UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203-2211

April 7, 1995

Mark Evans, Remedial Project Manager
U.S. Department of the Navy
Naval Facilities Engineering Command
Northern Division
10 Industrial Highway
Code 1823, Mail Stop 82
Lester, PA 19113-2090

Re: Phase II Remedial Investigation Report, Naval Submarine Base, Groton, CT

Dear Mr. Evans:

I am writing in response to your request for EPA to review the *Phase II Remedial Investigation ("RI") Report* for the Naval Submarine Base ("NSB") in Groton ,CT dated February 1995. This report was developed to provide essential information concerning 13 sites under investigation. These sites include the Area A Landfill, Area A Wetlands, Area A Downstream, Weapons Center, Torpedo Shop, Over the Bank Disposal Area Northeast ("OBDANE"), Construction Battalion Unit ("CBU") Drum Storage Area, Bunker A-86 Rubble Fill Area, Defense Reutilization and Marketing Office ("DRMO"), Lower Subase, Goss Cove Landfill, Spent Acid Storage and Disposal Area, and the Thames River. Media of concern include surface water, sediment, surface and subsurface soil, groundwater, and air.

EPA reviewed the RI in light of EPA's RI/FS and risk assessment guidance documents and the approved work plans. EPA also evaluated whether the data adequately characterizes the nature and extent of contamination and supports risk management decisions. Since the RI is an opportunity to settle many issues that we have discussed to date, it is somewhat disappointing that several issues remain unresolved. For example, EPA recommended that sites 10, 11, 13, Berth 16, and Building 31 be grouped with the Lower Subase (*see* letter dated November 22, 1994). Additionally, we have discussed the possibility of incorporating the Quay Wall Site into the Lower Subase (*see* letter dated February 8, 1995).

In general, the RI does not present information in a manner that is easy to decipher. As indicated in this letter and in Attachment A, many of our comments concern the need for further clarification. Comments concerning the human health and ecological risk assessments, the hydrogeologic investigations, data presentation, radiological data, and additional data needs are discussed in more detail below.

Human Health Risk Assessment

I understand that the risk assessment is based on use as an existing naval base. The Navy must demonstrate that a future residential land use scenario is inappropriate for the base by providing mechanisms, such as institutional controls and financial assurance, to ensure that the property will not be used for residential or recreational purposes without further evaluation. Should the NSB close in the future, EPA expects institutional controls to be established to ensure that human health and the environment remain adequately protected.

Insufficient detail was provided to fully evaluate the risk assessment and many of the exposure scenarios are not protective of human health. This is discussed further in the page-specific comments on Attachment A.

Ecological Assessment

I understand that the ecological data and revised risk assessments will be forthcoming after the data collection efforts are concluded in June 1995. However, EPA reviewed the RI to ensure that the ecological risk assessment followed an acceptable approach and that conclusions drawn from the risk characterization phase were supportable. EPA coordinated these ecological comments with the National Oceanic and Atmospheric Administration ("NOAA") who concurs with the recommendations and concerns herein. In my letter to you dated December 22, 1994, EPA recommended that you proceed with the portions of the ecological risk assessment regarding water quality, sediment quality, and benthic community structure. It is therefore unclear to me why the RI does not provide any ecological risk assessment discussions concerning the data that has been collected thus far.

The RI must determine whether potential exposure will cause adverse effects to ecological receptors and provide information concerning the nature and extent of contamination. If contaminant concentrations are below ecological effect guidelines and appropriate habitat is not present to complete an ecological exposure pathway, this must be explicitly stated in the report.

The document does not provide the rationale for the exclusion of ecological risk assessments at certain sites, including the Area A Weapons Center. The *Draft Installation Restoration Report, Section 7.0, Ecological Risk Assessment, Subsection 7.1.2*, states that the OBDANE site was not assessed because of low contaminant concentrations and the Rubble Fill at Bunker A-86 was only qualitatively assessed from a human health standpoint. However, the RI data indicates that at the OBDANE site, lead was found at a concentration of 403 mg/kg and DDTR at a concentration of 484 µg/kg. The NOAA ER-M for lead is 218 mg/kg and 50 mg/kg can cause toxicological effects on terrestrial plants (Suter *et al.*, 1993). At the Bunker A-86 Rubble Fill site, a substantial increase in PAH and DDTR concentrations over Phase I concentrations was detected.

The Weapons Center contaminant concentration information must be evaluated with respect to the following parameters: comparison to site specific background, frequency of occurrence,

bioavailability, physical-chemical properties, potential for bioaccumulation, toxicity, and potential for adverse ecological effects. In addition, the RI must include the appropriate documentation to justify the exclusion of ecological risk assessments at specific sites. More specifically, an explanation must be included to discuss the rationale for not performing an ecological risk assessment at both the OBDANE site and Bunker A-86 Rubble Fill site. It appears that the contamination at these sites has not been either delineated or characterized completely.

Throughout the Volume I text, the *Data Evaluation Study* states that contaminants of concern ("COCs") were selected based on USEPA Region III Screening Levels. COCs for ecological risk assessment should be selected based on comparison to site/media specific background, frequency of detection, toxicity, and bioaccumulation potential (*see also* my letter to you dated November 15, 1994). This should be revised where appropriate.

The data tables provide the maximum and range of contaminant concentrations, but should also provide the arithmetic average concentration, treating non-detects as half the detection limit. This will allow for evaluation of two different exposure concentrations.

The RI provides limited information regarding the relationship between COCs found in the Thames River and NSB sources. The weight of evidence approach allows for a moderate level of confidence within the decision process. Since there is little information available in the literature on shellfish toxicity, a comparison to other locations used in the shellfish study does little to define the level of risk to shellfish or secondary consumers. Some discussion, where possible, of shellfish body burdens, and its toxicity to both the shellfish and their avian predators would be beneficial.

Owing to the uncertainties regarding risk characterization, the next step, as discussed with both the Navy and Menzie-Cura, would be to determine whether there is a potential for adverse ecological impact to the benthic community. The potential for risk to benthic invertebrates from elevated concentrations of various sediment contaminants may need to be investigated further for inner Goss Cove. Sediments collected from this area indicated that benthic invertebrates may be at risk from detected concentrations of pesticides, PCBs, and several metals as these contaminants were detected at concentrations above sediment guidelines. As discussed with you on January 30, 1995, the upcoming amphipod toxicity testing will enable us to assess the potential for these sediments to cause adverse ecological effects. If the results from these toxicity tests indicate a cause for concern, collection of benthic invertebrate data from inner Goss Cove may be useful.

Hydrogeologic Investigations

The hydrogeological characterizations in the RI need substantial improvement. The revised RI must include more accurate groundwater flow maps, better hydraulic testing and analysis, and more developed site conceptual models. Many of the site-specific discussions of hydrogeology do not distinguish between the hydraulic properties of the various subsurface hydrostratigraphic units. In many cases, the hydraulic conductivities are *averaged* among different layers, including

bedrock, silt, sand, and fill. This approach is not appropriate, and should be replaced by a site-wide compilation of hydraulic conductivity data *by hydrostratigraphic layer*. The revised RI needs to include a discussion of the hydrostratigraphy of the base. The discussion should include a description of each subsurface aquifer and aquitard. Some of the tests are not useable because the monitoring wells are screened across multiple layers. As a result, it is likely that insufficient hydraulic conductivity data exists to develop average values for this site. EPA, the Connecticut Department of Environmental Protection, and the Navy should meet soon to discuss the additional testing that needs to be performed.

Data Presentation

It is unclear whether Phase I data were used in the Phase II risk assessment. The RI does not clearly indicate what data (*i.e.*, Phase I or Phase II or both) were used in each site-specific risk assessment. The report also does not provide the rationale or justification for eliminating sample data from inclusion in the risk assessment. Finally, the RI does not provide a summary table that allows the reviewer to confirm the COC selection process. Such a table should provide the range and frequency of detection for each detected contaminant, the applicable screening level and other applicable criteria such as Maximum Contaminant Levels ("MCLs"). The revised RI needs to present this information so that EPA can determine if the risk assessment database and COC selection are appropriate. All available data of sufficient data quality must be used.

The site figures in general do not provide sufficient detail to evaluate analytical results in relation to potential source areas. The site figures need to identify all known potential source areas.

The revised RI should include graphical presentations of the nature and extent of COCs at each site. This should include both maps and cross sections for all affected media. Currently, there is insufficient interpretive information to evaluate the conclusions and recommendations.

The maps presented on the large scale drawings need to be revised using an equally spaced contour interval. The maps currently give a misleading representation of slope, since the contour intervals are unequal. A variety of line thicknesses could be used to add contours in between the regularly spaced contours to preserve the level of detail necessary to portray the groundwater elevations, bedrock topography, and topography.

Radiological Data

The radiological data were not used in the risk assessment, and a background study was not performed to determine naturally occurring radiological levels. The summary data tables provided, however, indicate that radionuclides were evaluated in groundwater during Phase I, but they were not evaluated in Phase II nor included in the risk assessment. The revised RI should evaluate risks posed by radionuclides to potential receptors, including those present in the groundwater. A discussion of radiological contamination and comparison to background values should also be added to the revised RI.

Additional Data Needs

As discussed above, several issues that we have discussed still need to be resolved. The revised RI may be the appropriate place to do so. EPA requested that the Navy evaluate contamination in soils below three feet at DRMO (*see* letter dated February 7, 1995). EPA requested that the Navy investigate lead concentration in soils adjacent to Building 31 (*see* letter dated letter January 12, 1995). EPA further requested that the Navy evaluate the vertical extent of lead contamination in soils at Building 31, and any impact on groundwater (*see* letter dated letter November 22, 1994). The revised RI should contain this information.

The RI contains several "no further action" recommendations that cannot be substantiated with the existing information. EPA, the Connecticut Department of Environmental Protection, and the Navy must **jointly** decide whether additional investigations and clarifications are necessary or if it is appropriate to proceed with a No Action ROD.

The revised RI needs to present a map showing the groundwater classifications at the base. Groundwater under ten of the thirteen sites is classified as GA. Since groundwater at most sites contains contaminants in excess of MCLs or applicable health-based criteria, it is unclear why the RI concludes "no further action." This determination is not appropriate for such sites. Remedial measures must be proposed to ensure that groundwater contaminant levels are reduced and pose no risk to human health under current and potential future site conditions.

The RI analytical tables need to present the sampling date for each sample. Please note that EPA indicated in a letter dated July 22, 1994 that the July 12, 1994 sample results for Well 2DMW29S would not be accepted in the RI.

The groundwater analytical results and corresponding text sections for each site should clearly indicate whether the samples are filtered. All text and tables presenting metals concentrations in groundwater must clearly state if the data is from filtered or unfiltered samples.

The quality of the RI data cannot be assessed because the report does not include the information necessary to evaluate the data. The revised RI needs to contain an assessment of the data quality, including documenting actual collection frequency of QA/QC samples, blank contamination, precision and accuracy results, detection limits achieved, as well as the impact of any deviations from the precision, accuracy, and completeness objectives established in the QA/QC Plan.

When we met on January 4, 1995, I was informed that EPA would be receiving revised background data report soon (*see also* EPA's letter dated October 5, 1994). The RI appears to compare the soils data to the background data that EPA has repeatedly challenged. While it is currently unclear how this could have affected any of the RI analyses, a difference is plausible. The background soils data report should be finalized before the revised RI is issued. The revised

RI should compare the soils data to the revised ranges in the finalized background soils data report.

I look forward to working with you on the revised RI. Please do not hesitate to contact me at (617) 573-5777 should you have any questions or wish to arrange a meeting.

Sincerely,

Kymberlee Keckler, Remedial Project Manager
Federal Facilities Superfund Section

Attachment

cc: Mark Lewis, CT DEP, Hartford, CT
Andy Stackpole, NSBNL, Groton, CT
Dan Winograd, USEPA, Boston, MA
Patti Tyler, USEPA, Boston, MA
Dale Weiss, TRC, Lowell, MA
Ken Finkelstein, NOAA, Boston, MA

REFERENCES

Suter, G. W., II, M. E. Will and C. Evans. 1993. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants*. Oak Ridge National Laboratory, Oak Ridge, TN ES/ER/TW-85.

ATTACHMENT A

Page	Comment
p. 1-21, ¶1	The revised RI needs to provide a discussion on how revisions to the *Background Soils Report* (July 1994) will affect the findings of the risk assessment (*i.e.*, selection of COCs and conclusions regarding need for remediation).
p. 1-21, ¶2	Although this paragraph indicates that the results of the offsite residential well investigation are discussed in section 4.6.6, this section was not included in the RI. Results from this investigation need to be presented and included in the assessment of groundwater conditions at each site.
p. 2-30	In the last sentence on this page, "invertebrate benthic survey" should be changed to "benthic invertebrate survey."
p. 3-1, ¶1	The RI should discuss if the precision and accuracy objectives presented in the QA/QC Plan have been met. The report should also describe how any failures to meet the precision and accuracy objectives impact the overall quality of the program. The report does not provide sufficient information to determine if the detection limit objectives for all analytes described in the QA/QC Plan were achieved. Appendix D only presents detected results; the analytes that were not detected were not reported. These data should be added.
p. 3-3, ¶3	The revised RI needs to discuss the data validation results. The report needs to list which samples were validated in accordance with EPA Region I Guidance. Appendix D indicates that some data points were rejected, but the text does not describe why the data points were rejected. The revised RI needs to also discuss achievement of the completeness objective presented in the QA/QC Plan. The report should discuss the impact of the rejected data points on the project completeness objectives.
p. 3-4, ¶1	The RI does not discuss trip blank, field blank, and equipment rinsate results. The revised RI should summarize these results and discuss the impact of any contamination that may have occurred. The report should indicate at what frequency field quality control (field duplicates and blanks) samples were collected and if the frequency agrees

with that proposed in the QA/QC Plan. If not, then a discussion of the impact of this should be provided.

p. 3-22

The first bullet should include endpoint selection, and the third bullet the risk to non-human biota.

p. 3-25, ¶1

This section needs to clearly state what data were used in the comparison to Region III screening values and subsequently included in the risk assessment. The risk assessment database should include both Phase I and Phase II data. If only data from Phase II were used, sufficient justification for eliminating Phase I data, especially soil and sediment data, must be provided.

p. 3-25, ¶2

This paragraph does not provide sufficient information to allow evaluation of the COC selection process. It appears that contaminants detected at concentrations in excess of Region III levels in Phase I soil samples could have been deleted from evaluation because the Phase II concentrations are below Region III levels.

To facilitate review, tables for each site should be provided listing all sample analysis data from Phases I and II. Then, similar to the tables provided in each site-specific section of this report, present a table that lists all contaminants detected in Phases I and II, the range and frequency of detection, appropriate screening values and MCLs, background concentration, and the reason for elimination as a COC, if applicable. Without such tables, it is not possible to evaluate the risk assessment database or the COC selection process.

pp. 3-30, ¶2 & 3-36, ¶2

The conversion of a Reference Concentration ("RfC") or Unit Risk to a dose-based toxicity value may often be technically incorrect. The appropriateness of doing this must be evaluated on a case-by-case basis and based on a review of the literature or information from the Superfund Health Risk Technical Support Center.

p. 3-38, Table 3-7

IRIS and USEPA Region III list a chronic Oral Reference Dose ("RfD") of 7.00E-05 for Aroclor 1016. The RfD listed for Aroclor of 2E-05 appears incorrect.

The chronic oral RfD value listed for 2-nitroaniline was withdrawn from IRIS.

USEPA March 1994 HEAST does not list a oral chronic RfD for copper. The source of the 3.71E-02 oral RfD listed should be provided.

Both the oral and inhalation RfDs listed for 1,1,1-trichloroethane were withdrawn from IRIS/HEAST.

IRIS lists a unit risk value for beryllium of 2.4E-03. Table 3-7 currently provides no toxicity value for inhalation.

p. 3-58, ¶3

The decision to not consider a specific exposure pathway, *e.g.*, exposure to volatile emissions from soils, must be based on specific criteria such as a specific vapor pressure and concentration in soil. The Navy must demonstrate, based on specific criteria, that the evaluation of volatile emissions from soil is not necessary.

pp. 3-58, ¶6 & 3-59, § 3.3.3.4

Because residential areas (barracks) occur on and adjacent to the NSB, and groundwater in areas adjacent to the site supplies drinking water to private wells, the use of a future residential scenario that includes the evaluation of routine contact with groundwater and site soils seems appropriate. To demonstrate that future use of the site will remain industrial and that a future residential land use scenario is inappropriate, provide a description of the following: 1) institutional controls, such as deed restrictions, that will be put in place to protect human health and the environment by preventing human exposure to contaminants; and 2) financial assurance mechanisms to fund future cleanup consistent with a residential use should conditions change.

p. 3-59, ¶1

Groundwater at most of the NSB sites under investigation (DRMO, the Area A Landfill, Wetland, and Weapons Center, the CBU Drum Storage Area, the Rubble Fill Area, the Torpedo Shops, OBDA, Area A Downstream, and OBDANE) is classified as GA, a classification that requires the groundwater to be suitable for direct human consumption without the need for treatment. In addition, homes adjacent to the northeast portion of the site have on-site drinking water wells. Consequently, it seems reasonable to expect groundwater in this area of the site to meet drinking water standards. Therefore, routine exposures to groundwater via ingestion, inhalation of volatile emissions, or dermal contact should be evaluated in the risk assessment.

p. 3-64, Table 3-12

Body Surface Area should be presented in cm^2.

p. 3-70, ¶3

The algorithm presented on this page is not appropriate for estimating exposure via dermal contact with surface or groundwater. EPA's dermal risk assessment guidance dated January 1992 should be consulted. It provides a method for estimating the absorbed dose per cm^2 of exposed

skin occurring during a single water contact. This method accounts for the non steady-state conditions that characterize short exposure periods and generally provides a more conservative total absorbed dose.

p. 3-76, ¶2

It is not appropriate to remove chemicals from inclusion in the risk assessment simply because appropriate toxicity criteria are not readily available on IRIS or HEAST. These chemicals should be carried through the risk assessment and their impacts qualitatively assessed based on information available in the literature or from ECAO. The additive impact to risk from these chemicals must also be addressed.

p. 3-76, ¶5

See comment for Section 3.3.3.4 above regarding future land use assumptions.

p. 3-77, ¶3

The risk assessment needs to address the potential for receptors to be exposed to multiple sites at NSB and the associated risks.

p. 3-80, ¶1

The text should state if the literature was consulted prior to extrapolating from a RfC to a RfD in this risk assessment.

p. 4-12, Table 4-3

The hydraulic conductivity testing program conducted during the RI is not sufficient for the purpose of developing an understanding of the hydraulic conductivities associated with the various subsurface hydrostratigraphic units. Given that there are 13 sites and at least five hydrostratigraphic layers (fill, dredge spoils, deep sand layer, shallow silty sand layer, and bedrock), testing of only seven wells is not adequate. It appears that the Navy omitted the Phase I hydraulic conductivity data because it was inaccurate. However, some of the Phase II tests appear to be incorrect as well, and it is recommended that additional tests be conducted in each hydrostratigraphic layer at various locations around the base.

It appears that insufficient water-level changes may have been applied to stress the aquifer in most of the tests, resulting in hydraulic conductivity values that probably represent only the filter pack material surrounding the well screen. In addition, the analysis of recovery for wells 4MW2S and 6MW3D focused on the early portion of the semi-log plot, that represents the filter pack rather than the aquifer.

The nature of the fill material is likely different at each of the different sites, depending on whether the material is landfill solid waste, clean fill, or construction debris, and the nature of the natural materials is likely not homogeneous from site to site. Therefore, additional testing is necessary.

The RI identifies several types of bedrock present at the site, each of which will likely have different hydraulic conductivities. However, no bedrock wells were tested. Although the text indicates that well 4MW2S is screened in bedrock, it is a hybrid well screened across two different hydrostratigraphic layers. Hydraulic testing of a well screened in multiple layers is not meaningful. These data should be omitted and replaced with more accurate and comprehensive testing data.

Well 6MW7S is also screened across two layers (a fill and a sand layer) thereby limiting the value of hydraulic conductivity testing derived from that well.

Lastly, falling head tests were performed in some of the wells screened across the water table (including 15MW1S). Water draining into the unsaturated formation will flow more rapidly than predicted by Darcy's law. Therefore, the falling head tests conducted in wells with screens that bridge the water table yield distorted type curves that cannot be interpreted reliably.

p. 4-13, ¶2

The text should indicate that values of specific yield above 0.4 are atypical, and values above 1 are physically impossible. The text needs to discuss the implications of this relative to the accuracy of the other aquifer parameters derived from the pumping test.

p. 4-13, ¶3

Based on the wide variation in water levels noted on Table 4-5 between August and March, a water table map and bedrock potentiometric surface map should also be prepared for the March sampling round to determine the variability on the groundwater flow directions during different seasons. There are some wells that exhibit water level variations as high as 8 feet between the two sampling rounds (*e.g.*, 1MW2S, 2LMW13D, 2lMW8S), while others remain nearly constant or actually increase from March to August (*e.g.*, 2DMW27D).

p. 4-25, ¶1

The last sentence in this paragraph should be clarified.

p. 4-46, ¶1

The RI states that the Area A Wetland was artificially created, but does not substantiate this statement. There appears to have been an existing wetland present in this area that was extensively altered by the placement of the dredged material. Although the origin of this wetland does not alter the protection that it is afforded under the Clean Water Act, the text should be revised to more accurately describe the history of the wetland.

p. 5-8, Figure 5-3	The water level indicated by the contours on this map (approximately 85 feet) do not match that reported in Table 4-5 on August 23-24, 1994 (79.39 feet).
p. 5-9, ¶2	The hydraulic gradient which should be used for calculating seepage velocity can be estimated from the groundwater contours on Figure 5-3, and should be approximately 0.5.
p. 5-9, ¶5	The complete analytical database is not contained in Appendix D.1, only data from Phase II are presented. Phase I data need to be included in the database.
p. 5-19, ¶2	This section should discuss the mobility of the pesticides that were detected at the site. Page 5-14, ¶ 3 indicates that concentrations of 4,4'-DDT increase with depth, whereas Section 5.7.1 relies on the fact that the pesticides are "immobile."
p. 5-19, §5.6.1	This section needs to clearly state what data were included in the risk assessment. If Phase I data were not used, this needs to be stated and justification provided for not including the Phase I data. Based on a review of Table 5-3, it appears that the Phase I data should be included in the risk assessment database because several contaminants, such as xylene, selenium, and TPH, were detected at higher concentrations in Phase I soil samples. The complete risk assessment database needs to be provided in this document and this data must be summarized in a table that compares the maximum or UCL for each contaminant to the appropriate Region III screening level. Currently, it is not possible for the reviewer to confirm the COC selection process (*see also* previous comment for page 3-25, ¶2).
p. 5-20, § 5.6.2	The exposure scenarios for this site are not sufficiently protective of human health. A future excavation worker exposure to surface and subsurface soils scenario must be evaluated since development/construction in this area could occur. In addition, groundwater beneath this site is classified as GA, suitable for drinking water, and should be restored; for example, carbazole and manganese currently exceed the applicable Region III screening level and MCL, respectively.
p. 5-25, § 5.7.3	Groundwater at the site is classified as GA, yet concentrations of carbazole and manganese exceed applicable regulatory criteria or health-based standards. As a result, EPA cannot support the "no further action" recommendation because it may not be sufficiently protective.

p. 6-1, ¶2	This section should indicate the possibility that medical and radiological wastes were disposed in the Landfill, as discussed in the Draft Supplemental Initial Assessment Study and the Draft Final Feasibility Study for the Area A Landfill.
p. 6-19, ¶5	This section needs to present a map showing which wells were involved in the pumping test, and a map showing the pre- and post-testing water level elevations in the overburden and bedrock.
p. 6-31, Table 6-4	This table, and similar tables for other sites, lists radionuclides as detected in site media, but radionuclide contamination is not addressed in the risk assessment. Risks from exposure to radionuclides must be assessed and the additive impact on a potential receptor's total risk must be evaluated.
p. 6-38, ¶6	Again, all data, from both Phases I and II, need to be presented so that the COC selection can be confirmed. Currently, it is not possible for the reviewer to readily confirm that the appropriate COCs and exposure concentrations were selected for evaluation in the risk assessment.
p. 6-40, § 6.6.2 & p. 6-45, § 6.7.3	The groundwater beneath the Area A Landfill is classified as GA. In addition, as stated on page 6-44, several organics, including benzene and PCBs, and some metals, including cadmium and lead, were detected at concentrations exceeding regulatory criteria or health-based standards. As a result, the groundwater monitoring proposed in Section 6.7.3 may not be sufficiently protective. The need to remediate groundwater needs to be assessed more fully.
p. 6-45, ¶3	Until the Navy can demonstrate that bedrock groundwater is not flowing toward any residences, it is not reasonable to recommend no further action for the groundwater. For example, groundwater appears to be flowing southeast from well 2LMW17D to 2LMW18D (the most contaminated well) that is toward the nearest residential well, located 1000 feet away. Given that bedding also strikes southeast in this area, it is very possible that groundwater flow in the bedrock is highly anisotropic, and might possibly flow east, off site. A pumping test of the bedrock aquifer is recommended to evaluate the anisotropy in bedrock. A separate map of the bedrock potentiometric surface also needs to be prepared.
p. 7-18, ¶4	The alluvial deposits that underlie the remnant topsoil are not depicted on the site cross sections. The text should indicate the thickness of this unit,

	the lateral extent, and whether this unit is a separate hydrostratigraphic layer.
p. 7-24, Table 7-3	Explain why radionuclides were not analyzed in Phase II groundwater although they were in Phase I.
pp. 7-29 & 7-30	The notations in Table 7-6 regarding the cadmium results are misleading. The dash would appear to indicate non-detect. However, Appendix D.3 indicates cadmium was not analyzed. In addition, the zinc result shows 27.7 mg/L as a total concentration and 334 mg/L as a dissolved value. Review of Appendix D.3 shows these two values are from the same sample. It would be impossible to have more of a dissolved fraction than total from the same sample. Clarification is recommended.
p. 7-31, ¶1	The RI presents surface water concentrations of cadmium and manganese in units of μg/kg. The correct units should be μg/L.
p. 7-31, 3rd ¶	Current surface water data from Area A must be assessed and discussed with respect to the likelihood for ecological risk in the wetlands by comparing contaminant concentrations to Ambient Water Quality Criteria ("AWQC") and normalizing the criteria based on location-specific hardness concentrations. In addition, it is necessary to include information on frequency of detection, average and maximum concentrations and sampling location in relation to the potential exposure pathways for this assessment. Previous ecological concerns regarding potential risk from surface water quality was because of elevated cadmium levels. Cadmium data is missing from Appendix D.3. The original analyte list included the analysis of all Target Analyte List ("TAL") metals. This same concern is relevant to location 2WSW11 which is the only surface water data for the Area A wetland pond. As the only surface water body in this area, this pond should be an important point of the discussion.
p. 7-36, 4th ¶	According to Table 7-7, lead was found in a subsurface soil at 298 mg/kg. Note 3 at the bottom of the table does not include location 2WSD9, which is stated in this paragraph as the location of this lead concentration.
p. 7-37, § 7.6.1	This section needs to clearly state whether or not Phase I data were used in the risk assessment, and provide justification for not using any Phase I data (*see* previous comment for Page 3-25, ¶2). It is important to note that certain metals (*i.e.*, boron, cadmium, and chromium) were detected at higher concentrations in Phase I surface water samples than in Phase II. In

	addition, many organics detected in sediments collected during Phase I were either not detected or not analyzed in Phase II samples.
p. 7-39, § 7.6.2	The exposure assessment for this site should include an evaluation of exposures as a result of future excavation or utility work. The child recreational user may not be sufficiently conservative to protect all potential receptors.
p. 7-43, ¶5	The RI needs to develop a background value for manganese concentrations in surface water. The fact that manganese is present in other surface water bodies, is not sufficient to conclude that the concentrations observed in the Area A Wetland are naturally occurring.
p. 7-43, § 7.7.2	This section needs to state whether or not any detected groundwater contaminants exceed applicable criteria or health-based standards. In addition, because Area A Wetland groundwater is classified as GA, future risks from routine contact need to be assessed.
p. 7-43, § 7.7.3	Demonstrate that the presence of manganese is attributable to dredged material by providing the concentration of manganese in dredged material.
p. 8-11, 3rd ¶, last sentence	Concentrations of PAHs are found in Figure 8-5, not 8-4.
p. 8-17, ¶5	It should be clarified whether the statement, "...although no metals were found to exceed drinking water standards" refers to filtered or unfiltered samples.
p. 8-19, Table 8-4	Again, an explanation should be provided as to why radiological contaminants were analyzed in Phase I groundwater samples but not in Phase II.
p. 8-37, §8.7.2 & § 8.7.3	Several metals were detected in groundwater above MCLs at the Area A Weapons Center. Since this water is classified as GA, further actions at this site should include methods to prevent future exposure to contaminated groundwater.
p. 9-43, ¶2	The RI states that elevated levels of pesticides within the lower pond may be attributed to past application of DDT and the subsequent runoff and accumulation from surrounding areas. The lower pond appears to have a very small watershed and significant runoff to this pond is not likely under existing conditions. In addition, elevated concentrations of pesticides were not detected in adjacent surface soil samples. Additional justification is

	warranted to support the position that surface water runoff contributed to the elevated pesticide concentrations present within the lower pond.
p. 9-48, ¶5	North Lake is used for swimming by base residents. Therefore, exposure of a child resident via swimming in North Lake on a regular basis needs to be assessed.
p. 9-49, § 9.6.3	The potential for a single receptor to come into contact with contaminants located at all four locations needs to be evaluated and the potential risk resulting from the additive exposure to all four locations needs to be assessed.
p. 9-53, ¶2	When the ecological data collection efforts and risk assessment are completed, this section should also include the ecological risk assessment results.
p. 9-53, ¶3, 1st sentence	This sentence is not correct. Actually, the risk assessment was unable to satisfactorily demonstrate the lack of risk. As a consequence, further study was recommended.
p. 9-53, ¶3	It is recommended that additional site characterization activities be performed around well 2DMW29S where high levels of vinyl chloride were detected. This finding appears to be unrelated to the downstream watercourses, and may indicate a separate source area. Additional site characterization activities should include interviews and background reviews of the area, possibly a soil gas survey, and additional up- and downgradient well or microwell installations.
p. 9-53, § 9.7.2	The baseline risk assessment needs to consider exposures via swimming in North Lake and routine exposure to groundwater contaminants. Groundwater at the site is classified as GA and several contaminants, including vinyl chloride and lead, exceed MCLs.
p. 10-8, ¶4	This section needs to indicate whether the overburden is unsaturated, since there does not appear to be any overburden wells.
p. 10-8, ¶5	There are numerous methods for measuring water levels in artesian wells. One should be selected and used to determine the water level in well 4MW4D. The hydraulic conductivity testing performed in the wells that are screened both in overburden and bedrock are of little value. The limitations of the testing in these hybrid wells need to be indicated in the text.

p. 10-9	The groundwater elevation contours on this figure need to be corrected. The water elevation listed in Table 4-5 for wells 4MW4S and 4MW3S are 109.93, and 97.34, respectively. This indicates local groundwater flow to the west, rather than north as depicted in the figure. It is likely that the local groundwater elevation contours bend toward the stream, reflecting groundwater discharge. Given the number of data points available, and the close proximity of the wells, the minimum acceptable contour interval for this figure is 5 feet.
p. 10-10	This section is unclear because surface soil data from the 1994 sampling round is missing from Appendix D.6. While sample concentrations correlating to locations are generally described in terms of maximum concentration at several locations, it is impossible to associate certain locations with specific concentrations. From the 1994 data, the maximum concentrations of some PAHs, arsenic, copper and zinc, indicate exceedances of soil screening values. The data missing from Appendix D.6 should be provided, and an evaluation of ecological risk should be discussed in light of habitat types and the nature and extent of contamination.
p. 11-34, ¶2	This section needs to quantitatively evaluate the potential leachability of the VOCs observed in ATB4 and the high lead levels in saturated soils.
p. 11-42, ¶2	The Interim Action used at this site addressed only the upper three feet of fill material, that extends to a depth of 10 to 20 feet. The remaining saturated soils may be potential sources of groundwater contamination, based on the high VOC and lead concentrations. The revised RI needs to discuss recommendations for further work to evaluate the saturated fill material.
p. 11-42, § 11.7.3	Demonstrate that contaminant levels, specifically lead and PCB levels, that pose unacceptable risk in the risk assessment have been reduced to a level of acceptable risk. Additionally, it is unclear to us why the groundwater contaminants detected at levels above criteria or health-based standards, including lead and boron were not addressed.
p. 12-2	This figure needs to indicate the location of the leach fields, and all existing and previous USTs and ASTs.
p. 12-18, ¶4	A map presenting the soil gas survey results needs to be presented.

	Duplicate samples should not be averaged if they do not meet the EPA Region I guidelines for evaluating field duplicate results.
p. 12-35, ¶4	The rationale for excluding the Phase I soil data presented in this paragraph is incorrect. The purpose of the baseline risk assessment is to evaluate the risks posed by current site contamination. Data should not be eliminated simply because it was evaluated previously because some chemical-specific risks are assumed to be additive. In addition, a comparison of data presented in Table 12-3 to 12-4 indicates that a number of contaminants were detected at higher concentrations in Phase I samples than in Phase II. Therefore, Phase I soil data must be included in the baseline risk assessment.
p. 12-42, ¶2	It is unclear why no further action is proposed for this site when the Hazard Index for construction workers and full time employees exceed unity (page 12-39).
p. 12-42, § 12.7.3	Certain contaminants, including bis(2-ethylhexyl)phthalate and arsenic, were detected in site groundwater at concentrations exceeding MCLs. Because groundwater is classified as GA, these exceedances must be addressed. A"no further action" determination may not adequately protect human health.
pp. 13-16, ¶4	This paragraph indicates that the water level elevations are lowest at 8MW1; however, the groundwater contour map in Figure 13-3 indicates that the lowest groundwater levels are at well 8MW5S. It appears that the map needs to be corrected (*see* comment for Page 13-17).
p. 13-17	Many of the water level elevations are incorrectly interpreted on this map. For example well 8MW6S is contoured as approximately 2.5 feet, while the value listed in table 4-5 is 3.27 feet. Wells 8MW5S, 8MW1, and 8MW4 appear to be incorrectly contoured as well. This map should be prepared using a contour interval of no greater than 1 foot.
pp. 13-19, ¶2	It is not appropriate to average the hydraulic conductivities from multiple stratigraphic layers as was done in this section. Separate stratigraphic layers will likely exhibit different hydraulic conductivities. Failure to recognize the significance of different values of subsurface hydraulic conductivities may result in overlooking more transmissive contaminant migration pathways.

p. 13-45, § 13.6	The text needs to clearly state what sample data were evaluated in the risk assessment. If only Phase II data were used, justification needs to be provided for eliminating Phase I. A review of Table 13-3 indicates that several metals were detected at higher concentrations in Phase I soil samples than in Phase II.
p. 13-55, ¶2	Prior to conducting a Feasibility Study at this site, additional characterization is necessary. There is insufficient data available regarding the nature and extent of groundwater contamination in the bedrock aquifer. The hydraulic conductivity of the bedrock in the area of Goss Cove and the maximum level of TCE contamination in the bedrock aquifer need to be determined. The TCE concentrations noted in 8MW8D may be indicative of the presence of Dense Non Aqueous Phase Liquids ("DNAPL"). Further investigation will aid in determining the likelihood that DNAPL is or is not present.
p. 14-1, ¶2	This section needs to describe all of the individual potential source areas in the Lower Sub Base, and whether they were the focus of this RI, including Building 31, the former incinerator, Pier 33, Berth 16, the Quay Wall, and any other potential or known source areas. Given the complexities associated with this site, Section 14 needs to be extensively modified to clarify the source areas investigated, sample locations, and analytical results as they relate to specific source areas. As currently presented, the results cannot be related to the objectives of the investigation in this area, and it is not possible to evaluate such recommendations.
p. 14-3	This figure needs to indicate the location of the Building 79 waste oil pit, the Power Plant Oil Tanks, and the Fuel Oil Distribution System, the Fire House/Power House, as well as any other potential source areas.
p. 14-18, ¶3	It should be noted that the hydraulic conductivity testing performed during Phase I produced data of limited value because of the high permeability of the fill material, inadequate stresses applied to the aquifer, and improper analysis methods. In addition, it is not appropriate to average all of the hydraulic conductivity data for the site, without regard to the various hydrostratigrahic units.
p. 14-21, § 14.4.1	The text needs to clearly indicate whether the analytical results summarized in Tables 14-3 and 14-4 include all sample data from Phase I and Phase II.

p. 14-49, ¶1	Justification should be provided for not including Phase I soil data. The justification needs to be supported by a presentation of the analytical results from the Phase I soil samples.
p. 14-53, ¶5	The statement that "no one cumulative Hazard Index would exceed unity" should be demonstrated by providing the chemical-specific hazard quotients and associated toxic endpoints, as appropriate.
p. 14-57, §14.7	The baseline risk assessment is incomplete because the nature and extent of contamination by semivolatile organic compounds ("SVOCs") is not determined. The semivolatile compounds expected to be present will pose additional risks to potential site receptors. Therefore, their risk to potential receptors needs to be quantitatively evaluated.
p. 14-58, ¶3	The additional investigations should include a third confirmatory round of groundwater sampling at well NESO11 to determine whether the high metals results were representative.
p. 14-58, §14.7.2 & §14.7.3	The baseline risk assessment is incomplete because SVOCs have not been quantitatively evaluated. It is premature, therefore, to draw conclusions regarding site risks and subsequent remedial actions.
p. 15-9	Surface soil sample (14SS3) data was omitted from Appendix D.11.
p. 15-14, 5th ¶	The elevated lead concentration could indicate the need for further investigation.
p. 16-10	The groundwater elevation contours do not match the water elevations presented in Table 4-5. The measured elevation in Well 15MW1S (from Table 4-5) is 21.39 feet, while the mapped water level is approximately 26 feet. Similarly, the measured elevation in Well 15MW2S (from Table 4-5) is 21.63 feet, while the mapped water level is approximately 28 feet, Well 15MW3S has a measured water level elevation of 21.03, while the mapped water level is approximately 24 feet, and Well 15MW4S was measured at 21.56 while the mapped water level is about 23 feet. This error is significant because the existing wells appear to indicate groundwater flow to the south, rather than to the west as shown in the figure. The groundwater elevations for this and every site specific map need to be re-interpreted.
p. 16-29, ¶3	The recommendations for this site should be coordinated with the results of the Post-Sampling Report for the Interim Action at the Spent Acid Disposal Site.

p. 18-8	This section justifies for the comparison of indigenous shellfish from areas around the NSB to either non-deployed ribbed mussels or, in the case of other shellfish, to other areas such as Long Island. Out of necessity, it may be appropriate to compare to other "non polluted areas." However, where possible, comparison should also be made to body burden levels that are indicative of biological stress.
p. 18-8, 4th ¶	The connection between comparison to body burdens from other areas and the potential for bioaccumulation is not clear. A better comparison would include a comparison between body burden levels at NSB and concentrations shown to be detrimental to avian species.
Drawing 4	This map includes data points from several hydrostratigraphic layers and is therefore not very useful. Separate maps need to be prepared for each hydrostratigraphic unit. Several deep wells were used to construct this map should be omitted, including 4MW4D, 2LMW7D, 2DMW16D, 2DMW24D, 7MW3D, 2DMW23D, 2WMW22D, 2WMW5D, 2WMW21D, and many others, including the offsite residential wells completed in bedrock. The contour interval used for this map should be no more than 10 feet. Finer contour spacings need to be used for the site-specific maps. A constant contour interval needs to be used for this map. Where necessary, finer spaced contours may be added using thinner lines to identify the contours as having a smaller contour interval. The map needs to present the areas of unsaturated overburden. The map should also present the locations where the overburden is not present.
Drawing 5	This drawing needs to indicate the meaning of the dashed line. It is not clear whether this represents the bedrock surface, the water table, or some other feature.
Drawing 6	The water level elevations measured in several wells do not match the equipotential contours, including well 2DMW26D (measured = 19.31 feet, versus interpreted approximately 26 feet), well 27MW3D (measured = 38.32 feet, versus interpreted approximately 34 feet), and well 7MW1D (measured = 44.84 feet, versus interpreted approximately 49 feet). The equipotentials need to be modified to accurately reflect the water levels in the wells.

Drawing 7	A 100 foot equipotential should be added to Cross Section G.
p. 12	Biota sample numbers "MV4 and MV5" should be "MU4 and MU5."
p. 39, Measurement endpoints	Within the discussion of sediment associated endpoints, NOAA guidelines are selected as a measurement endpoint. Appendix E indicates that the NOAA guidelines are cited from the Howard and Long (1991) document titled, *The Potential For Biological Effects Of Sediment-sorbed Contaminants Tested In The National Status and Trends Program*. It is recommended that the most recent document by Long, MacDonald, Smith and Calder (1993), *Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments* be used for comparative purposes instead.
p. 40, 2nd ¶	If dilution is assumed, specific basis and calculations using 100 ug/L for hardness should be used in concert with the guidance presented in the *Quality Criteria for Water* (1986). Other information to consider and present would include the concentration of the AWQC value of the contaminant and the location of the well where the groundwater value was taken in reference to the river.
p. 40	Contaminant concentrations in surface water can be found in Appendix E not Appendix F.
p. 43	The last sentence of the first paragraph indicates unknown sources of pesticides other than DDTR. While it may be true that the present information on groundwater presents no evidence of these pesticides, these same pesticides have been detected in the surface soils at the Goss Cove Landfill. Therefore, the possibility of the base as a historical source of these pesticides is valid and should be assessed accordingly.
p. 43, ¶4	Concentrations of DDTR within the Goss Pond sediments are discussed in this section. However, the values presented differ from values listed in Appendix E-4. The values presented in the Appendix should be verified and the text should be corrected to correspond with these results.
p. 46, 2nd ¶	Copper, lead, mercury, and zinc were found in the Goss Cove Landfill at elevated concentrations. Lead was detected at very high concentrations in soils sampled from the lower subase. Based on these elevated contaminant concentrations and their persistent potential to erode, the idea that the subase is responsible for the release of some of these contaminants is plausible.

Figures 8, 9 & 10	The mass units for each of these figures should be mg/kg.
p. 55, ¶2	NOAA Mussel Watch data were converted from a dry weight concentration to a wet weight concentration assuming a moisture content of 80% for mussels and oysters. A reference or the rationale for this assumption should be provided.
p. 63, ¶1	Effects on water column organisms are assessed by comparing detected concentrations to federal and state water quality criteria (or LOEL values if AWQC were unavailable). However, many detected constituents do not have AWQC or LOEL values available. Therefore, the scientific literature (*e.g.*, AQUIRE database) needs to be examined to determine applicable effect levels for these chemicals. This would reduce the uncertainty associated with not evaluating many of the detected chemicals in the surface water samples.
p. 66, ¶1	A discussion regarding the comparison of pesticides detected in the Thames River and Goss Cove with Sediment Quality Criteria is presented. However, a review of tables presented in Appendices E-5 and E-6 shows that these tables contain incorrect toxicity quotients at each sampling station for all of the pesticides. Tables E-5 and E-6 should be corrected and the text should revised if necessary.
p. 66	Please refer to previous comment in Section 2.4 Thames River Native Bivalve Shellfish Collection, page 39, Measurement endpoints.
p. 82	This page was missing from the Ecological Assessment.
p. 87	This section be revised based on previous comments discussed within this review.
p. 88, 2nd ¶	Expand the discussion regarding possible "other factors" referenced in this paragraph as impacting the number of taxa of benthic invertebrates.
p. 88, 5th ¶	A risk to benthic invertebrates inhabiting the sediments of the Thames River and inner Goss Cove may result from detected concentrations of various contaminants. However, the text incorrectly identified river sediments as exceeding guidelines on the last line of this page. The last line should be corrected to reflect that PAHs, pesticides, PCBs, and metals in inner Goss Cove sediment exceed NOAA effects levels.
p. 88	The sentence should be corrected to "Goss Cove Sediments."

This section should discuss the presence of COCs detected in across channel or upgradient locations.

p. 89, 2nd point — It should be stated that detection limits, in some cases, also exceeded ER-M values.

p. 90 — Currently, it is too early to eliminate the NSB as a source contributing to the pesticide body burdens in mussels found along the NSB. When a comparison is evaluated with respect to tissue body burdens of deployed mussels adjacent to the base against upstream or downstream mussels, it is evident that all the detects were reported from mussels deployed along the base. The use of native mussel tissue results to confirm or deny this point is limited because of the elevated detection limit. It is recommended that this section be modified to address these points. Additional information concerning this issue can be found in EPA's letter to the Navy dated December 22, 1994.

p. 91, 1st ¶ — Risk to avian receptors inhabiting the river are not predicted owing to the low bioaccumulation observed in native and deployed shellfish. Although the detected concentrations of contaminants within the shellfish analyzed in this study do not appear to indicate a significant risk to birds, a qualitative discussion of risk to avian species that forage within inner Goss Cove or adjacent to Piers 15 and 17 (where a polychaete and bivalve were found in an earlier environmental assessment to bioaccumulate PAHs and PCBs) needs to be presented.

p. 92, top of page — Please modify the first sentence. Accumulation of COCs in shellfish in the Thames River similar to those at other locations, does not necessarily mean that secondary consumers are not ingesting these contaminants.

Table 11 — Potential risks to benthic invertebrates inhabiting inner Goss Cove are evaluated for PAHs by comparing detected sediment concentrations with sediment quality guidelines (NOAA values and guidelines derived from the equilibrium partitioning approach). It should be noted that PAHs exceeded NOAA sediment guidelines but did not exceed sediment quality guidelines based on the equilibrium partitioning approach. This table should be corrected to reflect this difference.

Appendix A Boring Logs/Monitoring Wells Construction Diagrams

The Boring Logs in the Appendix are difficult to read because of poor reproduction. More legible copies should be provided in the revised RI.

Appendix F Risk Assessment Calculations

The use of bioavailability factors other than 1 for certain pesticides, PCBs, and any other chemicals, needs to be justified. Use of a bioavailability of 1 rather than, for example, 0.03 may have a significant impact on the calculated risk estimates for certain sites.

Appendix F9

Explain why heptachlor, listed in the summary table at the start of the appendix and on Table 10-8 in the text, is not included in the risk spreadsheets.

Appendices E-3 through E-4

Shading denoting exceedances should be checked and included where necessary. This should be done after revisions to include new NOAA values.

Appendix E-4

The "Sum of DDE" should be replaced with "Sum of DDTR."

Appendix E-5, Pesticides and PCBs

The toxicity quotients calculated are erroneous. Koc * WQC = SQC ug/goC and SQC mg/KgC * foc = SQC mg/kg. The sediment concentration mg/kg can then be divided by the value SQC mg/kg to calculate a toxicity quotient.

For example, dieldrin, with an SQC of 20 mg/KgC * 0.013 KgC/Kg = 0.26 mg/Kg. Sample T1SD1 has a dieldrin concentration of 0.014 mg/Kg. Therefore, 0.014 mg/Kg/0.26 mg/kg = 0.05 = TQ. The TQ values should be reviewed for pesticides and revised where necessary.

Appendix E-6, Pesticides and PCBs

This portion of the Appendix should be reviewed, "#REF!" notations removed, and replaced by appropriate values.