FINAL RESPONSES TO REGULATORY AGENCY COMMENTS ON SITE 13, OFFSHORE SEDIMENTS, DRAFT RECORD OF DECISION NAVAL STATION TREASURE ISLAND, SAN FRANCISCO, CALIFORNIA

This document presents the U.S. Department of the Navy's (Navy) responses to comments from the U.S. Environmental Protection Agency (EPA); the California Environmental Protection Agency (Cal EPA) Regional Water Quality Control Board (Water Board); and the Cal EPA Department of Toxic Substances Control (DTSC) on the *Draft Site 13 Record of Decision, Naval Station Treasure Island, San Francisco, California*, dated November 19, 2004. The comments addressed below were received from the DTSC on December 15, 2004, the Water Board on December 23, 2004, and EPA on December 30, 2004 and January 12, 2005.

RESPONSES TO EPA (PATTI COLLINS) COMMENTS (Received 12/30/04 via e-mail)

Since the agencies support the no action decision, as was described in the Proposed Plan, these comments are intended to suggest language and provide comments to assure consistency with EPA guidance and to increase readability and continuity within the document.

1. **Comment:** **Format of a No Action ROD: From the EPA ROD Guidance:**

   See Chapter 8, which is provided in .PDF in Section F online,

   "Highlight 8-4 Documenting a No Action Decision: Action Not Necessary"

   Part 1: The Declaration, Assessment of Site is lined out. Line out Section 1.3, 'Assessment of Site' in the Table of Contents and Page 2. Delete the text.

   Part 2: Decision Summary, Selected Remedy is lined out. Line out Section 2.8, 'Selected Remedy' in the Table of Contents and Page 15. Delete the text.

   See also Chapter 6, which is provided in .PDF in Sections D and E online. There are highlights and suggestions for building the various parts towards supporting the decision.

   http://www.epa.gov/superfund/resources/remedy/rods/

   Response: Section 1.3 and 2.8 will be deleted as recommended. The Navy will also review Chapter 6 of the EPA ROD guidance to make sure the Site 13 ROD follows the format of a No Action ROD.

2. **Comment:** **Please double-check the terminology on EPA's role. Since EPA does not 'concur' through signature on the ROD, it might also be the case that the designation of operable units (OUs) was not a formal concurrence.**

Page 1 Section 1.1, second sentence uses 'concurrence' in reference to the OUs, please revise if needed. Alternate terms are 'with the support of' or 'in consultation with.' After checking how this process was accomplished, please advise.

Page 2 Section 1.2: OK

Response: The above referenced sentence will be changed as follows: "In 1996, in an effort to facilitate environmental cleanup, the Navy, in consultation with the California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC), the Cal EPA Regional Water Quality Control Board (Water Board), and the United States Environmental Protection Agency (EPA), designated the offshore area of NAVSTA TI into a distinct Operable Unit (OU)."

3. **Comment:** **Page 2: BCT description, see the DTSC comment. Add BCT to the Acronyms list.**

Response: Once Section 1.3 is deleted, the acronym BCT will only be used once in the document when first defined. Per the note at the end of the acronyms list, acronyms used only once in the text are not defined in the acronym list.

4. **Comment:** **Terminology on no action decision: "No action" is not a selected remedial action or remedial alternative. Since there was no need for an FS, there were no alternatives, and thus no selection. And further, no action will be taken. Chapter 8 of the ROD guidance uses the phrase, "basis for the no action decision."**

Page 1 Section 1.0 Declaration: Since the Declaration is the entire Section One, it does not need an introductory paragraph. It can be deleted. If this introduction is to be included, eliminate the phrase "identifies the selected remedy" and "selection of that remedy." Use "describes the decision" and "the decision."

Page 2 Section 1.2 Statement of Basis and Purpose: First paragraph, first sentence, delete "...selected remedial action (no action)..." Replace with "...basis for the no action decision..."

Second sentence, delete "This no action remedial alternative is chosen..." Replace with "The no action decision was made..."

Third sentence, delete "...remedy was chosen..." Replace with "...decision is made..."

Page 3 Section 1.4 Description of Selected Remedy: From ROD guidance Chapter 8 Highlight 8-4: "The lead agency should state that no CERCLA action is necessary..." Please amend, since the phrase "no CERCLA action" helps clarify that a no action decision is not a "remedy".

First sentence, delete "...the selected no action decision..." Replace with "...the no CERCLA action decision..."

Page 4 Section 1.5 Statutory Determination: First sentence, delete "A no action remedial alternative was selected..." Replace with "The no action decision was made..."

Second sentence, delete "Because a no remedial action was selected..." Replace with "Because the no action decision was made, ..."

Page 5 Section 2.0 Decision Summary: Delete "...the selected no action remedial alternative." Replace with "...the no action decision."

Pages 13 – 15, Risk Characterization, fourth and fifth paragraph: This section uses the term "remedial action" correctly, since it is summarizing the findings of the risk assessment. These findings eliminated the need for an FS, which evaluates alternative remedial actions.

Page 15 Section 2.9 Documentation of Significant Changes: First sentence, delete "...the preferred alternative..." Replace with "...the proposed decision..."

Last sentence: Delete "...the remedial alternative..." Replace with "...the no action decision..."

Response: The changes recommended above will be incorporated into the final ROD.

5. **Comment:** **Page 9 Section 2.5.2, Sampling History, first paragraph; page 11 Section 2.7.2.1, Problem Formulation, first paragraph; and page 13 Section 2.7.2.3, Risk Characterization, fourth paragraph: The various areas, A through G, are discussed in these three places. Figure 5 is referenced in the first two, but not in the third. And it is very hard to follow the text using the current version of Figure 5. Since the final conclusions of the Risk Characterization are organized by area, a clear figure is needed. It would provide continuity from the beginning of the technical discussion on page 9 to the risk characterization conclusions on page 13.**

Response: A reference to Figure 5 will be added to Section 2.7.2.3. Colored symbols were used to represent the different areas on Figure 5. In the final ROD, Figure 5 will be provided in 11 x 17 format for improved readability and each area title will be placed on the figure.

6. **Comment:** **<u>Page 13-15, Section 2.7.2.3 Risk Characterization</u>: There is a gap between the explanation about the benchmarks for the chemicals of concern, referring to tables for those that exceed various criteria, in paragraphs one, two and three – and paragraph four, the conclusions by area at the end of the Risk Characterization on pages 13 –15. In other words, first the discussion is from the perspective of chemical benchmarks, and then abruptly changes to a conclusion by area. Suggest that Section 2.7.2.3 include a short description of the specific chemicals of concern designated at the start of the risk characterization phase of the ecological risk assessment in the RI, and why each that exceeded the criteria does not require mitigation. Quoting from the Risk Characterization of the Ecological Risk Assessment is one option, since the ROD is not a new or independent analysis of technical data. This additional description will help lead the reader logically to the conclusions by area, which provides a clear statement of the results of the ecological risk assessment.**

Response: In the final ROD, a table will be added to summarize the details of the ecological risk characterization for each area (Table 10). Table 10 will be referenced in Section 2.7.2.3. Table 10 is provided as an attachment to these comments. A complete set of data tables listing detected chemical concentrations compared to screening values are provided in the Final RI report for Site 13 (Tetra Tech 2001a).

RESPONSES TO EPA (KAREN GOLDBERG) COMMENTS (Received 1/12/05 via e-mail)

1. **Comment:** **<u>Section 1.1, 3rd para, last sentence</u>: Should this read "Construction of the Bay Bridge is schedule for completion in 2007"?**

Response: Per DTSC comment number 1, the sentence will be revised as follows: "Construction of the Bay Bridge is scheduled for completion in 2012."

2. **Comment:** **<u>Section 1.2, 2nd para, 2nd sentence</u>: Should read "Although not signatories....."**

Response: The sentence will be change to read "Although not signatories, ..."

3. **Comment:** **<u>Section 1.3, first sentence</u>: Should read "....NAVSTA TI is a cooperative effort..."**

Response: Per EPA comment number 1 (Patti Collins), Section 1.3 will be deleted from the final ROD.

4. **Comment:** **<u>Section 1.6, last sentence</u>: Semicolon should be replaced with a comma.**

Response: The recommended change will be incorporated into the final ROD.

5. **Comment:** **<u>Section 2.5.1, 2nd para., last sentence</u>: "bay" is in lowercase and uppercase another time.**

Response: The final ROD will be modified so "Bay" is presented consistently throughout.

6. **Comment:** **<u>Section 2.5.2, page 9, first full para., last sentence</u>: Says "Phase II RI offshore samples included chemical analysis of sediments and pore water, as well as invertebrate bioassays and tissue residue analysis".... Please summarize the results in the ROD.**

Response: The following sentence will be added to the above referenced paragraph. "Sediment and pore water data are summarized in Table 3. Invertebrate bioassay results and tissue residue data are summarized on Tables 8 and 9, respectively.

7. **Comment:** **<u>Section 2.5.2, page 9, second para., last sentence</u>: Says "the results of this additional sampling event were summarized in a technical memorandum and no further sampling was recommended".... Please summarize results and explain why no further sampling was recommended.**

Response: In the final ROD, the last sentence will be modified to read: "The results of this additional sampling event are summarized in Table 3. A more detailed discussion of the results can be found in the Site 12 Offshore Area technical memorandum (Tetra Tech 2001b) and the Site 13 Final RI report (Tetra Tech 2001a)." The following sentence explaining why no further sampling was recommended will be incorporated into the final ROD: "The results of the Site 12 offshore investigation showed chemical concentrations just slightly greater than the effects-range low (ER-L) values. However, there was concern if debris had been pushed offshore, sediment may have accreted in the area effectively covering the debris. No debris from the onshore area was observed in the sediment cores. Additionally, sediment chronologies based on radioisotope depth profiles collected at three locations showed an erosional nearshore environment, which supports the results of the sediment sampling that debris is not buried offshore. Based on these results no additional offshore investigation was required."

8. **Comment:** **<u>Section 2.7.1, page 11, last sentence</u>: Says "Because the EPA screening values were developed as a benchmark for sports fish, data for fish tissue collected for the ERA were not screened against these benchmarks to evaluate human health risk"... I don't understand this.**

Response: The above mentioned text was added to the ROD in response to a public comment received on the Proposed Plan, stating risk associated with fishing activities was not evaluated. The RI concluded that there was not a complete exposure pathway for humans from exposure to the sediments, so human health risk was not evaluated. Thus, as noted by the reviewer, the discussion provided in the ROD was out of context. In the final ROD, paragraphs 2 and 3 of Section 2.7.1 will be deleted. The full explanation to address the public comment will be provided in Appendix D of the ROD.

9. **Comment:** **Section 2.7.2.3, page 13, 3rd para., next-to-last sentence: What are the "other factors" referred to here?**

Response: Other factors include the physical characteristics of the sediment affecting bioavailability and literature reviews. The final ROD will be modified to list the "other factors" in the text.

10. **Comment:** **Figure 3: The print on the map is too small to read easily?**

Response: In the final ROD, Figures 2, 3, and 5 will be provided in 11 x 17 format for improved readability.

11. **Comment:** **Tables 1, 2, and 3: It would be easier to read if the criteria and the actual sampling results are presented on the same table.**

Response: Tables 1, 2, and 3 are meant to be summary tables. A point by point comparison of the data with the screening values for each media is presented in the final RI report for Site 13 (Tetra Tech 2001a).

12. **Comment:** **Table 4: I agree with prior comments that these areas should be identified on the map.**

Response: Colored symbols were used to represent the different areas on Figure 5. In the final ROD, Figure 5 will be provided in 11 x 17 format for improved readability and each area title will be placed on the figure.

13. **Comment:** **Table 7: The footnotes indicate HIs exceeding 1. Please include rationale for no action when HI exceeds 1 (see ROD guidance)**

Response: HIs listed in the footnote were based on samples collected at depths greater than 2 feet below the sediment/water interface, thus were not considered to represent a complete exposure pathway to benthic receptors. In the final ROD, the HIs footnote will be deleted from Table 7.

14. **Comment:** **Table 9: I do not understand Table 9.**

Response: Table 9 will be deleted. The text in the ROD will be modified as follows: "The HQ is a ratio of an exposure estimate to a toxicity reference value or benchmark. The estimated dose (exposure) is divided by the toxicity reference value (TRV) to yield a hazard quotient (HQ). An HQ less than or equal to a value of 1 indicates that adverse impacts to ecological receptors are considered unlikely. An HQ greater than 1 is an indication that "further assessment" may be necessary to evaluate the potential for adverse impacts. At NAVSTA TI, a range of HQs were calculated to represent "very conservative" to "less conservative" estimates of risk.

A HQ1 > 1.0 is an indication of unacceptable risk. The HQ1 was based on a low dose and a high TRV (based on the lowest observed adverse effect level [LOAEL]). This scenario represented an exposure dose calculated for a high body weight receptor ingesting a minimal amount of food compared to a LOAEL and is considered "less conservative". No HQ1s exceeded 1 at NAVSTA TI.

A HQ2 > 1.0 is an indication further evaluation of the potential for risk is necessary. The HQ2 was based on a high dose and the low TRV (based on a no observed adverse effects level [NOAEL]). This scenario represented an exposure dose calculated for a low body weight receptor ingesting a lot of food compared to a NOAEL and is considered "very conservative". There were HQ2 exceedances of 1 at NAVSTA TI.

To evaluate the potential for risk where HQ2s exceeded 1, HQ3s were calculated. This scenario represented an exposure dose calculated for a low body weight receptor ingesting a lot of food compared to a LOAEL and is considered a more realistic exposure scenario.

An HQ3 exceedance of 1 was an indication of potential risk, but one that still required consideration of the uncertainty associated with the exposure dose model. Sources of uncertainty in the exposure dose estimates include individual and population variation in life history, and variation in dietary patterns of animals at the site. In addition, the use of simple scaling equations to estimate receptor-specific ingestion rates may not accurately represent actual ingestion rates. Based on an evaluation of the uncertainties associated with the exposure dose model, risk was considered to be acceptable where HQ3s were less than 5.

Although there were HQ2s exceeding 1 at NAVSTA TI, no HQ1s exceeded 1 and no HQ3s exceeded 5. Therefore, risk to avian receptors at NAVSTA TI is considered acceptable. A summary of the HQ results for avian receptors at each area investigated is provided in Table 10."

RESPONSES TO WATER BOARD (ALAN FRIEDMAN) COMMENTS (Received 12/23/04 via e-mail)

1. **Comment:** **Regional Water Quality Control Board (Water Board) staff reviewed the document titled Draft Site 13 Record of Decision, Naval Station Treasure Island, received on November 22, 2004 and prepared by SulTech on behalf of the Navy. The document presented the selected remedial action for the Site 13 offshore sediment at Treasure Island. While Water Board staff have previously agreed with the proposal for no further action at Site 13, the report gives an overly brief summary of previous work that makes it difficult, on the basis of this document alone, to support the rationale for no further action.**

   Response: In the final ROD, a table will be added to summarize the details of the ecological risk characterization for each area investigated (Table 10). Table 10 will be referenced in Section 2.7.2.3. Table 10 is provided as an attachment to these comments.

2. **Comment:** **The tables and graphics seem incomplete and conflict with the conclusions given in the text. Table 3 lists the locations of maximum detection of analytes in sediment, storm water, and porewater, but there is no figure to show these locations.**

   Response: Locations of maximum detected concentrations listed on Table 3 are provided on Figure 5. In the final ROD, Figure 5 will be provided in 11 x 17 format for improved readability and the area title will be added on the figure. A note will be added to each data table to inform the reader that sample locations are presented on Figure 5. Also, location identification between Table 3 and Figure 5 will be checked for consistency.

3. **Comment:** **Table 4 lists chemicals of potential ecological concern, arranged by analyte and associated sampling area, but it is not clear if these are simply chemicals that were detected or those that were detected and exceeded the screening values listed in Tables 1 and 2.**

   Response: Table 4 lists the chemicals of potential ecological concern which were based on exceedance of the screening values. In the final ROD, text will be added to Section 2.7.2.1 to clarify the COPC selection process.

4. **Comment:** **Table 7 states sample locations where the Hazard index exceeded 1.0 for benthic receptors, but again, there is no figure to show where these locations are, nor a description of what chemicals led to these exceedances.**

   Response: Locations where HIs exceeded 1.0 can be found on Figure 5. A note will be added to each data table to inform the reader that sample locations are presented on Figure 5. In the Final ROD, Table 7 will be modified to list the chemicals that contributed to the HIs that exceed 1.0.

5. **Comment:** **A figure showing the storm water outfalls and sample locations, superimposed on the map showing the bathymetry changes would be helpful.**

Response: The Navy does not propose including an overlay of the bathymetry changes with the outfalls and sample locations. The bathymetry map is too small of a scale and was provided only to show, in general, most of the offshore area surrounding NAVSTA TI is depositional.

6. **Comment:** **Section 2.7.2.3 summarizes the risk characterization for each of the areas evaluated in Site 13, but the description for each area is too brief to support the conclusion that no further action should be taken for each area.**

Response: In the final ROD, a table will be added to summarize the details of the ecological risk characterization for each area (Table 10). Table 10 will be referenced in Section 2.7.2.3. Table 10 is provided as an attachment to these comments.

7. **Comment:** **In Areas C, D, and E, the risk to avian receptors was considered acceptable based on the uncertainty associated with the dose model; this statement should be expanded. The description for each area also seems inconsistent with Tables 4 and 7; for instance, Table 4 states that Area A had several chemicals of ecological concern, and Table 7 lists two locations in Area A with a hazard index exceeding 1.0, yet the text in Section 2.7.2.3 simply says that all risk in this area is acceptable.**

Response: The estimate of risk was based on a weight-of-evidence approach, thus even though a HQ might exceed 1.0, the preponderance of evidence indicated acceptable risk. In the final ROD, a table will be added to summarize the details of the ecological risk characterization for each area (Table 10). Table 10 will be referenced in Section 2.7.2.3. Table 10 is provided as an attachment to these comments. Also, please see response to EPA's comment 14 for clarification of the uncertainty associated with the dose model.

RESPONSES TO DTSC (DAVID RIST) COMMENTS (Received 12/15/04 via telephone)

1. **Comment:** **<u>Section 1.1, last paragraph, last sentence</u>: ....completion in 2007. The Bay bridge project is scheduled to be complete in 2012.**

Response: The recommended change will be incorporated into the final ROD. The sentence will read: "Construction of the Bay Bridge is scheduled for completion in 2012."

2. **Comment:** **Section 1.3, 1st paragraph, 5th sentence: Rewrite to read "The BCT includes the Navy, DTSC, and the EPA. The Water Board serves as an advisory regulatory agency for groundwater investigations."**

Response: Per EPA comment 1, Section 1.3 will be deleted from the final ROD.

3. **Comment:** **Section 1.6, DTSC's signature block: Omit all and replace with:**

Anthony J. Landis, P.E.
Chief
Northern California Operations
Office of Military Facilities.

Response: The recommended change will be incorporated into the final ROD.

4. **Comment:** **Appendix A, Section 7, page A-4: Omit text.**

Response: Per the Health and Safety Code Section 25356.1(e) the Statement of Reason must include a Nonbinding Preliminary Allocation of Responsibility (NBAR) among all identifiable PRPs for a site. Based on a discussion with the DTSC RPM for TI, the text will not be omitted; however, the first sentence will be changed to delete the word "investigation". In the final ROD, the first sentence will read as follows: "The U.S. Department of the Navy is responsible for activities related to the Navy's practices during the Navy's use of Site 13 at NAVSTA TI."

REFERENCES

Tetra Tech. 2001a. "Final Remedial Investigation for the Offshore Sediment Operable Unit. Naval Station Treasure Island, San Francisco, California." December 28.

Tetra Tech. 2001b. "Draft Technical Memorandum, Site 12 Offshore Area Investigation, Naval Station Treasure Island, San Francisco, California." September 19.

TABLE 10: OFFSHORE SEDIMENTS REMEDIAL INVESTIGATION ECOLOGICAL RISK CHARACTERIZATION SUMMARY [1]
Site 13, Offshore Sediments, ROD, NAVSTA TI, San Francisco, California

Area	Risk Characterization Data Summary
Area A	**Risk to Benthic Invertebrates** • Detected concentrations of most chemicals were below or near San Francisco (SF) Bay ambient concentrations or the Low Effects Range (ER-L). The only location for which chemical concentrations exceeded the ER-M was A6; total Polychlorinated biphenyl (PCBs) and zinc exceeded the ER-M at this location. The potential for adverse effects at location A6 was considered unlikely because total PCBs were elevated above the Median Effects Range (ER-M) in only one subsurface sediment sample, where exposure is limited (deeper than 2 feet, considered an incomplete exposure pathway). Zinc, while above the ER-M in the 0 to 2 foot depth interval, was well below SF Bay ambient concentration in a surface grab sample collected at the same location. • Pore water Hazard Indexes (HIs) were above 1.0 at locations A6, A8, and A10 and ranged from 14 to 36; 4,4'-Dichlorodiphenyltrichorethane (DDT) was the main contributor. The 4,4'-DDT pore water concentrations were very close to the detection limit. Given a pore water 4,4'-DDT concentration of 0.02 parts per billion (ppb) (Schweitzer 1998), the sediment 4,4'-DDT concentration would be about 2 ppb, which is less than the SF Bay ambient concentration. None of the sediments in Area A exceeded the SF Bay ambient concentration for 4,4'-DDT. • Amphipod survival ranged from 64 to 90 percent, and was greater than or equal to the benchmark of 68 percent at all but two locations. Survival at all locations was well above that of the Paradise Cove reference site. Based on studies conducted by the Navy's Sediment Working Group (SWG), the original laboratory method imposed undo stress by rapid acclimation to salinity changes and reduced holding times before experimentation resulted in reduced survival. The SWG concluded, after further bioassay experiments, slower rates of salinity acclimation and longer holding times before sediment testing increased the survival rate of *Eohaustorius estuarius* by approximately 18 percent. • Pore water bioassays using the echinoderm also indicated no adverse effects. **Risk to Avian Receptors** Food chain analysis was not conducted for Area A. The riprap shoreline provides little shallow-water habitat. Thus, the risk to shorebirds from direct or indirect exposure to Area A sediments is limited and is not considered a complete exposure pathway. **Risk Assessment Conclusions for Area A** Incremental risk to benthic invertebrate receptors from exposure to sediments in Area A is considered acceptable. There is limited exposure to Area A sediments by avian receptors due to the riprap shoreline. No further investigation or action is necessary for Area A.

TABLE 10: OFFSHORE SEDIMENTS REMEDIAL INVESTIGATION ECOLOGICAL RISK CHARACTERIZATION SUMMARY [1]
Site 13, Offshore Sediments, ROD, NAVSTA TI, San Francisco, California

Area	Risk Characterization Data Summary
Area B	**Risk to Benthic Invertebrates** • Sediment concentrations of nickel exceeded the ER-M at B10, but were only slightly greater than SF Bay ambient concentration. The screening value for selenium was slightly exceeded at locations B8 and B11; however the maximum concentration (1.4 milligrams per kilogram [mg/kg]) was less than the maximum concentration of selenium in the Yerba Buena Island (YBI) background soil dataset (1.5 mg/kg) and was only slightly greater than the maximum concentration in the data set for Treasure Island (TI) ambient for artificial fill (1.2 mg/kg). Endrin was detected above the ER-L but was well below the ER-M. • In pore water, HIs ranged from 0 to 60. The maximum HI was due to the contribution of mercury at location B8; mercury in the sediment at the same location was slightly elevated above SF Bay ambient concentration, but was below the Paradise Cove reference site maximum and the ER-M. • Amphipod survival was greater than or equal to the benchmark of 68 percent at locations B2, B5, and B7. Amphipod survival was less than the benchmark at locations B4, B8, and B10. As discussed in Area A, amphipod survival was likely reduced by about 18 percent due to induced stress due to rapid acclimation to salinity conditions and reduced holding times. Secondary stressors such as the high percentage of fines at locations B8 and B10 and levels of sediment ammonia, may have further contributed to a decrease in amphipod survival at those locations. With the exception of location B10, all bioassay results showed higher survival than the Paradise Cove reference site. • Polychaete growth and echinoderm pore water bioassays indicated no adverse effects to benthic invertebrates. **Risk to Avian Receptors** Food chain analysis was not conducted for Area B. The riprap shoreline provides little shallow-water habitat. Thus, the risk to shorebirds from direct or indirect exposure to Area B sediments is limited and is not considered a complete exposure pathway. **Risk Assessment Conclusions for Area B** Although selenium was elevated above screening values at two locations, concentrations were similar to YBI background and TI ambient soil concentrations. In pore water, HIs were elevated due to the contribution of mercury; however, mercury was not detected at elevated levels in sediment. Incremental risk to benthic invertebrate receptors from exposure to sediments in Area B is considered acceptable. There is limited exposure to Area B sediments by avian receptors due to the riprap shoreline. No further investigation or remedial action is necessary for Area B.

TABLE 10: OFFSHORE SEDIMENTS REMEDIAL INVESTIGATION ECOLOGICAL RISK CHARACTERIZATION SUMMARY [1]
Site 13, Offshore Sediments, ROD, NAVSTA TI, San Francisco, California

Area	Risk Characterization Data Summary
Area C	**Risk to Benthic Invertebrates** • The screening value for selenium was exceeded at four locations, C3, C4, C9, and C12; however, the maximum concentration (2.1 mg/kg) was only slightly greater than the maximum concentrations of selenium in the YBI background soil and TI ambient for artificial fill (1.5 mg/kg and 1.2 mg/kg, respectively). Nickel exceeded the ER-M at location C5, but was only slightly above SF Bay ambient concentration. • In pore water, HIs ranged from 0 to 25. The maximum HI was due to the contribution of copper; which was not elevated in sediment samples collected from the same location. • Amphipod survival was less than the benchmark of 68 percent at locations C3, C6, C7, C8, C11, and C13. However, as discussed in Area A, the lower survival rate was attributed to induced stress from rapid acclimation to salinity changes, reduced holding time before experimentation, and fine grained sediments. The Navy's SWG conducted an independent bioassay at location C7 where the lowest survival was observed (41 percent survival). When the organisms were properly acclimated to salinity changes and holding times were increased, survival increased to 77 percent, which is above the 68 percent benchmark. Additionally, with the exception of C13, fines neared 100 percent at every location. Low percent survival was also observed in the Paradise Cove reference area where fines were near 100. In a study on the effect of sediment grain size on amphipod survival, Gunther and others (1997) found that survival was inversely correlated with percent fines. Sampling location C13 is located about 1,600 feet offshore of NAVSTA TI, thus regional effects from baywide sediments, are predominant and no chemicals of potential ecological concern (COPECs) were identified at this location. • The echinoderm bioassay results for Area C did not indicate toxicity. **Risk to Avian Receptors** A range of Hazard Quotient (HQs) were calculated to represent "very conservative" to "less conservative" estimates of risk. A HQ_1 represented the least conservative estimate. A $HQ_1 > 1.0$ indicates unacceptable risk. HQ_2 represented the most conservative estimate of risk. HQ_3 is between the HQ_1 and HQ_2. A HQ_3 less than 5.0 was considered acceptable risk. • No immediate or significant risk to the double-crested cormorant, willet, or peregrine from any chemical in Area C (all HQ_1s were less than 1.0). • Potential ($HQ_2 > 1.0$) but not probable ($HQ_3 < 1.0$) risk to the cormorant from copper, lead, mercury, and zinc. • Potential ($HQ_2 > 1.0$) but not probable ($HQ_3 < 1.0$) risk to the willet from copper and nickel. • Potential but not probable risk ($HQ_2 > 1$ and $HQ_3 < 2$) to the peregrine from copper, lead, mercury, nickel, zinc, and total DDT (based on 10 percent assimilation trophic transfer from willet prey to a willet body burden). • Potential and probable risk ($HQ_2 > 1$ and $HQ_3 = 3.6$) to the peregrine from selenium; however, sediment concentrations of selenium were not substantially elevated above ambient soil concentrations for TI and YBI. **Risk Assessment Conclusions for Area C** Concentrations of selenium at locations C3, C4, C9, and C12, although greater than screening values, are not substantially greater than TI and YBI ambient soil levels. Incremental risk to benthic invertebrate receptors from exposure to sediments in Area C is considered acceptable. The results of the food chain model indicated an acceptable risk to avian receptors resulting from exposure to Area C sediments or prey. HQ_1s are all less than 1 and HQ_3s are all less than 5. No further investigation or remedial action is necessary for Area C.

TABLE 10: OFFSHORE SEDIMENTS REMEDIAL INVESTIGATION ECOLOGICAL RISK CHARACTERIZATION SUMMARY [1]
Site 13, Offshore Sediments, ROD, NAVSTA TI, San Francisco, California

Area	Risk Characterization Data Summary
Area D	**Risk to Benthic Invertebrates** • With the exception of mercury at location D6 and nickel at locations D2 and D3, no ER-Ms were exceeded in Area D. Nickel was only slightly elevated above SF Bay ambient concentration. The concentration of mercury at location D6 was equal to the ER-M. • Pore water HIs ranged from 0 to 22. The maximum HI was due to the contribution of copper; which did not exceed SF Bay ambient concentration in the surface sediment sample collected from the same location. Organic HIs were less than 4. The sole contributor to pore water HIs was endosulfan sulfate, which was not detected in sediment. • Amphipod survival was less than the benchmark of 68 percent at locations D1, D4, D6, and D9. As discussed in Area A, the lower survival rate was attributed to induced stress from rapid acclimation to salinity changes, reduced holding time before experimentation, and fine grained sediments. At each of these locations, greater than 93 percent fines was observed. Similar percent fines were measured in the reference area where survival was also low. An independent test conducted by the Navy's SWG at location D6 where the 39 percent survival was observed during the Site 13 investigations, resulted in 75 percent survival when the organisms were properly acclimated to salinity changes and holding times were increased. • Pore water bioassay results were available only for location D1. The Effects concentration for 50 percent survival (EC_{50}) at this location was 100 percent, indicating no toxicity. **Risk to Avian Receptors** A range of HQs were calculated to represent "very conservative" to "less conservative" estimates of risk. A HQ_1 represented the least conservative estimate. A $HQ_1 > 1.0$ indicates unacceptable risk. HQ_2 represented the most conservative estimate of risk. HQ_3 is between the HQ_1 and HQ_2. A HQ_3 less than 5.0 was considered acceptable risk. • No immediate or significant risk to the double-crested cormorant, willet, or peregrine from any chemical in Area D (all HQ_1s were less than 1.0). • Potential ($HQ_2 > 1.0$) but not probable ($HQ_3 < 1.0$) risk to the cormorant from copper, mercury, and zinc. • Potential ($HQ_2 > 1.0$) but not probable ($HQ_3 < 1.0$) risk to the willet from copper, lead, and nickel. • Potential but not probable risk ($HQ_2 > 1$ and $HQ_3 < 2$) to the peregrine from copper, lead, and mercury (based on 10 percent assimilation trophic transfer from willet prey to a willet body burden). • Potential and probable risk ($HQ_2 > 1$ and $HQ_3 = 3.1$) to the peregrine from selenium; however, sediment concentrations of selenium were not substantially elevated above ambient soil concentrations for TI and YBI. **Risk Assessment Conclusions for Area D** Although the evaluation of the chemical and toxicity data indicated limited risk to benthic invertebrate receptors from exposure to mercury and nickel in the sediment at Area D, the incremental risk is considered acceptable. The results of the food chain model indicated an acceptable risk to avian receptors from exposure to sediments or prey in Area D. HQ_1s are all less than 1 and HQ_3s are all less than 5. No further investigation or remedial action is necessary for Area D.

TABLE 10: OFFSHORE SEDIMENTS REMEDIAL INVESTIGATION ECOLOGICAL RISK CHARACTERIZATION SUMMARY [1]
Site 13, Offshore Sediments, ROD, NAVSTA TI, San Francisco, California

Area	Risk Characterization Data Summary
Area E & IR Site 11 Beach Samples	**Risk to Benthic Invertebrates** • Chemicals for which ER-Ms were exceeded in Area E included mercury at location E9 and nickel in subsurface sediments at location E3. Nickel was only slightly elevated in subsurface sediments where exposure is limited (deeper than 2 feet, considered an incomplete exposure pathway). The screening value for selenium was exceeded at locations E2 and E3, but the concentrations were similar to TI and YBI ambient soil concentrations. • Pore water HIs ranged from 0 to 19. The maximum HI was due to the contribution of mercury, which was not elevated above SF Bay ambient concentration in the sediment sample collected from the same location. Organic HIs only exceeded 1.0 at location E2. The HI of 11.0 at location E2 was due to the contribution of DDT, which was not detected in sediment collected from the same location. • Amphipod survival was less than the benchmark of 68 percent at locations E1, E3, E5, and E9. An independent test conducted by the Navy's SWG at location E9 where the 32 percent survival was observed during the Site 13 investigations, resulted in 82 percent survival when the organisms were properly acclimated to salinity changes and holding times were increased. Percent fines ranged from 60 to 85, and may have acted as a secondary stressor, further contributing to amphipod mortality. • Pore water bioassay results for locations E3 and E7 had EC_{50}s of 79 and 100 percent, respectively, indicating no significant toxicity. Polychaete growth and survival also indicated no adverse effects to benthic invertebrates. • The Installation Restoration (IR) Site 11 Landfill Beach investigation area was adjacent to Area E along the shoreline. Results from this sampling event detected PCBs at concentrations below the ER-M, and concentrations of Total Petroleum Hydrocarbons (TPH) extractables were below both TPH action levels and below the TI residential screening criterion for soil. **Risk to Avian Receptors** A range of HQs were calculated to represent "very conservative" to "less conservative" estimates of risk. A HQ_1 represented the least conservative estimate. A $HQ_1 > 1.0$ indicates unacceptable risk. HQ_2 represented the most conservative estimate of risk. HQ_3 is between the HQ_1 and HQ_2. A HQ_3 less than 5.0 was considered acceptable risk. • No immediate or significant risk to the double-crested cormorant, willet, or peregrine from any chemical in Area E (all HQ_1s were less than 1.0). • Potential ($HQ_2 > 1.0$) but not probable ($HQ_3 < 1.0$) risk to the cormorant from copper, lead, and zinc. • Potential ($HQ_2 > 1.0$) but not probable ($HQ_3 < 1.0$) risk to the willet from copper and lead. • Potential but not probable risk ($HQ_2 > 1$ and $HQ_3 < 2$) to the peregrine from copper, manganese, mercury, selenium, and zinc (based on 10 percent assimilation trophic transfer from willet prey to a willet body burden). • Potential and probable risk ($HQ_2 > 1$ and $HQ_3 > 1$) to the peregrine from lead; however, HQ3s calculated using the refined dose model for the peregrine, which was based on more realistic exposure parameters, were all less than 1.0. **Risk Assessment Conclusions for Area E** Although the evaluation of the chemical and toxicity data indicated limited risk to benthic invertebrate receptors from exposure to mercury in the sediment at one location in Area E, this risk is considered acceptable. Concentrations of selenium in sediment at locations E2 and E3 are similar to YBI background and TI ambient soil concentrations. Incremental risk to benthic invertebrate receptors from exposure to sediments in Area E is considered acceptable. The results of the food chain model indicate an acceptable risk to avian receptors. HQ_1s are all less than 1 and HQ_3s are all less than 5. No further investigation or remedial action is deemed necessary for Area E and the intertidal area at IR Site 11.

TABLE 10: OFFSHORE SEDIMENTS REMEDIAL INVESTIGATION ECOLOGICAL RISK CHARACTERIZATION SUMMARY [1]
Site 13, Offshore Sediments, ROD, NAVSTA TI, San Francisco, California

Area	Risk Characterization Data Summary
Area G & IR Site 12 OA	**Risk to Benthic Invertebrates** • The only location for which inorganic chemical concentrations exceeded screening values was G7; selenium exceeded screening values, but did not exceed TI ambient or YBI background soils concentrations. Concentrations of 4-4'-DDT exceeded the ER-M at locations G2, G15, and G17; however, the ER-M for total DDT was not exceeded at any of these locations. • In pore water, the only inorganic HI greater than 1.0 was for location G4 (HI = 5.4) due to the contribution of mercury. Mercury concentration in sediment at location G4 was well below SF Bay ambient concentration. Organic HIs, due to the contribution of 4,4'-DDT, ranged from 12 to 88 at locations G9, G20, and G21. Given a pore water 4,4'-DDT concentration of 0.02 ppb, the sediment 4,4'-DDT concentration could be approximately 2 ppb (Schweitzer 1998), which is less than SF Bay ambient concentration. 4,4'-DDT was not detected in sediment at these locations and the 4,4'-DDT pore water concentrations were very close to the detection limit. • Amphipod survival was greater than the benchmark of 68 percent at all but three locations. Survival at all locations was well above that of the Paradise Cove reference site. Amphipod survival was probably reduced by about 18 percent due to induced stress from rapid acclimation to salinity conditions and reduced holding times as discussed above. • Pore water bioassays using the echinoderm indicated no adverse effects. • The IR Site 12 Offshore Area (OA) investigation area is contained within Area G. The results of the Site 12 OA investigation found that inorganic chemical concentrations in sediment in the IR Site 12 OA were similar to concentrations detected in samples collected in Area G in 1996. The results of both investigations showed concentrations slightly elevated above ER-Ls and SF Bay ambient concentrations; no ER-Ms were exceeded. The results of the Site 12 OA investigation determined there was an acceptable minimal risk to aquatic receptors. No onshore debris was found in the IR Site 12 OA. **Risk to Avian Receptors** Food chain analysis was not conducted for Area G. The riprap shoreline provides little shallow-water habitat. Thus, the risk to shorebirds from direct or indirect exposure to Area G sediments is limited and is not considered a complete exposure pathway. **Risk Assessment Conclusions for Area G** Incremental risk to benthic invertebrate receptors from exposure to sediments in Area G is considered acceptable. There is limited exposure to Area G sediments by avian receptors due to the riprap shoreline. No further investigation or remedial action is necessary for Area G. Although metals and PCBs were detected in the sediments at the IR Site 12 Offshore Area, concentrations were not elevated above the screening criteria. No further investigation or remedial action is necessary for the area directly northeast of onshore IR Site 12.

TABLE 10: OFFSHORE SEDIMENTS REMEDIAL INVESTIGATION ECOLOGICAL RISK CHARACTERIZATION SUMMARY
Site 13, Offshore Sediments, ROD, NAVSTA TI, San Francisco, California

Notes:

COPEC	Chemicals of potential ecological concern
DDT	Dichlorodiphenyltrichorethane
EC_{50}	Effects concentration for 50 percent survival
ER-L	Effects Range – Low (Long and others 1995)
ER-M	Effects Range – Median (Long and others 1995)
HI	Hazard Index
HQ	Hazard Quotient
HQ_1	$HQ_1 > 1$ = Significant immediate risk
HQ_2	$HQ_2 > 1$ = Potential risk
HQ_3	$HQ_3 > 1$ = Probable Risk
HQ_4	$HQ_4 > 1$ = Potential risk to typical receptor
IR	Installation Restoration
mg/kg	Milligrams per kilogram
NAVSTA TI	Naval Station Treasure Island
OA	Offshore area
PCB	Polychlorinated biphenyl
ppb	Parts per billion
Water Board	Regional Water Quality Control Board
SF Bay Ambient	San Francisco Bay Ambient Concentrations (Water Board 1998)
SWG	Sediment Work Group
TI	Treasure Island
TPH	Total Petroleum Hydrocarbons
YBI	Yerba Buena Island

Selenium was screened against the YBI background level and the TI fill ambient level per the recommendation by DTSC's ecological toxicologist.

At the request of the Water Board, the Navy collected sediment and bioassay samples at Paradise Cove in the SF Bay area to use as a reference data set.

[1] Data presented in this table summarize the results of the ecological risk characterization from the Final Remedial Investigation Report for the Offshore Sediments at NAVSTA TI (Tetra Tech 2001).

References:

Gunther, A.J., and others. 1997. "EROD Activity in Fish as an Independent Measure of Contaminant-Induced Mortality of Invertebrates in Sediment Bioassays." *Marine Environmental Research.* 44: 41-49.

Long , E.R., MacDonald, D.D., Smith, S.L., and F.D. Calder. 1995. "Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments." *Environmental Management.* 19(1):81-97.

Regional Water Quality Control Board (Water Board). 1998. "Ambient Concentrations of Toxic Chemicals in Sediments." April.

Schweitzer, L. 1998. "The Bioavailability and Toxicity of Polychlorinated Biphenyls to Sea Urchins." Ph.D. Thesis. University of California at Los Angeles, California.

Tetra Tech. 2001. "Final Remedial Investigation for the Offshore Sediment Operable Unit. Naval Station Treasure Island, San Francisco, California." December 28.