, page 5-80, last paragraph

The RI Report recommends additional investigation downgradient of monitoring well 25-MW03 to determine the extent of diesel contamination. This is appropriate, however, the source of the diesel contamination must also be investigated.

82. Section 5.22.5 SEAPLANE MAINTENANCE AREA (Site 25), Recommendation, page 5-80, last paragraph

Soil and groundwater contamination from UST 2C should be included in the next phase of the RI.

83. Chapter 6, RISK ASSESSMENT

Comments on the Ecological and Human Health Risk Assessments are included in this letter. Please refer to those comments when making changes to this chapter.

84. Chapter 7, CONTAMINANT FATE AND TRANSPORT/MODELING OF CONTAMINATED MEDIA

The conclusions and assumptions made in this chapter are dependent on the information presented in the draft Phase I, RI Report. The draft Phase I, RI Report requires significant changes. This chapter must also be rewritten

based on previous comments on the draft RI Report. Specifically, the extent of contaminations presented in Figures 43-54 are for the most part fictitious, since they are based on inappropriate assumptions and inadequate information.

85. Section 8.3, RECOMMENDATIONS AND CONCLUSIONS, DATA GAPS AND RECOMMENDATIONS FOR FURTHER STUDY

This section contains recommendations for additional work on individual sites. The DTSC has already provided comments on the sites in the Recommendation Sections in Chapter 5. Please see these comments. Further, the extent of work needed during the second Phase of the RI investigation will be defined in the Phase II RI Work Plan. The Navy should work closely with the DTSC and the RWQCB in developing that work plan.

86. Section 8.4, RECOMMENDATIONS AND CONCLUSIONS, CONCLUSIONS

Please refer to previous comments on individual sites when making changes to this section.

Comments on the draft Ecological Risk Assessment by the Department of Toxic Substances Control

1. Section 1.5, PRIOR ASSESSMENTS, SITE DESCRIPTIONS, AND OPERATIONAL HISTORIES, Yerba Buena Landfill (Site 11), page 8

The Yerba Buena Landfill (Site 11 should be monitored to assure that 'unsanctioned dumping' does not introduce contaminants which increase the risk to ecological receptors.

2. Section 1.5, PRIOR ASSESSMENTS, SITE DESCRIPTIONS, AND OPERATIONAL HISTORIES, Auto Hobby Shop (Site 20), page 10

The last sentence of the first paragraph describing the auto hobby shop (Site 20) should be amended to clearly state whether stockpiled soil was characterized as nonhazardous under the California hazardous waste regulations (CRC Title 22) or a soil bioassay showed no effect due to total petroleum hydrocarbon contamination.

3. Section 1.5, PRIOR ASSESSMENTS, SITE DESCRIPTIONS, AND OPERATIONAL HISTORIES, Fifth Street Fuel Releases/Dry Cleaning Facility (Site 24), page 11

Chlorinated solvents were detected in groundwater (Appendix B, site G4, page B-8), but it is difficult to determine whether soil was sampled for chlorinated solvents (Appendix

A, Site G4, page A-19).

4. Section 1.6, STUDY AREA INVESTIGATIONS, page 13

This document should state why only storm water samples were analyzed for cyanide.

5. Section 3.2.4, Site-specific Conditions, page 63

Statements regarding the unavailability of sediment-bound contaminants to benthic organisms are not true for infaunal or epibenthic organisms which directly ingest sediment or filter feeding organisms. This section should be amended to make clear the difference in exposure pathway and availability.

6. Section 4.1, EVALUATION OF EXISTING CRITERIA AND EFFECTS VALUES, page 72

National Oceanic and Atmospheric Administration (NOAA) Exposure Range-Median (ER-M and Exposure Range-Low (ER-L) sediment should be added to the list of existing criteria as To Be Considered (TBC) criteria and used in assessment of sediment concentrations.

7. Section 5.1.2, Soils on Yerba Buena Island, page 103

A determination should be made during the Phase II whether the California ground squirrel and California pocket mouse make use of the IR sites on YBI instead of relying on the 'most likely scenario' in the Phase II studies.

8. Section 5.2.1, Stressors in Groundwater, page 107

The 100 to 1 groundwater dilution ratio has been incorrectly applied at Treasure Island. A detailed comment on the dilution ratio is provided by the RWQCB in the draft RI Report comments (attached).

9. Section 5.4.1, Stressors in the Sediment, page 110

There is a NOAA ER-L of 50 ppb and ERM-M of 400 ppb for total polychlorinated biphenyls (PCBs) which could be used as a TBC for Aroclor in sediment.

10. Section 6.2.1, Soils, page 116

An inventory of the soil invertebrate community should be performed during Phase II at YBI sites in addition to the TI sites proposed.

11. Section 6.2.1, Soils, page 116

Remediation for human health reason may address risk to ecological receptors if the post remediation media concentrations are protective of ecological receptors as well as humans.

12. Section 6.2.2, Groundwater, page 117

Tidal influence monitoring should be included as part of the Phase II groundwater sampling effort.

13. Section 6.2.4, Sediments, page 118

The DTSC agrees that the biological community in the nearshore areas of NAVSTA TI should be more fully inventoried in Phase II.

Specific Comments on the draft Baseline Human Health Risk Assessment by the Department of Toxic Substances Control

1. General Comment

What data are there on the sources of lead contamination on Yerba Buena Island? For example; due to Bay Bridge motor traffic, or paint chips and other activities associated with the Bay Bridge.

2. Appendix A, Section 2.3.3, Laboratory Contaminants, page A-4

Some rationale should be provided to explain how carbon disulfide, phthalates, endrin and associated organic chlorine pesticides are present as laboratory contaminants. If this is the case, then these data suggest a dirty laboratory or sloppy handling of samples and calls into question reliability of the data upon which the risk assessment is based.

3. Appendix A, Section 3.4, Background

The DTSC disagrees with the practice of screening metal concentrations based on "those found in the western United States." It is preferable that documented local reference concentration ("background") values which take into account local anthropogenic contribution not otherwise a result of direct activities at NAVSTA Treasure Island. (see C.M. Scott. 1991. University of San Francisco, attached)

4. Appendix A, Section 3.5, Inorganics in Groundwater

The DTSC disagrees with the elimination of inorganics in groundwater as COPCs due to "lack of exposure pathway" since groundwater at NAVSTA TI is not used for drinking. The RWQCB has not determined if the groundwater at TI is non-

potable. On the contrary the RWQCB considers the groundwater at TI as a potential drinking water source (see SFRWQCB comments on draft RI Report). Further the State and RWQCBs have adopted Resolutions No. 68-16, "Statement of Policy with Respect to Maintaining High Quality Water in California" and Resolution 88-63, "Sources of Drinking Water Quality." The first outlines the principles of maximum benefit so as to not unreasonably affect present and probable future beneficial uses of such water and the second specifies ground and surface water and their beneficial uses.

Although 40 CFR 130.2(c) and 131.3(i)[Federal Clean Water Act] focus on surface waters, the Porter-Cologne Act includes both surface and groundwater; California's Water Quality Control Plans (e.g., 93-5WQ and 91-13WQ) are applied to ground and surface waters with the distinction being those waters with existing total dissolved solid concentrations in excess of 3000 mg/L, low sustained yield (less than 200 gallons/day for a single well), waters within agricultural drains and geothermal waters. Narrative objectives taken from the Basin Plan resolutions read as follows: "Groundwaters shall not contain chemical constituents in concentrations that adversely affect beneficial uses." Thus, inclusion of all potential beneficial uses of TI groundwater should be included in the baseline public health risk assessment. Potential for movement of compounds present in on-site groundwater to the Bay should be in the evaluation to comply with those same resolutions regarding toxicity: "All water shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal or aquatic life."

5. <u>Appendix C, INORGANIC CONSTITUENTS IN SOIL: RESULTS OF COMPARISON BETWEEN NAVSTA TI LEVELS AND AMBIENT LEVELS</u>

Comparison of site soil metal values to the entire Western United States is inappropriate. Copper and lead values in native soil, for example, in many areas of the United States are so high that historic commercial mining has been very profitable. In other area, native soil arsenic and associated groundwater arsenic values are so high that recent epidemiologic study results have been able to identify cancer clusters in towns built on those soils and whose occupants drink and bathe in the groundwater. Comparison of on-site to off-site reference concentrations ("background") should rely on local documented background data for the San Francisco Bay Area (C.M. Scott, 1991; attached) and for sites regulated by the DTSC where quality assurance/quality control and chain of custody procedures with state-certified laboratories have been used (e.g. Pacific State Steel, Union City). These values should be presented and discussed in relation to anthropogenic

concentrations (e.g. Appl. Occup. Environm. Hyg. 8:217-220, 1993) found in "background" soils not necessarily associated with site-specific activities of NAVSTA TI.

6. Appendix C, page C-4, top line

Cite title, date, and specific DTSC guidance which "does allow subtraction of background concentrations from measured levels for carcinogens."

If you have any questions regarding this letter, please call me at (510) 540-3809.

Sincerely,

Thomas P. Lanphar
Project Manager
Base Closure Branch

Enclosure(s)

cc: Ms. Gina Kathuria
San Francisco Bay
Regional Water Quality Control Board
2101 Webster Street, Suite 500
Oakland, California 94612

Mr. Jim Sullivan,
BRAC Environmental Coordinator
Code 80
Naval Station, Treasure Island
410 Palm Avenue
San Francisco, California 94130-0410

Admin Record (3 copies)

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
San Francisco Bay Region

Internal Memo

TO: Shin-Roei Lee, DoD Section Leader

FROM: Gin Kathuria, Project Manager, (510) 286-4267

DATE: February 1, 1994

SUBJECT: COMMENTS ON NAVAL STATION TREASURE ISLAND DRAFT PHASE I TREASURE ISLAND REMEDIAL INVESTIGATION REPORT VOLUMES I AND II, DATED 11/08/93

GENERAL COMMENTS:

1. According to the State Water Resources Control Board Resolution No. 88-63 "Sources of Drinking Water", **all** surface and groundwaters of the State are considered suitable , or potentially suitable for municipal or domestic water supply unless: (1) Total dissolved solids (TDS) exceed 3,000 mg/l or (2) The water source does not provide sufficient water to supply a single well capable of producing an average, sustained yield of 200 gallons per day. Please provide data (e.g. TDS and/or sustained yield) to support the statement in the text that the groundwater at Treasure Island does not have this beneficial use.

   If the groundwater is declared as not a potable water supply due to high TDS it is an indication that the groundwater maybe in communication with the San Francisco Bay. This creates another beneficial use for the groundwater termed **Surface water replenishment**. The San Francisco Bay Basin Plan states "Ground waters with a beneficial use of **surface water replenishment** shall not contain concentrations of chemicals in the amounts that will adversely affect the beneficial use of the receiving surface water." The beneficial uses of the Bay are as follows (1) navigation, (2) water contact recreation, (3) Non-contact water recreation, (4) ocean commercial and sport fishing, (5) cold fresh water habitat, (6) preservation of areas of special biological significance, (7) wildlife habitat, (8) preservation of rare and endangered species, (9) fish migration, (10) fish spawning, (11) shellfish harvesting, (12) estuarine habitat, (13) industrial process supply, and (14) industrial service supply. It will be appropriate to compare the groundwater data with the water quality standards established for protection of the beneficial uses of the Bay.

2. Although the literature used to establish ambient levels for Treasure Island/Yerba Buena Island includes the western states, it is not localized enough to provide ambient levels for the base. The ambient levels used to analyze inorganic contamination at the base is inadequate, refer to comments on Appendix F.

3. The water quality criteria values used for comparison with groundwater concentrations were multiplied by 100 (an attenuation factor). This 100 value was incorrectly derived for the following reasons.

   The first factor of 10 was apparently derived from a RWQCB guidance document entitled "The Designated Level Methodology for Waste Classification and Cleanup Level Determination", Marshak 1989. A factor of 10 was applied to attenuation of the groundwater at NAVSTA TI as it travels through the saturated zone and towards the Bay. Marshak intended to establish his methodology to analyze contaminant transport through the vadose zone to the saturated zone.

   According to Marshak's document, in situations where the water table is high an attenuation factor of (1) should be used. In other words an attenuation factor of 1 should be used for attenuation in soils at Treasure Island not groundwater. Marshak's guidance also states that if the groundwater is already contaminated, the attenuation factor has already been exhausted.

   A detailed, site-specific fate and transport analysis of contaminants within the groundwater at Treasure Island and Yerba Buena Island should be used in developing an attenuation factor for contaminant transport via groundwater.

   The second factor of 10 was chosen to allow for the dilution of the groundwater with the surface water (Bay). The RWQCB **does not allow for dilution of contaminants**.

   In conclusion, an attenuation factor for contaminant transport via groundwater should be based on a site-specific fate and transport model and the RWQCB does not allow for dilution.

4. The groundwater at NAVSTA TI does not fall into the EPA category Class IIIB. The beneficial uses of the groundwater is drinking water and surface water replenishment. See comment 12.

5. It is obvious that the groundwater investigation at NAVSTA TI has data gaps, quarterly groundwater monitoring should begin immediately.

6. See Attachment I for complete listing of potential State

ARARs.

SPECIFIC COMMENTS:

7. Page ES-4,Groundwater: The statement that "Treasure Island groundwater has no specific beneficial use" is false. According State Water Resource Control Board Resolution 88-63, all ground and surface waters of the State are considered potential drinking water sources unless TDS is greater than 3000 ppm or a well is unable to supply 200 gpd. Because the groundwater at TI flows into the San Francisco Bay, it possesses the beneficial use of **surface water replenishment.**

8. Page ES-4, 6th Paragraph: It is stated in the report that "..the groundwater is hydraulically connected to the bay". This in itself is a beneficial use of Treasure Island's groundwater.

9. Page ES-5, Top of Page: The statement that the "Groundwater analytical results compared to AWQC, after accounting for attenuation and eventual discharge to surface water" is inaccurate, please refer to comment 3.

10. Table ES-1: This table is inaccurate, the RWQCB does not agree with the manner in which the modified AWQC values were achieved.

11. Page 2-4, Soils: No attempt has been made to obtain a soil boring to bay mud. This should be done to characterize the fill at Treasure Island. Have previous investigations obtained data of the fill down to bay mud?

12. Page 2-5, Regional Hydrogeology: According to EPA's "Guidance on Remedial Actions for Contaminated Groundwater at Superfund Sites (1988g)", Class IIIB includes groundwater that has no interconnection to surface water or adjacent aquifers. The groundwater at TI is interconnected to the Bay and therefore does not fall into the Class IIIB category.

13. Page 2-5, Regional Hydrogelogy: Has the thickness of the top water bearing zone been determined yet?

14. Page 4-8, Top of Page: The LUFT manual is a guidance document and considered a TBC. The term "applicable to NAVSTA TI" is misleading. If tanks are or were present, the LUFT manual would be applicable to NAVSTA TI.

15. Page 4-8, 2nd Paragraph: The Tri-Regional Board Staff Recommendations for Preliminary Evaluation and Investigation of Underground Storage Tanks is a guidance document and considered a TBC. The term "applicable to NAVSTA TI" is misleading. If tanks are or were present, the Tri-Regional

Board Staff Recommendations for Preliminary Evaluation and Investigation of Underground Storage Tanks would be applicable to NAVSTA TI.

16. Page 4-9, 3rd Paragraph: The statement that "The groundwater at NAVSTA TI is nonpotable and has no specific beneficial use" is false. Refer to comment 1.

17. Page 4-10: What was the environment (criteria) of the 100-fold attenuation given in the reference (Ricciardelli 1990)? Does it fit the same scheme at Treasure Island (e.g. floating product on groundwater, high water table - approximately 3' to 6', contaminated groundwater at sites in close proximity to Bay, relationship of groundwater to surface water).

    Attenuation factors should be based on site-specific data. In most instances the attenuation factors developed will vary from site to site.

18. Page 4-11, 1st Paragraph: According to the SWRCB Resolution 88-63 all ground and surface waters are considered potential drinking water sources unless TDS is greater than 3000 ppm or a well is incapable of supplying 200 gpd.

    Reference to Class IIIB description of groundwater at TI is invalid. See comment 12.

19. Page 4-15: The San Francisco Bay Basin Plan is a State ARAR. State Water Resources Control Board Resolution 88-63 is a State ARAR.

20. Page 4-15,3rd Paragraph: RWQCB staff does not allow for dilution of contaminants into surface water. Although factors may be needed to allow for the reduction or attenuation of the concentration of contaminants as they migrate through the saturated zone, the factors must be established through a technical discussion with site specific data. See comment 3.

21. Page 4-16 Top of Page: The Marshak document was misused. The attenuation factor of 10 is invalid. See comment 3.

22. Page 4-16, Top of Page: The additional attenuation factor of 10 being assumed for mixing with surface water is unacceptable. The RWQCB staff does not allow for dilution (reduction) by a factor of 10 of the contaminants.

23. Page 5-1, 4th Paragraph: It was not agreed upon by CAL EPA (RWQCB and DTSC) to use the USGS paper (Shacklette and Boergner, 1984) as a starting place for eliminating inorganic analytes. It was understood by all parties involved that this survey would be used just as a reference point to compare inorganics concentrations in **native** soils at this base (e.g.

YBI). Treasure Island is fill, not native soil so comparisons made to this survey to eliminate inorganic analyses is unsupported. Ambient levels for NAVSTA TI can be established by collecting soil data at Treasure Island from areas not impacted by base operations. Background levels can be established at YBI by collecting soil data at YBI from areas not impacted by base operations.

24. Page 5-2 Top of Page: Please elaborate on the statement "that an ambient survey for the Bay Area would not be more useful than a national survey".

25. Page 5-5, Recommendations: Continuous monitoring of the groundwater should be conducted while the source is still present in the fill. Once the source is removed, one year of quarterly monitoring may be necessary conducted to confirm no impact to groundwater.

    What are the data results from soil boring 01-SB03, it is not presented on Figure 4?

26. Page 5-7, Recommendations: Were soil samples taken around the asphalt pad, to assess any surface water runoff impacts? What is the history of this asphalt pad? Has it always been there, especially when transformers where stored and repaired at this site? If the history of the asphalt pad is unclear, a groundwater sample may be needed to confirm no impact to groundwater.

27. Page 5-11, Recommendations: Concentrations of PAHs found in soil are high enough to have an impact on groundwater. The monitoring wells here should be part of a quarterly monitoring program.

28. Site 06, Recommendations: Dioxins should be analyzed at Site 6 during the Phase II RI. Dioxins are common analytes at fire training sites.

29. Page 5-19, 2nd Paragraph: The statement that no ARARs exist for the soil is inaccurate. ARARs are chemical-, location-, and action-specific. The correct manner in which to state this is there are no chemical-specific ARARs for soil.

30. Page 5-23, Site 08: Why is groundwater anticipated to be at 60 bgs? The groundwater at site 8 might be impacted by the contaminated sludge disposal area, this should be investigated as part of the Phase II RI.

    Why was soil boring SB07 terminated at 5 feet, according to the boring logs refusal was not encountered?

31. Page 5-25, Top of Page: The reasoning is unclear as to why

the cadmium concentrations from the 1991 Site Inspection would be used in determining extent? What were the QA/QC for these samples? Please elaborate.

32. Page 5-25, 2nd Paragraph: This site poses an ecological threat not only through soil contamination, but also by sediment contamination.

33. Page 5-27, Recommendations: The statement is made "that there are no ecological receptors at this site". Is this based on an actual site visit/field verification. And if so, how many times was the site field verified to substantiate that there are no ecological receptors.

    The stormwater runoff from this site exceeds San Francisco Bay Basin Plan values and directly impacts aquatic life (receptors in the Bay).

34. Page 5-30, Recommendations: TPH-Diesel was detected right above the water table. The groundwater should be analyzed to determine if there is any impact. The groundwater at this site most likely comes in contact with Bay waters, therefore the potential ecological receptors are aquatic.

35. Page 5-40, 3rd Paragraph: Although there are no water quality criteria for the explosive analyte PETN, the one groundwater sample containing the explosive analyte PETN is an indication of impact to groundwater. Because this site is used for residential purposes, additional investigation is warranted to determine nature and extent in soil and in groundwater and to identify the sources.

36. Page 5-47, Stormwater Screening Values: It is true that many of the sources of pollutants involve natural systems and natural phenomena, and many involve inadvertent spills and leaks. Treasure Island is unique in that past and present hazardous and non-hazardous waste activities also contribute to the contaminants found in the stormwater runoff.

37. Page 5-49, 1st Paragraph: The quality of the stormwater collected from Treasure Island's outfalls represent a combination of impact from naval operations and typical urban runoff. How would general bay pollution related to various industrial activities around the bay be the cause of the contaminated stormwater at NAVSTA TI?

38. Page 5-53, 5th Paragraph: The groundwater at this site is above AWQC and it most likely comes in contact with Bay waters, therefore the potential ecological receptors are aquatic.

39. Page 5-54, Top of Page: The statement in the text "None of the

organic or inorganic constituent concentrations detected in the groundwater samples exceeded potential TBC" is false. Benzene was detected at 2400 ppb and the human health value in AQWC is 21 ppb.

40. Page 5-56, 3rd Paragraph: The groundwater should be analyzed for SVOCs to determine if there is any impact. Because the site is in such close proximity to the Bay, there most likely is contact between the groundwater and the Bay. Thereby making the ecological receptors aquatic.

41. Page 5-65, Recommendations: This site should participate in a quarterly groundwater monitoring program to confirm that groundwater has not been impacted at this site or from any other sites.

42. Page 5-67, 2nd Paragraph: Although no habitat exists at this site, the contaminated sediments from this site pose a potential ecological risk to benthic organisms and aquatic receptors in the Bay.

43. Page 5-72, 4th Paragraph: This site should participate in a quarterly groundwater monitoring programs to confirm that groundwater has not been impacted at this site or from any other sites.

    Concentrations of BTEX need to be reported individually and compared with TBCs individually to determine exceedance or not of water quality criteria.

44. Page 5-80, 2nd Paragraph: Although no habitat exists at this site, the contaminated groundwater poses a potential ecological risk to aquatic receptors in the Bay.

45. Page 6-8, Exposure Analysis: If the San Francisco Bay ecosystem is considered an aquatic habitat (page 6-7, 2nd Paragraph) why was the pathway of contaminants via groundwater to aquatic receptors not analyzed?

46. Page 6-8, 5th Paragraph: Although, some sites have some degree of artificial covers, alkaline soil, and artificial fill materials the sites should be field verified before being classified as ecologically insignificant and excluded.

47. Page 6-10, 6th Paragraph: The statement that "No endangered species have been documented on TI" is misleading. According to the Draft Ecological Risk Assessment, dated 11/15/93, page 38, there are three species of birds classified as rare and endangered by both the state and federal governments known to occur in the Bay Area and have historically been reported to intermittently forage or roost at NAVSTA TI. These species include the peregrine falcon, California least tern, and

California brown pelican.

48. Page 7-50, Stormwater: Stormwater is the major pathway for transportation of contaminants from IR sites to the Bay; therefore investigation of the stormwater must be done under the IR Program. Stormwater data collected under the IR program can be used to comply with the NPDES monitoring program.

49. Page 8-8, Quarterly Groundwater Monitoring: Prior to initiation of the routine groundwater monitoring, a monitoring plan must be submitted and approved.

50. Table 15/16: The San Francisco Bay Basin Plan is an ARAR.

51. Table 16: Attenuation factors unacceptable. See comment 3.

52. Table 19: The following are additional State ARARs:

CHEMICAL-SPECIFIC POTENTIAL STATE ARARs	
Requirements	Comments
Porter-Cologne Water Quality Control Act (Water Code), Section 13304	This section of the Water Code is applicable and authorizes the Regional Boards to require cleanup and abatement of discharges of waste into waters of the state or discharges to land that have or threaten to result in discharges to waters of the state. The goal of Section 13304 is to attain background for the cleanups, since Treasure Island is fill (background cannot be attained), the cleanup level must at least protect the beneficial uses of the water and comply with the plans and policies of the State and Regional Water Boards.

Requirements	Comments
Water Quality Control Plan for the Regional Water Quality Control Board, San Francisco Bay Region (Water Code § 13240)	The Basin Plan describes the water basins in the Region, established beneficial uses of the ground and surface waters, establishes water quality objectives including narrative and numerical standards, establishes implementation plans to meet water quality objectives and protect beneficial uses, and incorporates statewide water quality control plans and policies.

ACTION-SPECIFIC POTENTIAL STATE ARARs	
Requirements	Comments
Porter-Cologne Water Quality Act as administered by the State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Boards (RWQCB)	Porter-Cologne delegates standard-setting authority to the RWQCBs. RWQCB emission standards are set on a case-by-case basis and apply to the treated waste- water to be injected.
State Water Resources Control Board Resolution No. 88-63	Defines all ground and surface waters of the state as potential drinking water sources unless the total dissolved solids are greater than 3000 ppm or the well yield is less than 200 gpd from a single well.
Porter-Cologne Water Quality Act (WCA 13000 13806) as administered by the SWRCB and the RWQCB	Regulations pertain to land disposal unit design and construction standards that minimize dangers to the water of the state. Waste are classified as hazardous, designated, or non-hazardous, and must be disposed of accordingly. Regulations regarding water quality protection standards are left to the RWQCB. Standards are determined by RWQCBs on a case-by-case basis based on federal water quality standards and state action levels.

Requirements	Comments
California Water Code, Division 7, Section 13000 to 13806 (Porter -Cologne Water Quality Control Act)	The Water Code authorizes the State and Regional Boards to establish Water Quality Control Plans beneficial uses and numerical and narrative standards to protect both the surface and ground water quality. Authorizes Regional Water Boards to issue permits for discharges to land or surface or ground water that could affect water quality, including NPDES permits, and to take enforcement action to protect water quality.
State Board Resolution No. 68-16 (Policy on Maintaining the High Quality of State Waters) (Water Code § 13140, Clean Water Act regulations 40 CFR § 131.12)	Resolution No. 68-16 (anti-degradation policy) has been incorporated into all Regional Board Basin Plans. Requires that quality of waters of the State that is better than needed to protect all beneficial uses be maintained. Requires cleanup to background water quality or to lowest concentrations technically and economically feasible to achieve. Beneficial uses must, at least, be protected.
Title 23, Division 3, Chapter 15 of the California Code of Regulations (CCR) (Chapter 15)	Regulations pertaining to waste discharges to land which may threaten water quality. Also this Chapter establishes water quality protection standards including concentration limits for constituents of concern at background levels. Cleanup levels greater than background may only be approved if background is not economically or technically achievable. Cleanup levels above background must meet its applicable water quality standards, must be the lowest level technologically and economically achievable, and must consider toxicologic effects of pollutants

Requirements	Comments
State Water Resources Control Board Resolution No. 92-49 (Policies and Procedures for Investigation and Cleanup and Abatement of Discharges under Water Code Section 13304) (Water Code § 13307)	Resolution 92-49 establishes policies and procedures for the oversight of investigations and cleanup and abatement activities resulting from discharges of waste which affect or threaten water quality.
Water Quality Control Plan for the Regional Water Quality Control Board, San Francisco Bay Region (Water Code § 13240)	The Basin Plan describes the water basins in the Region, established beneficial uses of the ground and surface waters, establishes water quality objectives including narrative and numerical standards, establishes implementation plans to meet water quality objectives and protect beneficial uses, and incorporates statewide water quality control plans and policies.

53. Table 31: The sites should be field verified to confirm the statement " No Habitat present".

54. Table 34: San Francisco Bay Basin Plan's value for Copper should be changed from 2.9 ppb to 4.9 ppb.

55. Table 35: The TBC values are misrepresented the 100 attenuation factor was not been based on site-specific data and the guidance was not used properly. See comment 3.

56. Appendix F, Page F-2: Are there any records to verify the fill came from bay sediments or to verify the origin of the fill?

57. Appendix F: The literature selected to not derive ambient concentration of inorganics for NAVSTA TI, is adequate. The data in this literature is to broad in scope, it describes the Western United States. Was any of the data reported in this paper from areas around San Francisco Bay?

per Gina Katherine Phone message 12:34 pm 2/9/94 BMG

Ambient levels can be established through a statistical analysis of the soil data at the base. The data gathered for the statistical analysis should be taken from areas not impacted by past or present base operations.

Yerba Buena Island contains naturally occurring soil; therefore background values can be developed for this site.

Background values can be established for Yerba Buena Island by obtaining soil data from areas not impacted by base operations.

ATTACHMENT I

STATE AND REGIONAL WATER BOARD ARARS

This chart provides a summary of the statutes, regulations, plans, and policies that are the source of State and Regional Water Board requirements that are applicable or relevant and appropriate or to-be-to considered at CERCLA sites. The first column states the name and citation of the requirement. The second column provides a description of the requirement. The third column should be used to state whether the requirement is (1) applicable, (2) relevant and appropriate, or (3) to-be-considered. This column should be used for other comments, including, if unclear, why the requirement is an ARAR or TBC. These generic ARARs should be used to identify chemical-specific, location-specific, and action-specific ARARs at the appropriate stage of the investigation. Not each requirement listed in the first column will be an ARAR for every site. When providing ARARs, list only those that are ARARs for the site. For example, the Aboveground Petroleum Storage Act is not an ARAR where there are no aboveground tanks at a site.

PAGE 1

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FOR ADDITIONAL INFORMATION, CONTACT:

DIANE C. SILVA, COMMAND RECORDS MANAGER, CODE EV33
NAVAL FACILITIES ENGINEERING COMMAND, SOUTHWEST
1220 PACIFIC HIGHWAY (NBSD BLDG. 3519)
SAN DIEGO, CA 92132

TELEPHONE: (619) 556-1280
E-MAIL: diane.silva@navy.mil

CITATION	DESCRIPTION	COMMENTS
	incorporates statewide water quality control plans and policies. (In designating ARARs, cite all applicable uses, objectives, and implementation program elements for the site.)	
Water Quality Control Plan for Inland Surface Waters of California (Water Code §13170; Clean Water Act §303(c)(1))	In compliance with the Water Code and the Clean Water Act, the State Water Board adopted the Inland Surface Waters Plan, which establishes numerical water quality objectives for the protection of human health and freshwater aquatic life for a large number of toxic pollutants. It also establishes narrative objectives and toxicity objectives. The plan provides a program of implementation and specifies proposals to adopt numerical standards for water bodies that are reclaimed water dominated and agricultural drainage dominated.	
Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California (Thermal Plan) (Water Code §§13140, 13142.5)	The Thermal Plan establishes prohibitions on discharges to cold interstate waters and maximum temperature changes to other waters to protect natural receiving water temperatures. The plan includes site specific temperature objectives for certain water bodies.	
Water Quality Control Plan for Ocean Water of California (California Ocean Plan) (Water Code §13170.2)	The Ocean Plan establishes beneficial uses of ocean waters, numerical and narrative water quality objectives, effluent quality objectives including toxic material limitations, and discharge prohibitions.	
Water Quality Control Plan for the Enclosed Bays and Estuaries of California (Water Code §13140)	The Enclosed Bays and Estuaries Plan establishes numerical water quality objectives for the protection of human health and aquatic life, effluent quality requirements and prohibitions that apply to disposal of waste to enclosed bays and estuaries.	

PAGE 3

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DIANE C. SILVA, COMMAND RECORDS MANAGER, CODE EV33
NAVAL FACILITIES ENGINEERING COMMAND, SOUTHWEST
1220 PACIFIC HIGHWAY (NBSD BLDG. 3519)
SAN DIEGO, CA 92132

TELEPHONE: (619) 556-1280
E-MAIL: diane.silva@navy.mil

CI[illegible]ION	DESCRIPTION	COMMENTS
	abatement to conform to Resolution 68-16, water quality control plans and policies, and applicable provisions of Title 23 California Code of Regulations, Division 3, Chapter 15 (discharges of waste to land) as feasible.	
Title 23 California Code of Regulations, Division 3, Chapter 15 (Discharges of waste to land)	Chapter 15 regulates the siting, design, construction, operation, closure, and monitoring (including corrective action) of waste discharges to land for treatment, storage, or disposal, including landfills, surface impoundments, waste piles, and land treatment facilities. Wastes regulated include "hazardous waste," "designated waste," "nonhazardous solid waste", and "inert waste".	
Title 23 California Code of Regulations, Division 3, Chapter 15, Article 5	Article 5 contains monitoring requirements for waste management units and establishes water quality protection standards for corrective action including concentration limits for constituents of concern at background levels unless infeasible to achieve. Cleanup levels greater than background must meet all applicable water quality standards, must be the lowest levels technologically and economically achievable, must consider exposure via other media, and must consider combined toxicologic effects of pollutants.	
Title 23 California Code of Regulations, Division 3, Chapter 16, (Underground tank regulations)	Chapter 16 regulates permitting and testing of underground tanks and specifies requirements for corrective action of discharges from tanks.	
Toxic Pits Cleanup Act, California Health and Safety Code §§25208, et seq.	TPCA authorizes the Regional Water Boards to regulate surface impoundments containing hazardous waste as defined in Title 22, California Code of Regulations, prohibits discharges to such surface impoundments unless they meet specified siting and design	

SR

PAGE 5

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EXTENSIVE RESEARCH WAS PERFORMED BY NAVFAC SOUTHWEST RECORDS OFFICE TO LOCATE THE MISSING PAGE. THIS PAGE HAS BEEN INSERTED AS A PLACEHOLDER AND WILL BE REPLACED SHOULD THE MISSING ITEM BE LOCATED.

FOR ADDITIONAL INFORMATION, CONTACT:

DIANE C. SILVA, COMMAND RECORDS MANAGER, CODE EV33
NAVAL FACILITIES ENGINEERING COMMAND, SOUTHWEST
1220 PACIFIC HIGHWAY (NBSD BLDG. 3519)
SAN DIEGO, CA 92132

TELEPHONE: (619) 556-1280
E-MAIL: diane.silva@navy.mil

CITATION	DESCRIPTION	COMMENTS
42 United States Code §300f (Safe Drinking Water Act) 40 Code of Federal Regulations Part 141 (National Primary Drinking Water Regulations)	SDWA establishes standards for current and potential drinking water supplies by setting Maximum Contaminant Levels (MCLs) and non-zero Maximum Contaminant Level Goals (MCLGs).	

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
San Francisco Bay Region

Internal Memo

TO: Shin-Roei Lee, DoD Section Leader

FROM: Gina Kathuria, Project Manager, (510) 286-4267

DATE: February 1, 1994

SUBJECT: COMMENTS ON NAVAL STATION TREASURE ISLAND DRAFT ECOLOGICAL RISK ASSESSMENT, DATED 11/15/93

GENERAL COMMENTS:

1. Although literature research was conducted for the qualitative phase of the NAVSTA TI ecological risk assessment, more site-specific data is needed to complete the qualitative phase. A site walk for NAVSTA TI should be conducted to gather the site-specific data. Protocols for a site walk were discussed in a Scoping Meeting held on August 17, 1993 between Navy, PRC, DTSC, and RWQCB. Attached is the memo which describes the protocols in detail.

2. The sites must be field verified to confirm that there are no wetland or intertidal saltwater habitats at NAVSTA TI.

3. Burrowing animals should be considered when conducting this ecological risk assessment.

4. The water quality criteria values used for comparison with groundwater concentrations were multiplied by 100 (an attenuation factor). This 100 value was incorrectly derived for the following reasons.

   The first factor of 10 was apparently derived from a RWQCB guidance document entitled "The Designated Level Methodology for Waste Classification and Cleanup Level Determination", Marshak 1989. A factor of 10 was applied to attenuation of the groundwater at NAVSTA TI as it travels through the saturated zone and towards the Bay. Marshak intended to establish his methodology to analyze contaminant transport through the vadose zone to the saturated zone.

   According to Marshak's document, in situations where the water table is high an attenuation factor of (1) should be used. In other words an attenuation factor of 1 should be used for attenuation in soils at Treasure Island not groundwater.

Marshak's guidance also states that if the groundwater is already contaminated, the attenuation factor has already been exhausted.

A detailed, site-specific fate and transport analysis of contaminants within the groundwater at Treasure Island and Yerba Buena Island should be used in developing an attenuation factor for contaminant transport via groundwater.

The second factor of 10 was chosen to allow for the dilution of the groundwater and the stormwater with the surface water (Bay). The RWQCB **does not allow for dilution of contaminants**.

In conclusion, an attenuation factor for contaminant transport via groundwater should be based on a site-specific fate and transport model and the RWQCB does not allow for dilution in groundwater and stormwater.

5. Out of the three Threatened and Endangered Species associated with NAVSTA TI, only one was discussed in the ecological risk assessment, Peregrine Falcon. What is the potential ecological risk to the other two, California Least Tern and California Brown Pelican?

SPECIFIC COMMENTS:

6. Page 12, 4th Paragraph: Groundwater samples from Site 06 where taken in 1987. What is the QA/QC for these groundwater samples?

7. Page 39, 3rd Paragraph: The statement made in the text "none of the endangered species (birds) been found to **breed or forage** extensively on the islands" is contradictory to the statement "Three species of birds, classified as rare and endangered by both the state and federal governments, are known to occur in the Bay Area and have historically been reported to intermittently **forage or roost** at NAVSTA TI" (page 38, Top of Page). How will this ecological risk assessment evaluate the risk to the three rare and endangered bird species?

8. Page 42, Figure 8: Aquatic habitat should be identified on this figure.

9. Page 63, 2nd Paragraph: The statement that "TI soils are physically unable to support a rich soil invertebrate community" is unsupported. This statement can only be supported if actual measurements of the invertebrate community are taken from the soil at TI.

10. Page 62, Unsuitable Habitat: Although some sites are paved, burrowing animals could still be potential receptors. It

should be demonstrated that there are no burrowing animals at NAVSTA TI, then it can be eliminated as a pathway of concern.

11. Page 64, Figure 10/Figure 11: Air should be added to Secondary Sources.

12. Page 66, Figure 12: Another receptor should be added, burrowing animals. It should come off of the "Decaying Organic Material and Soil" box.

13. Page 70, Table 11: Just because a site has "No Habitat of concern present" , the site's contamination may have ecological receptors. Receptors such as incidental invertebrates, burrowing animals, and mobile receptors (e.g. birds, mice).

    Sites that border the bay have aquatic receptors and benthic receptors. Sites such as G1, G2, 05, 07, 08, 09, 10, 11, 12, G3, 15, 16, and G4.

14. Page 72, 2nd Paragraph: The Aquatic Water Quality Criteria was modified in a manner that was not based on site-specific data. Please refer to comment 4.

15. Page 73, Inorganic Chemicals: The literature used to eliminate certain metals (aluminum, iron, and manganese) because they "occur naturally in high concentrations in soils of the western United States" is unsatisfactory. Site-specific data (e.g. background and ambient levels for both islands) is needed to support the elimination of any inorganics from the ecological risk assessment. To establish background values for YBI and ambient levels for TI, please refer to the RWQCB staff's comments on the NAVSTA TI Draft Phase I RI Report,Comment 57.

16. Page 103, 4th Paragraph: Again, the statement "that the burrowing mammals occur upgrade of the IR sites and do not come into direct contact with the contaminated soils at YBI", must be field verified.

17. Page 109, Effects of Dilution: The San Francisco Bay RWQCB does not allow for dilution of contaminants in stormwater to surface water. See comment 4.

    The statement made that "..no ecological receptors are expected to have direct contact with the stormwater" is unsupportive. This statement cannot be proven and is simply an assumption. The receptors are both benthic and aquatic life, contaminated stormwater from NAVSTA TI threatens the aquatic life and benthic organisms in San Francisco Bay.

18. Page 116, 3rd Paragraph: Burrowing animals at TI do have

direct exposure to the soil. The non-existence of burrowing animals on TI, must be field verified.

MEMORANDUM

TO: DOD/DOE AND SUPERFUND RPMS
FROM: BMS
RE: PROTOCOLS FOR SITE WALK REQUIREMENT FOR ECOLOGICAL ASSESSMENTS

The purpose of the Site Walk is to provide qualitative information on habitats, dominant and sensitive biota, potential pathways, and contaminants-of-concern for Phase I of the Ecological Assessment. The Ecological Assessment is an integral part of the Remedial Investigation process and is a requirement for investigation and cleanup under the CERCLA process. The results of the Site Walk will help focus later Phases of the Ecological Assessment, should these become necessary. The Site Walk is considered part of the facility-wide assessment. Please note that this approach does not use the "Hazard Quotient Method" to evaluate potential adverse ecological effects.

It is necessity to have close coordination among regulatory agencies, trustee agencies, and the PRP (DOD/DOE facility) in the form of "Scoping Meetings" for site-specific modifications of the Protocols, including the "Site Walk". It is important to note that the facility has federal resource trustee responsibilities under CERCLA and is required to coordinate with the State trustees whether or not the federal facility is listed on the National Priorities List (NPL). The workplan for the Site Walk should be developed within the context of a scoping meeting with regulatory and trustee agencies and the minutes of that meeting may serve as the Site Walk portion of the workplan document. This consensus approach may be used to accelerate the workplan development and review process.

The level-of-effort criterion should be based on the assumption that the data to be collected will be sufficient to make decisions regarding the Phase I Ecological Assessment Report and to decide whether and how to move on to the quantitative Phase II Ecological Assessment Workplan.

Definitions:

"Protocols" -- minimum requirements for data collection and presentation for the Phase I, Qualitative Ecological Risk Assessment portion of a remedial investigation. This term is used to apply broadly to field investigation techniques and includes a visual inspection of the facility and sites on the facility that are under investigation ("Site Walk"). For additional information, the PRP/Facility is referred to: 1. EPA ECO-Updates (e.g., August 1992: Briefing the BTAG: Initial Description of Setting, History, and Ecology of a Site); 2. Superfund Program, Checklist for Ecological Assessment/Sampling, 26 January 1993; 3. Screening Checklist for: Ecological Assessment in the RI/FS Work Plan; 4. Screening

Checklist for: Ecological Assessment in the RI/FS Report; 5. Framework for Ecological Risk Assessment, February 1992.

"Facility" – refers to the entire base including separate holdings or commands unless there is a written agreement that defines the facility otherwise.

"Site" – refers to the areas in which contamination is suspected, or an operable unit, or some geographic subdivision of the facility.

Site Walk Protocols

MAJOR HABITAT GROUPS

The qualitative ecological risk assessment must address site-specific habitats of the following major groups and subgroups: 1. marine (estuarine) (waters and sediments); 2. terrestrial (forests, oak woodland, grasslands [Jepson prairie], vernal pools, riparian, lacustrine, palustrine, deserts, dunes, coastal chapparal, agriculture, landscape [golf courses]); transition zones (freshwater, saltwater and brackish wetlands, intertidal zone and mudflats, rivers, lakes, streams). Included in each of the major habitats should be consideration of sensitive threatened or endangered and migratory species. Sensitive species should be assumed to be present if suitable habitat exists, until demonstrated otherwise. However, consideration of just the sensitive species does not constitute a complete ecological assessment. Presented below are minimum data and data presentation requirements for a Phase I, Qualitative Ecological Assessment.

1. **Marine (estuarine) Habitats "Site Walk" Requirements**

a. Both water and sediments should be assessed. Assessment of the media includes published information about species that inhabit each medium (species lists), likely seasonal occurrence, food web information, etc.

b. Wet season and dry season sampling of each medium to determine local presence of ecological receptors. Both plant (micro- and macroalgae) and animal species should be sampled. Site-specific variations on seasonal sampling may be appropriate.

c. The decision about the level-of-effort requirements for trapping of fishes and other mobile ecological receptors should be made in coordination with regulatory and resource agency representatives in a Site Walk scoping meeting.

d. Who should participate: a State or federal agency representative. The following persons and areas of expertise are available to the facilities:

Denise Klimas, NOAA: (access to expertise in fish taxonomy, benthic community

structure analysis, anadromous fishes, marine mammals)

Michael Martin, California Department of Fish & Game: California fisheries and game resources (access to expertise in fish taxonomy, endangered species, benthic community structure, migratory birds).

Barbara Smith, SFRWQCB: algal taxonomy.

e. Notification: facilities should notify the State and/or federal RPMs and Trustee Agencies. Coordination with regulatory and trustee agencies should take place before finalization of the schedules for the Site Walk.

2. **Terrestrial Habitats Site Walk Requirements**

a. Both wet and dry seasons should be assessed. Where ecologic receptors are seasonally present in the habitat (migratory species, seasonal plants), the appropriate season should be assessed. The rationale for the timing of the site walk should be explained in the narrative for the Ecological Assessment.

b. A minimum of three time periods should be assessed: 1. dawn to 0900; 2. mid-morning; 3. sunset to evening.

c. The decision about sampling design (whether to perform the assessment on a grid versus transect and perimeter basis) should be made in coordination with regulatory and resource agency representatives in a Site Walk scoping meeting.

d. Who should participate: a State or federal agency representative. The following persons and areas of expertise are available to the facilities:

Roxy Barnett, USEPA: birds, mammals (access to other expertise including terrestrial plants).

Clarence Callahan, USEPA: terrestrial invertebrates.

James Haas, U.S. Fish and Wildlife Service: birds, plants, mammals, (access to herpetologist and endangered species expertise).

Michael Martin, Cal Fish & Game: (access to expertise in endangered species and California resources)

e. Notification: facilities should notify the State and/or federal RPMs and Trustee Agencies. Coordination with regulatory and trustee agencies should take place before finalization of the schedules for the Site Walk.

3. Transition Zone Habitats Site Walk Requirements

a. Each of the following types of transition zones should be assessed: marine (salt) marsh, mud flats; estuarine (brackish) marsh; riverine, palustrine, lacustrine, fresh water marsh.

b. Both water and sediments should be assessed. Assessment of the media includes published information about species that inhabit each medium (species lists), likely seasonal occurrence, food web information, etc.

c. Both wet and dry seasons should be assessed. Where ecologic receptors are seasonally present in the habitat (migratory species, seasonal plants), the appropriate season should be assessed. The reasons for the timing of the site walk should be explained in the narrative for the Ecological Assessment.

d. A minimum of three time periods should be assessed: 1. dawn to 0900; 2. mid-morning; 3. sunset to evening.

e. The decision about sampling design (whether to perform the assessment on a grid versus transect and perimeter basis) should be made in coordination with regulatory and resource agency representatives in a Site Walk scoping meeting.

f. Who should participate: a State or federal agency representative. The following persons and areas of expertise are available to the facilities:

Roxy Barnett, USEPA: birds, mammals (access to other expertise including wetlands plants).

James Haas, U.S. Fish and Wildlife Service: birds, plants, mammals, (access to herpetologist and endangered species expertise).

Denise Klimas, NOAA: (access to expertise in fish taxonomy, benthic community structure analysis, anadromous fishes, marine mammals)

Michael Martin, California Department of Fish & Game: California fisheries and game resources (access to expertise in fish taxonomy, endangered species, benthic community structure, migratory birds)

Barbara Smith, SFRWQCB: wetlands plants, algal taxonomy.

Deliverables

1. MAPS

a. Facility-wide habitat map. Show all major habitat types. USGS Quad map (1:25000), qualitative (as appropriate show canopies, shrubs, dominant herbs), use existing maps.

and

b. Facility-wide land use history map. Show current and historical land use (especially landfills, waste piles, firing ranges, strafing areas, burn pits, explosives areas, hazardous waste storage areas, etc.)

or

c. An overlay or combination of "a" and "b".

and, as appropriate,

d. Site-specific habitat map. As appropriate, show individual sites. Alter scale to suit each site, habitat, and likelihood of encountering ecological receptors. For industrial sites where future land use is industrial, commercial or residential, smaller site-scale maps may not be necessary.

The scale of maps. Map scale is dependent of the habitat type and the size of the site and facility. The future land use at the facility also should be considered such that industrial sites with continuing industrial use may have larger scale maps than those where sensitive habitats and receptors in these habitats are of primary concern. The If these maps are to be used as decision tools for "no further action" at a site, they should necessarily be on a finer scale. More accurate maps (finer scale) will be required in later Phases of the Risk Assessment, whether or not "no further action" was proposed. Maps that are consistent with "National Locational Data Policies" are proposed. Existing documents such as Soil Conservation Service Maps, County Maps, facilities' "Natural Resource Management Plans", and Agricultural Outlease maps are suggested as appropriate references.

2. TABLES

a. Summary table of contaminants and range of concentrations (this will vary with facility and site and how much is known at the time of the Phase I Eco-Risk Assessment).

and

b. Current and historical land use information. This table may accompany and more fully explain the land use history map in 1.b. or 1.c.

and

c. Summary table of potential receptors including the following additional information using known species lists as a base: species name; season(s) in which it is expected to be found on the facility; presence noted during the site walk (visual sighting (photograph), tracks (photograph), nest (photograph), call, scat, etc.); nocturnal or diurnal in habit.

3. DATA

a. Copies of data logs used during site walk to generate tables.

b. Copies of photographs used to document presence of ecologic receptors.

4. DATA ANALYSIS FOR PHASE I

a. Preliminary list of potential receptors

b. Preliminary list of potential pathways

c. Qualitative understanding of facility-specific habitats

d. Preliminary list of assessment endpoints

e. Preliminary list of measurement endpoints

f. Preliminary conceptual site model

g. Proposed hypotheses

h. Proposed data quality objectives

i. Proposed Phase II Work Plan, as appropriate

5. REFERENCES

The following list of references is provided so that techniques can be standardized and data may be comparable within and between facilities. Descriptions/designations provided in the facilities' Natural Resource Management Plans may need to be modified in accordance with the references presented below (e.g., U.S. Army Corps of Engineers wetland delineations may not be exactly the same as those using the Fish and Wildlife Service). The need for such modifications will be determined in coordination with the

resource trustees.

a. Terrestrial habitats
Mayer K.E. and Raudenslayer W.F., eds. 1988. A guide to wildlife habitats of California. California Department of Forestry and Fire Protection.

b. Aquatic and transitional habitats
Cowardin P.M., Carter V., Golet F.C., and La Rue E.T. 1979. Classification of wetlands and deep water habitats of the United States. U.S. Fish and Wildlife Service Office of Biological Services (FWS/OBS-79/31).

BACKGROUND METAL CONCENTRATIONS IN SOILS IN NORTHERN SANTA CLARA COUNTY, CALIFORNIA

M.S. Thesis at the University of San Francisco
Environmental Management Program

December 1991

Christina Marie Scott

Environmental Project Manager
Lockheed Missiles and Space Co.
Sunnyvale, CA
(408) 524-6435

Objective: Document variability - determine background

XEROX TELECOPIER 295 : 5- 7-93; 3:31 PM; 510 887 4218 → 5105403738 ; # 2

101 and 201

Total metals

ABSTRACT

BACKGROUND METAL CONCENTRATIONS IN SOILS IN NORTHERN SANTA CLARA COUNTY, CALIFORNIA

Soil analytical data were evaluated to determine the natural background levels of selected metals in an area of northern Santa Clara County, California. The metals of interest are those designated by the U.S. Environmental Protection Agency as priority pollutants: silver, arsenic, beryllium, cadmium, chromium, copper, mercury, nickel, lead, antimony, selenium, thallium and zinc. The soil data used in this study were obtained from pre-existing reports for various environmental investigations. Results from over 150 samples were entered into a database for calculation of the average, standard deviation and range of concentration for each metal. Background metal concentrations (in milligrams per kilogram) were found to be: arsenic 0.2 to 5.5; beryllium 0.3 to 1.4; chromium 30.5 to 72; copper 23.8 to 47.5; nickel 46.4 to 101; lead 6.8 to 16.1; and zinc 47.7 to 82.8. Background concentrations were not determined in six cases where the metal was not present in at least fifty percent of the soil samples at a concentration above the analytical detection level. The background metal concentrations in the study area were compared to the range of concentrations reported by the U.S. Geological Survey in a nation-wide study and found to be within the low end of those ranges.

Used site w history of no previous contamination

XEROX TELECOPIER 295 : 5- 7-93; 3:32 PM; 510 887 4218 → 5105403738 ; # 3
MAY 07 '93 02:58PM FORENSIC ANALYTICAL P.3/9

Table 1 - Analytical Data for Soil Samples

Sample ID	Depth (ft)	Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Tl	Zn
Redlen R-10	.5	3.2	<4.0	0.58	<0.4	59	26	<0.25	58	12	3.7	<4.0	<0.5	53
Canonia 1-1	9-10	<0.5	1.2	<0.25	<0.25	35	39	<0.1	124	14	<5	0.34	2.5	72
1-1	29-30	<0.5	20	<0.25	<0.25	170	53	<0.1	136	11	<5	<0.25	3.1	74
1-3	4-5	<0.5	0.8	<0.25	<0.25	58	40	<0.1	122	15	<5	0.36	1.7	76
1-6	34-35	<0.5	1.8	<0.25	<0.25	33	28	<0.1	81	12	<5	0.26	1.7	56
1-7	24-25	<0.5	3.4	0.25	<0.25	74	44	<0.1	130	16	<5	<0.25	3.4	76
1-9	24-25	<0.5	2.4	<0.25	<0.25	45	34	<0.1	83	12	<5	<0.25	0.6	61
1-10	14-15	<0.5	1.4	<0.25	<0.25	67	51	<0.1	93	20	<5	2.6	<0.5	89
1-11	4-5	<0.5	1	<0.25	<0.25	63	40	<0.1	98	16	<5	<0.25	1.1	68
1-13	4-5	<0.5	3.2	<0.25	<0.25	59	43	<0.1	106	20	<5	<0.25	0.9	66
1-13	9-10	<0.5	0.8	<0.25	<0.25	24	46	<0.1	80	18	<5	<0.25	0.8	76
1-13	34-35	<0.5	1.4	<0.25	<0.25	50	42	<0.1	92	17	<5	<0.25	<0.5	70
HS-7	4-5	<0.5	2.9	0.32	<0.25	64	37	<0.1	67	16	<1.0	<0.25	<0.5	70
HS-7	5-6.5	<0.5	11.1	<0.25	<0.25	90	43	<0.1	101	22	<1.0	<0.25	1.6	79
HS-8	4-5	<0.5	7.9	0.28	<0.25	102	66	<0.1	110	23	<1.0	<0.25	<0.5	120
HS-8	5-6.5	<0.5	3.9	0.3	<0.25	78	62	<0.1	90	16	1	<0.25	<0.5	79
HS-9	4-5	<0.5	6.7	0.33	<0.25	69	50	<0.1	92	19	<1.0	<0.25	<0.5	87
HS-9	5-6.5	<0.5	8	<0.25	<0.25	104	52	<0.1	110	17	1.1	1.2	<0.5	84
4-2	1.5-3	<0.5	<0.5	0.62	<0.25	26	21	<0.1	24	19	<1.0	<0.25	0.6	37
4-2	8.5-10	<0.5	7.9	<0.25	<0.25	80	50	<0.1	76	17	<1.0	<0.25	<0.5	74
4-3	1.5-3	<0.5	<0.5	0.47	<0.25	28	21	<0.1	32	19	<0.1	<0.25	0.6	33
4-5	1.5-3	<0.5	0.6	0.64	<0.25	28	20	<0.1	32	23	<0.1	<0.25	0.6	31
4-6	1.5-3	<0.5	1.4	0.52	<0.25	40	22	<0.1	51	20	<1.0	<0.25	<0.5	42
4-9	1.5-3	<0.5	2.8	0.27	<0.25	44	30	<0.1	70	22	<1.0	<0.25	<0.5	56
4-14	1.5-3	<0.5	1.5	<0.25	<0.25	50	29	<0.1	65	15	<1.0	<0.25	<0.5	56
4-14	8.5-10	<0.5	2.3	<0.25	<0.25	93	46	<0.1	104	18	1.3	<0.25	2.5	90
9-3.2	9-10	<0.5	1.5	<0.25	<0.25	68	48	<0.1	140	15	<1.0	<0.25	1	84
9-3.2	37-38	0.8	0.7	<0.25	<0.25	44	39	<0.1	106	12	<1.0	<0.25	<0.5	72
9-14	1.5-3	<0.5	4.9	1.37	<0.25	63	44	<0.1	85	3.9	3.2	<0.25	1.4	58
9-14	3.5-5	<0.5	4.7	1.03	<0.25	71	53	<0.1	94	4.7	3.2	<0.25	2.4	67
9-18	1.5-3	<0.5	3.5	0.89	<0.25	62	38	<0.1	92	13.5	4.3	<0.25	<0.5	63

Table 1 - Analytical Data for Soil Samples

Sample ID	Depth (ft)	Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Tl	Zn
HS-10	4-5	<0.5	4.2	0.25	<0.25	76	48	<0.1	85	20	<1.0	<0.25	<0.5	89
HS-10	5-6	<0.5	3.9	<0.25	<0.25	94	48	<0.1	110	17	1	<0.25	0.7	84
HS-6	4-5	<0.5	2.4	<0.25	<0.25	33	29	<0.1	53	7.3	<1.0	<0.25	<0.5	54
HS-6	5-6.5	<0.5	0.9	<0.25	<0.25	<0.5	14	<0.1	49	<2.5	<1.0	<0.25	<0.5	48
19-2	9-10	0.6	1.3	<0.25	<0.25	36	24	<0.1	68	9.2	2.4	<0.25	1	48
19-2	39-40	<0.5	0.8	<0.25	<0.25	21	22	<0.1	60	9	3.2	<0.25	1.9	43
19-3	9-10	0.8	1.7	<0.25	<0.25	42	42	<0.1	98	14.8	3.3	<0.25	3	81
19-4	19-20	<0.5	1.6	<0.25	<0.25	38	28	<0.1	68	9.5	1.6	<0.25	1.3	65
19-4	39-40	<0.5	2.4	<0.25	<0.25	33	38	<0.1	106	12	2.4	<0.25	1.9	70
19-6	9-10	1	2.5	<0.25	<0.25	45	35	<0.1	84	11.8	1.8	<0.25	1.2	71
19-9	9-10	0.6	1.1	<0.25	<0.25	50	43	<0.1	90	14.8	1.8	<0.25	2.7	81
19-9	14-15	<0.5	2.6	<0.25	<0.25	40	42	<0.1	66	7.8	2.4	0.38	3.2	68
19-9	39-40	<0.5	2.3	<0.25	<0.25	43	33	<0.1	80	11	2	<0.25	1.1	66
HS-1	4-5	<0.5	0.6	0.39	<0.25	9.5	28	<0.1	73	5.9	<1.0	<0.25	<1	94
HS-1	5-6.5	<0.5	5.7	<0.25	<0.25	47	44	<0.1	128	12	1	0.53	<1	77
19-1	34-35	<0.5	0.8	<0.25	<0.25	24	26	<0.1	63	10	8.1	<0.25	2.6	40
19-13	64-65	<0.5	1.2	<0.25	<0.25	37	34	<0.1	80	10	2.5	<0.25	2.8	49
HS-2	4-5	<0.5	4.4	<0.25	<0.25	45	46	<0.1	91	16	<1.0	0.49	<1	81
HS-2	5-6.5	<0.5	5.2	<0.25	<0.25	26	39	<0.1	136	12	1.1	<0.25	<1	70
HS-3	4-5	<0.5	2	<0.25	<0.25	17	33	0.2	59	13	1.4	2.4	<1	56
HS-3	5-6.5	<0.5	6.8	<0.25	<0.25	50	46	<0.1	130	13	1.5	0.47	<0.5	83
19-15	19-20	<0.5	1.5	<0.25	<0.25	38	35	<0.1	64	10.5	2.8	<0.25	1.2	66
HS-4	4-5	<0.5	2.1	<0.25	<0.25	16	34	<0.1	70	12	<1.0	1.46	<1	61
HS-4	5-6.5	<0.5	2.1	<0.25	<0.25	22	37	<0.1	90	10	<1.0	0.3	<1	71
19-18	34-35	<0.5	0.5	<0.25	<0.25	82	54	<0.1	118	12	2.9	<0.25	3.2	74
19-19	19-20	1.7	2.5	<0.25	<0.25	40	34	<0.1	66	8.8	2.3	<0.25	2.2	70
19-20	9-10	<0.5	2.1	<0.25	<0.25	31	42	<0.1	102	13	4.4	<0.25	1.3	81
19-20	34-35	<0.5	0.6	<0.25	<0.25	47	34	<0.1	82	11	1.6	<0.25	2.5	63
HS-5	4-5	<0.5	0.8	<0.25	<0.25	11	32	<0.1	23	3.9	<1.0	<0.25	<0.5	56
HS-5	5-6.5	<0.5	2	<0.25	<0.25	34	40	<0.1	68	8.9	<1.0	<0.25	<0.5	68
19-23	4-5	0.6	1.9	<0.25	<0.25	48	36	<0.1	94	12.5	2.9	<0.25	1.3	72

Table 1 - Analytical Data for Soil Samples

Sample ID	Depth (ft)	Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Tl	Zn
19-30	8.5-10	<0.5	0.6	<0.25	<0.25	84	44	<0.1	120	17	1.3	<0.25	<0.5	79
19-30	28.5-30	<0.5	<0.5	<0.25	<0.25	62	49	<0.1	130	15	2.9	<0.25	<0.5	84
19-33	13.5-15	<0.5	<0.5	0.27	<0.25	47	57	<0.1	134	20	2.0	<0.25	<0.5	110
19-33	33.5-35	<0.5	1.1	<0.25	<0.25	72	60	<0.1	145	12	2.3	<0.25	<0.5	80
HLA-350E-2		<0.2	3.4	1.6	<1.0	56	37	<0.5	70	10	2.2	<0.3	<0.2	71
3		<0.2	2.6	1.3	<1.0	63	37	0.1	73	7	1.9	<0.3	<0.2	69
4		<0.2	2.5	1.3	<1.0	58	42	0.15	59	<3.0	1.6	<0.3	<0.2	73
5		<0.2	0.6	1.4	<1.0	58	37	0.1	64	9	2	<0.3	<0.2	69
6		<0.2	3.2	1.3	<1.0	63	37	0.1	65	12	2.2	<0.3	<0.2	74
HLA-415M-1		<0.2	2.3	1.1	<1	52	43	<0.05	60	13	0.6	<0.3	<0.2	69
2		<0.2	2.2	1.2	<1	55	37	<0.05	67	17	0.8	<0.3	<0.2	67
3		<0.2	2.3	1.2	<1	50	34	0.1	57	19	0.8	<0.3	<0.2	71
HLA-MM-1	.5	0.3	5.6	0.7	4	56	44	0.1	41	45		<0.3	<0.2	100
2	.5	0.8	6.3	0.8	4	60	47	0.1	47	48		<0.3	<0.2	110
HLA-MWW18-1		<0.2	5.9	0.9	<1	62	49	0.15	52	49		<0.3	<0.2	100
2		0.4	11	1.2	3	72	54	1.3	58	54		<0.3	<0.2	110
NGC	2-5	0.56	4.4	0.39	6.5	62	35	0.069	56	11	<5	4	<5	73
N&E-CT-001		<0.2	0.8	<0.2	0.4	37	6.4	<0.05	9.8	4.8	<0.2	<0.2	<0.2	13
-002		<0.2	<0.2	<0.2	0.4	17	4.6	<0.05	6	3.4	<0.2	<0.2	<0.2	7.8
TRU-WB-1	8	<1	4.6	<0.2	<0.2	27	27	0.03	51	11	<10	<0.2	3	44
-1	19.5	<1	4.5	<0.2	<0.2	23	30	0.07	51	9.8	<10	<0.2	3.1	47
-10	6.5	<1	2	0.5	<0.2	36	30	0.1	70	7.9	<10	<0.2	3.8	54
-10	18.5	<1	1.4	0.4	<0.2	20	25	0.04	57	7.9	<10	<0.2	3.8	52
LMSC555-01	2-2.5	<1.0		3.2	8.7	81	33		84	9.7				79
-01	2.5-3			1.2	5.5	64	18		67	22				54
-01	5-5.5			1.1	7.3	73	32		81	10				78
-01	7-7.5	<1.0		1.3	5.9	60	27		71	14				65
-01	8.5-9			1.1	5.2	50	25		60	8.6				54
LMSC555-02	1.5-2	<1.0		2.7	8.9	78	38		75	8.9				94
-02	3.5-4			1.3	4.6	54	17		55	5.2				47
-02	5.5-6			1.4	6.4	55	30		59	6.1				68

Table 1 - Analytical Data for Soil Samples

Sample ID	Depth (ft)	Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Tl	Zn
-02	7.5-8			1.2	5.3	52	26		57	7.9				58
-02	9.5-10			1.1	5.9	59	24		57	7.1				55
LMSC587-C	5	<5.0		<0.5	7	55	28		54	<15				56
-C1	5	<5.0		0.8	14	73	36		65	<15				74
-C2	5	<5.0		<0.5	9	47	22		49	<15				55
-C3	5	<5.0		0.55	9	66	30		56	<15				72
-C4	5	<5.0		0.5	10	48	30		50	<15				63
LMSC107-C1	1.5-2	<5.0		0.5	<2.5	43	23		46	<15				43
-C1	1.5-2	<5.0		0.55	2.5	53	23		57	<15				46
-C2	1.5-2	<5.0		0.65	3.7	46	26		49	<15				57
-C3	1.5-2	<5.0		0.65	3	51	27		51	<15				111
-C4	1.5-2	<5.0		<0.5	6.5	50	16		30	<15				35
LMSC076-02C	6	<5.0		<0.5	0.5	50	26		55	<15				86
-14C	0.5	<5.0		0.3	<2.5	55	8		54	<15				55
LMSC196-C	10-10.5	<5.0		0.5	4	81	32.5		60.5	<15				49.5
-C1	10.5-11	<5.0		<0.5	<2.5	41	14		42	<15				33
LMSC132-C4	6.5	<5.0		0.5	4	53	25		50	<15				48
-C5	11	<5.0		<0.5	3	33	18		38	<15				40
-C6	16.5	<5.0		1	<2.5	50	33		64	<15				68
-C7	18.5	<5.0		<0.5	<2.5	63	45		79	<15				87
MF-W10-6C-MD	3	<2	1.6	1.2	<1	38.4	61.7	<0.2	41.5	10.1	<12	<1	0.48	67.5
2	5	<2	1.6	1.6	<1	50.3	67	<0.2	52	8.7	7	<1	0.64	77.5
3	7	<2	2.6	1.2	<1	38.6	26.9	0.8	44.5	4.3	<11	<1	<0.38	49
4	9	<2	2.6	1.2	<1	30.5	26.5	<0.2	39.7	5.8	<12	<1	<0.4	40.2
W10-5A-MD1	1	1.6	<14.4	0.83	<1	58	54.2	<0.2	57.7	7.8	6	<1	0.41	78.1
2	3	1.3	<14.4	0.93	<1	72.5	34.4	<0.2	64.3	8.5	6	<1	<0.41	62.8
3	6	1.5	2	0.68	<1	40.7	27.6	<0.2	57.3	6.2	<12	<1	<0.41	44.3
SB13-4-MD1	.5	<0.57	3.4	<1	<1	73.8	37.3	0.3	74.1	13.1	8	<1	<2	67
2	5	1.6	2.8	<1	<1	80.9	33	<0.2	70.7	12.8	<13	<1	<2	57.6
W4-9B2-MD1	1	<0.61	1.8	0.7	<1	70.9	58.4	<0.04	76.1	8.2	11	<1	<2	85.2
2	3	4.8	2.1	1.2	<1	81.7	38.2	<0.04	78.3	15	22	<1	<2	73.6

Table 1 - Analytical Data for Soil Samples

Sample ID	Depth (ft)	Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Tl	Zn
3	5	0.72	<10.6	0.69	<1	63.6	40.5	<0.04	67.5	8.7	9	<1	<2	86.1
W4-7C-MD3	5	<2	3.1	0.85	<1	63	44.9	<0.04	65.8	9.7	<4.7	<0.59	<2	61.6
W4-11A-MD1	1	<2	<2	1.8	<1	71.4	41.2	<0.2	73.3	11.2	<12	<1	<2	66.3
2	3	<2	<2	2.3	<1	61.3	43.5	<0.2	80.6	10.2	<12	<1	<2	87.2
3	5	<2	<2	2.2	<1	63.8	58.3	<0.2	80.5	12.9	<12	<1	<2	92.8
4	6.5	<2	<2	1.7	<1	59.9	32.9	0.2	65.2	12.5	<12	<1	<2	67.7
W4-8C-MD1	1	<2	3.2	1.6	<1	66.3	41.1	<0.04	73.7	11.9	7	<1	<2	57.9
2	3	<2	3.1	1.7	<1	71.2	33.4	<0.04	69	10.3	7	<1	<2	57.9
3	5	<2	2.9	1.2	<1	56.8	32.3	<0.04	65.5	9.1	<13	<1	<2	55.4
RAS-10238		<2.0	3.25	0.78	<1.0	62	30		57	<6.0	<2.0	0.66	<5.0	50
10239		<2.0	1.97	0.59	<1.0	49	45		43	<6.0	<2.0	0.12	<5.0	32
10240		<2.0	3.13	0.68	<1.0	56	22		50	<6.0	<2.0	0.19	<5.0	39
McL-RA2	3-3.5			0.5	0.4	44		0.1		5				
2	4-4.5			0.5	0.8	24		0.1		7				
3	2.5-3			0.5	0.6	31		0.09		8				
4	2.5-3			0.6	0.5	44		0.1		9				
4	4-4.5			0.5	0.5	29		<0.02		5				
11	4-4.5			0.9	0.7	42		0.63		6				
13	1.5-2			1	0.7	46		0.44		7				
19	2.5-3			0.5	0.6	38		<0.02		7				
20	2.5-3			0.5	0.8	37		<0.02		8				
McL-SB-4	1.5-2			0.5	0.5	33		<0.02		6				
4	3-3.5			0.5	0.9	37		<0.02		8				
4	5-5.5			0.5	1	45		0.02		9				
4	7.5-8			0.6	1	39		<0.02		8				
4	10-10.5			0.5	0.8	47		<0.02		8				
SB-5	1.5-2			0.5	0.5	37		<0.02		6				
5	3-3.5			0.5	0.8	37		0.23		7				
5	6-6.5			0.6	1	47		<0.02		9				
5	9.5-10			0.6	1	45		0.35		8				
SB-8	2-2.5			0.5	0.6	35		0.1		7				

Table 1 - Analytical Data for Soil Samples

Sample ID	Depth (ft)	Ag	As	Be	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Se	Tl	Zn
8	3.5-4			0.5	0.8	37		0.1		7				
8	6.5-7			<0.5	0.5	36		<0.02		7				
8	8.5-9			<0.5	0.4	30		<0.02		5				
average		NC	2.86	0.88	NC	51.28	35.63	NC	73.53	11.43	NC	NC	NC	65.27
standard deviation		NC	2.61	0.55	NC	20.77	11.85	NC	27.15	4.66	NC	NC	NC	17.55
range		NC	0.2-5.5	0.3-1.4	NC	30.5-72.0	23.8-47.5	NC	46.4-101	6.8-16.1	NC	NC	NC	47.7-82.8
minimum value		<DL	<DL	<DL	<DL	<DL	4.6	<DL	6	<DL	<DL	<DL	<DL	7.8
maximum value		4.8	20	3.2	14	170	67	1.3	145	54	22	4	3.8	120
>DL/total		18/129	95/108	94/158	51/158	157/158	136/136	29/127	136/136	135/158	50/104	16/108	42/108	136/136
US average		NC	7.2	0.92	NC	54	25	0.09	19	19	0.66	0.39	NC	68

NOTES: All units are mg/kg.
Blank entries indicate data not available.
<4.0 = not detected above the detection level of 4.0
average = arithmetic mean of samples with detected concentrations
NC = not calculated
range = average ± one standard deviation
<DL = less than detection level
>DL/total = ratio of number of samples above detection level to total number analyzed
US average = Shacklette and Boerngen (1984) averages for United States soils

ND: Not included in mean calculation
If Cd > 50% ND - then no average calculated

Range: Average ± 1 Std deviation

Ni/Cu higher than US averages

As/Pb are less than US averages

MCL 80-90

Case Studies

A Survey of Lead Contamination in Soil Along Interstate-880, Alameda County, California

Dawn Tharr, Column Editor

Report by D. Coltrin, J. Teichman, and K. Prouty

Introduction

Background

Interstate 880 runs north and south through approximately 50 miles of residential and light industrial communities along the eastern shore of San Francisco Bay, including the city of Oakland. Soil samples were collected from the yards of homes, community parks and playgrounds, and public housing areas within one mile of the freeway. Approximately 200 surface and subsurface samples were collected and were analyzed by flame atomic absorption using U.S. Environmental Protection Agency (EPA) methods.

Previous studies[1] indicated that the distribution of lead in soil and plants along roadways is controlled by two factors: traffic volume and the prevailing wind direction. This same study found a marked decrease in lead concentrations in 6- and 12-inch core samples compared to surface samples. Motto *et al.*[1] discovered surface levels of soil contained approximately 165 ppm lead.

Studies of background levels of lead and other metals in adjacent northern Santa Clara County[2] indicated that lead levels range from 6.8 to 16.1 ppm. Scott[2] compared her findings with the range of concentrations reported by the U.S. Geological Survey in a nationwide study and found the Bay Area concentrations to be within the low end of these ranges.

Interstate 880

Interstate 880 is a major eight- to ten-lane route in Alameda County that serves as a commuter, recreation, and commercial corridor. It runs between San Jose and Oakland and serves residential, business, and industrial zones. Interstate 880 has experienced a significant increase in traffic as population and development have grown. Adding to this congestion is the heavy truck traffic which uses this freeway extensively. The congestion on Interstate 880 is not limited to commute hours; it occurs throughout the day. The roadway was originally completed in the 1950s. In 1970 traffic patterns along its route averaged 97,400 cars per day. By 1990 average daily traffic had risen 238 percent to 372,333 cars per day.

Sampling and Analytical Methods

Private homes, several parks and playgrounds, and public housing developments were sampled. Public housing samples were taken away from homes to avoid possible contributions of lead contamination from lead-based paint.

Surface samples were taken from the top ½ to ¾ inches of soil. Soil was sampled with disposable plastic spoons and placed in zip-seal sandwich bags. Subsurface samples were taken at depths of 3 to 8 inches at selected sites. The depth was measured through a 12-inch cross section of soil from the surface.

Samples were analyzed using EPA Method SW-846 for flame atomic absorption spectroscopy. Approximately 5 percent of the samples were randomly selected and sent to a second laboratory for quality control.

Results

Subsurface Samples

A total of 19 subsurface samples (including 6 from parks and playgrounds) were taken and compared to surface samples on the same site. Sixty-three percent of the subsurface lead concentrations exceeded corresponding surface concentrations. (See Table I.) When parks and playgrounds are omitted from these data, the number rises to 79 percent.

Many urban sample sites (except parks and playgrounds) have been undisturbed for many decades. Deposition of urban dust and debris over a period of years is evident in many residential and public agency housing areas where the grass and dirt areas exceed the sidewalk level by as much as 12 inches. Cross sections through undisturbed areas can be viewed as a chronological use of leaded gasoline and other leaded products. Several decades ago—when leaded gasoline use was at its peak—the lead content of soil was highest (deepest subsurface sample). As its use has decreased, so has the lead content of soil. The upper layers of soil and the surface contain less lead.

Prevailing Wind Direction

Prevailing winds in the Bay Area blow from west to east. Interstate 880 runs north and south and close to the eastern shore of San Francisco Bay. Throughout its length the majority of residential areas are situated on the east side, downwind from the emissions and dust created by traffic. Soil downwind from the freeway (east side) contained the highest lead concentrations, and average levels exceeded those found on the west side by 93 per-

TABLE I. Surface Versus Subsurface Samples

	Surface	Subsurface
Number of samples	13	13
Average lead (ppm)	567.7	618.3
Maximum lead (ppm)	2026.6	1405.7
Minimum lead (ppm)	195.3	369.8

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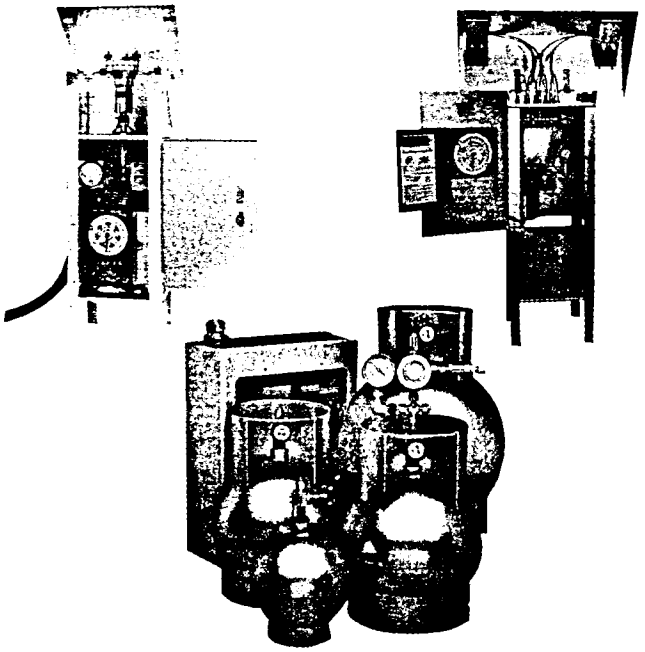

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TABLE II. Effects of Prevailing Weather

wind →

	East Side	West Side
Number of samples	116	22
Average surface lead (ppm)	594.3	263.3
Average subsurface lead (ppm)	554.6	288
Maximum lead (ppm)	3187.4	862
Minimum lead (ppm)	22.3	89.7

cent. (See Table II) This trend is seen in both surface and subsurface samples.

Parks and Playgrounds

Surface and subsurface samples from parks and playgrounds contained lower levels of lead than samples taken from private and public housing. (See Table III) This may result from several factors. Public parks and playgrounds have frequent and periodic maintenance which promotes the growth of vegetation and the repair/replacement of worn areas with new soil. Sand, soil, and cinders are frequently brought onsite from other sources to provide proper surfaces for baseball fields and play areas. These materials have generally not been onsite for many years and are well maintained. There is little chance that lead from auto emissions or other sources will accumulate under these conditions.

Recommendations

Soil Sampling Strategies

The following recommendations are based upon our experience with this study and are provided for those who intend to conduct soil sampling programs of their own.

- When sampling soil, attempt to duplicate worse-case scenarios and sample where exposures are likely to occur. Take samples where children are likely to play. Frequently, these areas are obvious in yards and are marked by the absence of ground cover and grass.

TABLE III. Parks and Playground Samples

	Surface	Subsurface
Number of samples	15	6
Average lead (ppm)	136.5	275.2
Maximum lead (ppm)	564.6	1405.7
Minimum lead (ppm)	6.2	11

Circle reader action no. 116

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RESEARCH AND DEVELOPMENT
ENVIRONMENTAL CRITERIA AND ASSESSMENT OFFICE
CINCINNATI, OHIO 45268

SUBJECT: 3QTR FY92 Master List Response Table Request

FROM: Joan S. Dollarhide
Associate Director
Superfund Health Risk Technical Support Center
Chemical Mixtures Assessment Branch

TO: Gerald Hiatt
U.S. EPA
Region IX

Attached please find the following responses requested from the 3QTR 1992 Master List of Chemical Specific Risk Assessment Issue Papers:

- Fuel (Diesel) - Provisional RfD; Oral Slope Factor Summary and Provisional Weight-of-Evidence
- Fuel (Gasoline) - Provisional RfD; Provisional Oral Slope Factor
- Fuel (JP-4) - Provisional RfD; Oral Slope Factor Summary and Provisional Weight-of-Evidence
- Fuel (JP-5) - Provisional RfD; Oral Slope Factor Summary and Provisional Weight-of-Evidence

Please feel free to contact Superfund Technical Support Center at (513) 569-7300 if you need further assistance.

Attachment

cc: R. Barnett (Region IX)
J. Dinan (OS-230)
B. Means (OS-230)
K. Poirier (ECAO-Cin)

Printed on Recycled Paper

Attachment

Risk Assessment Issue Paper for:
Oral Systemic and Carcinogenic Toxicity
for Multiple Fuels

INTRODUCTION

The requestor requested oral toxicity values for the insoluble and non-volatile components of hydrocarbon fuels found in the soil and groundwater. Sources of contamination were reported to be aviation gasoline (AVGAS), diesel fuel, and the jet fuels JP-4 and JP-5. According to the requestor, the chemical analyses at the sites usually report concentrations of gasoline, diesel, and kerosene.

All of these fuels are complex hydrocarbon mixtures produced by distillation of crude oil. They may contain hundreds of hydrocarbon components, as well as additives. The actual composition for any given fuel will vary depending on source of the crude oil, refinery processes used, and product specifications. Aviation gasoline is similar to automotive gasoline. It is a mixture of relatively volatile hydrocarbons [primarily C_4-C_{12} paraffins (66-69%), olefins (6-8%), and aromatics (24-27%), including benzene (0.5-5%)] that are distilled at temperatures of 25-170°C, to which additives such as dye, tetraethyllead, and antioxidant may be added (IARC, 1989a). Jet and diesel fuels are middle distillates that are composed of less volatile hydrocarbons, generally coming off the distillation column at temperatures of 150-360°C. JP-5 is essentially a specially-refined type of kerosene consisting of C_9-C_{16} paraffins (53%), cycloparaffins (31%), aromatics (16%), and olefins (0.5%). The benzene content of JP-5 is typically < 0.02% (IARC, 1989b; NTP, 1986). A small amount of polycyclic aromatic hydrocarbons (PAHs) may be present as well. JP-4, a "wide-cut" jet fuel, is a blend of kerosene with lower-boiling naphtha streams, such as those used to produce gasoline (IARC, 1989b). Consequently, it comprises hydrocarbons in the C_4-C_{16} range and contains a higher percentage of benzene (0.5%) than JP-5. There are three types of diesel fuel: diesel fuel #1 (a straight-run distillate that is basically the same as kerosene), diesel fuel #2 (a blend of diesel fuel #1 with higher-boiling streams), and diesel fuel #4 or marine diesel fuel (a blend of diesel fuel #2 with high-boiling residual oils) (IARC, 1989c). Diesel fuels consist primarily of C_9-C_{20} hydrocarbons. For marine diesel fuel these are roughly 13% paraffins, 44% aromatics, and 44% naphthalenes (NTP, 1986). Marine diesel fuel may also contain >10% PAHs, and even the lower-boiling diesel fuel #2 may contain as much as 5-10% PAHs (IARC, 1989c).

As provided by the requestor, chemical analysis of soil and groundwater samples showed high concentrations of gasoline, diesel, and kerosene present in the samples, along with smaller amounts of soluble, volatile components of these fuel mixtures such as benzene, toluene, xylenes, and ethylbenzene.

We have confirmed that oral toxicity values for these fuels are not available from the usual Agency sources (U.S. EPA, 1992a,b,c; 1991a,b). These fuels are not the subjects of ATSDR toxicological profiles. The only published U.S. EPA document available for any of these fuels is a carcinogenicity assessment for gasoline (U.S. EPA, 1987a), which also gives some information on JP-4 and JP-5. IARC has reviewed the carcinogenicity and toxicity data for gasoline (IARC, 1989a), jet fuels (IARC, 1989b), and diesel fuels (IARC, 1989c). These documents were examined for information pertinent to derivation of quantitative oral toxicity values. In addition, computer searches of TOXLINE (1981-1991), RTECS, HSDB, and TSCATS were performed for AVGAS, gasoline, JP-4, JP-5, diesel, and kerosene and inspected for relevant information. Defense Technical Information Center Searches of Technical Report Summaries were checked for any additional pertinent studies.

HEALTH EFFECTS SUMMARY

Gasoline

The health effects resulting from exposure to gasoline have been summarized in some detail in previous reviews (U.S. EPA, 1987a; IARC, 1989a; Anonymous, 1989). Only a brief review of this literature is presented here. Acute ingestion of gasoline may result in burning of the mouth and throat, gastrointestinal irritation, nausea, vomiting, and diarrhea (Anonymous, 1989). Very large doses can produce unconsciousness, coma, and death. The fatal dose for humans has been estimated to be 10 g for children and 350 g for adults (Anonymous, 1989). The central nervous system effects of acute gasoline exposure have been studied in more detail following inhalation exposure; effects such as headache, dizziness, nausea, and drowsiness may occur at around 500 ppm, more severe effects such as anesthesia, loss of reflexes, convulsions, and delirium may occur at 1000-5000 ppm (after 15-60 minutes), and unconsciousness, coma, and death may occur at >5000 ppm (Anonymous, 1989).

Studies in animals of health effects resulting from repeated exposure to gasoline have identified other target organs, in addition to the central nervous system. Gavage administration of 500 or 2000 mg/kg/d of unleaded gasoline for 4 weeks (5 d/wk) produced hyaline droplet nephropathy in the kidneys of male rats

(Halder et al., 1985). Hyaline droplet nephropathy is a renal lesion characterized by the presence of cytoplasmic hyaline droplets in the proximal tubular epithelium, necrosis and exfoliation of tubular cells, and blockage and dilation of tubular segments near the corticomedullary junction with casts of necrotic cell debris. In a subsequent study, it was shown that repeated gavage doses of unleaded gasoline as low as 30 mg/kg/day (9-day exposure) can produce this lesion (Olson et al., 1987).

Hyaline droplet nephropathy was also the most prominent effect observed in studies of subchronic gasoline inhalation. Among male and female rats and monkeys exposed to wholly-vaporized unleaded (384 or 1552 ppm) or leaded (103 or 374 ppm) gasoline intermittently (6 hr/d, 5 d/wk) for 90 days and monitored for clinical signs, organ and body weight changes, shifts in hematological and urinary parameters, gross and microscopic lesions, pulmonary function, and central nervous system response, the only effect reported was increased incidence and severity of regenerative epithelium and dilated tubules in the kidneys of male rats exposed to 1552 ppm (Kuna and Ulrich, 1984; MacFarland, 1984). A study that was designed specifically to investigate the renal effects of unleaded gasoline vapor detected hyaline droplet nephropathy in male rats exposed to wholly-vaporized unleaded gasoline at concentrations as low as 40 ppm (exposure was 6 hr/d, 5 d/wk for 90 days); the incidence and severity of these lesions increased with concentration (Halder et al., 1984).

The lungs have been reported to be a target of inhalation exposure to leaded gasoline vapor. Rats of both sexes exposed to 100 ppm of leaded gasoline (containing 0.45 g/l tetraethyllead) vapor intermittently (8 hr/d, 5 d/wk) for 12 weeks developed lesions in the lung parenchyma ranging from scattered foci of interstitial fibrosis to widespread sclerosis; these lesions were often accompanied by alveolar collapse (Lykke and Stewart, 1978; Lykke et al., 1979).

The neurological effects of prolonged exposure to unleaded gasoline vapor have also been studied. Fischer 344 rats of both sexes were exposed to 1500 ppm of unleaded gasoline vapor intermittently (6 hr/d, 5 d/wk) for 18 months, with interim sacrifices at 6 and 12 months (Spencer, 1983). Although no unique clinical or pathological changes were observed in exposed rats, age-related changes such as axonal dystrophy and degeneration in the distal gracile tract of the spinal cord were found to be more extensive in exposed rats than in controls.

Reliable data concerning the reproductive effects of gasoline were not located. The single developmental toxicity study located (Litton Bionetics, 1978) was inconclusive. In this study, mated female Charles River rats [CRL: COBS CD(SD)BR] were exposed to 0, 400, or 1600 ppm of unleaded gasoline on days 6-15

of gestation (6 hr/d). There was an apparent increase in the incidence of skeletal abnormalities in the high-dose group (significant when using the fetus as the unit of comparison). However, this increase was not significant when using the litter as the unit of comparison (the approach recommended by U.S. EPA, 1991c). The variations observed were primarily related to delayed bone ossification. The biological significance of these variations is uncertain (Khera, 1981), but U.S. EPA (1991c) considers them to be a possible indication of developmental toxicity. Another result of this study was that all the fetuses in one litter from the high-dose group were extremely small. It is not clear if this effect was related to exposure, however.

One study of chronic gasoline exposure was located. Groups of Fischer 344 rats (100/sex/group) and B6C3F1 mice (100/sex/group) were exposed to whole vapors of unleaded gasoline at 0, 67, 292, or 2056 ppm intermittently (6 hr/d, 5 d/wk) for 103-113 weeks (MacFarland et al., 1984). Body weight gain was significantly reduced in male rats (after 13 weeks), female rats (after 26 weeks), and male mice (after 66 weeks) exposed to 2056 ppm. Interim sacrifices at 3 and 6 months revealed dose-related hyaline droplet nephropathy in all exposed groups of male rats. In addition, both absolute and relative kidney weight were increased in high-dose male rats. At later sacrifices, hyaline droplet nephropathy was obscured by the onset of progressive glomerulonephrosis, which is characteristic of aging rats. Mineralization of the renal pelvis occurred with a dose-related incidence in male rats from 6 months through the end of the study. In addition, several preneoplastic changes were noted in exposed male rats during the second year of the study, including karyomegaly, hyperplasia, and one early benign renal cortical adenoma in a high-dose male rat. At final sacrifice there was a seemingly dose-related increase in the incidence of primary renal tumors in exposed male rats. Incidence rates were 0 in controls, 1 (carcinoma) in low-dose male rats, 5 (2 adenoma, 2 carcinoma, 1 sarcoma) in intermediate-dose male rats, and 7 (1 adenoma, 6 carcinoma) in high-dose male rats. In addition, there was a renal sarcoma in one intermediate-dose female rat. The authors attributed these tumors to gasoline exposure, noting that spontaneous incidence of renal tumors in Fischer 344 rats is extremely low. In mice, there was an increased incidence of hepatocellular tumors (adenomas and carcinomas) in high-dose females. Incidence rates for the various treatment groups were 14% (controls), 19% (low-dose), 21% (intermediate-dose), and 48% (high-dose). Two renal tumors (adenoma and adenocarcinoma) were observed in high-dose female mice.

Epidemiological studies in humans have not positively demonstrated an association between gasoline exposure (usually assumed based on occupation) and cancer (IARC, 1989a; U.S. EPA, 1987a). However, some studies have reported results suggestive of such an association. For example, Siemiatycki et al. (1987)

reported an increased risk of kidney cancer in men exposed to aviation gasoline, Stemhagen et al. (1983) provided some evidence for an association between gasoline service station employment and risk of primary liver cancer, and Howe et al. (1980) provided limited evidence of an association between petroleum industry employment and risk of bladder cancer.

IARC (1989a) concluded there was inadequate evidence for carcinogenicity of gasoline in humans and limited evidence for carcinogenicity of unleaded automotive gasoline in experimental animals. Based on these conclusions and supporting data showing (1) that gasoline induces unscheduled DNA synthesis in mice *in vivo* and in mouse, rat, and human hepatocytes *in vitro*, (2) that the light straight-run naphtha and light catalytically cracked naphtha streams used to blend gasoline produce skin tumors in dermally-exposed mice, and (3) that gasoline components such as benzene (Group 1) and 1,3-butadiene (Group 2B) are known or suspected carcinogens, IARC concluded that gasoline is possibly carcinogenic to humans (Group 2B).

Diesel and Jet Fuels (Kerosene)

Toxicity data for diesel and jet fuels have been summarized by IARC (1989b, 1989c). Because of the fundamental similarities among these fuels (all are middle distillates) they are discussed together below. As noted in the introduction, JP-5 is a refined type of kerosene, and JP-4 is a blend of kerosene with lower-boiling naphtha streams (such as used to produce gasoline).

Acute inhalation of jet fuel vapors has been reported to produce dizziness, headache, nausea, and fatigue in exposed workers (IARC, 1989b). In addition, there is evidence that chronic inhalation of jet fuel vapors (time-weighted average of 300 mg/m^3 for 17 years) may induce neurasthenic symptoms (e.g., fatigue, anxiety, mood changes, and memory difficulties) in exposed workers (Knave et al., 1978, 1979). Other systemic effects associated with exposure of humans to jet fuels were not identified. However, two people dermally exposed to diesel fuel both experienced renal failure (IARC, 1989c). In a monitoring study intended to explore the association between cancer and exposure to various petroleum-derived fuels, Siemiatycki et al. (1987) found increased risk of kidney cancer among workers exposed to jet fuel and increased risk of squamous-cell lung cancer and prostate cancer among workers exposed to diesel fuel. No conclusive evidence of carcinogenicity in humans was located, however, for either fuel.

Acute toxicity studies in animals determined oral LD50 values of >60 ml/kg for jet fuel JP-5, >5.0 g/kg for jet fuel JP-4, and 7.5 g/kg for diesel fuel in rats (Beck et al., 1984; Clark

et al., 1989; Parker et al., 1981). Single oral doses of JP-5 as low as 1 ml/kg produced behavioral effects in rats (Bogo et al., 1984), and a dose of 24 ml/kg of JP-5 produced hyaline droplet nephropathy and hepatic fatty change in male rats (Parker et al., 1981). Oral studies in animals were available only for acute exposure durations; studies of the subchronic/chronic toxicity of diesel and jet fuels were conducted only by the inhalation and dermal routes.

Continuous 90-day inhalation exposure of Fischer-344 rats (75/sex/group), C57BL/6 mice (150 females/group) and pure-bred beagle dogs (3/sex/group) to 0, 150 or 750 mg/m^3 of petroleum or shale-derived JP-5 produced effects on the kidney, liver, blood, and nasal mucosa of the JP-5 exposed groups (Gaworski et al., 1984; Bruner, 1984; MacEwen and Vernot, 1985). The most obvious changes were seen in the kidneys of exposed male rats, which developed hyaline droplet nephropathy, as described above for gasoline. The incidence of hyaline droplet nephropathy was close to 100% in both low- and high-concentration groups, but a clear dose response was noted in severity, with only minimal renal changes occurring at 150 mg/m^3 and moderate lesions at 750 mg/m^3. Other indications of renal toxicity in male rats exposed to 750 mg/m^3 were significantly elevated BUN and plasma creatinine, and significantly increased absolute and relative kidney weights. Treatment-related renal lesions observed in male rats held for life following 90-day exposure to JP-5 were abundant deposits of mineralized material in medullary tubules and renal papillary hyperplasia. The liver was also a target of JP-5 in this study; mild hepatocellular fatty change and vacuolization were reported in rats and mice exposed to 150 or 750 mg/m^3, and mild, diffuse hepatocellular swelling (determined to be due to excessive glycogen accumulation) was observed in dogs exposed to 750 mg/m^3. There were some discrepancies between the liver effects of petroleum- and shale-derived JP-5, but the researchers questioned the significance of these differences. Other effects of JP-5 exposure were slightly reduced red blood cell count, hematocrit, and hemoglobin in rats and dogs (statistically significant only in male rats exposed to 750 mg/m^3), mild nasal inflammatory changes in rats (all groups exposed to shale JP-5), and moderately decreased body weight gain in rats (males at both concentrations, females at 750 mg/m^3).

Continuous 90-day inhalation exposure to 500 or 1000 mg/m^3 of JP-4 produced results similar to those for JP-5 (MacEwen and Vernot, 1984, 1985; MacNaughton and Uddin, 1984). The most obvious effect was hyaline droplet nephropathy in male rats, which was noted in both dose groups and accompanied by increased kidney weight, increased plasma creatinine, and decreased urine osmolality. The most prominent effect in exposed female mice was centrilobular hepatocellular fatty change, which occurred with an incidence of 88% in the low dose group, 89% in the high dose

group, and 6% in controls. In dogs, there was a dose-related increase in BUN and elevated serum globulin and total protein at both dose levels. An earlier study of intermittent 8-month exposure to 2500 or 5000 mg/m^3 reported only organ weight changes in male rats exposed to the high dose level and a transient increase in red blood cell fragility in female dogs (MacNaughton and Uddin, 1984). Decreased body weight was reported for male rats exposed to 500 or 1000 mg/m^3 intermittently for 1 year (MacEwen and Vernot, 1981; MacNaughton and Uddin, 1984).

Continuous 90-day exposure to 50 or 300 mg/m^3 of marine diesel fuel derived from petroleum or shale produced results similar to the other middle distillates (MacEwen and Vernot, 1985; Bruner, 1984). The primary effects in rats were hyaline droplet nephropathy and reduced body weight gain in males at both doses. The incidence of fatty change in the liver of female mice was elevated in both exposure groups (85-94%) compared to controls (35%) for shale-derived fuel. Fatty change was not increased by exposure to petroleum-derived marine diesel fuel. Increased lung and liver inflammation were also reported to be results of marine diesel fuel exposure in female mice. The only changes noted in dogs, all of which were mild in degree, were increased osmotic fragility of red blood cells, increased frequency of cytoplasmic vacuolization of hepatocytes (due to accumulation of excess glycogen), and elevated BUN.

Both JP-5 and marine diesel fuel produced lesions in the kidneys of C3Hf/Bd mice treated dermally with undiluted fuel 3 times/wk for 60 weeks (Easley et al., 1982). The lesion was distinct from the hyaline droplet nephropathy seen in male rats following oral or inhalation exposure and characteristically consisted of atrophied and degenerating nephrons supported by an intact reticulum, with a high incidence of papillary necrosis. Although both male and female mice were affected, the incidence of renal lesions was much higher in females. Kidney lesions were not observed in a second dermal study in which B6C3F1 mice were treated with up to 500 mg/kg of JP-5 or marine diesel fuel diluted in acetone 5 times/wk for 103 weeks (NTP, 1986). JP-5 also failed to produce skin tumors or other neoplasms in this study. Marine diesel fuel produced a slight, but significant dose-related increase in the incidence of squamous cell neoplasms of the skin (primarily carcinomas) that was considered by NTP to be equivocal evidence of carcinogenicity in male and female mice. Jet fuel JP-4 has also been reported to produce skin tumors following chronic dermal treatment of mice (Clark et al., 1988). Although diesel fuel #2 did not produce tumors by itself, it did promote the development of skin tumors initiated by other chemicals (Slaga et al., 1986). The evidence suggests that both tumor promotion and complete carcinogenesis of middle distillates, including jet and diesel fuels, is probably due to chronic irritation and hyperplasia produced by these chemicals

(McKee et al., 1989; Skisak, 1991).

The reproductive and developmental toxicity of diesel and jet fuels has not been well studied. Inhalation of up to 400 ppm of jet fuel A, which is similar to JP-5, on days 6-15 of gestation produced no embryotoxic, fetotoxic, or teratogenic effect in rats (IARC, 1989b). The occurrence of maternal toxicity was not reported. A similar lack of developmental toxicity was reported for an unspecified diesel fuel (IARC, 1989c).

IARC (1989b, 1989c) concluded that marine diesel fuel is possibly carcinogenic to humans (Group 2B), but that light diesel fuels and jet fuels are not classifiable as to their carcinogenicity in humans (Group 3).

QUANTITATIVE RISK ASSESSMENT

Existing oral data are inadequate for use in quantitative risk assessment. Alternative approaches for derivation of oral toxicity values are (1) route-to-route extrapolation from the inhalation data or (2) basing estimates of toxicity for these complex mixtures on the toxicity of important components and assuming the effects are additive. There are several problems associated with using the inhalation data to produce oral toxicity values. One is that pharmacokinetic data are not available to indicate whether absorption is similar by the different routes, making it necessary to proceed with the unverified assumption of equal absorption. Another problem is that for hydrocarbon fuels composition of the water soluble fraction differs markedly from that of the original mixture (Coleman et al., 1984). The more soluble components such as benzene and naphthalene and their derivatives occur in much higher proportions in the water soluble fractions of the fuels than in the original mixtures. This difference in composition is likely to have some effect on toxicity, although the type and magnitude of the probable change is uncertain (one might guess toxicity of the water soluble fraction would be greater, and that of the remaining insoluble fraction would be less, but no data are available to address this point). An additional concern about basing the toxicity estimate on the original fuel, and this would apply even if the data were obtained by studies using drinking water exposure, is that differential volatilization and biodegradation will further alter the composition of the fuel mixtures in the environment. The relative contribution of various compounds to both the water soluble fraction and the remaining insoluble fraction will change continuously with the passage of time due to differential occurrence of these fate processes.

The alternative to using the inhalation data is to base the estimate of a fuel mixture's toxicity on the toxicity of that mixture's most important components ("importance" in this case depending on quantity in the media of concern and toxicity). Hartley and Ohanian (1990) recommend this approach for estimating the hazard of unleaded gasoline migration into groundwater/drinking water. They consider the critical components for this fuel to be benzene, toluene, xylenes, ethylbenzene, n-hexane, and methyl-tert-butyl ether (an additive). The problem in the present case, however, is not so much to assess the toxicity of gasoline (or the other fuels) per se as it is to assess the toxicity of the insoluble and non-volatile components remaining some time after a spill. Hartley and Ohanian (1990), who based their approach upon a supposition of migration of the soluble components of gasoline through soil to groundwater (e.g., from a leak in storage tank), do not concern themselves with the possibility of a large spill, because they consider such spills to be an unusual occurrence and conclude that the relatively insoluble components will float to the top and render the water completely unpalatable. However, the problem for the requestor is to quantify the toxic hazard posed by this "completely unpalatable" water by old spills from which the volatile and soluble components have already escaped, issues not taken up by Hartley and Ohanian (1990).

Therefore, neither route-to-route extrapolation nor consideration of only the toxicity of the more soluble components is a completely satisfactory method for estimating the desired toxicity values. Because basing the toxicity estimate for the fuel mixture on the toxicities of the more soluble components altogether ignores the effect of the material in which the requestor is actually interested, route-to-route extrapolation from the inhalation data appears to offer the better alternative. In this case, a site-wide risk assessment using the hazard index and total cancer risk methods would actually include a combination of both approaches, with the toxicity values extrapolated from the inhalation data from whole fuels providing a value to be used in assessing risk from the insoluble and non-volatile fuel components and the toxicity values for individual components providing values for assessing risk from the more soluble components (e.g., toluene, xylenes, benzene), which can be quantified and accounted for independently of the parent mixtures.

In reviewing the health effect summaries for the fuel mixtures, it may have been noted that the effects of each are similar, and that in each case the most visible effect is male rat hyaline droplet nephropathy and its sequelae (including renal tumors). This effect is limited in occurrence to male rats, and has been found to be related to the presence of a low-molecular weight protein called $alpha_{2u}$-globulin in these animals.

Available evidence suggests that humans are not likely to experience these effects (U.S. EPA, 1991d). Therefore, hyaline droplet nephropathy and related endpoints (including renal carcinogenicity) were not considered in the development of quantitative oral toxicity values.

The oral toxicity values derived in the following sections were derived by route-to-route extrapolation from inhalation data on the fuels that are the source of contamination at the Superfund sites in question. When using these values it should be noted that in addition to the usual uncertainties associated with route-to-route extrapolation and derivation of toxicity values, there is an additional element of uncertainty due to the difference in composition between the original fuel mixtures and their nonvolatile or less-soluble fractions which are of concern to the requestor.

Gasoline

Derivation of oral RfD:

A provisional oral RfD for unleaded gasoline can be derived by using the results of the chronic inhalation study (MacFarland et al., 1984) and performing route-to-route extrapolation. In this study, Fischer 344 rats (100/sex/group) and B6C3F1 mice (100/sex/group) were exposed to 0, 67, 292, or 2056 ppm of whole vapors of unleaded gasoline 6 hours per day, 5 days per week for 103-113 weeks. Body weight gain was reported to be significantly reduced (although the actual body weight data were not presented) in male rats (after 13 weeks), female rats (after 26 weeks), and male mice (after 66 weeks) exposed to 2056 ppm. The NOAEL for this effect was 292 ppm. Adjusting for intermittent exposure and converting to mg/m^3 produces an adjusted NOAEL of 230 mg/m^3:

$$NOAEL_{ADJ} = 292 \text{ ppm} \times (6 \text{ hr}/24 \text{ hr}) \times (5 \text{ days}/7 \text{ days}) \times (108/24.45)$$
$$= 230 \text{ mg/m}^3,$$

where 108 is the mean molecular weight of unleaded gasoline (Anonymous, 1989) and 24.45 is a constant. Male rats were not considered as the basis for the RfD because weight loss in these animals may have been related to hyaline droplet nephropathy, which is not a relevant endpoint for humans (see discussion above). Conversion to an equivalent oral dose (EOD) was performed for female rats and male mice by assuming equal absorption by inhalation and oral routes and using standard reference values for body weight and inhalation rate (U.S. EPA, 1987b):

$$\text{EOD (female rat)} = 230 \text{ mg/m}^3 \times (1/0.229 \text{ kg}) \times (0.24 \text{ m}^3\text{/day})$$
$$= 241 \text{ mg/kg/day}$$
$$\text{EOD (male mouse)} = 230 \text{ mg/m}^3 \times (1/0.0373 \text{ kg}) \times (0.063 \text{ m}^3\text{/day})$$
$$= 388 \text{ mg/kg/day}$$

The female rat was chosen as the basis of the RfD because these animals received a lower equivalent oral dose than male mice and displayed greater susceptibility by becoming significantly underweight 40 weeks earlier. The RfD is calculated from the equivalent oral dose in female rats by applying an uncertainty factor of 1000 (10 for intraspecies variation, 10 for interspecies variation, and 10 for deficiencies in the database):

$$RfD = 241 \text{ mg/kg/day} \times (1/1000) = 2\times10^{-1} \text{ mg/kg/day}.$$

In this way, a provisional RfD of 2×10^{-1} mg/kg/day was calculated for unleaded gasoline.

Confidence in the critical study (MacFarland et al., 1984) is medium because even though hematology, clinical chemistry, and histopathology endpoints were monitored throughout the study, the focus was on results related to carcinogenicity; results relating to systemic toxicity were not well reported. For example, effects on body weight are discussed, but the actual data are not presented. Confidence in the data base is low because oral studies were not available and it was necessary to derive the provisional oral RfD based on route-to-route extrapolation from an inhalation study. In addition, supporting data were not available via any route of exposure. Also, the reproductive and developmental effects of gasoline have not been adequately studied. Therefore, overall confidence in the provisional RfD is low.

Cancer weight-of-evidence classification:

The available epidemiological studies found no substantial evidence of carcinogenicity of gasoline to humans. Chronic inhalation of unleaded gasoline produced renal tumors in male rats and liver tumors in female mice (MacFarland et al., 1984). However, the development of kidney tumors in male rats as a sequela of hyaline droplet (alpha$_{2\mu}$-globulin) nephropathy, as occurred with gasoline inhalation exposure, is not considered to be predictive for tumor development in humans (U.S. EPA, 1991d). The elevated incidence of liver tumors in female mice constitutes limited evidence of the carcinogenicity of unleaded gasoline in animals [see U.S. EPA (1986) for discussion of this issue]. Other data suggesting that unleaded gasoline has carcinogenic potential include positive results in both <u>in vivo</u> and <u>in vitro</u> assays for unscheduled DNA synthesis, the production of skin tumors in dermal carcinogenicity assays by distillation streams used to blend gasoline, and the presence of carcinogenic components such as benzene (Group A) and 1,3-butadiene (Group B2). Based on the available evidence, unleaded gasoline can be assigned to U.S. EPA (1986) weight-of-evidence Group C: possible human carcinogen. An earlier U.S. EPA document assigned unleaded gasoline to Group B2 as a probable human carcinogen (U.S. EPA, 1987a), but that document predates the U.S. EPA (1991d) conclusion that the male rat kidney tumors produced by gasoline

are not predictive for humans, and therefore should not contribute to the weight-of-evidence or dose-response assessment of carcinogenicity.

Derivation of oral slope factor:

An inhalation unit risk of 2.1×10^{-3} ppm^{-1} was calculated by U.S. EPA (1987a) based on the incidence of hepatocellular adenomas/carcinomas in female mice exposed to unleaded gasoline. Although this value has been published by U.S. EPA, it is not verified and/or available on IRIS (U.S. EPA, 1992a,c) and so should be considered an interim value. This inhalation unit risk can be converted to an oral slope factor in humans by first converting to $(mg/m^3)^{-1}$,

$$2.1 \times 10^{-3}\ ppm^{-1} \times (24.45/108) = 4.75 \times 10^{-4}\ (mg/m^3)^{-1},$$

where 24.45 is a constant and 108 is the mean molecular weight of unleaded gasoline (Anonymous, 1989), and then dividing by the adult human reference inhalation rate of 20 m^3/day and multiplying by the reference body weight of 70 kg:

$$4.75 \times 10^{-4} (mg/m^3)^{-1} \times (1/20\ m^3/day) \times (70\ kg) =$$
$$1.7 \times 10^{-3}\ (mg/kg/day)^{-1}.$$

In the absence of any data to the contrary, absorption by the oral and inhalation routes is assumed to be equal. Therefore, a provisional oral slope factor of 1.7×10^{-3} $(mg/kg/day)^{-1}$ can be calculated for unleaded gasoline.

<u>Diesel and Jet Fuels (Kerosene)</u>

Derivation of oral RfDs:

The data are sufficient to derive provisional oral RfDs for the jet fuels JP-4 and JP-5 and marine diesel fuel based on subchronic inhalation studies with these chemicals. For JP-5, pure-bred beagle dogs (3/sex/group), Fischer-344 rats (75/sex/group), and C57BL/6 mice (150 females/group) were exposed continuously to 150 or 750 mg/m^3 of petroleum or shale-derived JP-5 for 90 days (Gaworski et al., 1984; MacEwen and Vernot, 1985). A LOAEL of 150 mg/m^3 was identified based on hepatocellular fatty change and vacuolization in female mice. Although response rates were similar in both low- and high-dose groups, this is a mild, reversible lesion and use of this LOAEL for risk assessment appears to be reasonable. Conversion to an equivalent oral dose (EOD) is effected by assuming equal absorption by the inhalation and oral routes and by using standard reference values (U.S. EPA, 1987b) for female C57BL/6 mouse body weight (0.0246 kg) and inhalation rate (0.040 m^3/day):

$$EOD = 150\ mg/m^3 \times (0.040\ m^3/day) \times (1/0.0246\ kg)$$
$$= 244\ mg/kg/day.$$

Applying the maximum uncertainty factor of 10,000 (reflecting five areas of uncertainty: variation within and between species,

use of a LOAEL, extrapolation to chronic duration, and deficiencies in the database) produces a provisional oral RfD of $2x10^{-2}$ mg/kg/day for JP-5. If a toxicity value is needed for kerosene (because of the manner in which chemical analyses for the site are reported), the provisional oral RfD for JP-5, which is a refined kerosene, would be the most appropriate.

Studies on JP-4 and marine diesel fuel were conducted in a manner similar to the study on JP-5. Exposure concentrations were 500 and 1000 mg/m^3 for JP-4 and 50 and 300 mg/m^3 for marine diesel fuel. LOAELs of 500 and 50 mg/m^3 were identified for JP-4 and marine diesel fuel, respectively, based (as was the case for JP-5) on fatty change in the livers of female C57BL/6 mice (MacEwen and Vernot, 1985; MacNaughton and Uddin, 1984). Equivalent oral doses and provisional RfDs were calculated in the same manner as for JP-5. For JP-4, the equivalent oral dose of the LOAEL was 813 mg/kg/day and the provisional RfD was $8x10^{-2}$ mg/kg/day. For marine diesel fuel, the equivalent oral dose of the 50 mg/m^3 LOAEL was 81 mg/kg/day, and the provisional RfD was $8x10^{-3}$ mg/kg/day.

Confidence in the critical studies (Gaworski et al., 1984; MacEwen and Vernot, 1985; MacNaughton and Uddin, 1984) is medium. These studies used adequate numbers of test animals from several species and included examination of a variety of endpoints, including hematology, blood chemistry, and histopathology, but they included only two dose levels, failed to identify NOAEL values, and were not generally well reported. Confidence in the data base is low because it was necessary to use inhalation studies and route-to-route extrapolation to calculate provisional RfDs for oral exposure, the inhalation studies used were of subchronic rather than chronic duration, and no studies of developmental or reproductive toxicity were available. Therefore, overall confidence in these provisional RfDs is low.

Cancer weight-of-evidence classifications:

Epidemiological studies provided no conclusive evidence for carcinogenicity of diesel or jet fuels to humans. Skin painting assays in animals have reported positive results for some of these fuels, but this response is apparently due to epigenetic processes related to skin irritation (McKee et al., 1989), and therefore, not necessarily relevant to exposure by other routes. Oral or inhalation cancer bioassays were not located. Based on the available data, diesel fuel and the jet fuels JP-4 and JP-5 can be assigned to U.S. EPA (1986) weight-of-evidence Group D: not classifiable as to human carcinogenicity.

Derivation of oral slope factors:

Classification of a chemical in weight-of-evidence Group D precludes quantitative risk assessment (U.S. EPA, 1986).

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