N00129.AR.000751
NSB NEW LONDON
5090.3a

EA ENGINEERING, SCIENCE, AND TECHNOLOGY

The Maple Building
3 Washington Center
Newburgh, NY 12550
(914) 565-8100

LETTER OF TRANSMITTAL

TO Northern Division, NAVFAC
10 Industrial Highway, Mail Stop 82
Lester, Pennsylvania 19113-2090

DATE: 9/14/99	JOB NO.: 29600.90.3650
ATTENTION: Mr. Mark Evans, Code 1823/ME	
RE: Contract No. N62472-92-D-1296	
CTO No. 0090	

WE ARE SENDING YOU [X] Attached [ ] Under separate cover via _____ the following items:

[ ] Shop drawings [ ] Prints [ ] Plans [ ] Samples [ ] Specifications

[ ] Copy of letter [ ] Change order [ ] _____

COPIES	DATE	NO.	DESCRIPTION
2	9/14/99		Response to EPA Comments on the Draft Feasibility Study, Site 20 – Area A Weapons Center, Naval Submarine Base, New London, Groton, Connecticut
2	9/14/99		Response to CTDEP Comments on the Draft Feasibility Study, Site 20 – Area A Weapons Center, Naval Submarine Base, New London, Groton, Connecticut

THESE ARE TRANSMITTED as checked below:

[X] For approval [ ] Approved as submitted [ ] Resubmit _____ copies for approval

[ ] For your use [ ] Approved as noted [ ] Submit _____ copies for distribution

[ ] As requested [ ] Returned for corrections [ ] Return _____ corrected prints

[X] For review and comment [ ] _____

[ ] **FOR BIDS DUE** _____ 19__ [ ] PRINTS RETURNED AFTER LOAN TO US

REMARKS The attached documents are being provided on behalf of the Navy for your review. Upon agreement with these responses, the Draft Final Feasibility Study will be prepared.

COPY TO
K. Keckler, EPA (4 copies)
M. Lewis, CTDEP (2 copies)
D. Ward (NSB-NLON) (3 copies)
J. Ropp, EA (1 copy)
M. Green, EA PMO (1 copy)
G Hicks, Navy (w/o enclosure)
C. Flynn, EA PMO (w/o enclosure)
B. Lesinski, EA PMO (w/o enclosure)

SIGNED Charles E. McLeod, Jr.
Charles E. McLeod, Jr., P.E.
CTO Manager

EA 0110 (Rev. 1/28/93) If enclosures are not as noted, kindly notify us at once.

RESPONSE TO COMMENTS ON
DRAFT FEASIBILITY STUDY
SITE 20 – AREA A WEAPONS CENTER
NAVAL SUBMARINE BASE NEW LONDON, CONNECTICUT

COMMENTOR: Kymberlee Keckler, U.S. EPA **DATED: 27 July 1999**

GENERAL COMMENTS

1. Since the FS did not include alternative specific Applicable or Relevant and Appropriate Requirements (ARARs) tables, EPA developed them for each alternative and provided them in Attachment B.

   Response—The ARAR tables in Chapter 2 of the draft FS will be removed and replaced with alternative-specific ARAR tables to be included in Chapter 4. The new tables are modified versions of the ARAR tables provided by EPA and CTDEP (see Attachment 1).

2. Given that the FS will be a public document and the basis for future decision-making, EPA also reviewed the FS in light of its clarity to a non-technical reviewer. As indicated in some of our comments in Attachment A, the FS needs substantial improvement in this arena and several issues should be better explained before the draft final FS is issued. In particular, the FS should minimize the use of jargon and better explain the methodologies used to develop cleanup goals and compare alternatives.

   Response—Comment noted. Technical terms and methodologies will be clarified in the FS to facilitate public reviews.

3. Risks have been recalculated in this FS using supplemental data. However, such data are not presented in this report. As a result, exposure point concentrations and final COCs cannot be verified. All data that have not been presented elsewhere should be included in this report and appropriately referenced.

   Response—Comment noted. Appropriate data tables will be added as an appendix.

4. Appendix A shows the Preliminary Remediation Goal (PRG) calculations. Based on review of the calculations for all of the Inhalation Conversion Factors and Inhalation Lifetime Average Doses, several problems were noted with these calculations. Using the information presented, some of the units did not cancel out. The units of the PM10 Factor used are not defined in this Appendix. The IRc for the inhalation pathway is given as mg/event rather than the standard 20 m^3/day. The equations and parameters for the inhalation doses should be checked to ensure that the risk results from this pathway are accurate. In addition, the source of the equation used to calculate the intake for the inhalation pathway should be cited.

Response—Comment noted. The units have been verified and corrected. Detailed calculations will be included in Appendix A (Attachment 2), and appropriately referenced in the text.

5. A treatment alternative must be developed and evaluated to provide a full range of alternatives, because the NCP expresses a preference for treatment alternatives. As stated in the NCP, EPA expects to use treatment to address the principal threats posed by a site, wherever practicable [40 C.F.R. §300.430(a)(iii)(A)]. The FS must be substantially modified to present a clearer rationale for dismissing each of the treatment technologies.

   Response—Alternative 3 (Selective Excavation/Offsite Disposal) satisfies the NCP's preference for treatment of the site. After remedial actions have been completed under Alternative 3, the toxicity, mobility, and volume of COCs in soil and sediment would be reduced at Site 20. It is agreed that Alternative 3 would not result in the direct treatment of the COCs within the excavated material, but this is an established method for remediating soil and sediment. The rationale for screening out potential treatment technologies and process options will be further clarified in Chapter 3.

6. In discussing the development of PRGs, the FS should discuss how site background concentrations affect the selection of constituents and their PRGs. Please describe how background concentrations affected the selection of COCs and their PRGs.

   Response—Comment noted. Appropriate text will be added to Section 2.4.1 to discuss the development of PRGs with regards to background concentrations as follows:

   In the development of PRGs, analytical results for inorganics were also compared to site background concentrations. Constituents with concentrations below site background concentrations were not retained as COCs.

7. In Section 3.0 the technologies considered must address contaminated soil and sediment. The discussion for most technologies mentions soil but not sediment. Please edit the discussions to include both soil and sediment.

   Response—Where missing, technology evaluations for addressing COCs in sediment will be added to Chapter 3.

8. The FS does not show the calculations for the 95 percent UCL of the mean used in Appendix A. Please include those calculations in the FS.

   Response—An example calculation for the 95 percent UCL, and summary tables from the COC database, will be added to Appendix A (Attachment 2).

9. The FS must present the analytical data for this site including the depth of each sample because the ARARs establish different action levels based on depth. Certain ARARs apply to samples that are less than 2 feet if under pavement, less than 4 feet if covered by

permeable material, and contaminant depth relative to the water table. Please include an appendix with tables that clearly provide this necessary information.

Response—Comment noted. A summary table of the analytical data will be added as Appendix B.

10. The document needs to have a thorough QC review, not only for the issues discussed in these comments, but also for consistency and grammar.

    Response—Comment noted.

11. Various sections in the Feasibility Study that contain information and conclusions about the human health and ecological risk assessment need to be revised to be consistent with the Phase II Remedial Investigation and appropriate regulatory guidance.

    Response—Please refer to the specific responses to individual comments below.

12. From the review of Tables 8-20 Hazard Quotients for Benthic Invertebrates Based On Maximum Sediment Concentrations and 8-21 Hazard Quotients for Benthic Invertebrates Based on Average Sediment Concentrations, it is apparent the gamma-chlordane is present at an elevated concentration largely contributing to an HQ of 362. In addition, the soil component of the exposure pathway to the short-tailed shrew is responsible for contributing approximately 55 percent to the overall exposure pathway (soil, food, and water). Antimony is the major contaminant responsible for contributing to the greatest percentage (approximately 70 percent) of the calculated risk. Any future remedial activities should consider where elevated gamma chlordane concentrations were detected in the sediments and whether a preliminary remedial goal should be established for this contaminant. EPA recognizes that there are a number of uncertainties associated with terrestrial food chain models. However, the FS could benefit from inclusion of a brief discussion about the uncertainties surrounding the derivation of antimony reference toxicity values since this contaminant contributes significantly to the Hazard Indices for both the short-tailed shrew and red-tailed hawk. This uncertainty combined with the use of more realistic site use factors could result in much lower Hazard Quotients and Hazard Indices and therefore lead to the conclusion that site contaminants are not responsible for an adverse effect to these terrestrial vertebrates. As a result, it is important to discuss how uncertainty affects the conclusions of both the ecological risk assessment, development of cleanup goals, and the alternatives developed to address those risks.

    Response—Commented noted. In order to most effectively address this and subsequent comments related to the summary of results from the ecological risk assessment from the Phase II RI, Section 1.7 in the FS has been revised (see Attachment 3).

    An error in the calculation of the site-specific sediment quality benchmark value in the Phase II RI resulted in the appearance that the Hazard Quotient (HQ=3.6E+2) for gamma-chlordane was the primary driver in the risk assessment for benthic invertebrates. Gamma-chlordane was only detected in 1 of 6 sediment samples from Drainage Areas 1 and 3; the

single sample (2WCSD5) in which chlordane was detected was collected in Drainage Area 3 near the edge of the Area A Wetland and had a relatively elevated total organic carbon (16,000 mg/kg). The sediment quality benchmark reported in the RI (Appendix 1.4) was 1.92E-5 mg/kg. However, the correct value is 9.63E-3 mg/kg calculated as follows:

$$\text{Site-specific sediment quality benchmark} = CAWQC * f_{oc} * K_{oc}$$

where

CAWQC	=	Connecticut chronic ambient water quality criterion = 4.3E-6 mg/L
f_{oc}	=	Fraction of organic carbon = 0.016
K_{oc}	=	Organic carbon partitioning coefficient = 1.4E+5.

Using the correct sediment quality benchmark, the calculated HQ based on the maximum concentration of gamma-chlordane (7.00E-3 mg/kg) is 7.27E-1; that is, the maximum concentration does not exceed the sediment quality benchmark. Thus, gamma-chlordane is not carried through the risk assessment for benthic invertebrates in the FS.

13. Any excavation impacts within the Area A wetland boundaries must be mitigated pursuant to Section 404 of the Clean Water Act. The FS must be clear on this point and incorporate any associated mitigation costs into the alternatives analysis.

    Response—Comment noted. Costs for wetland restoration are included in the cost line item for site restoration. The following text will be added to 2.2.5.2:

    Clean Water Act, Section 404

    Section 404 of the Clean Water Act regulates the discharge of dredged or fill materials into a water of the United States. Remedial actions at Site 20 will be conducted such that potential adverse impacts to the adjacent Area A wetlands are minimized to the extent practicable. Impacts to wetlands may require mitigation/restoration.

14. A table with a comparison of site data and the corresponding preliminary remediation goal (PRGs) and chemical specific ARARs could be useful. In addition, the site-specific chemical data point (i.e., maximum, and/or average, and/or 95 percent UCL) used for comparison with PRGs and ARARs should be discussed in the text and noted in the PRG/ARAR/data table proposed.

    Response—Commented noted. Appropriate tables will be added in an appendix that compares the maximum, average, and 95 percent UCL concentrations of detected constituents to chemical-specific ARARs and PRGs, and will be discussed appropriately in the text. Table 2-6 will be retained to summarize which COCs exceeded PRGs/ARARs.

15. Please discuss the relevance of the presence of arsenic above PRGs. How does it relate to site background data? Currently, arsenic is mentioned in the text (i.e., page 2-16) and in some tables, but does not appear in Table 2-6.

    Response—Arsenic concentrations in shallow soil do not exceed background concentrations (3 mg/kg) or identified ARARs. Therefore, arsenic in shallow soil is not retained as a COC. Arsenic concentrations in deep soil (for construction worker scenario) exceed identified Region III industrial risk-based concentrations. However, the associated incremental risk for arsenic does not exceed 1×10^{-6} and, therefore, no risk-based PRGs were developed, and arsenic in deep soil was not retained as a COC. Similarly, the associated incremental risk for arsenic in sediment does not exceed background concentrations and, therefore, no risk-based PRGs were developed, and arsenic in sediment was not retained as a COC. The text throughout the FS will be modified accordingly.

SPECIFIC COMMENTS

1. ***Executive Summary, Page ES-2***—In the beginning paragraph of this page, the first sentence incorrectly states, "...Site 20...and no ecological risks...." Please revise and review Section 8.9.3 titled *Ecological Risk Assessment* which is located within the Phase II RI. The third paragraph of this section presents the following important information: "...The results of the ecological risk assessment indicate that with the exception of soil invertebrates, organisms using this area would potentially be at risk, assuming that the Area A Weapons Center provided habitat and forge for terrestrial receptors. However, because of the current conditions associated with this site, actual risks to ecological receptors are likely to be much less than those calculated for the area. When the current site conditions are factored into this evaluation, it is concluded that the Area A Weapons Center represents little potential risk to ecological receptors that might utilize this area. However, it should be noted, due to potential transport from this site, contaminants associated with the Area A Weapons Center may be impacting organisms inhabiting the Area A Wetland...."

   Response—Comment noted. The text "...and no ecological risks..." will be deleted and the following will be added to the end of Section ES.2:

   ...The results of the ecological risk assessment indicate that with the exception of soil invertebrates, organisms using this area would potentially be at risk, assuming that the Area A Weapons Center provided habitat and forge for terrestrial receptors. However, because of the current conditions associated with this site, actual risks to ecological receptors are likely to be much less than those calculated for the area. When the current site conditions are factored into this evaluation, it is concluded that the Area A Weapons Center represents little potential risk to ecological receptors that might utilize this area. Although very unlikely, it should be noted that due to potential transport of drainage swale sediment from this site, COCs contained in the sediment may impact organisms inhabiting the adjacent wetlands.

2. ***Executive Summary, Page ES-2, Bullets***—The contaminants of concern (COCs) noted for each drainage area bullet do not agree with information presented later in the document. For instance, arsenic is the only COC evaluated for the full-time employee and construction worker in the PRG appendixes. A PRG is also calculated and presented for arsenic in soil on Page 2-14. In addition, beryllium contributes a similar risk as the other polycyclic aromatic hydrocarbons (PAHs). Therefore, the COCs included in these bullets should be expanded or their selection criteria should be clarified.

   Response—Comment noted. The bullets listed in the Executive Summary are the comprehensive list of COCs for each media addressed in the FS. The following text will be added to the Executive Summary to clarify the selection criteria for the COCs:

- ***Drainage Area 1***
  - — ***Sediment***—*Beryllium, benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene*
  - — ***Shallow Soil***—*Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene*

- ***Drainage Area 2***
  - — ***Sediment***—*Beryllium and benzo(a)pyrene*

- ***Drainage Area 3***
  - — ***Sediment***—*Benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene*
  - — ***Shallow Soil***—*Beryllium and benzo(a)pyrene.*

Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, and dibenzo(a,h)anthracene exceeded Pollutant Mobility Criteria. Benzo(b)fluoranthene and dibenzo(a,h)anthracene exceeded their respective Residential Direct Exposure Criteria; and no COCs exceeded the Industrial Direct Exposure Criteria. Beryllium, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene in soil and beryllium, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene in sediment exceeded Human Health Risk-Based Preliminary Remediation Goals.

3. ***Executive Summary, Page ES-2, Section ES.2.1***—Another remedial action objective should be developed to minimize the potential future overland transport of contaminants from the three drainage areas into the Area A Wetlands and the Area A Downstream watercourses. This is important because surface water concentrations of cadmium and zinc were detected above acute Ambient Water Quality Criteria. Furthermore, Section 8.9.5 of the Phase II RI states that "...potential exists for contaminants to migrate from the site to Area A Wetland and impact ecological receptors...."

   Response—Comment noted. The following remedial action objective will be added:

   - *Minimize potential future overland transport of COCs from the three drainage areas into the Area A Wetlands and the Area A Downstream watercourses.*

4. ***Page 1-1, Section 1.1.2***—Based on comments provided in this review, the information and discussion presented within the FS does not adequately address potential risks to the environment in all three drainage areas. Revisions to this document should better describe those ecological risks.

   Response—Comment noted. Revisions to this document will better describe the ecological risks associated with Site 20. Please refer to the specific responses to individual comments below.

5. ***Page 1-4, Section 1.2.1.2***—Before the late 1950s, the Area A Wetland was undeveloped and possibly a wetland. In the late 1950s, dredge spoils from the Thames River were deposited into this area and this disturbance has resulted in the development of a wetlands that is dominated by the Great Reed, *Phragmites australis*. The monotypic stand of this invasive species indicates a disturbed habitat and one that is not fully functional. Therefore, any potential migration of contaminants should be avoided.

   Response—The third full sentence on Page 1-4 will be replaced with the following text:

   The Area A Wetland generally supports standing surface water much of the year. However, the wetland is dominated by the invasive reed, Phragmites australis, therefore, the area does not appear to be "fully functional" as a wetland.

   As outlined in Section 2.6, the Remedial Action Objectives include minimizing potential migration of COCs of soil into ground water and minimizing potential future overland transport of COCs from the three drainage areas into the Area A Wetlands and the Area A Downstream watercourses.

6. ***Page 1-4, Section 1.2.1.2***—The last paragraph appears to state that samples of media and excavated materials collected at the southern bunker area were found to contain cyanide, TPH, and various metals. However, the text does not indicate if these constituents were found in the media left in place or the material removed from the site. The results of confirmation samples for media left in place need to be considered for this FS. Please edit the text to indicate if detections of constituents were found in media left in place and, if so, what the concentrations were. The document needs to be edited to include these data and discuss its impact on the FS. Delete the last sentence.

   Response—Based on the available information, the last paragraph in Section 1.2.1.2 will be modified to read as follows:

   The southern area bunkers were reconstructed approximately 15 years ago. Part of the reconstruction involved removal of structurally unsuitable soil from the site, most likely dredged spoils associated with the Area A Wetland. Prior to offsite disposal, the material, excavation, and ground water were sampled and analyzed for metals, volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), cyanide, 4,4'-DDT, and total petroleum hydrocarbons (TPHs). Cyanide, TPH, and various metals were detected in the samples of the material being disposed. However, the Phase II RI completed in 1997 did not identify cyanide or TPH as COC in soil or sediment at Site 20. The results of the Phase II RI are summarized in Section 1.2.2 (Previous Investigations) and Section 1.4 (Nature and Extent). Comparison of COC concentrations to cleanup goals is presented in Section 2.4.

7. ***Page 1-5, Section 1.2.2.2***—The Phase II RI indicated that cadmium (6.6 μg/L) and zinc (135 μg/L) were detected in surface water collected from WCSW3 at concentrations greater than the acute Ambient Water Quality Criteria. Also, contaminants of concern in collected sediments were identified by comparing the site-specific chemical concentrations against

NOAA's Effect Range Low, NOAA's Effect Range Median,. This discussion is presented within Chapter 3 of the Phase II RI.

Response—The following text will be added at the top of Page 1-6 before the sentence related to arsenic:

Sediment COCs were identified by comparison of measured concentrations of inorganic constituents to Ontario Ministry of Environment Lowest Effect Level and Severe Effect Level and non-polar organics compounds to (EqP) model estimates of biological availability.

Cadmium and zinc measured at one surface water sampling location in the Area A Wetland within Drainage Area 3 exceeded the acute AWQC for aquatic life....

8. ***Page 1-5, Section 1.2.2.2***—The third paragraph states that various soil samples may have exceeded the Connecticut Remediation Standards but provides few additional details. Are the analytical results for all the samples exceeding the Connecticut Remediation Standards presented and discussed fully in subsequent sections of the FS? Since the Connecticut Remediation Standards are ARARs, any exceedances in samples collected at the site must be addressed in the FS. An appendix with the RI data could clarify this issue.

   Response—Comment noted. The ARAR discussion will be discussed fully in Chapter 2 of the FS. Summary tables of the analytical data will be added to the appendixes. In addition, the following text summarizing ARAR exceedances will be added to this section:

   Soil COCs were identified by comparison of measured concentrations of constituents to Pollutant Mobility Criteria (PMC), Industrial/Commercial Direct Exposure Criteria (ICDEC), and Residential Direct Exposure Criteria (RDEC). Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, and dibenzo(a,h)anthracene exceeded PMC. Benzo(b)fluoranthene and dibenzo(a,h)anthracene exceeded their respective RDEC; and no COCs exceeded the ICDEC.

9. ***Page 1-7, Section 1.3.2***—The second bullet in this section states that the Pleasant Valley community borders the southern boundary of NSB-NLON. The second paragraph states that Site 20 is located just west of the Pleasant Valley neighborhood. These statements contradict.

   Response—Comment noted. The second paragraph will be revised to state:

   Site 20 is located just west of the Baldwin Hill neighborhood.

10. ***Page 1-8, Section 1.3.4***—The second paragraph discusses a storm sewer at the site. Is this text describing a storm sewer pipe along the southwestern boundary of Drainage Area 1 that connects the western culvert to the southeastern culvert? None of the figures appear to show storm sewer pipes on the site. Please describe the surface water features in more detail, and include a figure with the necessary details.

Response—The description of the stormwater system at Site 20 will be depicted on Figure 1-4 and the text will be modified as follows:

Site 20 is principally urbanized and runoff is managed via a stormwater conveyance system constructed as part of the facility infrastructure. Site 20 drainage is conveyed through a series of grass-lined swales. Two drainage culverts (one along the northwest side and one along the southeast side of the site) collect runoff from the surrounding hillsides and from Site 20 and discharge it to the Area A Wetland (Figure 1-4). The drainage culvert along the northwest side eventually discharges to a storm sewer that passes along the southern side of the site and discharges into the Area A Wetland (Drainage Area 1). The drainage culvert along the southeast side of the site collects runoff from the hillside north of the site and continues along the southeast side of the site, eventually discharging to the Area A Wetland (Drainage Area 2). There are no drainage culverts in Drainage Area 3; however, there is a storm sewer under the southern bunkers in Drainage Area 3 along the southeast fence that discharges into the Area A Wetland (Figure 1-4). The Area A Wetland serves as a detention basin for site drainage. Drainage from Area A Wetland is influenced by dike and discharge culvert elevations which serve to detain water in the depression. The culvert has a water control gate which can manipulate water elevations in the wetlands. The Area A Wetland discharges to the Area A Downstream Watercourses and subsequently into the Thames River.

11. ***Page 1-8, Section 1.3.4***—This section does not include a description of Drainage Area 3.

    Response—Comment noted. The following text will be added:

    There are no drainage culverts in Drainage Area 3.

12. ***Page 1-14, Section 1.4.2***—Within the discussion presented for each of the drainage areas, note what contaminant concentrations exceed ecotoxicological benchmarks and present this information in Section 1.7, Ecological Risk Assessment.

    Response—Section 1.4 discusses the nature and extent of COCs at Site 20. The COC concentrations exceeding ecotoxicological benchmarks will be added in the revision of Section 1.7, Ecological Risk Assessment (see Attachment 3).

13. ***Page 1-15, Section 1.4.2.3***—The first sentence states that Drainage Area 3 is located on the southeast side of the weapons storage bunkers. It appears that it should read "southwestern."

    Response—The sentence will be modified to read:

    ...located on the southwest side....

14. ***Page 1-15, Section 1.4.2.3***—In the second paragraph, for the sediment constituents that exceed the direct exposure criteria for residential land use, include the maximum concentrations. Also, include the constituents that exceed the Pollutant Mobility Criteria

and their associated maximum concentrations. These constituents and concentrations also need to be incorporated into subsequent tables, figures, and text.

Response—As noted in EPA Comment No. 15, the CTDEP Remediation Standard Regulations (DEC/PMC) for soil do not apply to sediment. Comparisons to ARARs will be removed from Section 1.4 (and subsections). Data comparisons to ARARs/PRGs will be retained for Section 2.4.3.

15. ***Page 1-15, Paragraph 3***—Remove the second and third sentences since the CT Remediation Standards define soil as not including sediment (RSCA 22A-133k-1(a)(60)). In addition, the pollutant mobility criteria only apply to soils above the water table and are not relevant to saturated conditions (such as sediment). Cleanup of sediments should be risk-based.

    Response—Data comparisons to ARARs will be removed from Section 1.4 (and subsections). Comparison of sediment data to risk-based PRGs will be retained for Section 2.4.3.

16. ***Page 1-16, Section 1.4.3***—The last sentence in the first paragraph of this page states, "The only chemical reported as...was arsenic." This statement should be revised to include the contaminants that exceeded the state or federal Ambient Water Quality Criteria for the protection of freshwater aquatic life and human health.

    Response—Data comparisons to ARARs will be removed from Section 1.4 (and subsections). Comparison of surface water data to ARARs/PRGs will be retained for Section 2.4.3.

17. ***Page 1-16, Paragraph 5***—In the third sentence, how was the 0-10 depth for residential soil exposure determined? Under the Connecticut remediation regulations, "inaccessible soil" is 4 ft below the surface (2 ft if below a paved surface or underneath a building) (RSCA Section 22A-133k-1[a][28]). Direct exposure criteria do not apply to "inaccessible soil" unless contaminated with PCBs, except that if the inaccessible soil is less than 15 ft from the surface an Environment Land Use Restriction must be recorded on the property to prevent exposure to the contaminated soil (RSCA Section 22A-133k-2[b][3]). The top 1 ft of soil was used in the Human Health Risk Assessment.

    Response—Section 1.6.1 summarizes the human health exposure assessment completed for the RI, in which it was assumed that "Future residents could come into direct contact with 'all soil' (soil from depths of 0 to 10 ft)" and that "The full-time employee could conceivably come into contact with surface soil on a routine basis." The Direct Exposure Criteria apply to soil within 15 ft of the surface. However, the regulations specify that soil below a depth of 4 ft is considered "inaccessible." The Direct Exposure Criteria do not apply to inaccessible soil, providing that an ELUR is in effect to ensure that the soil will not be exposed as a result of excavation, demolition, or other activities. In Section 2.4 (Development of PRG), this distinction will be further discussed.

18. ***Page 1-17, Section 1.6.2.2***—This section summarizes the carcinogenic risks and does not fully agree with the results presented in the Phase II RI. The RI states that estimated carcinogenic risks for future residents are mainly a result of exposure to dibenz(a,h)anthracene and arsenic in ground water. This section states that unacceptable risk for future residents were primarily attributable to incidental ingestion of benzo(a)pyrene and arsenic in soil. This statement should be corrected to match the Phase II RI results.

    Response—Comment noted. The results presented in the Phase II RI discussed ground water and soil. This FS does not address ground water at Site 20, as a result, only the unacceptable risks in soil were discussed. In order to clarify this, the text will be revised to state:

    Unacceptable carcinogenic risks in soil for future residents under the RME scenario were shown to be primarily attributable to incidental ingestion of benzo(a)pyrene and arsenic.

19. ***Page 1-17, Section 1.6.2.2***—The fourth sentence of this section appears to be missing key words. The statement "...For incidental ingestion of the unacceptable carcinogenic risk..." is unclear.

    Response—Comment noted. Refer to response to Comment No. 18.

20. ***Page 1-18, Section 1.7***—Delete the last part of the last sentence in the introductory paragraph that states: "...which is supported by the fact that no evidence of adverse impacts have been observed in the vicinity of Site 20....." EPA recognizes that the levels of contaminants detected in site-related media are unlikely to cause outright mortality requiring immediate action. Moreover, it is very unlikely that one could observe chronic or subchronic affects with the data collected thus far. Therefore, this sentence is senseless.

    Response—The following text will be deleted:

    ...which is supported by the fact that no evidence of adverse impacts have been observed in the vicinity of Site 20.

21. ***Page 1-18, Section 1.7.1***—Replace "...robust emergent marsh..." with "...monotypic stand of *Phragmites australis....*"

    Response—Comment noted. The text "robust emergent marsh" has been replaced with "an emergent marsh dominated by *Phragmites australis.*"

22. ***Page 1-21, Paragraph 1***—The risk assessment did not evaluate potential downstream receptors, or investigate if the ditches were used intensively by species such as breeding frogs, which use temporary waterways for laying eggs and supporting tadpoles for a few months of the year (primarily in the spring). Please delete the misleading text.

Response—The revision to Section 1.7 clarifies this issue (see Attachment 3). Although these ditches are generally wet throughout the year due to the shallow water table, the depth of standing/running surface water in these ditches would be adequate to support amphibian reproduction only during brief periods of runoff from precipitation and snowmelt. These periods are typically not of sufficient duration to support aquatic populations and reproductive or nursery habitat uses.

23. ***Page 1-21, Section 1.7.2.2***—Please remove the last sentence in this section as it is not relevant to the characterization of potential risk to terrestrial vegetation.

    Response—The sentence will be deleted.

24. ***Page 1-22, Section 1.7.2.4***—The latter part of this section should clearly state: "When the size of the Area A Weapons Center is factored into the Hazard Index (HI) calculations for the short-tailed shrew, the resulting values are less than 1.0. These results, coupled with the fact that this site provides lower quality habitat, suggests that contaminants detected in this location are unlikely to represent an adverse risk to this receptor."

    Response—The suggested text modification will be incorporated into the revision to Section 1.7 (see Attachment 3).

25. ***Page 1-22, Section 1.7.3***—Please integrate more of the significant uncertainties discussed within Section 8.7.5.4 of the Phase II RI.

    Response—The requested information will be incorporated into the revision to Section 1.7 (see Attachment 3).

26. ***Figure 1-3***—Sediment sample location 2WCSD2 and soil sample 2WCTB1 are not labeled. Please correct.

    Response—Comment noted. Labels for 2WCSD2 and 2WCTB1 will be added to Figure 1-3.

27. ***Figures 1-6 and 1-7***—The legend includes symbols for monitoring wells, but there are no wells on these figures. Please add the monitoring well locations.

    Response—Comment noted. Figures 1-6 and 1-7 depict geologic topography only. Therefore, monitoring wells will be removed from the legend. The existing monitoring wells at Site 20 will be added to Figure 1-3.

28. ***Table 1-1***—The table indicates that one well (two samples) were analyzed for radiological parameters. Is there reason to believe that radiological contamination might exist at this site? Could storage of submarine components or weapons radiologically contaminate the area? Please explain and indicate why only one location was sampled. Also, please explain why a dioxin sample was collected at one location.

Response—The radiological and dioxin analyses were performed during the Phase II RI as part of the overall characterization of COCs at Site 20. These parameters were likely selected as part of a general screening of the site conditions. No dioxins were detected at Site 20 during the RI. Further information regarding radiological assessments at NSB-NLON can be found in the "Historical Radiological Assessment" (Radiological Controls Office, November 1997). The study concluded that no additional characterization and no remedial actions are necessary at NSB-NLON.

29. ***Page 2-1, Section 2.1***—In the first bullet and throughout the document change "ARAR" to "ARARs" since it is plural (unless a single specific ARAR is being discussed).

    Response—The text will be changed accordingly. An "s" will be added to all plural acronyms as applicable.

30. ***Page 2-1, Section 2.2***—Change the two sentences in the first paragraph from "is similar to the CERCLA process. Pursuant to SARA and the NCP, the development and evaluation of remedial alternatives under CERCLA includes...ARAR" to "complies with CERCLA standards, including...ARARs."

    Response—Comment noted. The text will be modified as requested.

    Change the third sentence in the first paragraph from "neither SARA nor the NCP" to "SARA and the NCP." The nine criteria in the NCP are the standards for determining whether a particular remedy provides a sufficient cleanup.

    Response—Comment noted. The text will be modified as requested.

    In the second paragraph, first sentence, remove ", techniques, materials, equipment, and methods." In the second sentence, change "public health, welfare," to "human health."

    Response—Comment noted. The text will be modified as requested.

    In the third paragraph, change the second and third sentences to: "The remedial alternative must attain applicable or relevant and appropriate requirements under federal environmental; laws and state environmental or facility siting laws or provide grounds for invoking one of the waivers permitted under the statute."

    Response—In the third paragraph, the second and third sentences will be changed as follows:

    The remedial alternative must attain applicable or relevant and appropriate requirements under federal environmental laws and state environmental or facility siting laws or provide grounds for invoking one of the waivers permitted under the statute.

31. ***Page 2-2, Paragraph 1***—Change the sentence to: "CERCLA Section 121, codified at 40 CFR Part 300.400(e), states that removal or remedial actions conducted entirely onsite do not require Federal, State, or local permits. However, any substantive, non-administrative requirements of statutes and regulations which include permitting requirements must be complied with or waived."

    Response—Comment noted. The text will be modified as requested.

32. ***Page 2-2, Section 2.2.1***—In the first bullet and second bullets, change "substantive environmental protection" to "substantive Federal environmental and State environmental and facility siting."

    Response—Comment noted. The text will be modified as requested.

33. ***Page 2-2, Section 2.2.2***—In the first sentence, change the beginning of the sentence to: "ARARs for remedial action alternative can be classified into..."

    Response—Comment noted. The text "...can be generally classified..." has been changed to "...can be classified...."

34. ***Page 2-3***—Remove the third and fourth bullets since these are To Be Considered (TBC), not ARARs.

    Response—Comment noted. The first full paragraph and set of bullets on Page 2-3 will be modified to read as follows:

    To be consistent with the NCP definition of ARAR and changes made by SARA, Federal requirements and State of Connecticut requirements were considered during the ARAR identification process.

    The text from the last two bullets will be deleted.

35. ***Page 2-3, Section 2.2.3***—Change the section to: "Federal and state guidance documents or advisories do not have the status of ARARs and are not enforceable. However, they may be considered when developing remedies that will be protective of human health and the environment."

    Response—Comment noted. The text of Section 2.2.3 will be replaced as requested.

36. ***Page 2-3, Section 2.2.4***—Change the first paragraph to: "To comply with CERCLA, a remedy must either meet all identified ARAR standards or qualify for a waiver. Pursuant to Section 300.430(f)(3), there are several criteria under which an ARAR may be waived, if the standard cannot be attained." The last sentence of the original paragraph is not accurate because the cost-effectiveness of a remedy is not grounds for a waiver.

    Response—Comment noted. The text will be changed as requested.

37. ***Page 2-4, Section 2.2.5.1***—Human health risk calculations are To Be Considered (TBC) not an ARAR. You may chose to add "and To Be Considered" after "Requirements" in the title, and in the last sentence of the first paragraph change "ARAR were considered" to "ARARs and TBCs were considered." Also in the last sentence of the section, change "ARAR are described" to "ARARs and TBCs are described." This approach is consistent with the ARARs tables provided in Attachment B.

    Response—Comment noted. The second bullet under 2.2.5.1 will be deleted. The subsection under 2.2.5.1 entitled "Human Health Risk Calculations for Soil and Sediment" will be moved to Section 2.2.5.4 (To Be Considered Guidance). Table 2-1 correctly lists CSFs and RfDs used in risk calculations as TBC. ARAR tables in Chapter 2 will be replaced with alternative-specific ARAR tables in Chapter 4 (see Attachment 1).

38. ***Page 2-5, Paragraph 1***—The second sentence is not accurate, since land under a Land Use Restriction may still be required to have soil in the first two feet to meet direct exposure criteria.

    Response—The meaning of this comment is unclear. The indicated paragraph does not discuss compliance relative to depth distribution of COCs. The paragraph accurately summarizes the statistical procedure for determining whether soil constituents are in compliance with either residential or industrial/commercial direct exposure criteria. It is also correct that where an appropriate Environmental Land Use Restriction is implemented, the site is not required to meet residential direct exposure criteria, but will still need to meet the industrial/commercial criteria. The following text will be added after the first sentence in this paragraph as additional clarification regarding compliance and "inaccessible" soil:

    Even where ELUR is implemented, CTDEP Remediation Standard Regulations stipulate that remedial measures must ensure that COCs are less than ICDEC in the first 2 ft if the soil is paved or covered by a building, or in the first 4 ft of exposed soil.

    In the second paragraph, explain the abbreviations "PMC" and "COC."

    Response—Comment noted. In the second paragraph, "PMC" has already been defined at its first use on Page 1-14. The acronym "COC" was previously defined on Page 1-1.

39. ***Page 2-5, Section 2.2.5.1.***—The last paragraph on this page refers to the current EPA Region II Risk-Based Concentration table. This should be corrected to be Region III.

    Response—Comment noted. The correction will be made to "Region III."

40. ***Page 2-6, Section 2.2.5.1***—The first paragraph on this page uses the acronym "CFS." The acronym should be "CSF" for Cancer Slope Factor.

    Response—Comment noted. The typo will be corrected to "CSF."

41. ***Page 2-6, Section 2.2.5.1***—At the end of the first paragraph on this page explain that the Connecticut regulations consider an excess cancer risk of less than 1×10^{-5} as acceptable.

Response—See response to Comment No. 42.

42. ***Page 2-6, Paragraph 1***—Add at the end of the paragraph: "A remedy may be selected that will result in a risk range between 1×10^{-4} and 1×10^{-6}."

Response—Comment noted. Based on the above two comments, the end of the referenced paragraph will be modified to read as follows:

Incremental lifetime cancer risks below 1×10^{-6} are considered to be acceptable by EPA, and incremental lifetime cancer risks greater than 1×10^{-4} are considered to be unacceptable. Under the State of Connecticut Remediation Standard Regulations, incremental cancer risks are considered to be acceptable below 1×10^{-6} for individual chemicals and below 1×10^{-5} for the cumulative effect of multiple chemicals. Therefore, in order to meet both EPA and CTDEP requirements, a remedy for Site 20 may be selected that will meet the more conservative CTDEP requirement of 1×10^{-6} for individual chemicals.

43. ***Page 2-6, Paragraph 4***—There are no federal endangered species at the base. One of the state species is a fish that lives in the Thames. There are five species of state listed plants that may occur on the base (see the Area A Downstream FS).

Response—Comment noted. The paragraph will be modified to read as follows:

Six state-listed Endangered, Threatened, or Special Concern species have been identified in the vicinity of NSB-NLON. This includes one fish species of the Thames River (Atlantic sturgeon [Acipenser oxyrhnchus]) and five plant species in the Area A Downstream (golden Alexander [Zizia aptera], seaside crowfoot [Ranunculus cymbalacia], creeping bush-clover [Lespedeza repens], crooked-stem aster [Aster prenanthoides], and Crawford's sedge [Carex crawfordii]). Although these species have the potential to be present in the vicinity/downgradient of Site 20, the1997 Integrated Natural Resources Endangered Species Act Management Plan for NSB-NLON indicated no Federal or State Endangered, Threatened, or Special Concern species at NSB-NLON or in adjacent Navy Housing areas. Remedial actions involving excavation within or adjacent to the Area A Wetland will be coordinated with the NSB-NLON Natural Resources Manager prior to the start of project; and the Natural Resources Manager will specify additional surveys, if any, for endangered and threatened species or significant natural communities.

44. ***Page 2-6, Paragraph 5***—The National Historic Preservation Act is not an ARAR if there are no sites or suspected sites in the area of the Remedial Action. What information is available to evaluate the area's sensitivity to the presence of historic cultural resources?

Response—Comment noted. No known or suspected historic sites are located at Site 20. Therefore, the National Historic Preservation Act will be removed from this section and the alternative-specific ARAR tables in Chapter 4.

45. ***Page 2-7, Section 2.2.5.3***—In the first bullet, spell out RCRA and what the sections cited apply to (remove 263 and 268 - see response below).

Response—Comment noted. RCRA has been defined on Page 1-3. Text will be modified as follows:

Federal RCRA 40 CFR 262 (Generator Requirements for Manifesting Waste for Offsite Disposal), and 40 CFR 264 Subpart I (Use and Management of Containers).

The text "40 CFR 264.1030 through 264.1036 (Subpart AA - Air Emission Standards for Process Vents)" will be deleted from the last paragraph on Page 2-7 and from the ARAR tables because it does not apply to the types of remedial alternatives developed in Chapter 4.

In the second bullet, the only CWA action-specific ARAR would be Section 302 (33 U.S.C. 1342; 40 C.F.R. 122 through 125) if the remedy will result in any discharge of water into downstream waterbodies or wetlands. Section 404 would be a location-specific ARAR and Section 311 is not an ARAR (but instead addresses liability).

Response—Comment noted. The second bullet will be modified as follows:

Federal Clean Water Act (33 USC 1342; 40 CFR 122-125).

The CWA Section 404 will be moved to location-specific ARARs (see responses to general comments). The fourth bullet on Page 2-8 will be deleted.

In the third bullet, the name of the regulation is missing, and there is only a partial citation. State that Sec. 22a-426 are the Connecticut Water Quality Standards.

Response—Comment noted. The third bullet will be modified as follows: "State of Connecticut Water Quality Standards (Connecticut General Statutes Section 22a-426)."

In the fourth bullet, the CT Inland Wetland and Watercourses Act is a location-specific ARAR.

Response—Comment noted. The fourth bullet will be deleted and the associated text on Page 2-9 (Connecticut Inland Wetland and Watercourses Act) will be moved to Section 2.2.5.2 (Location-Specific ARAR). Table 2-2 will be modified accordingly.

46. ***Page 2-7, Last Paragraph***—Section 263 is not an ARAR since it addresses offsite transportation and Section 268 is only cited as an ARAR if the levels of contaminants at the site exceed the regulatory thresholds.

Response—Comment noted. References to 40 CFR 263 and 40 CFR 268 will be deleted from Section 2.2.5.3 and Table 2-3.

47. ***Page 2-8, CWA***—In the first bullet, this is not an action-specific ARAR. If you are using AWQCs to develop sediment cleanup levels then they would be chemical-specific ARARs.

    Response—Comment noted. The summary of the Clean Water Act will be moved to Section 2.2.5.2, Location-Specific ARAR (see responses to General Comments). The first bullet will not be retained because AWQC were not used for the development of sediment PRG. Similarly, the second bullet pertaining to NPDES will be deleted because no alternatives were developed that include discharge to a surface water.

    In the third bullet the correct citation for the pretreatment standards is 40 C.F.R. 403. Do not cite this standard as an ARAR unless discharge into a POTW is proposed.

    Response—Comment noted. The summary of the Clean Water Act will be moved to Section 2.2.5.2, Location-Specific ARAR (see responses to General Comments). The third bullet will not be retained because no alternatives were developed that include discharge to a POTW.

    In the fourth bullet move Section 404 into location-specific ARARs section.

    Response—Comment noted. The summary of the Clean Water Act will be moved to Section 2.2.5.2, Location-Specific ARAR (see responses to General Comments).

48. ***Page 2-8, Last Paragraph***—In the second sentence change "a Connecticut Pollutant Discharge Elimination System permit" to "the Connecticut Water Pollution Control regulations (RSCA Sections 22a-430-1 through 8)."

    Response—Comment noted. The text will be modified as requested.

49. ***Page 2-9, Paragraph 2***—The CT Wetlands and Watercourses Act is a location-specific ARAR and should be moved to that section.

    Response—Comment noted. As previously noted, this text on Page 2-9 (Connecticut Inland Wetland and Watercourses Act) will be moved to Section 2.2.5.2 (Location-Specific ARAR).

    In the first sentence, change "may be relevant" to "may be applicable."

    Response—Comment noted. The text will be modified as requested.

    In the second sentence insert "remedial" after "All" and change "would require a permit from the local wetlands agency in accordance with Section 22-42a" to "will meet the substantive requirements."

Response—Comment noted. The text will be modified as requested.

Delete the last two sentences.

Response—Comment noted. The sentences will be deleted.

50. ***Page 2-9, Section 2.2.5.4***—Promulgated regulations cannot be a To Be Considered. The only TBCs cited in the text should be Cancer Slope Factors and Reference Doses.

Response—Comment noted. The Clean Air Act and Connecticut Air Pollution Control Act sections in 2.2.5.4 will be moved to Section 2.2.5.3, "Action-Specific ARARs." The first paragraph under Section 2.2.5.4 will be replaced with the following text:

> *Federal and state guidance documents or criteria that are not generally enforceable, but are advisory, do not have the status of potential ARARs. Guidance documents or advisories to be considered in determining the necessary level of cleanup for protection of human health or the environment may be used where no specific ARARs exist for a chemical or situation, or where such ARARs are not sufficient to afford protection. The following To Be Considered guidance was identified for Site 20:*
>
> - *Human health risk calculations for soil and sediment*

The section on Page 2-5 entitled "Human Health Risk Calculations for Soil and Sediment," which includes a summary of Cancer Slope Factors and Reference Doses, will be moved to follow the above text.

51. ***Page 2-11, Section 2.3.2***—Based on the extent of elevated concentrations or gamma chlordane detected in sediments, it should be retained as a COC throughout the FS.

Response—See response to General Comment No. 12 regarding the issue of gamma-chlordane. The apparent significant contribution of gamma-chlordane to the risk for benthic invertebrates was due to an error in the calculated site-specific sediment quality benchmark that has been corrected.

52. ***Page 2-11, Section 2.3.1***—To show the results of the screening in a straightforward manner, please create a table that includes the COCs in soil and sediment, their maximum concentrations, and the threshold concentrations for each scenario to pass the screening criteria.

Response—Comment noted. Appropriate data tables will be added as an appendix.

53. ***Page 2-11, Section 2.3.1***—The last paragraph in this section refers to potential soil COCs. The COCs actually are for both soil and sediment so delete the word "soil" from the sentence.

Response—Comment noted. The word "soil" will be deleted.

54. ***Page 2-11, Section 2.3.3***—The text states that the maximum arsenic concentration in soil exceeded the Connecticut Remediation Standard for RDEC. Please include the maximum concentration detected and the required value to meet the arsenic standard for RDEC.

    Response—Comment noted. The maximum arsenic concentration in "accessible" soil did not exceed the Connecticut Remediation Standard for residential land use. Therefore, the text will be revised as follows:

    The constituents reported at maximum concentrations (Table 2-3) exceeding the RDEC include the following: benzo(b)fluoranthene and dibenzo(a,h)anthracene. No maximum constituent concentrations exceeded ICDEC.

55. ***Page 2-12, Paragraph 2***—Sediment cleanup levels may be derived from AWQCs or from risk-based calculations (based on either federal or state guidance). Were not these considered in assessing potential exposure to sediment?

    Response—Risk-based PRGs for sediment were developed in Section 2.4.1. The referenced text in Section 2.3.3 pertains to CTDEP Remediation Standard Regulations only.

56. ***Page 2-12, Paragraph 3***—In the third sentence, could the ditches possibly support seasonal populations of aquatic life, such as breeding frogs?

    Response—See response to Comment No. 22. Potential ecological receptors associated with Site 20 were evaluated as part of the RI. It was determined that the ditches did not provide adequate habitat for an adequate length of time to complete these biological functions. No intensive use of these drainage ditches has been observed or would be expected.

57. ***Page 2-12, Section 2.3.3***—The first paragraph on this page lists constituents in soil with maximum concentrations that exceed the GB PMC. The 95 percent UCL for the mean values was not provided and it does not appear that at least 20 soil samples were collected. Therefore, both indeno(1,2,3-cd)pyrene and dibenzo(a,h)anthracene should have a PRG for PMC.

    Response—Both of these constituents have PRGs that are presented in Section 2.4.1 and Table 2-4. A "Comparison of Analytical Data to Preliminary Remediation Goals" is presented in Section 2.4.3.

58. ***Page 2-12, Section 2.4.1***—In the second sentence, add at the end ", if risks to human and ecological receptors are adequately addressed."

    Response—Comment noted. The text will be modified as requested.

59. ***Page 2-13, Paragraph 1***—What is the basis for assessing soil data down to 10 ft below the surface for human exposure?

Response—Comment noted. Soil data down to 4 ft below ground surface will be used for the full-time employee and future resident scenario. Soil data down to 10 ft below ground surface will be used for the construction worker scenario. The text will be modified as follows:

Using recalculated risk values based on the analyte concentrations with validated and unvalidated data and for soil data from 0 to 4 ft below ground surface (from 0 to 10 ft for the construction worker scenario), PRGs for the COCs identified in Section 2.3.1 were calculated for several potential human receptors at NSB-NLON.

60. ***Page 2-13, Section 2.4.1***—The second bullet in the second paragraph lists protection of ecological receptors as a goal, but prior discussion in the FS eliminated ecological issues at this site. Please correct.

Response—Comment noted. It appears the comment pertains to the second bullet on Page 2-12. The second bullet will be deleted and the paragraph will be modified as follows:

PRGs were developed for the COCs identified in Section 2.3 (Table 2-2). No COCs were identified for ecological receptors (Section 2.3.2); therefore, the soil and sediment PRGs were based on....

61. ***Page 2-13, Section 2.4.1***—The third bullet in the second paragraph on this page lists inhalation of dust and emissions for soil only. However, based on the rationale that the drainage channels are dry most of the year, inhalation of sediment emissions is also a concern. Please emend the text accordingly.

Response—As indicated in response to Comment No. 22, standing or running water typically occurs in the drainage ditches during periods of precipitation runoff and snowmelt; however, due to the shallow ground-water table at Site 20, sediment in the ditches generally remains wet. Thus, these sediments are not subject to suspension as dust, and the inhalation pathway is not complete and not relevant in the HHRA.

62. ***Page 2-13, Section 2.4.1***—The discussion in the third paragraph on this page begins "For each scenario..." is not clear and may confuse individual and aggregate risks. The discussion in the first paragraph on page 2-14 seems to be what was actually done to select the constituents and their PRGs. Please clarify.

Response—Comment noted. The text will be modified as follows:

For each scenario, individual COCs which contributed at least 1×10^{-6} to the incremental cancer risk or 1.0 to the HI were selected. If the risk or hazard values approached these levels, the contributing COCs were also included in the PRG calculations.

63. ***Page 2-14, Paragraph 4***—Please note that an environmental LUR under the State Remediation Standards cannot be established until a deed is created for the parcel. Since there are no deeds for the base, the best that can be done are restrictions included on the Base Master Plan. In the DRMO ROD a requirement was included that if the site was ever sold, that upon the creation of a deed, that the environmental LUR would be recorded in accordance with the applicable state standard.

Response—Comment noted. The text will be modified as follows:

> *RDEC are more stringent than ICDEC, but are not applicable where ELURs exist or will be implemented in conjunction with the selected remedial action. Under the State Remediation Standards, ELUR cannot be established until a deed is created for the parcel. Because there are no deeds currently for NSB-NLON, the Base Master Plan would need to include a requirement that stated if the site was ever sold, upon the creation of a deed, ELUR would be recorded in accordance with the applicable federal, state, and local standards. ELUR will prohibit....*

The text in Chapters 3 and 4 pertaining to ELUR will also be modified accordingly.

64. ***Page 2-14, Section 2.4.1***—The first two bullets on the page appear to summarize the COCs selected for PRG development based on risks from residential exposure to soil and sediment. Based on the results presented in Appendix A, additional chemicals meet the listed criteria for COC development. These chemicals include benzo(a)pyrene, and dibenzo(a,h)anthracene in soil, and arsenic, benzo(b)fluoranthene, dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene for sediment. In addition, a PRG should be developed for arsenic in soil based on risks to the full-time employee. The list of COCs selected for PRG development should be verified and expanded as necessary.

Response—Comment noted. Based on CTDEP comments, a screening level of 1×10^{-6} will be used. The list of COCs selected for PRG development will be verified and expanded as necessary. The following text will be added to this section to clarify which COCs were selected for PRG development:

> *The following HHRA risk-based PRGs were developed for the COCs identified:*
>
> - *Soil PRG for Full-Time Employee:*
> *Benzo(a)pyrene* *0.65 mg/kg*
>
> - *Soil PRG for Future Resident:*
> *Beryllium* *0.14 mg/kg*
> *Benzo(a)pyrene* *0.12 mg/kg*
> *Benzo(b)fluoranthene* *1.27 mg/kg*
> *Dibenzo(a,h)anthracene* *0.13 mg/kg*

- *Sediment PRG for Full-Time Employee:*

Benzo(a)pyrene	*0.29 mg/kg*
Dibenzo(a,h)anthracene	*0.29 mg/kg*

- *Sediment PRG for Future Resident:*

Beryllium	*0.19 mg/kg*
Benzo(a)pyrene	*0.13 mg/kg*
Benzo(a)anthracene	*1.27 mg/kg*
Benzo(b)fluoranthene	*1.27 mg/kg*
Indeno(1,2,3-cd)pyrene	*1.27 mg/kg*
Dibenzo(a,h)anthracene	*0.13 mg/kg*

Arsenic concentrations in shallow soil do not exceed background concentrations. Therefore, arsenic is not retained as a COC.

65. ***Page 2-14, Section 2.4.1***—This section discusses the development of the final PRGs. The text on the top of Page 2-14 shows a final arsenic PRG for soil of 0.27 mg/kg for the future resident. However, the tables in Appendix A show the arsenic soil PRGs for the future resident as 0.236 mg/kg. Please correct.

    Response—See response to Comment No. 15. In addition, the following text will be added:

    Arsenic concentrations in shallow soil do not exceed background concentrations. Therefore, arsenic is not retained as a COC.

66. ***Page 2-15, Paragraph 3***—Remove this paragraph as waiving an ARAR is not relevant to any of the remedies evaluated in the FS. Also cost is not a grounds for a waiver of an ARAR or exceeding a PRG.

    Response—Comment noted. The text in Section 2.4.2 will be replaced with the following:

    The PRGs differ between the two land use scenarios and their associated receptors. The PRGs for current industrial land use and its associated receptors (i.e., full-time employees and construction workers) are less stringent than the PRGs associated with the primary receptor under the future residential land use scenario (i.e., future residents).

    The status of Site 20 will remain industrial use. Therefore, soil PRGs were selected to comply with numerical soil cleanup standards established by the State of Connecticut for the protection of human health, that is, PMC and ICDEC for the current industrial land use. These standards and the associated exposure scenarios are not applicable to sediment. Consequently, human health risk-based PRGs were calculated for sediment in the drainage ditches and contiguous portion of the Area A Wetland at Site 20.

67. ***Page 2-15, Paragraph 4***—The example of excavation and disposal of the entire site is not a CERCLA waiver situation, unless an ARAR would require such action. A waiver may only be sought for the remedial alternative that is being chosen. The feasibility of excavation and

disposal of the entire site might be a grounds for eliminating an alternative, but that is not an ARAR issue.

Response—See response to Comment No. 66.

68. ***Page 2-16, Section 2.5***—See comment for Page 2-14, Paragraph 4 regarding environmental LURs.

Response—Comment noted. The text will be modified as follows:

> *...ELUR will prohibit future residential use of the area without further actions to achieve compliance with residential PRGs. Because ELUR cannot be established until a deed is created for the parcel, and no deeds currently exist for NSB-NLON, the Base Master Plan would need to include a requirement that stated if the site was ever sold, ELUR would be recorded along with the deed in accordance with the applicable federal, state, and local standards.*
>
> *Accordingly, the remedial alternatives will address....*

69. ***Page 2-16, Deep Soil***—Please explain why arsenic in deep soil is an issue for the full-time employee. According to the Phase II Remedial Investigation, the full-time employee should only be exposed to surface soil.

Response—Comment noted. The full-time employee scenario will be reevaluated to include only soil data 4 ft below ground surface. Arsenic in deep soil is not of concern for the full-time employee.

70. ***Page 2-16 and Appendix A.1, First Table***—If deep soil was only evaluated for the construction worker, why are the COCs different for the future resident? Please clarify through site data and PRG comparison tables in the text.

Response—Deep soil was only evaluated for the construction worker scenario. Some constituents in deep soil exceeded their respective Region III industrial risk-based concentrations. However, their associated incremental risk did not exceed 1×10^{-6} and, therefore, no risk-based PRGs were developed. Site data and PRGs comparison tables will be presented in the appendixes.

71. ***Page 2-16, Section 2.4.3.1***—The last sentence under Deep Soil states that arsenic exceeded the HHRA risk-based PRGs for full-time employees. Please explain why arsenic is not listed as a COC in Table 2-6.

Response—Please refer to the previous two responses.

72. ***Page 2-16, Section 2.4.3.2***—Under Deep Soil the text states that arsenic exceeded the HHRA risk-based PRGs for the future resident scenario. However, arsenic is not listed as a COC in Table 2-6. Please explain.

Response—Please refer to the previous three responses.

73. ***Page 2-16, Section 2.4.3.2***—Under Sediment, the text states that benzo(a)pyrene exceeded the HHRA-based PRGs for the future resident scenario. Appendix A.2 calculations show that in addition, arsenic, benzo(a)fluoranthene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene also exceed the HHRA-based PRGs for the future resident. Please explain why these additional constituents were not also included in Table 2-6 or correct the error.

Response—Comment noted. The list of COCs selected for PRG development will be verified and expanded as necessary.

74. ***Page 2-16, Section 2.5***—This paragraph is not clear, especially considering what is presented in Table 2-6. Please review this paragraph, Table 2-6, and rewrite this paragraph to clarify the intended meaning.

Response—Comment noted. The text in Section 2.5 will be rewritten as follows and Table 2-6 (Attachment 4) will be modified to reflect the specific areas where COCs exceeded PRGs for current industrial and future residential land use:

2.5 AREA OF ATTAINMENT

The remedial alternatives developed in Chapter 4 will address COC concentrations that exceed risk-based and ARAR-based PRGs in sediment and soil at Site 20. Specific areas where COC concentrations exceeded PRGs for current industrial and future residential land use scenarios, and for which remedial alternatives will be developed, are summarized below.

Current Industrial Land Use

- ***Drainage Area 1***—*Soil with PAH concentrations in excess of PMC is located at 2WCTB2 from 0 to 2 ft under pavement. Sediment with COC concentrations in excess of HHRA risk-based PRGs occur along the drainage swales at 2WCSD2 and 2WCSD3 (0-1 ft bgs) and in the Area A Wetlands at 2WCSD14 from 0 to 1 ft bgs (Figure 2-1).*

- ***Drainage Area 2***—*No COC concentrations exceeded PRGs.*

- ***Drainage Area 3***—*Sediment with COC concentrations in excess of HHRA risk-based PRGs is concentrated outside of the Site 20 fenced area in the Area A Wetlands at 2WCSD4 and 2WCSD7 from 0 to 1 ft bgs (Figure 2-1).*

Future Residential Land Use

- ***Drainage Area 1****—Soil with PAH concentrations in excess of PMC and RDEC is located at 2WCTB2 from 0 to 2 ft under pavement. Soil and sediment with PAH and inorganic concentrations in excess of HHRA risk-based PRGs occur along the drainage swales at 2WCSD1, 2WCSD2, 2WCSD3 (0-1 ft bgs), and 2WCTB3 (4-6 ft bgs); under the pavement at 2WCTB2 (0-2 ft bgs), 2WCTB5 (6-8 ft bgs), and 2WCTB6 (8-10 ft bgs); and in the Area A Wetlands at 2WCSD14 (Figure 2-2).*

- ***Drainage Area 2****—Sediment with a COC concentration in excess of HHRA risk-based PRGs occur in the drainage swale at 2WCSD10 from 0 to 1 ft bgs (Figure 2-2).*

- ***Drainage Area 3****—Soil and sediment with COC concentrations in excess of HHRA risk-based PRGs is concentrated outside of the Site 20 fenced area in the Area A Wetlands at 2WCSD4 (0-1 ft bgs), 2WCSD5 (0-1 ft bgs), 2WCSD7 (0-1 ft bgs), 2WCMW1S (0-2 ft bgs), 2WCTB1 (0-2 ft bgs), 2WCTB4 (2-4 ft bgs), 2WCTB7 (8-10 ft bgs), and 2WCTB8 (10-12.6 ft bgs) (Figure 2-2).*

75. ***Page 2-17, Section 2.6***—The RAOs also include achieving ARARs. Please include additional bullets to state this.

Response—Comment noted. The Remedial Action Objectives will be modified as follows:

- *Minimize potential human exposure to COCs above Connecticut Remediation Standard Regulations in soil and risk-based PRGs in sediment under the current industrial and future residential land use scenarios*

- *Minimize the potential migration of COCs above PMC in soil into ground water*

- *Minimize potential future overland transport of COCs from the three drainage areas into the Area A Wetlands and the Area A Downstream watercourses*

The NCP specifies that "...remediation goals shall establish acceptable exposure levels that are protective of human health and the environment...." The RAOs should list the PRG concentrations.

Response—As noted above, the RAOs include references to Connecticut Remediation Standard Regulations and risk-based PRGs. The acceptable exposure levels (Remediation Standard Regulations and PRGs) are summarized in Table 2-6.

76. ***Page 2-17, Section 2.7***—The reference in the first sentence to Section 2.5 should be Section 2.6.

Response—Comment noted. Section "2.5" will be changed to Section "2.6."

77. ***Page 1-17, Section 2.7***—All the bullets in this section that refer to soil should instead refer to soil and sediment.

Response—Comment noted. "Soil" in the bullets of Section 2.7 will be modified to read "soil and sediment."

78. ***Figure 2-1***—It appears that locations where arsenic exceeded the HHRA risk-based PRGs have not been presented in the figure. Please edit accordingly.

Response—Comment noted. The figures will be edited based on the revisions made.

79. ***Figure 2-2***—It appears that locations where arsenic, beryllium, and dibenzo(a,h)anthracene exceeded the HHRA risk-based PRGs have not been presented in the figure. Please explain or edit the figure.

Response—Comment noted. Please refer to previous responses. The figures will be edited based on the revisions made.

80. ***Tables 2-1, 2-2, and 2-3***—Revise all of these tables based on the EPA supplied tables. For example: CT Remediation Standards, Requirement: Change "22a-133k-3" to "22a-113k-2" since "3" pertains to ground water, which will be remediated as part of a separate OU.

Response—Comment noted. ARAR tables in Chapter 2 will be replaced with alternative-specific ARAR tables in Chapter 4 (see Attachment 1) that are based on the EPA- and CTDEP-supplied tables.

81. ***Table 2-3***—For the Connecticut Inland Wetlands and Water Courses Act, the action to be taken is incorrect. Please correct.

Response—Comment noted. The action to be taken will be corrected. ARAR tables in Chapter 2 will be replaced with alternative-specific ARAR tables in Chapter 4 (see Attachment 1) that are based on the EPA- and CTDEP-supplied tables.

82. ***Table 2-3***—Connecticut Hazardous Waste Management Regulations are listed twice with different actions to be taken. Please correct.

Response—Comment noted. The first reference pertaining to onsite treatment will be deleted. ARAR tables in Chapter 2 will be replaced with alternative-specific ARAR tables in Chapter 4 (see Attachment 1) that are based on the EPA- and CTDEP-supplied tables.

83. ***Table 2-3***—Add the following ARAR and TBC: (1) Connecticut Water Pollution Control (RCSA Section 22a, 430 1 to 8), applicable; and (2) Connecticut Guidelines for Soil Erosion and Sediment Control, TBC.

Response—Comment noted. ARAR tables in Chapter 2 will be replaced with alternative-specific ARAR tables in Chapter 4 (see Attachment 1) that are based on the EPA- and CTDEP-supplied tables.

84. ***Table 2-3***—The Connecticut Air Pollution Control Regulations will also require that odors and dust emissions be appropriately controlled.

    Response—Comment noted. ARAR tables in Chapter 2 will be replaced with alternative-specific ARAR tables in Chapter 4 (see Attachment 1) that are based on the EPA- and CTDEP-supplied tables.

85. ***Table 2-5***—There are several values in this table listed as zero that do not appear to be correct. If parameters do not have listed or calculated values, use "not applicable" rather than zero. If the zeros are correct, then there are additional parameters in exceedance of the Connecticut Remediation Standards.

    Response—Comment noted. Where appropriate, zeros will be replaced with dashes (---) to indicate "not applicable."

86. ***Table 2-6***—In Table 2-5, the RDEC for indeno(1,2,3-cd)pyrene is 0.84 mg/kg, and the PMC is 0.017. These differ from the values listed in Table 2-6. Please correct.

    Response—Comment noted. Table 2-6 will be reviewed and modified accordingly (Attachment 4).

87. ***Table 2-6***—Regarding the HHRA PRG for benzo(a)pyrene, achieving the PRG of 0.127 does not reduce the cumulative excess risk for sediment to less than 1×10^{-5}. Therefore, this is not adequate risk reduction for the site. Please explain why only the PRG for benzo(a)pyrene is listed for sediment in Table 2-6 when arsenic and beryllium significantly exceeded their PRGs and benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene also exceeded their PRGs, according to Appendix A calculations.

    Response—Comment noted. The list of COCs selected for PRG development will be verified and expanded as necessary. Based on CTDEP comments, a screening level of 1×10^{-6} will be used. Table 2-6 and Appendix A calculations will be expanded to reflect this. Confirmatory samples will be taken to verify that concentrations of COCs are below ARARs and PRGs.

88. ***Table 2-6***—It appears that other constituents identified previously in the text have maximum concentrations in excess of screening criteria that have not been included in this table, and the text has not explained this. If PRGs have not been exceeded based on depth of soil or depth to water table, that needs to be adequately discussed in the text. Please edit accordingly.

Response—Comment noted. The list of COCs selected for PRG development will be verified and expanded as necessary. Text will be added to the FS to clarify which COCs were selected for PRG development. Based on re-evaluation of COC data, an additional sample location (2WCTB2) was identified which contained COCs above ARAR PRGs. These COCs have been added to Table 2-6 (see Attachment 4).

89. ***Page 3-2, Section 3.1***—Delete the first sentence under "Cost" and put the last sentence first.

    Response—Comment noted. The text will be modified as requested.

90. ***Page 3-2, Last Paragraph***—In the last two sentences change "Deed restrictions" to "Land use restrictions recorded on the Base Master Plan."

    Response—For the technology/process option screening sections in Chapter 3, the first paragraph describes the technology/option in general terms. The remainder of the section describes the technology/option with respect to the site conditions. Therefore, the implementability portion within this section will be modified as follows:

    - ***Implementability***—*Under the State Remediation Standards, ELUR cannot be established until a deed is created for the parcel. Because there are no deeds currently for NSB-NLON, the Base Master Plan would need to include a requirement that stated if the site was ever sold for non-Department of Defense use in the future, upon the creation of a deed, ELUR would be recorded in accordance with the applicable federal, state, and local standards. Physical barriers and/or notices are not required because Site 20 is located on an active military base. Site access is already controlled by base security.*

    Add a last sentence: "If property interests in the Site are ever transferred, land use restrictions will be recorded against the deed according to applicable federal, state, and local standards."

    Response—See above response.

91. ***Page 3-3, Section 3.1.1.2***—In the first sentence under effectiveness, delete "in soil" following COC. Exposed sediment must be considered as well, based on prior comments.

    Response—Comment noted. The text "in soil" will be deleted.

92. ***Page 3-3, Bullet 1***—Add at the end of the last sentence "and land use restrictions are recorded on the Base Master Plan."

    Response—See response to Comment No. 90.

93. ***Page 3-3, Section 3.1.2.1***—Under implementability the text states that the impacted areas are already paved. However, contaminated sediment exists in several areas that are not paved. Please correct.

Response—Comment noted. The text will be modified as follows:

- ***Effectiveness***—*Capping is an established technology that would be effective for preventing direct contact with COCs in soil. Capping would not be effective for impacted sediment within the drainage swale or within the adjacent wetlands due to the periodic saturated conditions that may mobilize COCs and/or compromise the integrity of the cover system.*

- ***Implementability***—*Capping is not implementable at Site 20 because of the existing buildings, ongoing operations, and presence of wetlands. The impacted soil at Site 20 is already paved with concrete or asphalt that prevent exposure and limit infiltration. Capping of the impacted portion of the drainage swale would require reconfiguring the stormwater conveyance system at Site 20. Capping of impacted sediment in other areas at Site 20 would adversely impact wetlands.*

Capping would not be effective for sediment and would not be implementable for soil or sediment at Site 20. Therefore, this technology will not be retained for further consideration.

94. ***Page 3-3, Bullet 2***—In second sentence remove the statement that notices are not required. Signs should be installed if waste is left in place that poses a risk. In addition any land use restrictions should be recorded on the Base Master Plan.

Response—The text will be changed accordingly. See also response to Comment No. 90.

95. ***Page 3-3, Paragraph 2***—In the second sentence insert "recorded on the Base Master Plan" after "LUR.."

Response—The text will be changed as requested. See also response to Comment No. 90.

96. ***Pages 3-3 to 3-4, Section 3.1.2***—It would be more appropriate to refer to surface water control as surface water runoff control throughout this section.

Response—Comment noted. The text will be modified as requested.

97. ***Page 3-7, Paragraph 1; Page 3-8, Bullet 4; and Page 3-10, Bullet 2***—Change the last sentence (and everywhere else this appears in the text) from "CTDEP" to "federal and state regulators."

Response—Comment noted. The text will be modified as requested.

98. ***Page 3-7, Section 3.1.4.2***—Edit the last sentence in the second paragraph to read: "Therefore, considering that the soil and sediment volume requiring remediation is relatively small,...."

Response—Comment noted. The text will be modified as requested.

99. ***Comment No. 99, Page 3-10, Section 3.1.4.5***—The last paragraph states that in situ soil flushing has been demonstrated to be effective...." This implies that a pilot study or other testing has been conducted at Site 20. Is that correct? If not please correct the text. Also, the rationale for eliminating this technology is inadequate. Please correct.

Response—Comment noted. The last paragraph will be modified as follows:

In situ soil flushing may be effective and implementable for PAHs at Site 20; however, a treatability study would be required to confirm the effectiveness of this technology for addressing PAHs under the site-specific conditions. In general, soil flushing is less cost-effective than alternative technologies for addressing PAHs. Soil flushing may mobilize PAH in soil to the adjacent wetlands and/or ground water, where no PAH impacts have been identified. Therefore, this technology will not be retained for further consideration.

100. ***Page 3-13, Section 3.1.4.10***—The discussion of *in situ* vitrification does not address PAHs. Could this technology be used to treat site COCs? The discussion under cost and the last sentence in this subsection are inconsistent with the site characteristics, because there is only a limited amount of soil and sediment to treat at the site. Please correct the inconsistency.

Response—Comment noted. The text will be modified as follows:

- ***Effectiveness***—*In situ vitrification is an effective method for immobilizing and/or oxidizing COCs in soil. Although in situ vitrification would be effective for PAH at Site 20, this technology is best suited for wastes that are more difficult to treat, such as mixtures of organics and metals.*

- ***Implementability***—*The equipment and vendors necessary to perform in situ vitrification are available. This technology would be difficult to implement for sediment due to the water content of the media and the potential adverse impacts to the wetlands. Operation of the high-power electrical equipment within the bunker area would require precautions with respect to the storage of torpedoes.*

- ***Cost***—*In situ vitrification is cost-prohibitive except for very limited soil volumes. Although the volumes of impacted soil and sediment are low at Site 20, the costs of this technology would not be warranted for addressing low PAH concentrations.*

In situ vitrification would be difficult to implement and would not be cost effective for the low PAH concentrations at Site 20. Therefore, this technology will not be retained for further consideration.

101. ***Page 3-19, Section 3.1.5.9***—The text should explain why *ex situ* SVE would not be for the primary COCs at Site 20.

Response—Comment noted. The text will be modified as follows:

- ***Effectiveness****—This technology is most effective for VOC in excavated soil; therefore, ex situ SVE would have low effectiveness for volatilizing the high-molecular weight PAH (SVOC) identified in Site 20 soil and sediment.*

102. ***Page 3-23, Section 3.1.7.1***—Under effectiveness, add a sentence: "Needs to be implemented with a capping technology to be effective."

Response—Comment noted. The text will be added as requested.

103. ***Table 3-1***—Rather than including a summary description of each technology, this table should include the rationale for retaining or rejecting each technology.

Response—Comment noted. Table 3-1 (see Attachment 5) has been modified. The summary descriptions of each technology have been removed and a more descriptive summary of the rationale for retaining or rejecting each technology has been included.

104. ***Page 4-1, Section 4.1***—The rationale for eliminating COCs other than those listed here is not clearly presented. As discussed earlier, exposed sediment must be considered when selecting primary COCs. Contaminants in soil other than those listed pose an excess HHR in the future resident scenario (see Appendix A.1). Also, arsenic in soil poses an excess HHR in the full-time employee scenario. Finally, other COCs exceeding the PMC (see top of page 2-12) have not been properly eliminated in a text discussion. Please add the appropriate COCs to this section and add an adequate explanation for not assigning PRGs to COCs identified previously in the FS.

Response—Comment noted. The list of COCs selected for PRG development will be verified and expanded as necessary. Text will be added to this section to clarify which COCs were selected for PRG development.

105. ***Page 4-4, Paragraph 1***—In the last sentence change "This FS states that a more realistic assessment of the ERA" to "Further evaluation noted in this FS" and add at end of the sentence "due to limitations in available habitat, but also recognizes that migration of Area A Weapons Center COCs could cause potential effects to receptors in adjacent areas."

Response—Comment noted. The text will be modified as follows:

Further evaluation noted in this FS that there are no risks to potential ecological onsite or offsite receptors due to limitations in available habitat. However, it should be recognized that migration of Area A Weapons Center COCs could cause potential effects to receptors in adjacent areas.

106. ***Page 4-4, Paragraph 2***—At the end of the first sentence add: "(Tables 4-1, 4-2, and 4-3)." Remove the third sentence since No Action alternatives do not have location-specific ARARs.

Response—Comment noted. As indicated by Comment No. 142, EPA requests that monitoring be included as part of the 5-year review process (Alternatives 1 and 2). Therefore, the paragraph will be modified as follows:

The No Action alternative would not comply with chemical-specific ARARs (Table 4-2) because no action would be taken to address COCs at concentrations reported above the PRGs. Although natural attenuation processes would reduce COC concentrations over time, no specialized monitoring would be conducted under the No Action alternative to verify that COCs are being naturally attenuated at acceptable rates. Monitoring for the 5-year reviews would be conducted in accordance with location- and action-specific ARARs.

107. ***Page 4-5, Section 4.3.2.1***—Edit the bullet to read: "LUR to prevent removal of asphalt over areas where COCs in soil exceed the PMC and prevent residential use of the site." LUR would not prevent contact with impacted sediment.

Response—Comment noted. The bullet will be modified as follows:

ELUR to prevent removal of asphalt over areas where COCs in soil exceed the PMC and prevent residential use of the site.

108. ***Page 4-5, Section 4.3.2.1***—In the last paragraph, describe better the administrative procedure for obtaining an LUR and why a deed restriction cannot be implemented at the same time. In order to get an LUR, a legal description of the property would need to be obtained, and presumably a deed could be drawn up at that time and the restriction attached.

Response—Comment noted. The text will be modified in accordance with response to Comment No. 63, as follows:

Institutional controls will be implemented to prevent/control future contact with elevated concentrations of COCs in soil and sediment. Under the State Remediation Standards, ELUR cannot be established until a deed is created for the parcel. Because there are no deeds currently for NSB-NLON, the Base Master Plan would need to include a requirement that stated if the site was ever sold, upon the creation of a deed, ELUR would be recorded in accordance with the applicable federal, state, and local standards. ELUR, recorded in the Base Master Plan and in any future property transfer documents, will be required to: (1) prevent future residential contact with COCs in sediment that exceed risk-based PRGs; (2) prevent future contact with COCs in soil that exceed Direct Exposure Criteria; and (3) prevent removal of asphalt over areas where COCs in soil exceed PMC. ELUR would include limitations to construction activities at Site 20 to maintain the asphalt integrity and prevent infiltration of precipitation that could result in migration of COCs into ground water. ELUR would cover the extent of Site 20 and be

maintained for as long as COCs are presented above standards. Unless additional remediation is undertaken, Site 20 could not be redeveloped for residential land use.

109. ***Page 4-5, Last Paragraph***—In the first sentence change "LUR will" to "LURs, recorded in the Base Master Plan and in any future property transfer documents, will."

Response—Comment noted. Refer to response to Comment No. 108.

110. ***Page 4-6, Paragraph 4***—At the end of the first sentence add: "(Tables 4-4, 4-5, and 4-6)."

Response—Comment noted. The text will be modified to reference the new ARAR tables (Attachment 1).

111. ***Page 4-6, Paragraph 5***—In the first sentence change "LUR would" to "LURs, recorded in the Base Master Plan and in any future property transfer documents, would."

Response—Comment noted. Refer to response to Comment No. 108.

112. ***Page 4-7, Paragraph 3***—In the first sentence change "no remedial actions are specified" to "required monitoring can be conducted."

Response—The text will be changed to read as follows:

...Alternative 2 would be readily implementable because the required monitoring can be conducted.

113. ***Page 4-7, Paragraph 4***—Monitoring must be included in the cost of the remedy.

Response—Costs for 5-year monitoring events will be included under Alternatives 1 and 2 (see also response to Comment No. 142).

114. ***Page 4-7, Section 4.3.3***—Throughout this section, only PAH contamination is addressed. Inorganic COCs also need to be addressed.

Response—There are no inorganic COCs retained for Site 20, because no inorganic concentrations exceeded regulatory standards or risk-based PRGs in soil or sediment. See also response to Comment No. 15 regarding the discussion of arsenic in the Feasibility Study.

115. ***Page 4-7, Section 4.3.3***—Consider asphalt batching, soil recycling, or other offsite treatment process to treat the waste off-site under this alternative.

Response—As shown in Section 3.1.5, various *ex situ* treatment technologies (e.g., such as biopiles, soil washing, thermal desorption, etc.) were evaluated, but not retained due to the small soil volume to be handled, the ineffectiveness for PAH, and/or the low cost/effectiveness as compared to offsite disposal. The text in Section 3.1.5.6 for

cost/effectiveness as compared to offsite disposal. The text in Section 3.1.5.6 for thermoplastic stabilization/solidification, which includes asphalt batching, will not be retained because it is primarily used for petroleum-impacted soil and would not be cost effective for the small soil volume as compared to offsite disposal. Asphalt batching of impacted soil may also have increased permitting difficulties.

116. ***Page 4-7, Section 4.3.3.1***—A 5-year review program is not warranted for Alternative 3 if all soil and sediment exceeding PRGs is removed.

Response—Comment noted. Section 4.3.3.1 already states that 5-year reviews are not required under Alternative 3. For clarity, the text "as mandated by CERCLA" in the second sentence of the last paragraph on Page 4-7 will be deleted.

117. ***Page 4-8, Bullets 2 and 3***—Side wall and bottom testing must be conducted to determine whether all material exceeding PRGs has been removed.

Response—Comment noted. The fourth sentence in the first paragraph on Page 4-8 will be modified as follows:

Confirmatory soil/sediment samples would be collected from the bottom and sidewalls of the excavations and sent to a laboratory for PAH analyses to confirm that material exceeding PRGs has been removed.

118. ***Page 4-8, Section 4.3.3.1***—Under Drainage Area 3, in the second sentence, insert "2WCTB1" after "excavated at."

Response—Comment noted. The text will be modified as requested.

119. ***Page 4-8, Paragraph 3***—In the last sentence insert "treatment or disposal" after "licensed."

Response—Comment noted. The text will be modified as requested.

120. ***Page 4-8, Paragraph 4***—In the first sentence change "CTDEP" to "federal and state regulators." Remove the second sentence and change the third from "If a potential conflict exists" to "If site investigation determine that state-listed protected species are present within the site."

Response—Comment noted. The paragraph will be modified as follows:

Excavation within the Area A Wetland would require coordination with federal and state regulators. However, based on the 1997 Integrated Natural Resources Endangered Species Act Management Plan for NSB-NLON no Federal or State Endangered, Threatened, or Special Concern species were identified at NSB-NLON or in adjacent Navy Housing areas. Therefore, remedial actions involving excavation within or adjacent to the Area A Wetland will be coordinated with the NSB-NLON Natural Resources Manager

121. ***Page 4-8, Paragraph 5***—In the first sentence, change "CTDEP" to "federal and state regulators." Add at the end of the paragraph: "Any ground water or surface what in the excavations will be tested for hazardous constituents, treated if necessary, and disposed of in accordance with applicable federal and state water quality standards."

Response—Comment noted. The first sentence will be modified as requested. The following text will be added at the end of the paragraph:

Ground water or surface water within the excavation area would be tested for the site COCs. If elevated COC concentrations are detected, then the water will be treated/disposed in accordance with applicable federal and state requirements.

122. ***Page 4-9, Paragraph 3***—In the first sentence, add at the end "(Tables 4-7, 4-8, and 4-9)." In the last sentence, insert "treatment or disposal" after "licensed."

Response—Comment noted. The text will be modified to reference the new ARAR tables (Attachment 1).

123. ***Page 4-9, Paragraph 5***—Change the paragraph to: "Excavation and removal would not create any reduction in toxicity, mobility, or volume through treatment. However, if the material is sent to an offsite treatment facility, such as a soil recycling or asphalt batching plant, then this criteria would be achieved. Landfill disposal will not satisfy this criterion."

Response—As noted in response to Comment No. 115, asphalt batching will be screened out in Section 3.1.5.6 based on the reduced cost effectiveness for handling low volumes of soil as compared to other *ex situ* options such as offsite disposal. The text on Page 4-9 will be modified as follows:

Selective excavation would eliminate the toxicity, mobility, and volume of COCs from shallow soil and sediment at Site 20. However, selective excavation would not create any reduction in toxicity, mobility, or volume through treatment in the removed material. Offsite disposal at a licensed landfill would contain the impacted material but would not satisfy the NCP's preference for treatment of COCs.

124. ***Page 4-10, Section 4.4.1***—In the fourth sentence, delete the phrase "and the environment."

Response—Comment noted. The text will be modified as requested.

125. ***Page 4-10, Section 4.4.2***—Delete Alternative 2 from the first sentence and add a new sentence stating that Alternative 2 meets human health risk-based PRGs, but not all ARARs. Carry through the rest of the discussion in Section 4.4.

Response—Comment noted. The text will be modified as follows (see response to Comment No. 142 regarding ARAR for monitoring):

Alternative 3 would comply with the established ARARs and risk-based PRGs. Alternative 2 would comply with ARARs and risk-based PRGs, except for achieving Connecticut Remediation Standard Regulations for soil in a limited area. Alternative 1 would not comply with the established ARARs or risk-based PRGs.

Alternative 1, the No Action alternative, would not comply with the chemical-specific ARARs because no institutional controls or remediation are specified to address COCs above Connecticut Remediation Standard Regulations and human health risk-based PRGs. Alternative 2 would not remediate soil/sediment to achieve these criteria, but instead would mitigate potential risks through institutional controls (i.e., ELUR). Alternative 3 would comply with the chemical-specific ARARs and risk-based PRGs through selective excavation of elevated COC concentrations in soil and sediment.

The 5-year sampling events under Alternatives 1 and 2 would meet location-specific ARARs. Alternative 3 would meet location-specific ARARs provided that alterations to wetlands and watercourse during excavation activities comply with federal and state standards. Each of the alternatives would be conducted in accordance with their respective action-specific ARARs.

126. ***Page 4-11, Paragraph 2***—Add three new beginning sentences: "There are no location-specific ARARs for the No Action Alternative. Alternative 2 meets all location-specific ARARs. Alternative 3 will meet all location-specific ARARs if alterations to wetlands and watercourse comply with federal and state standards."

Response—See response to Comment Nos. 125 and 142.

127. ***Page 4-11, Paragraph 5***—Change the sentence to: "None of the alternatives will provide onsite reduction in toxicity, mobility, or volume of COCs through treatment. Under Alternative 3 it may be possible to treat the excavated waste material off-site in a soil recycling or asphalt batching, or similar treatment facility."

Response—In accordance with response to Comment No. 123, Section 4.4.4 will be changed as follows (Table 4-2 will also be changed accordingly):

None of the alternatives would provide onsite reduction in the toxicity, mobility, or volume of COCs through treatment. However, Alternative 3 would remove the toxicity, mobility, and volume of COCs from Site 20 through selective excavation and offsite disposal. Offsite disposal at a licensed landfill would contain the impacted material but would not satisfy the NCP's preference for treatment of impacted media.

Remove the second and third paragraphs under Section 4.4.4.

Response—See response to Comment No. 127.

128. ***Page 4-12, Section 4.4.5***—In the second paragraph, add to the second sentence: ", although Alternative 3 has the greatest potential for creating impacts."

Response—Comment noted. The text will be modified as requested.

129. ***Page 4-12, Section 4.4.7***—The Cost of Alternative 2 should include the cost of monitoring. The cost of Alternative 3 should include the cost of water treatment as part of the removal and disposal of ground water and surface water from the excavations.

Response—The costs for Alternative 2 will be modified to include 5-year sampling of soil and sediment in order to provide data for the 5-year reviews. It is anticipated that no water treatment would be required as part of Alternative 3. Excavation activities can be conducted during a dry time period when the water table is low to avoid pooling within the excavation and to minimize water content of the excavated material. In addition, temporary diversions can be constructed to prevent overland runoff from entering the excavation area. The description of Selective Excavation in Section 4.3.3.1 will be modified accordingly.

130. ***Page 4-13, Paragraph 1***—The net present worth ($61,000) of Alternative 2 should be stated along with the net present worth of Alternatives 1 ($48,000) and 3 ($68,000).

Response—Comment noted. The last sentence in the referenced paragraph will be modified as follows:

The total 30-year net present worth costs for Alternatives 1, 2, and 3 are comparable ($91,000, $104,000, and $103,000, respectively).

Changes in the estimated costs are due to edits to the scope of the alternatives as outlined in other responses to comments (e.g., extent of excavation, addition of monitoring programs).

131. ***Page 4-13, Bullet 2***—Change to "LURs and Monitoring."

Response—Monitoring will be conducted as part of the 5-year reviews for Alternatives 1 and 2. The following sentence will be added:

Alternatives 1 and 2 include 5-year reviews with monitoring for as long as COCs are present above acceptable concentrations.

132. ***Page 4-13, Section 4.5***—In the last paragraph, alternative 2 does not meet ARARs, therefore, delete the first sentence.

Response—Although Alternative 2 would result in PAH concentrations in soil remaining above ICDEC/PMC and above risk-based PRGs in sediment, the impacted area is limited and the ELUR/monitoring program would mitigate potential risks to site workers by preventing contact with COCs. Alternative 2 would also address the potential migration of COCs by ensuring that the overlying asphalt is maintained in good condition (reducing infiltration) and by monitoring downgradient areas for changes in COC concentration.

Therefore, the first sentence will be retained because it is correct when considering the industrial use of Site 20.

133. ***Figure 4-1***—There are reaches of the drainage swales where the chance for sediment deposition appears high, yet no samples were collected there. These areas include: the western end of Drainage Area 1 where the swale makes a 90 degree turn; a wide area in the last segment of the continuation of that swale; and the wide area in the swale in Drainage Area 2 following the last bend. The remediation should include a pre-design or remedial action sampling task to address these areas as they may be areas where sediment has accumulated.

Response—Delineation of the nature and extent of COCs at Site 20 was completed during the Phase II RI and accepted by EPA and CTDEP. However, if Alternative 3 is selected, pre-design sampling may be appropriate in areas where sedimentation may occur (e.g., turns in the directions of the drainage swales or in areas where surface water velocities dissipate). Pre-design sampling costs will be added to the capital costs for Alternative 3. Furthermore, Alternative 3 would include confirmatory sampling of the sidewalls and bottoms of the excavation areas to ensure that impacted soil/sediment has been removed.

134. ***Table 4-2***—Please revise to reflect the comments made on the text and in the new ARARs tables.

Response—Comment noted. The text in this table (to be retitled as 4-5) will be modified to reflect changes as outlined in the responses to EPA and CTDEP comments.

135. ***Table 4-2***—Under Alternative 2 for "Potential onsite receptors," an ELUR will not prevent the migration of COCs from contaminated sediment. Please revise.

Response—Comment noted. The text will be modified as follows:

Would not address; however, existing asphalt cover reduces exposure to and migration of COCs.

The corresponding text for Alternative 1 will also be modified as such.

136. ***Table 4-2***—Under Alternative 3 for "Reduction of TMV," state that no treatment is used. Also, this alternative does not satisfy the statutory preference for treatment.

Response—As per response to Comments Nos. 123 and 127, the referenced text will be changed as follows:

Treatment processes used and material treated:
No treatment included. However, COCs in soil/sediment would be excavated and disposed at an offsite, licensed facility.

Hazardous material destroyed or treated:

No treatment included. However, COCs in soil/sediment would be excavated and disposed at an offsite, licensed facility.

Type and quantity of residuals remaining after treatment:

No treatment included. However, COCs in soil/sediment would be excavated to meet risk-based PRGs and PMC.

Degree to which treatment is irreversible:

No treatment included. However, excavation and offsite disposal of impacted soil/sediment would be irreversible.

Statutory preference for treatment:

Does not satisfy the preference for direct treatment of COCs. However, does satisfy the preference to remediate COC concentrations at the site.

137. ***Table 4-2***—Under Alternative 3 for "Protection of community," state that engineered controls would prevent significant risks.

Response—Comment noted. The text will be modified as follows:

Engineered safety controls would prevent risks to the community during excavation activities.

138. ***Table 4-2***—Under Alternative 1 for "Ability to construct," change "No treatment included" to " No action required."

Response—Comment noted. The text will be modified as requested.

139. ***Table 4-2***—Under Alternative 2 for "Ability to obtain approvals," state that approval is questionable because the alternative does not address migration of COCs from exposed sediment.

Response—The text will be modified as follows:

Ability to receive regulatory support is uncertain. Although ELUR and the monitoring program would address site risks, the potential migration of COCs from exposed sediment to the adjacent wetlands would not be addressed.

140. ***Appendix A***—This appendix presents the calculation of PRGs. The equations for the Inhalation Conversion Factor include the Contaminant Fraction (Fi) parameter. However, this parameter was not defined in the inhalation parameters located above the equations. Please define.

Response—Comment noted. The text will be modified as requested.

141. ***Appendix A***—The units for the Conversion Factors are not shown for either inhalation, dermal, or ingestion exposure pathways. This information should be presented on the tables.

Response—Comment noted. The text will be modified as requested.

142. ***Appendix B***—The costs presented in all the tables do not clearly show the scope of work required, and may not adequately address the required costs. One of the purposes of the five-year review is to monitor the status of the site by collecting and analyzing samples of media to determine if the condition of the site has changed such that it warrants closure. The costs for the five-year review need to include that sampling and analysis effort. If these costs have been included, please note that in the description of the cost item, otherwise, add these costs.

Response—Costs associated with 5-year monitoring of soil and sediment will be added to Alternatives 1 and 2. No monitoring or 5-year reviews would be required under Alternative 3 because risk-based PRGs and ARAR-based PRGs would be met through selective excavation and offsite disposal.

143. ***Appendix B***—Please check the calculations for 30-year present worth. The numbers presented are not correct.

Response—The total 30-year net present worth costs are correct as shown. Net present worth represents the amount of dollars that would have to be set aside today (e.g., through the securing of bonds) to fund the project over time. The total 30-year net present worth costs were calculated by adding the capital cost to a scaled factor on the annual operation and maintenance. The operation and maintenance scaling factor (uniform series present worth) was taken from standard engineering economics tables assuming a 5 percent effective interest rate over 30 years.

144. ***Appendix B***—Under operation and maintenance costs: "Annual 30-year review costs" should be "annualized 30-year review costs (future dollars)."

Response—Comment noted. "Annual 30-year review costs" under Alternative 2 and "Annual O&M costs" under Alternative 1, will be modified to "Annualized O&M Costs." The costs are shown in present dollars.

145. ***Appendix B-3***—Under cost summary: "annual O&M costs" should be "Present worth of O&M costs." Use the present worth value of the O&M added to the capital costs to calculate the 30-year present worth costs.

Response—Comment noted. The text will be changed as requested.

146. ***Appendix B-3***—For completeness, include both "B. O&M Costs" and "C. Total Present Worth O&M Costs" in this table (as zero cost), so it does not appear to be omitted.

Response—Comment noted. The text will be changed as requested.

147. ***Appendix B-3***—Under pre- and post-excavation sampling: the samples may not need to include a full suite of analyses, therefore, the cost per sample may be overestimated. However, more than 10 samples is expected to be required. Please edit these numbers to reflect what is required for this site.

Response—Comment noted. The cost per sample will be changed to $975. Approximately 38 samples will be required at Site 20. Five samples will be taken at each excavation location and one sample per 10 ft along the drainage swale. In addition, one sample per truck load disposed (20 yd^3) will be taken. The cost tables will be modified to reflect this.

148. ***Appendix B-3***—The engineering design costs presented seem to be underestimated. A 10 percent multiplier may not be appropriate for such a small job. $10,000 may be a more appropriate cost.

Response—The engineering design cost for Alternative 3 (Line Item 1.7) will be changed to an estimated lump sum of $10,000.

Attachment 1

Revised Chapter 4 ARAR Tables

TABLE 4-2 ASSESSMENT OF CHEMICAL-, LOCATION-, AND ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND TO BE CONSIDERED GUIDANCE FOR ALTERNATIVE 1 – NO ACTION SITE 20 – AREA A WEAPONS CENTER, NAVAL SUBMARINE BASE, NEW LONDON, CONNECTICUT

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
FEDERAL				
Chemical-Specific				
Cancer Slope Factors		To Be Considered	These are guidance values used in risk assessment to evaluate the potential carcinogenic hazard caused by exposure to contaminants.	The No Action Alternative would provide no protection from risk posed by constituents of concern in the soil and sediment.
Reference Dose		To Be Considered	These are guidance values used in risk assessment to evaluate the potential carcinogenic or non-carcinogenic hazard caused by exposure to contaminants.	The No Action Alternative would provide no protection from risk posed by constituents of concern in the soil and sediment.
Location-Specific				
Clean Water Act, Section 404	33 USC 1344; 40 CFR Part 230 and 33 CFR parts 320-323	Applicable	These rules regulate the discharge of dredge and fill materials in wetlands and navigable waters. Such discharges are not allowed if practicable alternatives are available.	Includes potential monitoring activities within wetlands and ditches during the 5-year reviews. Measures will be taken to minimize adverse effects and to replace or restore protected wetland functions and values.
Executive Order 11990 RE: Protection of Wetlands	Executive Order 11990, 40 CFR Part 6, Appendix A	Applicable	This Order requires federal agencies to take action to avoid adversely impacting wetlands wherever possible, to minimize wetlands destruction and to preserve the values of wetlands, and to prescribe procedures to implement the policies and procedures of this Executive Order.	Includes potential monitoring activities within wetlands and ditches during the 5-year reviews. Measures to minimize adverse effects and to replace or restore protected wetland functions and values will be considered and incorporated into any plan or action wherever feasible.
Fish and Wildlife Coordination Act	16 USC Part 661 *et seq.* 40 CFR 122.49	Applicable	This order protects fish and wildlife when federal actions result in control or structural modification of a natural stream or body of water.	Appropriate agencies would be consulted prior to implementation to find ways to minimize adverse effects to fish and wildlife from potential monitoring activities within wetlands and waterways during the 5-year reviews.
Action-Specific				
None				

NOTE: ARAR = Applicable or relevant and appropriate requirements.
CFR = Code of Federal Regulations.
USC = United States Code.

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
STATE OF CONNECTICUT				
Chemical-Specific				
Remediation Standard Regulations	RCSA 22a-133k -1 through 3	Applicable	Adopted on 30 January 1996 under the statutory authority provided by CGS 22a-133k, these regulations contain numeric Direct Exposure Criteria and Pollutant Mobility Criteria for constituents in soil based on either industrial or residential use of the site. Requirements are based on ground water in the area being classified by the state as GB.	The No Action Alternative does not satisfy state standards for either site remediation nor for sufficient engineering controls to prevent risk to human health and the environment.
Location-Specific				
Inland Wetlands and Watercourses	CGS § 22a-36 through 45, RCSA § 22a-39-1 through 15 (Surface Water and Wetlands); CGS § 22a-45a (General Permit Requirements)	Applicable	These statutes regulate any operation in or affecting a wetland or watercourse involving removal or deposition of material or any obstruction, construction, alteration, or pollution of such wetlands. CGS § 22a-45a authorizes the Commissioner to adopt a general permit for various minor activities including installation of water quality monitoring equipment, excavation of test pits, and core sampling.	Monitoring activities within the Area A Wetlands will meet the substantive requirements of these statutes.
Action-Specific				
Hazardous Waste Management: Generator and Handler Requirements – General Requirements, Listing, and Identification	RCSA § 22a-449(c) 100-101	Applicable	Connecticut is delegated to administrate the federal Resource Conservation and Recovery Act statute through its state regulations. These sections establish standards for listing and identification of hazardous waste. The standards of 40 CFR 260-261 are incorporated by reference.	Hazardous waste determinations will be performed on all impacted material generated during monitoring activities conducted during the 5-year reviews to determine that the levels of regulated constituents do not exceed applicable limits. Constituents of concern which exceed applicable limits will be managed in accordance with requirements of these regulations, if necessary.

NOTE: RCSA = Regulations of Connecticut State Agencies.
CGS = Connecticut General Statutes.

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Hazardous Waste Management: Generator Standards	RSCA § 22a-449(c) 102	Relevant and Appropriate	This section establishes standards for various classes of generators. The standards of 40 CFR 262 are incorporated by reference. Storage requirements given at 40 CFR 265.15 are also included.	Investigation-derived waste from monitoring events will be handled in accordance with these requirements.
Hazardous Waste Management: TSDF Standards	RCSA § 22a-449 (c) 104	Applicable	This section establishes standards for treatment, storage, and disposal of hazardous waste, and establishes standards for closure and post-closure care. The standards of 40 CFR 264 are incorporated by reference.	Any hazardous waste which is temporarily stored on this site as part of the monitoring activities for the 5-year reviews will be managed in accordance with the requirements of this section.
Hazardous Waste Management: Interim Status Facilities and Ground-Water Monitoring Requirements, Closure, and Post-Closure Requirements	RCSA § 22a-449 (c) 105	Relevant and Appropriate	This section establishes interim status standards for treatment, storage, and disposal of hazardous waste, and establishes standards for closure, post closure, and ground-water monitoring. The standards of 40 CFR 265 are incorporated by reference. The Commissioner may require ground-water monitoring based on site-specific standards.	Investigation-derived waste from monitoring activities will be handled in accordance with these requirements.
Hazardous Waste Management: Permit Requirements	RCSA § 22a-449 (c) 110	Relevant and Appropriate	This section incorporates by reference the federal hazardous waste permitting requirements given at 40 CFR 270 and 124.	Handling of investigation-derived waste would comply with the substantive requirements of this section.

TABLE 4-3 ASSESSMENT OF CHEMICAL-, LOCATION-, AND ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND TO BE CONSIDERED GUIDANCE FOR ALTERNATIVE 2 – ENVIRONMENTAL LAND USE RESTRICTION SITE 20 – AREA A WEAPONS CENTER, NAVAL SUBMARINE BASE, NEW LONDON, CONNECTICUT

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
			FEDERAL	
Chemical-Specific				
Cancer Slope Factors		To Be Considered	These are guidance values used in risk assessment to evaluate the potential carcinogenic or non-carcinogenic hazard caused by exposure to contaminants.	The Alternative would limit exposure to constituents of concern in the soil and sediment through institutional controls.
Reference Dose		To Be Considered	These are guidance values used in risk assessment to evaluate the potential carcinogenic or non-carcinogenic hazard caused by exposure to contaminants.	The Alternative would limit exposure to constituents of concern in the soil and sediment through institutional controls.
Location-Specific				
Clean Water Act, Section 404	33 USC 1344; 40 CFR Part 230 and 33 CFR parts 320-323	Applicable	These rules regulate the discharge of dredge and fill materials in wetlands and navigable waters. Such discharges are not allowed if practicable alternatives are available.	Includes potential monitoring activities within wetlands and ditches during the 5-year reviews. Measures will be taken to minimize adverse effects and to replace or restore protected wetland functions and values.
Executive Order 11990 RE: Protection of Wetlands	Executive Order 11990, 40 CFR Part 6, Appendix A	Applicable	This Order requires federal agencies to take action to avoid adversely impacting wetlands wherever possible, to minimize wetlands destruction and to preserve the values of wetlands, and to prescribe procedures to implement the policies and procedures of this Executive Order.	Includes potential monitoring activities within wetlands and ditches during the 5-year reviews. Measures to minimize adverse effects and to replace or restore protected wetland functions and values will be considered and incorporated into any plan or action wherever feasible.
Fish and Wildlife Coordination Act	16 USC Part 661 *et seq.* 40 CFR 122.49	Applicable	This order protects fish and wildlife when federal actions result in control or structural modification of a natural stream or body of water.	Appropriate agencies would be consulted prior to implementation to find ways to minimize adverse effects to fish and wildlife from potential monitoring activities within wetlands and waterways during the 5-year reviews.
Action-Specific				
None				

NOTE: ARAR = Applicable or relevant and appropriate requirements.
CFR = Code of Federal Regulations.
USC = United States Code.

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
STATE OF CONNECTICUT				
Chemical-Specific				
Remediation Standard Regulations	RCSA 22a-133k-1 through 3	Applicable	Adopted on 30 January 1996 under the statutory authority provided by CGS 22a-133k, these regulations contain numeric Direct Exposure Criteria and Pollutant Mobility Criteria for constituents in soil based on either industrial or residential use of the site. Requirements are based on ground water in the area being classified by the state as GB.	Land use controls would limit direct exposure to constituents of concern in soil to acceptable levels under industrial use. The Alternative does not meet residential use standards, but does prevent residential use of the site.
Location-Specific				
Inland Wetlands and Watercourses	CGS § 22a-36 through 45, RCSA § 22a-39-1 through 15 (Surface Water and Wetlands); CGS § 22a-45a (General Permit Requirements)	Applicable	These statutes regulate any operation in or affecting a wetland or watercourse involving removal or deposition of material or any obstruction, construction, alteration, or pollution of such wetlands. CGS § 22a-45a authorizes the Commissioner to adopt a general permit for various minor activities, including installation of water quality monitoring equipment, excavation of test pits, and core sampling.	Monitoring activities within the Area A Wetlands will meet the substantive requirements of these statutes.
Action-Specific				
Hazardous Waste Management: Generator and Handler Requirements – General Standards, Listing, and Identification	RCSA § 22a-449(c) 100-101	Applicable	Connecticut is delegated to administrate the federal Resource Conservation and Recovery Act statute through its state regulations. These sections establish standards for listing and identification of hazardous waste. The stndards of 40 CFR 260-261 are incorporated by reference.	Hazardous waste determinations will be performed on all impacted material generated during monitoring activities conducted during the 5-year reviews to determine that the levels of regulated constituents do not exceed applicable limits. Constituents of concern which exceed applicable limits will be managed in accordance with requirements of these regulations, if necessary.
Hazardous Waste Management: Generator Standards	RSCA § 22a-449(c) 102	Relevant and Appropriate	This section establishes standards for various classes of generators. The standards of 40 CFR 262 are incorporated by reference. Storage requirements given at 40 CFR 265.15 are also included.	Investigation-derived waste from monitoring events will be handled in accordance with these requirements.

NOTE: RCSA = Regulations of Connecticut State Agencies.
CGS = Connecticut General Statutes.

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Hazardous Waste Management: TSDF Standards	RCSA § 22a-449 (c) 104	Applicable	This section establishes standards for treatment, storage, and disposal of hazardous waste, and establishes standards for closure and post-closure care. The standards of 40 CFR 264 are incorporated by reference.	Any hazardous waste which is temporarily stored on this site as part of the remedy will be managed in accordance with the requirements of this section.
Hazardous Waste Management: Interim Status Facilities and Ground-Water Monitoring Requirements, Closure, and Post-Closure Requirements	RCSA § 22a-449 (c) 105	Relevant and Appropriate	This section establishes interim status standards for treatment, storage, and disposal of hazardous waste, and establishes standards for closure, post closure, and ground-water monitoring. The standards of 40 CFR 265 are incorporated by reference. The Commissioner may require ground-water monitoring based on site specific standards.	Investigation-derived waste from monitoring activities will be handled in accordance with these requirements.
Hazardous Waste Management: Permit Requirements	RCSA § 22a-449 (c) 110	Relevant and Appropriate	This section incorporates by reference the federal hazardous waste permitting requirements given at 40 CFR 270 and 124.	Handling of investigation-derived waste would comply with the substantive requirements of this section.

TABLE 4-4 ASSESSMENT OF CHEMICAL-, LOCATION-, AND ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND TO BE CONSIDERED GUIDANCE FOR ALTERNATIVE 3 – EXCAVATION/DREDGING OF SOILS/SEDIMENTS AND OFFSITE DISPOSAL SITE 20 – AREA A WEAPONS CENTER, NAVAL SUBMARINE BASE, NEW LONDON, CONNECTICUT

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
			FEDERAL	
Chemical-Specific				
Cancer Slope Factors		To Be Considered	These are guidance values used in risk assessment to evaluate the potential carcinogenic or non-carcinogenic hazard caused by exposure to contaminants.	The Alternative would eliminate exposure to constituents of concern in the sediment and soil through excavation and offsite disposal.
Reference Dose		To Be Considered	These are guidance values used in risk assessment to evaluate the potential carcinogenic or non-carcinogenic hazard caused by exposure to contaminants.	The Alternative would eliminate exposure to constituents of concern in the sediment and soil through excavation and offsite disposal.
Location-Specific				
Clean Water Act, Section 404	33 USC 1344; 40 CFR Part 230 and 33 CFR Parts 320-323	Applicable	These rules regulate the discharge of dredge and fill materials in wetlands and navigable waters. Such discharges are not allowed if practicable alternatives are available.	Remedial action includes excavation of soil sediment from the impacted wetlands and ditches and replacement/restoration with clean fill. Measures will be taken to minimize adverse effects and to replace or restore protected wetland functions and values.
Executive Order 11990 RE: Protection of Wetlands	Executive Order 11990, 40 CFR Part 6, Appendix A	Applicable	This Order requires federal agencies to take action to avoid adversely impacting wetlands wherever possible, to minimize wetlands destruction and to preserve the values of wetlands, and to prescribe procedures to implement the policies and procedures of this Executive Order.	Remedial action includes excavation of soil and sediment from the impacted wetlands and ditches and replacement/restoration with clean fill. However, measures to minimize adverse effects and to replace or restore protected wetland functions and values will be considered and incorporated into any plan or action wherever feasible.
Fish and Wildlife Coordination Act	16 USC Part 661 *et seq.* 40 CFR 122.49	Applicable	This order protects fish and wildlife when federal actions result in control or structural modification of a natural stream or body of water.	Appropriate agencies would be consulted prior to implementation to find ways to minimize adverse effects to fish and wildlife from potential monitoring activities within wetlands and waterways.

NOTE: ARAR = Applicable or relevant and appropriate requirements.
CFR = Code of Federal Regulations.
USC = United States Code.

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Clean Water Act, Section 402, National Pollution Discharge Elimination System	33 USC 1342; 40 CFR 122-125	Applicable	These standards govern the discharge of water into surface waters.	Ground and surface water removed from excavations, along with water from sediment/soil dewatering process will be treated, if necessary, to meet discharge criteria according to substantive requirements of National Pollution Discharge Elimination System if the discharge occurs onsite.
STATE OF CONNECTICUT				
Chemical-Specific				
Remediation Standard Regulations	RCSA 22a-133k-1 through 3	Applicable	Adopted on 30 January 1996 under the statutory authority provided by CGS 22a-133k, these regulations contain numeric Direct Exposure Criteria and Pollutant Mobility Criteria for constituents in soil based on either industrial or residential use of the site. Requirements are based on ground water in the area being classified by the state as GB.	The Alternative would eliminate exposure to constituents of concern in the soil through excavation and offsite disposal. The Alternative meets residential use standards.
Location-Specific				
Inland Wetlands and Watercourses	CGS § 22a-36 through 45, RCSA § 22a-39-1 through 15 (Surface Water and Wetlands); CGS § 22a-45a (General Permit Requirements)	Applicable	These statutes regulate any operation in or affecting a wetland or watercourse involving removal or deposition of material or any obstruction, construction, alteration, or pollution of such wetlands. CGS § 22a-45a authorizes the Commissioner to adopt a general permit for various minor activities including installation of water quality monitoring equipment, excavation of test pits, and core sampling.	Alternative 3 proposes to excavate soil and sediment from the impacted wetlands and watercourses and to restore the areas using clean fill. The substantive requirements of Connecticut standards will be met to address the alteration of wetlands and watercourses.
Coastal Management Act	CGS 22a-90-112	Applicable	This statute establishes Connecticut's enforceable coastal zone policies in accordance with the federal Coastal Zone Management Act.	Excavation and restoration activities will be coordinated with Connecticut Department of Environmental Protection in accordance with the requirements of this statute.

NOTE: RCSA = Regulations of Connecticut State Agencies.
CGS = Connecticut General Statutes.

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Connecticut Endangered Species Act	CGS § 26-303 through 314	Applicable	Regulates activities affecting state-listed endangered or threatened species or their critical habitat.	Two state-threatened plants, Golden Alexanders and Seaside Crowfoot, have been sighted in the NSB-NLON area. In addition, three state special concern species, Creeping Bush-clover, Crooked-stem Aster, and Carex *crawfordii,* have been documented in the NSB-NLON area. Excavation and restoration of the impacted area will be implemented so as to address potential negative impacts to the listed plant species or any of their critical habitat which might occur within the site.
Action-Specific				
Hazardous Waste Management: Generator and Handler Requirements – General Requirements, Listing, and Identification	RCSA § 22a-449 (c) 100-101	Applicable	Connecticut is delegated to administrate the federal Resource Conservation and Recovery Act statute through its state regulations. These sections establish standards for listing and identification of hazardous waste. The standards of 40 CFR 260-261 are incorporated by reference.	Hazardous waste determinations will be performed on all soil/sediment excavated to determine that levels of regulated constituents do not exceed applicable limits. Any constituents of concern in soil/sediment which exceeds applicable limits will be managed in accordance with requirements of these regulations, if necessary. Also, wastes produced from surface and ground water and dewatering treatment will be tested to determine whether levels of certain regulated constituents exceed Toxicity Characteristic Leaching Procedure limits.
Hazardous Waste Management: Generator Standards	RSCA § 22a-449(c) 102	Relevant and Appropriate	This section establishes standards for various classes of generators. The standards of 40 CFR 262 are incorporated by reference. Storage requirements given at 40 CFR 265.15 are also included.	Excavated soil/sediment and investigation-derived waste will be handled in accordance with these requirements.
Hazardous Waste Management: Treatment, Storage, or Disposal Facility Standards	RCSA § 22a-449 (c) 104	Applicable	This section establishes standards for treatment, storage, and disposal of hazardous waste, and establishes standards for closure and post-closure care. The standards of 40 CFR 264 are incorporated by reference.	Any hazardous waste which is treated or temporarily stored onsite as part of the remedy will be managed in accordance with the requirements of this section.

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Hazardous Waste Management: Interim Status Facilities and Ground-Water Monitoring requirements, Closure, and Post-Closure Requirements	RCSA § 22a-449 (c) 105	Relevant and Appropriate	This section establishes interim status standards for treatment, storage, and disposal of hazardous waste, and establishes standards for closure, post closure, and ground-water monitoring. The standards of 40 CFR 265 are incorporated by reference. The Commissioner may require ground-water monitoring based on site-specific standards.	Investigation-derived waste from excavation activities will be handled in accordance with these requirements.
Hazardous Waste Management: Land Disposal Restrictions	RCSA § 22a-449 (c) 108	Potentially Relevant and Appropriate	This section incorporates by reference the federal Land Disposal Restrictions given at 40 CFR 268.	The regulations would be complied with for the disposal of hazardous waste or investigation-derived waste.
Hazardous Waste Management: Permit Requirements	RCSA § 22a-449 (c) 110	Relevant and Appropriate	This section incorporates by reference the federal hazardous waste permitting requirements given at 40 CFR 270 and 124.	Remedial activities that constitute treatment, storage, or disposal of hazardous waste would comply with the substantive requirements of this section.
Air Pollution Control – Particulates	RCSA § 22a-174 1-20	Applicable	These regulations require permits to construct and to operate specified types of emission sources and contain emission standards that must be met prior to issuance of a permit. Pollutant abatement controls may be required. Specific standards pertain to fugitive dust (18b).	Emission standards for fugitive dust from excavation and restoration operations will be met with dust control measures. Emissions will be managed to comply with these standards.
Air Pollution Control – Odors	RCSA § 22a-174-23	Applicable	This section prohibits emission of any substance that constitutes a nuisance because of objectionable odor.	Potential odors from excavation activities will be managed to comply with these requirements.
Air Pollution Control – Control of Hazardous Air Pollutants	RCSA § 22a-174-29	Applicable	This section establishes testing requirements and allowable stack concentrations for many specific substances.	Remedial activities that result in the emission of substances identified as hazardous would comply with the substantive requirements of this section.
Control of Noise Regulations	RSCA § 22a-69-1 to 69-7.4	Applicable	These regulations establish allowable noise levels.	Excavation activities would be conducted in accordance with these requirements.
Water Pollution Control	RCSA § 22a-430-1 to 8 and §22a-430b	Potentially Applicable	These regulations establish permitting requirements and criteria for water discharge to surface water, ground water, and publicly-owned treatment works.	Discharge of any water from excavated soil/sediment would comply with the substantive requirements of this regulation.

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Water Quality Standards	CGS §22a-426	Potentially Applicable	Connecticut's Water Quality Standards were adopted under this statue. They establish specific numeric criteria, designated uses, and anti-degradation policies for ground water and surface water.	Excavation activities (and any required dewatering activities) would be conducted in a manner consistent with the anti-degradation policies of the Water Quality Standards.
Connecticut Guidelines for Soil Erosion and Sediment Control	Connecticut Council on Soil and Water Conservation	To Be Considered	Technical and administrative guidance for development, adoption, and implementation of erosion and sediment control program.	Guidelines will be incorporated into the remedial design for the site to protect wetland and aquatic resources.

Attachment 2

Revised Appendix A

Detailed Calculations and Summary Tables

APPENDIX A.1

DETAILED PRG CALCULATIONS
SITE 20 - AREA A WEAPONS CENTER
NAVAL SUBMARINE BASE, NEW LONDON CONNECTICUT

1. CALCULATE INTAKE OF CHEMICAL FOR EACH EXPOSURE

Intake Via Inhalation (All Scenarios)

$$Intake_{ai} = (C_{ai})(IR)(ET)(EF)(ED)/BW)(AT)$$

where:
- $Intake_{ai}$ = Intake of chemical "I" from air (PM10 or vapor) inhalation (mg/kg/day)
- C_{ai} = UCL Concentration of chemical "I" in PM10 fraction or air (mg/m^3)
- IR = Inhalation rate (m^3/hr)
- ET = exposure time (hours/day)
- EF = Exposure frequency (days/year)
- ED = Exposure duration (year)
- BW = Body weight (kg)
- AT = averaging time (days);
  For noncarcinogens, AT=ED*365 days/year;
  For Carcinogens, AT = 70yr*365 days/year

Intake via Ingestion of Soil/Sediment

Full-time Employee and Construction Worker:

$$Intake_{si} = (C_{si})(IR)(FI)(EF)(ED)(CF)/(BW)(AT)$$

Future Resident:

$$IR_{adj} = \frac{(IR_c)(ED_c)}{BW_c} + \frac{(IR_a)(ED_a)}{BW_a}$$

$$Intake_{si} = (C_{si})(IR_{adj})(FI)(EF)(CF)/(AT)$$

where:
- $Intake_{si}$ = Intake of chemical "I" from soil or sediment (mg/kg/day)
- C_{si} = Concentration of chemical "I" in soil or sediment (mg/kg)
- IR = Ingestion rate (mg/day)
- FI = Fraction ingested from contaminated source (decimal fraction)
- EF = Exposure frequency (days/year)
- ED = Exposure duration (year)
- CF = Conversion factor (10^{-6} kg/mg)
- BW = Body weight (kg)
- IR_{adj} = Age-adjusted rate for a 30- and 9-year future resident
- AT = Averaging time (days)
  For noncarcinogens, AT=ED*365 days/year
  For carcinogens, AT = 70yr*365 days/year

Dermal Contact with Soil/Sediment

Full-time Employee and Construction Worker:

$$Intake_{si} = (C_{si})(SA)(AF)(ABS)(Fd)(CF)(EF)(ED) / (BW)(AT)$$

Future Resident:

$$SA_{adj} = \frac{(SA_c)(ED_c)(Fd)}{BW_c} + \frac{(SA_a)(ED_a)(Fd)}{BW_a}$$

$$Intake_{si} = (C_{si})(SA_{adj})(AF)(EF)(ABS)(CF)/(AT)$$

where:
- $Intake_{si}$ = Amount of chemical "I" absorbed during contact with soil (mg/kg/day)
- C_{si} = Concentration of chemical "I" in soil or sediment (mg/kg)
- SA = Skin surface area available for contact (cm^2/day)
- AF = Skin adherence factor (mg/cm^2)
- ABS = Absorption factor (decimal fraction)
- Fd = Fraction available for contact from contaminated source
- CF = Conversion factor (10^{-6} kg/mg)
- EF = Exposure frequency (days/year)
- ED = Exposure duration (year)
- BW = Body weight (kg)
- SA_{adj} = Age-adjusted rate for a 30- and 9-year future resident
- AT = Averaging time days
  For noncarcinogens, AT = ED*365 days/year
  For carcinogens, AT = 70 yr*365/year

2. CALCULATE RISK OF CHEMICAL FOR EACH EXPOSURE

Carcinogenic Risk

$$ILCR_1 = (Intake_1)(CSF_1)$$

where:
- $ICLR_1$ = Incremental Lifetime Cancer Risk for chemical "I," expressed as a unitless probability
- $Intake_1$ = Intake of Chemical "I" (mg/kg/day)
- CSF_1 = Cancer Slope Factor of chemical "I" $(mg/kg/day)^{-1}$

Non-Carcinogenic Risk

$$HQ_1 = Intake/RfD_1$$

where:
- HQ_1 = Hazard Quotient for chemical "I" (unitless)
- $Intake_1$ = Intake of chemical "I" (mg/kg/day)
- RfD_1 = Reference Dose of Chemical "I" (mg/kg/day)

3. SUM THE CANCER AND NONCANCER RISK OF EACH CHEMICAL

Calculated Risk Value = Inhalation $ILCR_1$ + Dermal $ILCR_1$ + Ingestion $ILCR_1$
Calculated Risk Value = Inhalation HQ_1 + Dermal HQ_1 + Ingestion HQ_1

4. CALCULATE THE PRG

PRG = (Exposure Concentration) (Desired Risk Level)/Calculated Risk Value.

For noncarcinogens: Desired Risk Level = 10^{-6}
For carcinogens: Desired Risk Level = 1

UCL CALCULATIONS

$$UCL = x + z(\alpha/2)[S/\sqrt{n}]$$

where UCL = 95% Upper Confidence Limit of the mean
x = Arithmetic average*
$z(\alpha/2)$ = Critical value of z score = 1.96
S = Standard deviation
n = Number of samples

*To calculate the arithmetic average, ½ the detection limit was used for nondetect values.

TABLE A-1 TOXICITY VALUES
SITE 20 - AREA A WEAPONS CENTER
NAVAL SUBMARINE BASE, NEW LONDON CONNECTICUT

Chemical	Oral Chronic RfD	Dermal Chronic RfD	Inhalation Chronic RfD	Oral Cancer Slope Factor	Inhalation Cancer Slope Factor	Dermal Cancer Slope Factor
Arsenic	3.00E-04	1.23E-04		1.50E+00	1.51E+01	3.66E+00
Benzo(a)anthracene				7.30E-01		2.35E+00
Benzo(a)pyrene				7.30E+00	3.10E+00	2.35E+01
Benzo(b)fluoranthene				7.30E-01		2.35E+00
Beryllium	2.00E-03	2.00E-05	5.71E-06		8.40E+00	4.30E+02
Dibenzo(a,h)anthracene				7.30E+00		2.35E+01
Indeno(1,2,3-cd)pyrene				7.30E-01		2.35E+00
Iron	3.00E-01					
Manganese	1.40E-01	5.60E-03	1.43E-05			
Benzo(k)fluoranthene				7.30E-02		2.35E-01

TABLE A-2 EXPOSURE PARAMETERS FOR FULL-TIME EMPLOYEES, CONSTRUCTION WORKERS, AND FUTURE RESIDENTS[1]
SITE 20 – AREA A WEAPONS CENTER, NAVAL SUBMARINE BASE, NEW LONDON CONNECTICUT

Exposure Scenario	Parameter (units)	Full-Time Employee		Construction Worker		Future Residents[2]			
						Adult		Child	
		RME	CTE	RME	CTE	RME	CTE	RME	CTE
Soil Ingestion	Exposure Concentration (mg/kg)	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL
	Ingestion Rate (mg/day)	100	50	480	240[2]	100	50	200	100
	Exposure Frequency (day/yr)	150	150	120[3]	80[3]	150	150	150	150
	Exposure Duration (yr)	25	6[3]	1[3]	1[3]	24	7	6	2
	Body Weight (kg)	70	70	70	70	70	70	15	15
Soil Dermal Contact	Exposure Concentration (mg/kg)	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL	95% UCL
	Body Surface Area (cm^2)	20,000[4]	20,000[4]	20,000[4]	20,000[4]	20,000[4]	20,000[4]	6,980[4]	6,980[4]
	Fraction Exposed (forearms, head, hands)	0.19[5]	0.19[5]	0.19[5]	0.19[5]	0.19[5]	0.19[5]	0.30[5]	0.30[5]
	Adherence Factor (mg/cm^2)	1.0[4]	0.2[4]	1.0[4]	0.2[4]	1.0[4]	0.2[4]	1.0[4]	0.2[4]
	Exposure Frequency (day/yr)	150	150	120[3]	80[3]	150	150	150	150
	Exposure Duration (yr)	25	6[3]	1[3]	1[3]	24	7	6	2
	Body Weight (kg)	70	70	70	70	70	70	15	15
Inhalation of Dust/Air	PM10 Exposure Concentration (mg/m_3)	1.8E-8 X UCL[3]	1.8E-8 X UCL[3]	9E-8 X UCL[3]	9E-8 X UCL[3]	1.8E-8 X UCL[3]	1.8E-8 X UCL[3]	NA[8]	NA
	Inhalation Rate (m^3/hr)	2.5[5]	2.5[5]	3.9[5]	3.9[5]	0.833[7]	0.833[7]	NA	NA
	Exposure Time (hr/day)	8[6]	8[6]	8[6]	8[6]	24	24	NA	NA
	Exposure Frequency (day/yr)	150	150	120[3]	80[3]	350	234	NA	NA
	Exposure Duration (yr)	25	6[3]	1[3]	1[3]	30	9	NA	NA
	Body Weight (kg)	70	70	70	70	70	70	NA	NA

1. EPA Region I, August 1994, unless otherwise noted.
2. A 30- and 9-year future resident evaluated. Age-adjusted ingestion and dermal contact rates will be used for soil exposure.
3. Based on Phase I RI (Atlantic, August 1992).
4. EPA, January 1992.
5. EPA, May 1989.
6. Professional judgement.
7. 20 m^3/day.
8. NA – Exposure route not evaluated.

Preliminary Remediation Goal Calculations for Soil

APPENDIX A.2 DEVELOPMENT OF SOIL RISK-BASED PRELIMINARY REMEDIATION GOALS
FOR THE FULL-TIME EMPLOYEE AND FUTURE RESIDENT SCENARIOS
SITE 20 - AREA A WEAPONS CENTER, NEW LONDON, CONNECTICUT

PARAMETER	FRACTION	Samples	Positive	Maximum	UCL	IRBC	RRBC	UNITS	Max Exceed IRBC	Max Exceed RRBC	COC Retained
ALUMINUM	M	4	4	9,200.00	8,421.47	1,000,000.00	78,000.00	MG/KG	N	N	NO
ANTIMONY	M	3	2	5.40	5.41	820.00	31.00	MG/KG	N	N	NO
ARSENIC	M	4	2	3.00	2.45	3.80	0.43	MG/KG	N	Y	**YES**
BARIUM	M	4	4	60.80	54.03	140,000.00	5,500.00	MG/KG	N	N	NO
BERYLLIUM	M	4	3	0.41	0.39	1.30	0.15	MG/KG	N	Y	**YES**
CADMIUM	M	4	2	1.20	0.97	1,000.00	39.00	MG/KG	N	N	NO
CALCIUM	M	4	4	1,870.00	1,703.23	--	--	MG/KG	N	N	NO
CHROMIUM	M	4	4	10.90	11.98	1,000,000.00	78,000.00	MG/KG	N	N	NO
COBALT	M	4	4	4.60	4.74	120,000.00	4,700.00	MG/KG	N	N	NO
COPPER	M	4	4	10.80	10.74	82,000.00	3,100.00	MG/KG	N	N	NO
IRON	M	4	4	10,800.00	10,824.61	610,000.00	23,000.00	MG/KG	N	N	NO
LEAD	M	4	4	12.30	11.07	--	400.00	MG/KG	N	N	NO
MAGNESIUM	M	4	4	3,520.00	3,206.41	--	--	MG/KG	N	N	NO
MANGANESE	M	4	4	257.00	230.02	47,000.00	1,800.00	MG/KG	N	N	NO
NICKEL	M	4	4	8.40	8.37	41,000.00	1,600.00	MG/KG	N	N	NO
POTASSIUM	M	4	4	2,900.00	2,509.70	--	--	MG/KG	N	N	NO
SODIUM	M	4	4	267.00	257.57	--	--	MG/KG	N	N	NO
VANADIUM	M	4	4	17.50	18.20	14,000.00	550.00	MG/KG	N	N	NO
ZINC	M	4	4	46.50	41.02	610,000.00	23,000.00	MG/KG	N	N	NO
2-METHYLNAPHTHALENE	OS	4	1	54.00	325.11	41,000,000.00	1,600,000.00	UG/KG	N	N	NO
ACENAPHTHENE	OS	4	1	140.00	183.40	120,000,000.00	4,700,000.00	UG/KG	N	N	NO
ACENAPHTHYLENE	OS	4	1	31.00	327.54	82,000,000.00	--	UG/KG	N	N	NO
ANTHRACENE	OS	4	2	540.00	442.00	610,000,000.00	23,000,000.00	UG/KG	N	N	NO
BENZO(A)ANTHRACENE	OS	4	2	1,300.00	1,017.53	7,800.00	880.00	UG/KG	N	Y	**YES**
BENZO(A)PYRENE	OS	4	2	1,300.00	1,017.53	780.00	88.00	UG/KG	Y	Y	**YES**
BENZO(B)FLUORANTHENE	OS	4	2	2,300.00	1,756.67	7,800.00	880.00	UG/KG	N	Y	**YES**
BENZO(G,H,I)PERYLENE	OS	4	2	770.00	617.70	82,000,000.00	--	UG/KG	N	N	NO
BENZO(K)FLUORANTHENE	OS	4	1	220.00	329.25	78,000.00	8,800.00	UG/KG	N	N	NO
BIS(2-ETHYLHEXYL)PHTHALATE	OS	4	1	35.00	327.08	410,000.00	46,000.00	UG/KG	N	N	NO
CARBAZOLE	OS	3	1	400.00	397.00	290,000.00	32,000.00	UG/KG	N	N	NO
CHRYSENE	OS	4	2	1,400.00	1,092.61	780,000.00	88,000.00	UG/KG	N	N	NO
DIBENZO(A,H)ANTHRACENE	OS	4	1	450.00	378.50	780.00	88.00	UG/KG	N	Y	**YES**
DIBENZOFURAN	OS	4	2	84.00	186.03	8,200,000.00	310,000.00	UG/KG	N	N	NO
FLUORANTHENE	OS	4	2	3,200.00	2,456.52	82,000,000.00	3,100,000.00	UG/KG	N	N	NO
FLUORENE	OS	4	2	180.00	198.73	82,000,000.00	3,100,000.00	UG/KG	N	N	NO
INDENO(1,2,3-CD)PYRENE	OS	4	2	760.00	607.48	7,800.00	880.00	UG/KG	N	N	NO
PHENANTHRENE	OS	4	2	2,400.00	1,851.60	82,000,000.00	--	UG/KG	N	N	NO
PYRENE	OS	4	2	2,500.00	1,943.46	61,000,000.00	2,300,000.00	UG/KG	N	N	NO
4,4'-DDE	PEST/PCB	3	1	4.00	17.78	17,000.00	1,900.00	UG/KG	N	N	NO
AROCLOR-1260	PEST/PCB	3	1	50.00	221.79	2,860.00	319.00	UG/KG	N	N	NO
ENDRIN	PEST/PCB	3	2	11.00	11.80	610,000.00	23,000.00	UG/KG	N	N	NO
ENDRIN ALDEHYDE	PEST/PCB	2	1	7.00	22.54	--	--	UG/KG	N	N	NO

Notes: IRBC = Region III Industrial Risk Based Concentrations, RRBC = Region III Residential Risk Based Concentrations, UCL = 95% Upper Confidence Limit
COC = Contaminants of concern. M = Metals. OS = Organic Semivolatiles.
Shallow soil (< 4 ft) was used for the full-time employee and future resident scenarios.
Maximum concentrations were compared to the Region III Industrial Risk Based Concentrations for the full-time employee scenario and to the Residential Risk Based Concentrations for the future resident scenario.

APPENDIX A.2 DEVELOPMENT OF SOIL RISK-BASED PRELIMINARY REMEDIATION GOALS
FOR THE CONSTRUCTION WORKER SCENARIO
SITE 20 - AREA A WEAPONS CENTER, NEW LONDON, CONNECTICUT

PARAMETER	FRACTION	Samples	Positive	Maximum	UCL	IRBC	Units	Max > Exceed IRBC	Is COC Retained
ALUMINUM	M	11	11	18,200.00	14,572.43	1,000,000.00	MG/KG	N	NO
ANTIMONY	M	9	2	5.40	9.70	820.00	MG/KG	N	NO
ARSENIC	M	11	8	10.80	7.27	3.80	MG/KG	Y	**YES**
BARIUM	M	11	11	131.00	70.48	140,000.00	MG/KG	N	NO
BERYLLIUM	M	11	10	0.84	0.59	1.30	MG/KG	N	NO
BORON	M	10	4	51.80	25.67	180,000.00	MG/KG	N	NO
CADMIUM	M	11	2	1.20	0.54	1,000.00	MG/KG	N	NO
CALCIUM	M	11	11	5,050.00	2,783.63	--	MG/KG	N	NO
CHROMIUM	M	11	11	78.70	45.22	1,000,000.00	MG/KG	N	NO
COBALT	M	11	11	8.60	6.64	120,000.00	MG/KG	N	NO
COPPER	M	11	11	41.40	25.32	82,000.00	MG/KG	N	NO
IRON	M	11	11	28,600.00	22,196.57	610,000.00	MG/KG	N	NO
LEAD	M	11	11	66.10	29.26	--	MG/KG	N	NO
MAGNESIUM	M	11	11	8,450.00	6,095.14	--	MG/KG	N	NO
MANGANESE	M	11	11	390.00	276.76	47,000.00	MG/KG	N	NO
MERCURY	M	11	2	0.29	0.14	610.00	MG/KG	N	NO
NICKEL	M	11	11	22.70	17.12	41,000.00	MG/KG	N	NO
POTASSIUM	M	11	11	6,300.00	4,128.00	--	MG/KG	N	NO
SILVER	M	11	3	1.50	0.75	10,000.00	MG/KG	N	NO
SODIUM	M	11	11	7,390.00	2,388.42	--	MG/KG	N	NO
VANADIUM	M	11	11	49.60	38.65	14,000.00	MG/KG	N	NO
ZINC	M	11	11	69.30	55.52	610,000.00	MG/KG	N	NO
2-METHYLNAPHTHALENE	OS	11	2	54.00	267.03	41,000,000.00	UG/KG	N	NO
ACENAPHTHENE	OS	11	1	140.00	240.09	120,000,000.00	UG/KG	N	NO
ACENAPHTHYLENE	OS	11	1	31.00	270.41	82,000,000.00	UG/KG	N	NO
ANTHRACENE	OS	11	4	540.00	280.26	610,000,000.00	UG/KG	N	NO
BENZO(A)ANTHRACENE	OS	11	6	1,300.00	482.52	7,800.00	UG/KG	N	NO
BENZO(A)PYRENE	OS	11	8	1,300.00	458.80	780.00	UG/KG	Y	**YES**
BENZO(B)FLUORANTHENE	OS	11	6	2,300.00	774.80	7,800.00	UG/KG	N	NO
BENZO(G,H,I)PERYLENE	OS	11	5	770.00	335.82	82,000,000.00	UG/KG	N	NO
BENZO(K)FLUORANTHENE	OS	11	5	260.00	253.20	78,000.00	UG/KG	N	NO
BENZOIC ACID	OS	11	5	480.00	963.60	1,000,000,000.00	UG/KG	N	NO
BIS(2-ETHYLHEXYL)PHTHALATE	OS	11	2	360.00	297.07	410,000.00	UG/KG	N	NO
CARBAZOLE	OS	10	1	400.00	284.40	290,000.00	UG/KG	N	NO
CHRYSENE	OS	11	6	1,400.00	527.88	780,000.00	UG/KG	N	NO
DI-N-OCTYL PHTHALATE	OS	11	3	89.00	244.17	41,000,000.00	UG/KG	N	NO
DIBENZO(A,H)ANTHRACENE	OS	11	2	450.00	280.32	780.00	UG/KG	N	NO
DIBENZOFURAN	OS	11	2	84.00	238.90	8,200,000.00	UG/KG	N	NO
DIETHYL PHTHALATE	OS	11	2	32.00	249.85	1,000,000,000.00	UG/KG	N	NO
FLUORANTHENE	OS	11	7	3,200.00	1,026.78	82,000,000.00	UG/KG	N	NO
FLUORENE	OS	11	2	180.00	240.87	82,000,000.00	UG/KG	N	NO
INDENO(1,2,3-CD)PYRENE	OS	11	5	760.00	332.68	7,800.00	UG/KG	N	NO
PHENANTHRENE	OS	11	6	2,400.00	789.41	82,000,000.00	UG/KG	N	NO
PYRENE	OS	11	7	2,500.00	859.86	61,000,000.00	UG/KG	N	NO
2-BUTANONE	OV	11	3	240.00	75.26	1,000,000,000.00	UG/KG	N	NO
ACETONE	OV	11	1	690.00	202.73	200,000,000.00	UG/KG	N	NO
CARBON DISULFIDE	OV	11	1	11.00	7.76	200,000,000.00	UG/KG	N	NO
TOLUENE	OV	11	2	8.00	6.96	410,000,000.00	UG/KG	N	NO
TRICHLOROETHENE	OV	11	1	3.00	7.04	520,000,000.00	UG/KG	N	NO
4,4'-DDE	PEST/PCB	7	1	4.00	22.15	17,000.00	UG/KG	N	NO
AROCLOR-1260	PEST/PCB	7	1	50.00	229.12	2,860.00	UG/KG	N	NO
ENDRIN	PEST/PCB	7	2	11.00	21.41	610,000.00	UG/KG	N	NO
ENDRIN ALDEHYDE	PEST/PCB	6	2	7.00	22.09	--	UG/KG	N	NO

Notes: IRBC = Region III Industrial Risk Based Concentrations, UCL = 95% Upper Confidence Limit, COC = Contaminants of concern.
M = Metals. OS = Organic Semivolatiles. OV = Organic Volatiles. All soil data was used for the construction worker scenario.
Maximum concentrations were compared to the Region III Industrial Risk Based Concentrations.

APPENDIX A.2 SELECTION OF SOIL CONTAMINANTS OF CONCERN EXCEEDING RISK-BASED PRELIMINARY REMEDIATION GOALS
SITE 20 - AREA A WEAPONS CENTER, NEW LONDON, CONNECTICUT

SCENARIO	PARAMETER	FRACTION	Samples	Positive	UCL (MG/KG)	RISK	Risk Exceed 10^-6	BASED PRG (MG/KG)	UCL Exceed PRG	COC Retained
FULL-TIME EMPLOYEE										
	BENZO(A)PYRENE	OS	4	2	1.02	1.56E-06	Y	0.65	Y	YES
CONSTRUCTION WORKER										
	ARSENIC	M	11	8	7.27	3.79E-07	N	NC	--	NO
	BENZO(A)PYRENE	OS	11	8	0.46	1.36E-07	N	NC	--	NO
FUTURE RESIDENT										
	ARSENIC**	M	4	2	2.45	1.04E-05	Y	0.24	Y	NO**
	BERYLLIUM	M	4	3	0.39	2.80E-06	Y	0.14	Y	YES
	BENZO(A)PYRENE	OS	4	2	1.02	8.66E-06	Y	0.12	Y	YES
	BENZO(A)ANTHRACENE	OS	4	2	1.02	7.99E-07	N	NC	--	NO
	BENZO(B)FLUORANTHENE*	OS	4	2	1.76	1.38E-06	Y	1.27	Y	NO*
	DIBENZO(A,H)ANTHRACENE	OS	4	1	0.38	2.97E-06	Y	0.13	Y	YES

Notes: NC = Not calculated. PRG = Preliminary Remediation Goals. UCL = 95% Upper Confidence Limit. M = Metals. OS = Organic Semivolatiles.
All soil was used for the construction worker scenario. Shallow soil (< 4 ft) was used for the full-time employee and future resident scenarios.
PRG were only developed if incremental risk > 10^-6
* UCL exceeded PRG; however, no individual sample exceeded the PRG.
** Arsenic did not exceed the site background concentration of arsenic (3 mg/kg).

RME PRELIMINARY REMEDIATION GOALS FOR SOIL

FULL-TIME EMPLOYEE

Chemical	Route-Specific Cancer Risks Ingestion	Dermal	Inhalation	Total Risk	Concentration	Preliminary Remediation Goals (mg/kg) 1.00E-06
Benzo(a)pyrene	**1.5574E-06**	**0.00**	**0.00**	**1.5574E-06**	**1.018**	**0.653**
Totals	1.5574E-06	0.00	0.00 **Total**	1.5574E-06		

Chemical	Route-Specific Hazard Index Ingestion	Dermal	Inhalation	Total HI	Concentration	Preliminary Remediation Goals (mg/kg) 1.0
Benzo(a)pyrene	0.00	0.00	0.00	0.00	1.018	NC
Totals	0.00	0.00	0.00 **Total**	0.00		

CONSTRUCTION WORKER

Chemical	Route-Specific Cancer Risks Ingestion	Dermal	Inhalation	Total Risk	Concentration	Preliminary Remediation Goals (mg/kg) 1.00E-06
Arsenic	3.5124E-07	6.785E-09	2.0684E-08	3.7871E-07	7.3	NC
Benzo(a)pyrene	1.0787E-07	2.749E-08	2.6796E-10	1.3562E-07	0.459	NC
Totals	4.591E-07	3.427E-08	2.0952E-08 **Total**	5.1433E-07		

Chemical	Route-Specific Hazard Index Ingestion	Dermal	Inhalation	Total HI	Concentration	Preliminary Remediation Goals (mg/kg) 1.0
Arsenic	0.0546	0.0011	0.00	0.05569171	7.3	NC
Benzo(a)pyrene	0.0000	0.0000	0.00	0.00	0.459	NC
Totals	0.05463674	0.001055	0.00 **Total**	0.05569171		

FUTURE RESIDENT

Chemical	Route-Specific Cancer Risks Ingestion	Dermal	Inhalation	Total Risk	Concentration	Preliminary Remediation Goals (mg/kg) 1.00E-06
Arsenic	**2.47E-06**	**1.13E-07**	**7.82E-06**	**1.04E-05**	**2.5**	**0.236**
Beryllium	**0.00E+00**	**2.11E-06**	**6.92E-07**	**2.80E-06**	**0.4**	**0.139**
Benzo(a)pyrene	**4.98E-06**	**3.00E-06**	**6.66E-07**	**8.66E-06**	**1.0**	**0.118**
Benzo(a)anthracene	4.98E-07	3.00E-07	0.00E+00	7.99E-07	1.0	NC
Benzo(b)fluoranthene	**8.60E-07**	**5.19E-07**	**0.00E+00**	**1.38E-06**	**1.8**	**1.274**
Dibenzo(a,h)anthracene	**1.85E-06**	**1.12E-06**	**0.00E+00**	**2.97E-06**	**0.4**	**0.127**
Totals	1.0662E-05	7.162E-06	9.1743E-06 **Total**	2.70E-05		

Chemical	Route-Specific Hazard Index Ingestion	Dermal	Inhalation	Total HI	Concentration	Preliminary Remediation Goals (mg/kg) 1.0
Arsenic	0.04261796	0.0019468	0.00	0.04	2.5	NC
Beryllium	0.00101761	0.0019059	0.03	0.04	0.4	NC
Benzo(a)pyrene	0.00	0.00	0.00	0.00	1.0	NC
Benzo(a)anthracene	0.00	0.00	0.00	0.00	1.0	NC
Benzo(b)fluoranthene	0.00	0.00	0.00	0.00	1.8	NC
Dibenzo(a,h)anthracene	0.00	0.00	0.00	0.00	0.4	NC
Totals	0.04363557	0.0038527	0.03366932 **Total**	0.08		

NC = PRG not calculated because incremental risk did not exceed 1x10^-5.

RISK ASSESSMENT SPREADSHEET
FUTURE RESIDENT RESEASONABLE MAXIMUM EXPOSURE SCENARIO FOR SOIL
SITE 20 - AREA A WEAPONS CENTER
NAVAL SUBMARINE BASE, NEW LONDON, CONNECTICUT

CANCER RISK

Ingestion Parameters		Dermal Contact Parameters		Inhalation Parameters	
IRc: Ingestion Rate-child (mg/day)	200	SAc: Skin Surface Area-child (cm^2/day)	2094	IR: Inhalation Rate-adult (m^3/hr)	0.833
EDc: Exposure Duration-child (years)	6	EDc: Exposure Duration-child (years)	6	ET: Exposure Time (hours/day)	24
BWc: Body Weight-child (kg)	15	BWc: Body Weight-child (kg)	15	EF: Exposure Frequency (days/year)	350
IRa: Ingestion Rate-adult (mg/kg)	100	SAa: Skin Surface Area-adult (cm^2/day)	3800	ED: Exposure Duration (years)	30
EDa: Exposure Duration-adult (years)	24	EDa: Exposure Duration-adult (years)	24	BW: Body Weight-adult (kg)	70
BWa: Body Weight-adult (kg)	70	BWa: Body Weight-adult (kg)	70	AT: Averaging Time (days)	25550
Fi: Contaminant Fraction (decimal)	1	AF: Adherence Factor (mg/cm^2)	1		
EF: Exposure Frequency (days/year)	150	EF: Exposure Frequency days/year)	150		
AT: Averaging Time (days)	25550	AT: Averaging Time (days)	25550		
Ingestion Conversion Factor (CF)		**Dermal Contact Conversion Factor (CF)**		**Inhalation Conversion Factor**	
Ifadj=(IRcxEDc)/BWc + (IRaxEDa)/BWa	114.2857143	SAadj=(SAcxEDc)/BWc + (SAaxEDa)/BWa	2140.457143		
CF=(IFadjxFixEF)/(ATx1E6) (day^{-1})	**6.71E-07**	CF=(SAadjxAFxEF)/(ATx1E6) (day^{-1})	**1.26E-05**	CF=(IRxFixEFxED)/(BWxAT) (day^{-1})	**1.17E-01**

Exposure Route	Chemical	Concentration (mg/kg)*	Factor**	Lifetime Average Dose (mg/kg/day)	Cancer Slope Factor (kg-day)/mg	Cancer Risk
Ingestion						
	Arsenic	2.5	1	1.64E-06	1.5	2.47E-06
	Beryllium	0.4	1	2.62E-07	0	0.00E+00
	Benzo(a)pyrene	1.018	1	6.83E-07	7.3	4.98E-06
	Benzo(a)anthracene	1.018	1	6.83E-07	0.73	4.98E-07
	Benzo(b)fluoranthene	1.757	1	1.18E-06	0.73	8.60E-07
	Dibenzo(a,h)anthracene	0.379	1	2.54E-07	7.3	1.85E-06
Total						**1.07E-05**
Dermal Contact						
	Arsenic	2.5	0.001	3.08E-08	3.66	1.13E-07
	Beryllium	0.4	0.001	4.90E-09	430	2.11E-06
	Benzo(a)pyrene	1.018	0.01	1.28E-07	23.5	3.00E-06
	Benzo(a)anthracene	1.018	0.01	1.28E-07	2.35	3.00E-07
	Benzo(b)fluoranthene	1.757	0.01	2.21E-07	2.35	5.19E-07
	Dibenzo(a,h)anthracene	0.379	0.01	4.76E-08	23.5	1.12E-06
Total						**7.16E-06**
Inhalation						
	Arsenic	2.5	1.80E-06	5.18E-07	15.1	7.82E-06
	Beryllium	0.4	1.80E-06	8.24E-08	8.4	6.92E-07
	Benzo(a)pyrene	1.018	1.80E-06	2.15E-07	3.1	6.66E-07
	Benzo(a)anthracene	1.018	1.80E-06	2.15E-07	0	0.00E+00
	Benzo(b)fluoranthene	1.757	1.80E-06	3.71E-07	0	0.00E+00
	Dibenzo(a,h)anthracene	0.379	1.80E-06	8.00E-08	0	0.00E+00
Total						**9.17E-06**
Cumulative						***2.70E-05***

Notes: *95% UCL of shallow soils (0-4 ft)
**Ingestion Bioavailability/ Dermal Absorption Factor/ Inhalation PM10 Factor

RISK ASSESSMENT SPREADSHEET
FUTURE RESIDENT RESEASONABLE MAXIMUM EXPOSURE SCENARIO FOR SOIL
SITE 20 - AREA A WEAPONS CENTER
NAVAL SUBMARINE BASE, NEW LONDON, CONNECTICUT

NONCANCER RISK

Ingestion Parameters		Dermal Contact Parameters		Inhalation Parameters	
IRc: Ingestion Rate-child (mg/day)	200	SAc: Skin Surface Area-child (cm^2/day)	2094	IR: Inhalation Rate-adult (m^3/hr)	0.833
EDc: Exposure Duration-child (years)	6	EDc: Exposure Duration-child (years)	6	ET: Exposure Time (hours/day)	24
BWc: Body Weight-child (kg)	15	BWc: Body Weight-child (kg)	15	EF: Exposure Frequency (days/year)	350
IRa: Ingestion Rate-adult (mg/kg)	100	SAa: Skin Surface Area-adult (cm^2/day)	3800	ED: Exposure Duration (years)	30
EDa: Exposure Duration-adult (years)	24	EDa: Exposure Duration-adult (years)	24	BW: Body Weight-adult (kg)	70
BWa: Body Weight-adult (kg)	70	BWa: Body Weight-adult (kg)	70	AT: Averaging Time (days)	10950
Fi: Contaminant Fraction (decimal)	1	AF: Adherence Factor (mg/cm^2)	1		
EF: Exposure Frequency (days/year)	150	EF: Exposure Frequency days/year)	150		
AT: Averaging Time (days)	3285	AT: Averaging Time (days)	3285		
Ingestion Conversion Factor (CF)		**Dermal Contact Conversion Factor (CF)**		**Inhalation Conversion Factor**	
Ifadj=(IRcxEDc)/BWc + (IRaxEDa)/BWa	114.2857143	SAadj=(SAcxEDc)/BWc + (SAaxEDa)/BWa	2140.457143		
CF=(IFadjxFixEF)/(ATx1E6) (day^{-1})	**5.22E-06**	CF=(SAadjxAFxEF)/(ATx1E6) (day^{-1})	**9.77E-05**	CF=(IRxFixEFxED)/(BWxAT) (day^{-1})	**2.74E-01**

Exposure Route	Chemical	Concentration (mg/kg)*	Factor**	Adult Annual Dose (mg/kg/day)	Reference Dose (mg/kg/day)	Hazard Index
Ingestion						
	Arsenic	2.5	1	1.28E-05	0.0003	4.26E-02
	Beryllium	0.4	1	2.04E-06	0.002	1.02E-03
	Benzo(a)pyrene	1.018	1	5.31E-06	0	0.00E+00
	Benzo(a)anthracene	1.018	1	5.31E-06	0	0.00E+00
	Benzo(b)fluoranthene	1.757	1	9.17E-06	0	0.00E+00
	Dibenzo(a,h)anthracene	0.379	1	1.98E-06	0	0.00E+00
Total						**4.36E-02**
Dermal Contact						
	Arsenic	2.5	0.001	2.39E-07	0.000123	1.95E-03
	Beryllium	0.4	0.001	3.81E-08	0.00002	1.91E-03
	Benzo(a)pyrene	1.018	0.01	9.95E-07	0	0.00E+00
	Benzo(a)anthracene	1.018	0.01	9.95E-07	0	0.00E+00
	Benzo(b)fluoranthene	1.757	0.01	1.72E-06	0	0.00E+00
	Dibenzo(a,h)anthracene	0.379	0.01	3.70E-07	0	0.00E+00
Total						**3.85E-03**
Inhalation						
	Arsenic	2.5	1.80E-06	1.21E-06	0	0.00E+00
	Beryllium	0.4	1.80E-06	1.92E-07	0.00000571	3.37E-02
	Benzo(a)pyrene	1.018	1.80E-06	5.02E-07	0	0.00E+00
	Benzo(a)anthracene	1.018	1.80E-06	5.02E-07	0	0.00E+00
	Benzo(b)fluoranthene	1.757	1.80E-06	8.66E-07	0	0.00E+00
	Dibenzo(a,h)anthracene	0.379	1.80E-06	1.87E-07	0	0.00E+00
Total						**3.37E-02**
Cumulative						***8.12E-02***

Notes: *95% UCL of shallow soils (0-4 ft)
**Ingestion Bioavailability/ Dermal Absorption Factor/ Inhalation PM10 Factor

RISK ASSESSMENT SPREADSHEET
CONSTRUCTION WOR R RESEASONABLE MAXIMUM EXPOSURE SCENARIO FOR SOIL
SITE 20 - AREA A WEAPONS CENTER
NAVAL SUBMARINE BASE, NEW LONDON, CONNECTICUT

CANCER RISK

Ingestion Parameters		Dermal Contact Parameters		Inhalation Parameters	
IR: Ingestion Rate (mg/day)	480	SA: Skin Surface Area (cm^2/day)	3800	IR: Inhalation Rate-adult (m^3/hr)	3.9
ED: Exposure Duration (years)	1	ED: Exposure Duration (years)	1	ET: Exposure Time (hours/day)	8
BW: Body Weight (kg)	70	BW: Body Weight (kg)	70	EF: Exposure Frequency (days/year)	120
Fi: Contaminant Fraction (decimal)	1	AF: Adherence Factor (mg/cm^2)	1	ED: Exposure Duration (years)	1
EF: Exposure Frequency (days/year)	120	EF: Exposure Frequency (days/year)	120	BW: Body Weight-adult (kg)	70
AT: Averaging Time (days)	25550	AT: Averaging Time (days)	25550	AT: Averaging Time (days)	25550
Ingestion Conversion Factor (CF)		Dermal Contact Conversion Factor (CF)		Inhalation Conversion Factor	
CF=(IRxFixEFxED)/(BWxATx1E6) (day^{-1})	**3.22E-08**	CF=(SAxAFxEFxED)/(BWxATx1E6) (day-1)	**2.55E-07**	CF=(IRxFixEFxED)/(BWxAT) (day-1)	**2.09E-03**

Exposure Route	Chemical	Concentration (mg/kg)*	Factor**	Lifetime Average Dose (mg/kg/day)	Cancer Slope Factor (kg-day)/mg	Cancer Risk
Ingestion						
	Arsenic	7.27	1	2.34E-07	1.5	3.51E-07
	Benzo(a)pyrene	0.46	1	1.48E-08	7.3	1.08E-07
Total						**4.59E-07**
Dermal Contact						
	Arsenic	7.27	0.001	1.85E-09	3.66	6.78E-09
	Benzo(a)pyrene	0.46	0.01	1.17E-09	23.5	2.75E-08
Total						**3.43E-08**
Inhalation						
	Arsenic	7.27	9.00E-08	1.37E-09	15.1	2.07E-08
	Benzo(a)pyrene	0.46	9.00E-08	8.64E-11	3.1	2.68E-10
Total						**2.10E-08**
Cumulative						***5.14E-07***

NONCANCER RISK

Ingestion Parameters		Dermal Contact Parameters		Inhalation Parameters	
IR: Ingestion Rate (mg/day)	480	SA: Skin Surface Area (cm^2/day)	3800	IR: Inhalation Rate-adult (m^3/hr)	3.9
ED: Exposure Duration (years)	1	ED: Exposure Duration (years)	1	ET: Exposure Time (hours/day)	8
BW: Body Weight (kg)	70	BW: Body Weight (kg)	70	EF: Exposure Frequency (days/year)	120
Fi: Contaminant Fraction (decimal)	1	AF: Adherence Factor (mg/cm^2)	1	ED: Exposure Duration (years)	1
EF: Exposure Frequency (days/year)	120	EF: Exposure Frequency (days/year)	120	BW: Body Weight-adult (kg)	70
AT: Averaging Time (days)	365	AT: Averaging Time (days)	365	AT: Averaging Time (days)	365
Ingestion Conversion Factor (CF)		Dermal Contact Conversion Factor (CF)		Inhalation Conversion Factor	
CF=(IRxFixEFxED)/(BWxATx1E6) (day^{-1})	**2.25E-06**	CF=(SAxAFxEFxED)/(BWxATx1E6) (day-1)	**1.78E-05**	CF=(IRxFixEFxED)/(BWxAT) (day-1)	**1.47E-01**

Exposure Route	Chemical	Concentration (mg/kg)*	Factor**	Adult Annual Dose (mg/kg/day)	Reference Dose (mg/kg/day)	Hazard Index
Ingestion						
	Arsenic	7.27	1	1.64E-05	0.0003	5.46E-02
	Benzo(a)pyrene	0.46	1	1.03E-06	0	0.00E+00
Total						**5.46E-02**
Dermal Contact						
	Arsenic	7.27	0.001	1.30E-07	0.000123	1.05E-03
	Benzo(a)pyrene	0.46	0.01	8.19E-08	0	0.00E+00
Total						**1.05E-03**
Inhalation						
	Arsenic	7.27	9.00E-08	9.59E-08	0	0.00E+00
	Benzo(a)pyrene	0.46	9.00E-08	6.05E-09	0	0.00E+00
Total						**0.00E+00**
Cumulative						***5.57E-02***

Notes: *95% UCL of all soils (0-10 ft),
**Ingestion Bioavailability/ Dermal Absorption Factor/ Inhalation PM10 Factor

RISK ASSESSMENT SPREADSHEET
FULL-TIME EMPLOYEE RESEASONABLE MAXIMUM EXPOSURE SCENARIO FOR SOIL
SITE 20 - AREA A WEAPONS CENTER
NAVAL SUBMARINE BASE, NEW LONDON, CONNECTICUT

CANCER RISK

Ingestion Parameters		Dermal Contact Parameters		Inhalation Parameters	
IR: Ingestion Rate (mg/day)	100	SA: Skin Surface Area (cm^2/day)	3800	IR: Inhalation Rate-adult (m^3/hr)	2.5
ED: Exposure Duration (years)	25	ED: Exposure Duration (years)	25	ET: Exposure Time (hours/day)	8
BW: Body Weight (kg)	70	BW: Body Weight (kg)	70	EF: Exposure Frequency (days/year)	150
Fi: Contaminant Fraction (decimal)	1	AF: Adherence Factor (mg/cm^2)	1	ED: Exposure Duration (years)	25
EF: Exposure Frequency (days/year)	150	EF: Exposure Frequency (days/year)	150	BW: Body Weight-adult (kg)	70
AT: Averaging Time (days)	25550	AT: Averaging Time (days)	25550	AT: Averaging Time (days)	25550
Ingestion Conversion Factor (CF)		Dermal Contact Conversion Factor (CF)		Inhalation Conversion Factor	
CF=(IRxFixEFxED)/(BWxATx1E6) (day^{-1})	**2.10E-07**	CF=(SAxAFxEFxED)/(BWxATx1E6) (day-1)	**7.97E-06**	CF=(IRxFixEFxED)/(BWxAT) (day-1)	**4.19E-02**

Exposure Route	Chemical	Concentration (mg/kg)*	Factor**	Lifetime Average Dose (mg/kg/day)	Cancer Slope Factor (kg-day)/mg	Cancer Risk
Ingestion						
	Benzo(a)pyrene	1.02	1	2.13E-07	7.3	1.56E-06
Total						**1.56E-06**
Dermal Contact						
	Benzo(a)pyrene	1.02	0.01	8.11E-08	23.5	1.91E-06
Total						**1.91E-06**
Inhalation						
	Benzo(a)pyrene	1.02	1.80E-06	7.68E-08	3.1	2.38E-07
Total						**2.38E-07**
Cumulative						***3.70E-06***

NONCANCER RISK

Ingestion Parameters		Dermal Contact Parameters		Inhalation Parameters	
IR: Ingestion Rate (mg/day)	100	SA: Skin Surface Area (cm^2/day)	3800	IR: Inhalation Rate-adult (m^3/hr)	2.5
ED: Exposure Duration (years)	25	ED: Exposure Duration (years)	25	ET: Exposure Time (hours/day)	8
BW: Body Weight (kg)	70	BW: Body Weight (kg)	70	EF: Exposure Frequency (days/year)	150
Fi: Contaminant Fraction (decimal)	1	AF: Adherence Factor (mg/cm^2)	1	ED: Exposure Duration (years)	25
EF: Exposure Frequency (days/year)	150	EF: Exposure Frequency (days/year)	150	BW: Body Weight-adult (kg)	70
AT: Averaging Time (days)	9125	AT: Averaging Time (days)	9125	AT: Averaging Time (days)	9125
Ingestion Conversion Factor (CF)		Dermal Contact Conversion Factor (CF)		Inhalation Conversion Factor	
CF=(IRxFixEFxED)/(BWxATx1E6) (day^{-1})	**5.87E-07**	CF=(SAxAFxEFxED)/(BWxATx1E6) (day-1)	**2.23E-05**	CF=(IRxFixEFxED)/(BWxAT) (day-1)	**1.17E-01**

Exposure Route	Chemical	Concentration (mg/kg)*	Factor**	Adult Annual Dose (mg/kg/day)	Reference Dose (mg/kg/day)	Hazard Index
Ingestion						
	Benzo(a)pyrene	1.02	1	5.97E-07	0	0.00E+00
Total						**0.00E+00**
Dermal Contact						
	Benzo(a)pyrene	1.02	0.01	2.27E-07	0	0.00E+00
Total						***0.00E+00***
Inhalation						
	Benzo(a)pyrene	1.02	1.80E-06	2.15E-07	0	0.00E+00
Total						**0.00E+00**
Cumulative						***0.00E+00***

Notes: *95% UCL of shallow soils (0-4 ft), **Ingestion Bioavailability/ Dermal Absorption Factor/ Inhalation PM10 Factor

Preliminary Remediation Goal Calculations for Sediment

APPENDIX A.2 DEVELOPMENT OF SOIL RISK-BASED PRELIMINARY REMEDIATION GOALS
FOR THE FULL-TIME EMPLOYEE AND FUTURE RESIDENT SCENARIOS
SITE 20 - AREA A WEAPONS CENTER, NEW LONDON, CONNECTICUT

PARAMETER	FRACTION	Samples	Positive	Maximum	UCL	IRBC	RRBC	UNITS	Max Exceed IRBC	Max Exceed RRBC	COC Retained
ALUMINUM	M	4	4	9,200.00	8,421.47	1,000,000.00	78,000.00	MG/KG	N	N	NO
ANTIMONY	M	3	2	5.40	5.41	820.00	31.00	MG/KG	N	N	NO
ARSENIC	M	4	2	3.00	2.45	3.80	0.43	MG/KG	N	**Y**	**YES**
BARIUM	M	4	4	60.80	54.03	140,000.00	5,500.00	MG/KG	N	N	NO
BERYLLIUM	M	4	3	0.41	0.39	1.30	0.15	MG/KG	N	**Y**	**YES**
CADMIUM	M	4	2	1.20	0.97	1,000.00	39.00	MG/KG	N	N	NO
CALCIUM	M	4	4	1,870.00	1,703.23	--	--	MG/KG	N	N	NO
CHROMIUM	M	4	4	10.90	11.98	1,000,000.00	78,000.00	MG/KG	N	N	NO
COBALT	M	4	4	4.60	4.74	120,000.00	4,700.00	MG/KG	N	N	NO
COPPER	M	4	4	10.80	10.74	82,000.00	3,100.00	MG/KG	N	N	NO
IRON	M	4	4	10,800.00	10,824.61	610,000.00	23,000.00	MG/KG	N	N	NO
LEAD	M	4	4	12.30	11.07	--	400.00	MG/KG	N	N	NO
MAGNESIUM	M	4	4	3,520.00	3,206.41	--	--	MG/KG	N	N	NO
MANGANESE	M	4	4	257.00	230.02	47,000.00	1,800.00	MG/KG	N	N	NO
NICKEL	M	4	4	8.40	8.37	41,000.00	1,600.00	MG/KG	N	N	NO
POTASSIUM	M	4	4	2,900.00	2,509.70	--	--	MG/KG	N	N	NO
SODIUM	M	4	4	267.00	257.57	--	--	MG/KG	N	N	NO
VANADIUM	M	4	4	17.50	18.20	14,000.00	550.00	MG/KG	N	N	NO
ZINC	M	4	4	46.50	41.02	610,000.00	23,000.00	MG/KG	N	N	NO
2-METHYLNAPHTHALENE	OS	4	1	54.00	325.11	41,000,000.00	1,600,000.00	UG/KG	N	N	NO
ACENAPHTHENE	OS	4	1	140.00	183.40	120,000,000.00	4,700,000.00	UG/KG	N	N	NO
ACENAPHTHYLENE	OS	4	1	31.00	327.54	82,000,000.00	--	UG/KG	N	N	NO
ANTHRACENE	OS	4	2	540.00	442.00	610,000,000.00	23,000,000.00	UG/KG	N	N	NO
BENZO(A)ANTHRACENE	OS	4	2	1,300.00	1,017.53	7,800.00	880.00	UG/KG	N	**Y**	**YES**
BENZO(A)PYRENE	OS	4	2	1,300.00	1,017.53	780.00	88.00	UG/KG	**Y**	**Y**	**YES**
BENZO(B)FLUORANTHENE	OS	4	2	2,300.00	1,756.67	7,800.00	880.00	UG/KG	N	**Y**	**YES**
BENZO(G,H,I)PERYLENE	OS	4	2	770.00	617.70	82,000,000.00	--	UG/KG	N	N	NO
BENZO(K)FLUORANTHENE	OS	4	1	220.00	329.25	78,000.00	8,800.00	UG/KG	N	N	NO
BIS(2-ETHYLHEXYL)PHTHALATE	OS	4	1	35.00	327.08	410,000.00	46,000.00	UG/KG	N	N	NO
CARBAZOLE	OS	3	1	400.00	397.00	290,000.00	32,000.00	UG/KG	N	N	NO
CHRYSENE	OS	4	2	1,400.00	1,092.61	780,000.00	88,000.00	UG/KG	N	N	NO
DIBENZO(A,H)ANTHRACENE	OS	4	1	450.00	378.50	780.00	88.00	UG/KG	N	**Y**	**YES**
DIBENZOFURAN	OS	4	2	84.00	186.03	8,200,000.00	310,000.00	UG/KG	N	N	NO
FLUORANTHENE	OS	4	2	3,200.00	2,456.52	82,000,000.00	3,100,000.00	UG/KG	N	N	NO
FLUORENE	OS	4	2	180.00	198.73	82,000,000.00	3,100,000.00	UG/KG	N	N	NO
INDENO(1,2,3-CD)PYRENE	OS	4	2	760.00	607.48	7,800.00	880.00	UG/KG	N	N	NO
PHENANTHRENE	OS	4	2	2,400.00	1,851.60	82,000,000.00	--	UG/KG	N	N	NO
PYRENE	OS	4	2	2,500.00	1,943.46	61,000,000.00	2,300,000.00	UG/KG	N	N	NO
4,4'-DDE	PEST/PCB	3	1	4.00	17.78	17,000.00	1,900.00	UG/KG	N	N	NO
AROCLOR-1260	PEST/PCB	3	1	50.00	221.79	2,860.00	319.00	UG/KG	N	N	NO
ENDRIN	PEST/PCB	3	2	11.00	11.80	610,000.00	23,000.00	UG/KG	N	N	NO
ENDRIN ALDEHYDE	PEST/PCB	2	1	7.00	22.54	--	--	UG/KG	N	N	NO

Notes: IRBC = Region III Industrial Risk Based Concentrations, RRBC = Region III Residential Risk Based Concentrations, UCL = 95% Upper Confidence Limit
COC = Contaminants of concern. M = Metals. OS = Organic Semivolatiles.
Shallow soil (< 4 ft) was used for the full-time employee and future resident scenarios.
Maximum concentrations were compared to the Region III Industrial Risk Based Concentrations for the full-time employee scenario and to the Residential Risk Based Concentrations for the future resident scenario.

APPENDIX A.2 DEVELOPMENT OF SOIL RISK-BASED PRELIMINARY REMEDIATION GOALS
FOR THE CONSTRUCTION WORKER SCENARIO
SITE 20 - AREA A WEAPONS CENTER, NEW LONDON, CONNECTICUT

PARAMETER	FRACTION	Samples	Positive	Maximum	UCL	IRBC	Units	Max Exceed IRBC	COC Retained
ALUMINUM	M	11	11	18,200.00	14,572.43	1,000,000.00	MG/KG	N	NO
ANTIMONY	M	9	2	5.40	9.70	820.00	MG/KG	N	NO
ARSENIC	M	11	8	10.80	7.27	3.80	MG/KG	**Y**	**YES**
BARIUM	M	11	11	131.00	70.48	140,000.00	MG/KG	N	NO
BERYLLIUM	M	11	10	0.84	0.59	1.30	MG/KG	N	NO
BORON	M	10	4	51.80	25.67	180,000.00	MG/KG	N	NO
CADMIUM	M	11	2	1.20	0.54	1,000.00	MG/KG	N	NO
CALCIUM	M	11	11	5,050.00	2,783.63	--	MG/KG	N	NO
CHROMIUM	M	11	11	78.70	45.22	1,000,000.00	MG/KG	N	NO
COBALT	M	11	11	8.60	6.64	120,000.00	MG/KG	N	NO
COPPER	M	11	11	41.40	25.32	82,000.00	MG/KG	N	NO
IRON	M	11	11	28,600.00	22,196.57	610,000.00	MG/KG	N	NO
LEAD	M	11	11	66.10	29.26	--	MG/KG	N	NO
MAGNESIUM	M	11	11	8,450.00	6,095.14	--	MG/KG	N	NO
MANGANESE	M	11	11	390.00	276.76	47,000.00	MG/KG	N	NO
MERCURY	M	11	2	0.29	0.14	610.00	MG/KG	N	NO
NICKEL	M	11	11	22.70	17.12	41,000.00	MG/KG	N	NO
POTASSIUM	M	11	11	6,300.00	4,128.00	--	MG/KG	N	NO
SILVER	M	11	3	1.50	0.75	10,000.00	MG/KG	N	NO
SODIUM	M	11	11	7,390.00	2,388.42	--	MG/KG	N	NO
VANADIUM	M	11	11	49.60	38.65	14,000.00	MG/KG	N	NO
ZINC	M	11	11	69.30	55.52	610,000.00	MG/KG	N	NO
2-METHYLNAPHTHALENE	OS	11	2	54.00	267.03	41,000,000.00	UG/KG	N	NO
ACENAPHTHENE	OS	11	1	140.00	240.09	120,000,000.00	UG/KG	N	NO
ACENAPHTHYLENE	OS	11	1	31.00	270.41	82,000,000.00	UG/KG	N	NO
ANTHRACENE	OS	11	4	540.00	280.26	610,000,000.00	UG/KG	N	NO
BENZO(A)ANTHRACENE	OS	11	6	1,300.00	482.52	7,800.00	UG/KG	N	NO
BENZO(A)PYRENE	OS	11	8	1,300.00	458.80	780.00	UG/KG	**Y**	**YES**
BENZO(B)FLUORANTHENE	OS	11	6	2,300.00	774.80	7,800.00	UG/KG	N	NO
BENZO(G,H,I)PERYLENE	OS	11	5	770.00	335.82	82,000,000.00	UG/KG	N	NO
BENZO(K)FLUORANTHENE	OS	11	5	260.00	253.20	78,000.00	UG/KG	N	NO
BENZOIC ACID	OS	11	5	480.00	963.60	1,000,000,000.00	UG/KG	N	NO
BIS(2-ETHYLHEXYL)PHTHALATE	OS	11	2	360.00	297.07	410,000.00	UG/KG	N	NO
CARBAZOLE	OS	10	1	400.00	284.40	290,000.00	UG/KG	N	NO
CHRYSENE	OS	11	6	1,400.00	527.88	780,000.00	UG/KG	N	NO
DI-N-OCTYL PHTHALATE	OS	11	3	89.00	244.17	41,000,000.00	UG/KG	N	NO
DIBENZO(A,H)ANTHRACENE	OS	11	2	450.00	280.32	780.00	UG/KG	N	NO
DIBENZOFURAN	OS	11	2	84.00	238.90	8,200,000.00	UG/KG	N	NO
DIETHYL PHTHALATE	OS	11	2	32.00	249.85	1,000,000,000.00	UG/KG	N	NO
FLUORANTHENE	OS	11	7	3,200.00	1,026.78	82,000,000.00	UG/KG	N	NO
FLUORENE	OS	11	2	180.00	240.87	82,000,000.00	UG/KG	N	NO
INDENO(1,2,3-CD)PYRENE	OS	11	5	760.00	332.68	7,800.00	UG/KG	N	NO
PHENANTHRENE	OS	11	6	2,400.00	789.41	82,000,000.00	UG/KG	N	NO
PYRENE	OS	11	7	2,500.00	859.86	61,000,000.00	UG/KG	N	NO
2-BUTANONE	OV	11	3	240.00	75.26	1,000,000,000.00	UG/KG	N	NO
ACETONE	OV	11	1	690.00	202.73	200,000,000.00	UG/KG	N	NO
CARBON DISULFIDE	OV	11	1	11.00	7.76	200,000,000.00	UG/KG	N	NO
TOLUENE	OV	11	2	8.00	6.96	410,000,000.00	UG/KG	N	NO
TRICHLOROETHENE	OV	11	1	3.00	7.04	520,000.00	UG/KG	N	NO
4,4'-DDE	PEST/PCB	7	1	4.00	22.15	17,000.00	UG/KG	N	NO
AROCLOR-1260	PEST/PCB	7	1	50.00	229.12	2,860.00	UG/KG	N	NO
ENDRIN	PEST/PCB	7	2	11.00	21.41	610,000.00	UG/KG	N	NO
ENDRIN ALDEHYDE	PEST/PCB	6	2	7.00	22.09	--	UG/KG	N	NO

Notes: IRBC = Region III Industrial Risk Based Concentrations, UCL = 95% Upper Confidence Limit, COC = Contaminants of concern.
M = Metals. OS = Organic Semivolatiles. OV = Organic Volatiles. All soil data was used for the construction worker scenario.
Maximum concentrations were compared to the Region III Industrial Risk Based Concentrations.

APPENDIX A.2 SELECTION OF SOIL CONTAMINANTS OF CONCERN EXCEEDING RISK-BASED PRELIMINARY REMEDIATION GOALS
SITE 20 - AREA A WEAPONS CENTER, NEW LONDON, CONNECTICUT

SCENARIO	PARAMETER	FRACTION	Samples	Positive	UCL (MG/KG)	RISK	Risk Exceed 10^-6	BASED PRG (MG/KG)	UCL Exceed PRG	COC Retained
FULL-TIME EMPLOYEE										
	BENZO(A)PYRENE	OS	4	2	1.02	1.56E-06	Y	0.65	Y	YES
CONSTRUCTION WORKER										
	ARSENIC	M	11	8	7.27	3.79E-07	N	NC	--	NO
	BENZO(A)PYRENE	OS	11	8	0.46	1.36E-07	N	NC	--	NO
FUTURE RESIDENT										
	ARSENIC**	M	4	2	2.45	1.04E-05	Y	0.24	Y	NO**
	BERYLLIUM	M	4	3	0.39	2.80E-06	Y	0.14	Y	YES
	BENZO(A)PYRENE	OS	4	2	1.02	8.66E-06	Y	0.12	Y	YES
	BENZO(A)ANTHRACENE	OS	4	2	1.02	7.99E-07	N	NC	--	NO
	BENZO(B)FLUORANTHENE*	OS	4	2	1.76	1.38E-06	Y	1.27	Y	NO*
	DIBENZO(A,H)ANTHRACENE	OS	4	1	0.38	2.97E-06	Y	0.13	Y	YES

Notes: NC = Not calculated. PRG = Preliminary Remediation Goals. UCL = 95% Upper Confidence Limit. M = Metals. OS = Organic Semivolatiles.
All soil was used for the construction worker scenario. Shallow soil (< 4 ft) was used for the full-time employee and future resident scenarios.
PRG were only developed if incremental risk > 10^-6
* UCL exceeded PRG; however, no individual sample exceeded the PRG.
** Arsenic did not exceed the site background concentration of arsenic (3 mg/kg).

FULL-TIME EMPLOYEE

Chemical	Route-Specific Cancer Risks Ingestion	Dermal	Inhalation	Total Risk	Concentration	Preliminary Remediation Goals (mg/kg) **1.00E-06**
Benzo(a)pyrene	**1.5574E-06**	**0.00**	**0.00**	**1.5574E-06**	**1.018**	**0.653**
Totals	1.5574E-06	0.00	0.00 **Total**	1.5574E-06		

Chemical	Route-Specific Hazard Index Ingestion	Dermal	Inhalation	Total HI	Concentration	Preliminary Remediation Goals (mg/kg) 1.0
Benzo(a)pyrene	0.00	0.00	0.00	0.00	1.018	NC
Totals	0.00	0.00	0.00 **Total**	0.00		

CONSTRUCTION WORKER

Chemical	Route-Specific Cancer Risks Ingestion	Dermal	Inhalation	Total Risk	Concentration	Preliminary Remediation Goals (mg/kg) **1.00E-06**
Arsenic	3.5124E-07	6.785E-09	2.0684E-08	3.7871E-07	7.3	NC
Benzo(a)pyrene	1.0787E-07	2.749E-08	2.6796E-10	1.3562E-07	0.459	NC
Totals	4.591E-07	3.427E-08	2.0952E-08 **Total**	5.1433E-07		

Chemical	Route-Specific Hazard Index Ingestion	Dermal	Inhalation	Total HI	Concentration	Preliminary Remediation Goals (mg/kg) 1.0
Arsenic	0.0546	0.0011	0.00	0.05569171	7.3	NC
Benzo(a)pyrene	0.0000	0.0000	0.00	0.00	0.459	NC
Totals	0.05463674	0.001055	0.00 **Total**	0.05569171		

FUTURE RESIDENT

Chemical	Route-Specific Cancer Risks Ingestion	Dermal	Inhalation	Total Risk	Concentration	Preliminary Remediation Goals (mg/kg) **1.00E-06**
Arsenic	**2.47E-06**	**1.13E-07**	**7.82E-06**	**1.04E-05**	**2.5**	**0.236**
Beryllium	**0.00E+00**	**2.11E-06**	**6.92E-07**	**2.80E-06**	**0.4**	**0.139**
Benzo(a)pyrene	**4.98E-06**	**3.00E-06**	**6.66E-07**	**8.66E-06**	**1.0**	**0.118**
Benzo(a)anthracene	4.98E-07	3.00E-07	0.00E+00	7.99E-07	1.0	NC
Benzo(b)fluoranthene	**8.60E-07**	**5.19E-07**	**0.00E+00**	**1.38E-06**	**1.8**	**1.274**
Dibenzo(a,h)anthracene	**1.85E-06**	**1.12E-06**	**0.00E+00**	**2.97E-06**	**0.4**	**0.127**
Totals	1.0662E-05	7.162E-06	9.1743E-06 **Total**	2.70E-05		

Chemical	Route-Specific Hazard Index Ingestion	Dermal	Inhalation	Total HI	Concentration	Preliminary Remediation Goals (mg/kg) 1.0
Arsenic	0.04261796	0.0019468	0.00	0.04	2.5	NC
Beryllium	0.00101761	0.0019059	0.03	0.04	0.4	NC
Benzo(a)pyrene	0.00	0.00	0.00	0.00	1.0	NC
Benzo(a)anthracene	0.00	0.00	0.00	0.00	1.0	NC
Benzo(b)fluoranthene	0.00	0.00	0.00	0.00	1.8	NC
Dibenzo(a,h)anthracene	0.00	0.00	0.00	0.00	0.4	NC
Totals	0.04363557	0.0038527	0.03366932 **Total**	0.08		

NC = PRG not calculated because incremental risk did not exceed 1x10^-5.

RISK ASSESSMENT SPREADSHEET
FUTURE RESIDENT RESEASONABLE MAXIMUM EXPOSURE SCENARIO FOR SOIL
SITE 20 - AREA A WEAPONS CENTER
NAVAL SUBMARINE BASE, NEW LONDON, CONNECTICUT

CANCER RISK

Ingestion Parameters		Dermal Contact Parameters		Inhalation Parameters	
IRc: Ingestion Rate-child (mg/day)	200	SAc: Skin Surface Area-child (cm^2/day)	2094	IR: Inhalation Rate-adult (m^3/hr)	0.833
EDc: Exposure Duration-child (years)	6	EDc: Exposure Duration-child (years)	6	ET: Exposure Time (hours/day)	24
BWc: Body Weight-child (kg)	15	BWc: Body Weight-child (kg)	15	EF: Exposure Frequency (days/year)	350
IRa: Ingestion Rate-adult (mg/kg)	100	SAa: Skin Surface Area-adult (cm^2/day)	3800	ED: Exposure Duration (years)	30
EDa: Exposure Duration-adult (years)	24	EDa: Exposure Duration-adult (years)	24	BW: Body Weight-adult (kg)	70
BWa: Body Weight-adult (kg)	70	BWa: Body Weight-adult (kg)	70	AT: Averaging Time (days)	25550
Fi: Contaminant Fraction (decimal)	1	AF: Adherence Factor (mg/cm^2)	1		
EF: Exposure Frequency (days/year)	150	EF: Exposure Frequency days/year)	150		
AT: Averaging Time (days)	25550	AT: Averaging Time (days)	25550		
Ingestion Conversion Factor (CF)		**Dermal Contact Conversion Factor (CF)**		**Inhalation Conversion Factor**	
Ifadj=(IRcxEDc)/BWc + (IRaxEDa)/BWa	114.2857143	SAadj=(SAcxEDc)/BWc + (SAaxEDa)/BWa	2140.457143		
CF=(IFadjxFixEF)/(ATx1E6) (day^{-1})	**6.71E-07**	CF=(SAadjxAFxEF)/(ATx1E6) (day^{-1})	**1.26E-05**	CF=(IRxFixEFxED)/(BWxAT) (day^{-1})	**1.17E-01**

Exposure Route	Chemical	Concentration (mg/kg)*	Factor**	Lifetime Average Dose (mg/kg/day)	Cancer Slope Factor (kg-day)/mg	Cancer Risk
Ingestion						
	Arsenic	2.5	1	1.64E-06	1.5	2.47E-06
	Beryllium	0.4	1	2.62E-07	0	0.00E+00
	Benzo(a)pyrene	1.018	1	6.83E-07	7.3	4.98E-06
	Benzo(a)anthracene	1.018	1	6.83E-07	0.73	4.98E-07
	Benzo(b)fluoranthene	1.757	1	1.18E-06	0.73	8.60E-07
	Dibenzo(a,h)anthracene	0.379	1	2.54E-07	7.3	1.85E-06
Total						**1.07E-05**
Dermal Contact						
	Arsenic	2.5	0.001	3.08E-08	3.66	1.13E-07
	Beryllium	0.4	0.001	4.90E-09	430	2.11E-06
	Benzo(a)pyrene	1.018	0.01	1.28E-07	23.5	3.00E-06
	Benzo(a)anthracene	1.018	0.01	1.28E-07	2.35	3.00E-07
	Benzo(b)fluoranthene	1.757	0.01	2.21E-07	2.35	5.19E-07
	Dibenzo(a,h)anthracene	0.379	0.01	4.76E-08	23.5	1.12E-06
Total						**7.16E-06**
Inhalation						
	Arsenic	2.5	1.80E-06	5.18E-07	15.1	7.82E-06
	Beryllium	0.4	1.80E-06	8.24E-08	8.4	6.92E-07
	Benzo(a)pyrene	1.018	1.80E-06	2.15E-07	3.1	6.66E-07
	Benzo(a)anthracene	1.018	1.80E-06	2.15E-07	0	0.00E+00
	Benzo(b)fluoranthene	1.757	1.80E-06	3.71E-07	0	0.00E+00
	Dibenzo(a,h)anthracene	0.379	1.80E-06	8.00E-08	0	0.00E+00
Total						**9.17E-06**
Cumulative						***2.70E-05***

Notes: *95% UCL of shallow soils (0-4 ft)
**Ingestion Bioavailability/ Dermal Absorption Factor/ Inhalation PM10 Factor

RISK ASSESSMENT SPREADSHEET
FUTURE RESIDENT RESEASONABLE MAXIMUM EXPOSURE SCENARIO FOR SOIL
SITE 20 - AREA A WEAPONS CENTER
NAVAL SUBMARINE BASE, NEW LONDON, CONNECTICUT

NONCANCER RISK

Ingestion Parameters		Dermal Contact Parameters		Inhalation Parameters	
IRc: Ingestion Rate-child (mg/day)	200	SAc: Skin Surface Area-child (cm^2/day)	2094	IR: Inhalation Rate-adult (m^3/hr)	0.833
EDc: Exposure Duration-child (years)	6	EDc: Exposure Duration-child (years)	6	ET: Exposure Time (hours/day)	24
BWc: Body Weight-child (kg)	15	BWc: Body Weight-child (kg)	15	EF: Exposure Frequency (days/year)	350
IRa: Ingestion Rate-adult (mg/kg)	100	SAa: Skin Surface Area-adult (cm^2/day)	3800	ED: Exposure Duration (years)	30
EDa: Exposure Duration-adult (years)	24	EDa: Exposure Duration-adult (years)	24	BW: Body Weight-adult (kg)	70
BWa: Body Weight-adult (kg)	70	BWa: Body Weight-adult (kg)	70	AT: Averaging Time (days)	10950
Fi: Contaminant Fraction (decimal)	1	AF: Adherence Factor (mg/cm^2)	1		
EF: Exposure Frequency (days/year)	150	EF: Exposure Frequency days/year)	150		
AT: Averaging Time (days)	3285	AT: Averaging Time (days)	3285		
Ingestion Conversion Factor (CF)		Dermal Contact Conversion Factor (CF)		Inhalation Conversion Factor	
Ifadj=(IRcxEDc)/BWc + (IRaxEDa)/BWa	114.2857143	SAadj=(SAcxEDc)/BWc + (SAaxEDa)/BWa	2140.457143		
CF=(IFadjxFixEF)/(ATx1E6) (day^{-1})	**5.22E-06**	CF=(SAadjxAFxEF)/(ATx1E6) (day^{-1})	**9.77E-05**	CF=(IRxFixEFxED)/(BWxAT) (day^{-1})	**2.74E-01**

Exposure Route	Chemical	Concentration (mg/kg)*	Factor**	Adult Annual Dose (mg/kg/day)	Reference Dose (mg/kg/day)	Hazard Index
Ingestion						
	Arsenic	2.5	1	1.28E-05	0.0003	4.26E-02
	Beryllium	0.4	1	2.04E-06	0.002	1.02E-03
	Benzo(a)pyrene	1.018	1	5.31E-06	0	0.00E+00
	Benzo(a)anthracene	1.018	1	5.31E-06	0	0.00E+00
	Benzo(b)fluoranthene	1.757	1	9.17E-06	0	0.00E+00
	Dibenzo(a,h)anthracene	0.379	1	1.98E-06	0	0.00E+00
Total						**4.36E-02**
Dermal Contact						
	Arsenic	2.5	0.001	2.39E-07	0.000123	1.95E-03
	Beryllium	0.4	0.001	3.81E-08	0.00002	1.91E-03
	Benzo(a)pyrene	1.018	0.01	9.95E-07	0	0.00E+00
	Benzo(a)anthracene	1.018	0.01	9.95E-07	0	0.00E+00
	Benzo(b)fluoranthene	1.757	0.01	1.72E-06	0	0.00E+00
	Dibenzo(a,h)anthracene	0.379	0.01	3.70E-07	0	0.00E+00
Total						**3.85E-03**
Inhalation						
	Arsenic	2.5	1.80E-06	1.21E-06	0	0.00E+00
	Beryllium	0.4	1.80E-06	1.92E-07	0.00000571	3.37E-02
	Benzo(a)pyrene	1.018	1.80E-06	5.02E-07	0	0.00E+00
	Benzo(a)anthracene	1.018	1.80E-06	5.02E-07	0	0.00E+00
	Benzo(b)fluoranthene	1.757	1.80E-06	8.66E-07	0	0.00E+00
	Dibenzo(a,h)anthracene	0.379	1.80E-06	1.87E-07	0	0.00E+00
Total						**3.37E-02**
Cumulative						***8.12E-02***

Notes: *95% UCL of shallow soils (0-4 ft)
**Ingestion Bioavailability/ Dermal Absorption Factor/ Inhalation PM10 Factor

SK ASSESSMENT SPREADSHEET
CONSTRUCTION WC RESEASONABLE MAXIMUM EXPOSURE SCENARIO FOR SOIL
ITE 20 - AREA A WEAPONS CENTER
NAVAL SUBMARINE BASE, NEW LONDON, CONNECTICUT

CANCER RISK

Ingestion Parameters		Dermal Contact Parameters		Inhalation Parameters	
IR: Ingestion Rate (mg/day)	480	SA: Skin Surface Area (cm^2/day)	3800	IR: Inhalation Rate-adult (m^3/hr)	3.9
ED: Exposure Duration (years)	1	ED: Exposure Duration (years)	1	ET: Exposure Time (hours/day)	8
BW: Body Weight (kg)	70	BW: Body Weight (kg)	70	EF: Exposure Frequency (days/year)	120
Fi: Contaminant Fraction (decimal)	1	AF: Adherence Factor (mg/cm^2)	1	ED: Exposure Duration (years)	1
EF: Exposure Frequency (days/year)	120	EF: Exposure Frequency (days/year)	120	BW: Body Weight-adult (kg)	70
AT: Averaging Time (days)	25550	AT: Averaging Time (days)	25550	AT: Averaging Time (days)	25550
Ingestion Conversion Factor (CF)		Dermal Contact Conversion Factor (CF)		Inhalation Conversion Factor	
CF=(IRxFixEFxED)/(BWxATx1E6) (day^{-1})	**3.22E-08**	CF=(SAxAFxEFxED)/(BWxATx1E6) (day-1)	**2.55E-07**	CF=(IRxFixEFxED)/(BWxAT) (day-1)	**2.09E-03**

Exposure Route	Chemical	Concentration (mg/kg)*	Factor**	Lifetime Average Dose (mg/kg/day)	Cancer Slope Factor (kg-day)/mg	Cancer Risk
Ingestion						
	Arsenic	7.27	1	2.34E-07	1.5	3.51E-07
	Benzo(a)pyrene	0.46	1	1.48E-08	7.3	1.08E-07
Total						**4.59E-07**
Dermal Contact						
	Arsenic	7.27	0.001	1.85E-09	3.66	6.78E-09
	Benzo(a)pyrene	0.46	0.01	1.17E-09	23.5	2.75E-08
Total						**3.43E-08**
Inhalation						
	Arsenic	7.27	9.00E-08	1.37E-09	15.1	2.07E-08
	Benzo(a)pyrene	0.46	9.00E-08	8.64E-11	3.1	2.68E-10
Total						**2.10E-08**
Cumulative						***5.14E-07***

NONCANCER RISK

Ingestion Parameters		Dermal Contact Parameters		Inhalation Parameters	
IR: Ingestion Rate (mg/day)	480	SA: Skin Surface Area (cm^2/day)	3800	IR: Inhalation Rate-adult (m^3/hr)	3.9
ED: Exposure Duration (years)	1	ED: Exposure Duration (years)	1	ET: Exposure Time (hours/day)	8
BW: Body Weight (kg)	70	BW: Body Weight (kg)	70	EF: Exposure Frequency (days/year)	120
Fi: Contaminant Fraction (decimal)	1	AF: Adherence Factor (mg/cm^2)	1	ED: Exposure Duration (years)	1
EF: Exposure Frequency (days/year)	120	EF: Exposure Frequency (days/year)	120	BW: Body Weight-adult (kg)	70
AT: Averaging Time (days)	365	AT: Averaging Time (days)	365	AT: Averaging Time (days)	365
Ingestion Conversion Factor (CF)		Dermal Contact Conversion Factor (CF)		Inhalation Conversion Factor	
CF=(IRxFixEFxED)/(BWxATx1E6) (day^{-1})	**2.25E-06**	CF=(SAxAFxEFxED)/(BWxATx1E6) (day-1)	**1.78E-05**	CF=(IRxFixEFxED)/(BWxAT) (day-1)	**1.47E-01**

Exposure Route	Chemical	Concentration (mg/kg)*	Factor**	Adult Annual Dose (mg/kg/day)	Reference Dose (mg/kg/day)	Hazard Index
Ingestion						
	Arsenic	7.27	1	1.64E-05	0.0003	5.46E-02
	Benzo(a)pyrene	0.46	1	1.03E-06	0	0.00E+00
Total						**5.46E-02**
Dermal Contact						
	Arsenic	7.27	0.001	1.30E-07	0.000123	1.05E-03
	Benzo(a)pyrene	0.46	0.01	8.19E-08	0	0.00E+00
Total						**1.05E-03**
Inhalation						
	Arsenic	7.27	9.00E-08	9.59E-08	0	0.00E+00
	Benzo(a)pyrene	0.46	9.00E-08	6.05E-09	0	0.00E+00
Total						**0.00E+00**
Cumulative						***5.57E-02***

Notes: *95% UCL of all soils (0-10 ft),
**Ingestion Bioavailability/ Dermal Absorption Factor/ Inhalation PM10 Factor

RISK ASSESSMENT SPREADSHEET
FULL-TIME EMPLOYEE RESEASONABLE MAXIMUM EXPOSURE SCENARIO FOR SOIL
SITE 20 - AREA A WEAPONS CENTER
NAVAL SUBMARINE BASE, NEW LONDON, CONNECTICUT

CANCER RISK

Ingestion Parameters		Dermal Contact Parameters		Inhalation Parameters	
IR: Ingestion Rate (mg/day)	100	SA: Skin Surface Area (cm^2/day)	3800	IR: Inhalation Rate-adult (m^3/hr)	2.5
ED: Exposure Duration (years)	25	ED: Exposure Duration (years)	25	ET: Exposure Time (hours/day)	8
BW: Body Weight (kg)	70	BW: Body Weight (kg)	70	EF: Exposure Frequency (days/year)	150
FI: Contaminant Fraction (decimal)	1	AF: Adherence Factor (mg/cm^2)	1	ED: Exposure Duration (years)	25
EF: Exposure Frequency (days/year)	150	EF: Exposure Frequency (days/year)	150	BW: Body Weight-adult (kg)	70
AT: Averaging Time (days)	25550	AT: Averaging Time (days)	25550	AT: Averaging Time (days)	25550
Ingestion Conversion Factor (CF)		Dermal Contact Conversion Factor (CF)		Inhalation Conversion Factor	
CF=(IRxFixEFxED)/(BWxATx1E6) (day^{-1})	**2.10E-07**	CF=(SAxAFxEFxED)/(BWxATx1E6) (day-1)	**7.97E-06**	CF=(IRxFixEFxED)/(BWxAT) (day-1)	**4.19E-02**

Exposure Route	Chemical	Concentration (mg/kg)*	Factor**	Lifetime Average Dose (mg/kg/day)	Cancer Slope Factor (kg-day)/mg	Cancer Risk
Ingestion						
	Benzo(a)pyrene	1.02	1	2.13E-07	7.3	1.56E-06
Total						**1.56E-06**
Dermal Contact						
	Benzo(a)pyrene	1.02	0.01	8.11E-08	23.5	1.91E-06
Total						**1.91E-06**
Inhalation						
	Benzo(a)pyrene	1.02	1.80E-06	7.68E-08	3.1	2.38E-07
Total						**2.38E-07**
Cumulative						***3.70E-06***

NONCANCER RISK

Ingestion Parameters		Dermal Contact Parameters		Inhalation Parameters	
IR: Ingestion Rate (mg/day)	100	SA: Skin Surface Area (cm^2/day)	3800	IR: Inhalation Rate-adult (m^3/hr)	2.5
ED: Exposure Duration (years)	25	ED: Exposure Duration (years)	25	ET: Exposure Time (hours/day)	8
BW: Body Weight (kg)	70	BW: Body Weight (kg)	70	EF: Exposure Frequency (days/year)	150
FI: Contaminant Fraction (decimal)	1	AF: Adherence Factor (mg/cm^2)	1	ED: Exposure Duration (years)	25
EF: Exposure Frequency (days/year)	150	EF: Exposure Frequency (days/year)	150	BW: Body Weight-adult (kg)	70
AT: Averaging Time (days)	9125	AT: Averaging Time (days)	9125	AT: Averaging Time (days)	9125
Ingestion Conversion Factor (CF)		Dermal Contact Conversion Factor (CF)		Inhalation Conversion Factor	
CF=(IRxFixEFxED)/(BWxATx1E6) (day^{-1})	**5.87E-07**	CF=(SAxAFxEFxED)/(BWxATx1E6) (day-1)	**2.23E-05**	CF=(IRxFixEFxED)/(BWxAT) (day-1)	**1.17E-01**

Exposure Route	Chemical	Concentration (mg/kg)*	Factor**	Adult Annual Dose (mg/kg/day)	Reference Dose (mg/kg/day)	Hazard Index
Ingestion						
	Benzo(a)pyrene	1.02	1	5.97E-07	0	0.00E+00
Total						**0.00E+00**
Dermal Contact						
	Benzo(a)pyrene	1.02	0.01	2.27E-07	0	0.00E+00
Total						**0.00E+00**
Inhalation						
	Benzo(a)pyrene	1.02	1.80E-06	2.15E-07	0	0.00E+00
Total						**0.00E+00**
Cumulative						***0.00E+00***

Notes: *95% UCL of shallow soils (0-4 ft), **Ingestion Bioavailability/ Dermal Absorption Factor/ Inhalation PM10 Factor

Preliminary Remediation Goal Calculations for Sediment

APPENDIX A.3 DEVELOPMENT OF SEDIMENT RISK-BASED PRELIMINARY REMEDIATION GOALS FOR ALL SCENARIOS
SITE 20 - AREA A WEAPONS CENTER, NEW LONDON, CONNECTICUT

PARAMETER	Samples	Positive	Minimum	Maximum	UCL	IRBC	RRBC	UNITS	Max Exceed IRBC	Max Exceed RRBC	COC Retained
ALUMINUM	17	17	2560	26400	16,987.42	1,000,000.00	78,000.00	MG/KG	N	N	NO
ANTIMONY	14	4	1.6	15	6.97	820.00	31.00	MG/KG	N	N	NO
ARSENIC	17	17	1.2	13.5	8.86	3.80	0.43	MG/KG	**Y**	**Y**	**YES**
BARIUM	17	17	17	103	79.32	140,000.00	5,500.00	MG/KG	N	N	NO
BERYLLIUM	15	4	0.275	1.1	0.78	1.30	0.15	MG/KG	N	**Y**	**YES**
BORON	14	8	6.15	39.7	25.94	180,000.00	7,000.00	MG/KG	N	N	NO
CADMIUM	14	3	0.215	29.5	6.60	1,000.00	39.00	MG/KG	N	N	NO
CALCIUM	14	14	680	3290	2,039.75	--	--	MG/KG	N	N	NO
CHROMIUM	17	16	2.85	97.5	48.61	1,000,000.00	78,000.00	MG/KG	N	N	NO
COBALT	17	17	2.2	14.4	8.89	120,000.00	4,700.00	MG/KG	N	N	NO
COPPER	17	14	2.3	57.2	33.80	82,000.00	3,100.00	MG/KG	N	N	NO
IRON	17	17	6430	51600	32,482.71	610,000.00	23,000.00	MG/KG	N	**Y**	**YES**
LEAD	17	17	3.5	204	81.09	--	400.00	MG/KG	N	N	NO
MAGNESIUM	17	17	1160	6140	4,924.98	--	--	MG/KG	N	N	NO
MANGANESE	17	17	79.8	2640	882.43	47,000.00	1,800.00	MG/KG	N	**Y**	**YES**
MERCURY	14	9	0.055	0.6	0.34	610.00	23.00	MG/KG	N	N	NO
NICKEL	17	17	3.3	31.5	19.79	41,000.00	1,600.00	MG/KG	N	N	NO
POTASSIUM	17	15	411	4020	3,059.61	--	--	MG/KG	N	N	NO
SELENIUM	14	1	0.215	0.67	0.56	10,000.00	390.00	MG/KG	N	N	NO
SILVER	14	2	0.215	1.9	0.84	10,000.00	390.00	MG/KG	N	N	NO
SODIUM	14	6	14.2	1120	397.03	--	--	MG/KG	N	N	NO
THALLIUM	14	1	0.105	0.34	0.26	140.00	--	MG/KG	N	N	NO
VANADIUM	17	17	8	62.2	45.44	14,000.00	550.00	MG/KG	N	N	NO
ZINC	17	16	5.15	292	146.89	610,000.00	23,000.00	MG/KG	N	N	NO
2-METHYLNAPHTHALENE	14	1	31	31	306.15	41,000,000.00	1,600,000.00	UG/KG	N	N	NO
ACENAPHTHENE	14	4	36	79	275.28	120,000,000.00	4,700,000.00	UG/KG	N	N	NO
ACENAPHTHYLENE	14	2	47	90	297.68	82,000,000.00	--	UG/KG	N	N	NO
ANTHRACENE	14	7	22	400	259.75	610,000,000.00	23,000,000.00	UG/KG	N	N	NO
BENZO(A)ANTHRACENE	17	16	63	3400	1,365.03	7,800.00	880.00	UG/KG	N	**Y**	**YES**
BENZO(A)PYRENE	17	14	73	4400	1,686.54	780.00	88.00	UG/KG	**Y**	**Y**	**YES**
BENZO(B)FLUORANTHENE	17	16	140	4900	2,417.57	7,800.00	880.00	UG/KG	N	**Y**	**YES**
BENZO(G,H,I)PERYLENE	17	14	47	3500	1,251.86	82,000,000.00	--	UG/KG	N	N	NO
BENZO(K)FLUORANTHENE	17	10	120	2100	1,256.27	78,000.00	8,800.00	UG/KG	N	N	NO
BENZOIC ACID	14	9	61	190	231.84	1,000,000,000.00	310,000,000.00	UG/KG	N	N	NO

APPENDIX A.3 DEVELOPMENT OF SEDIMENT RISK-BASED PRELIMINARY REMEDIATION GOALS FOR ALL SCENARIOS
SITE 20 - AREA A WEAPONS CENTER, NEW LONDON, CONNECTICUT

PARAMETER	Samples	Positive	Minimum	Maximum	UCL	IRBC	RRBC	UNITS	Max Exceed IRBC	Max Exceed RRBC	COC Retained
BIS(2-ETHYLHEXYL)PHTHALATE	14	1	175	1100	515.58	410,000.00	46,000.00	UG/KG	N	N	NO
CARBAZOLE	17	8	31	660	406.13	290,000.00	32,000.00	UG/KG	N	N	NO
CHRYSENE	17	16	110	4300	1,954.33	780,000.00	88,000.00	UG/KG	N	N	NO
DI-N-BUTYL PHTHALATE	14	1	175	180	308.93	200,000,000.00	7,800,000.00	UG/KG	N	N	NO
DI-N-OCTYL PHTHALATE	14	2	26	72	303.58	41,000,000.00	1,600,000.00	UG/KG	N	N	NO
DIBENZO(A,H)ANTHRACENE	17	6	52	870	472.68	780.00	88.00	UG/KG	**Y**	**Y**	**YES**
DIBENZOFURAN	14	2	45	86	305.83	8,200,000.00	310,000.00	UG/KG	N	N	NO
FLUORANTHENE	17	16	100	6900	2,848.57	82,000,000.00	3,100,000.00	UG/KG	N	N	NO
FLUORENE	14	4	46	140	278.12	82,000,000.00	3,100,000.00	UG/KG	N	N	NO
INDENO(1,2,3-CD)PYRENE	17	16	49	3300	1,309.81	7,800.00	880.00	UG/KG	N	**Y**	**YES**
NAPHTHALENE	14	3	36	160	294.44	82,000,000.00	3,100,000.00	UG/KG	N	N	NO
PHENANTHRENE	17	15	77	2300	1,205.20	82,000,000.00	--	UG/KG	N	N	NO
PHENOL	14	1	32	32	312.35	1,000,000,000.00	47,000,000.00	UG/KG	N	N	NO
PYRENE	17	16	120	6900	2,955.02	61,000,000.00	2,300,000.00	UG/KG	N	N	NO
1,1,1-TRICHLOROETHANE	6	1	5.5	13	10.56	72,000,000.00	2,700,000.00	UG/KG	N	N	NO
METHYLENE CHLORIDE	6	4	8.5	22	16.07	760,000.00	85,000.00	UG/KG	N	N	NO
TETRACHLOROETHENE	6	1	5.5	8	8.75	110,000.00	12,000.00	UG/KG	N	N	NO
TOLUENE	6	2	2	4	7.96	410,000,000.00	16,000,000.00	UG/KG	N	N	NO
TRICHLOROETHENE	6	1	5.5	22	14.79	520,000.00	58,000.00	UG/KG	N	N	NO
4,4'-DDD	6	3	6.5	32	28.15	24,000.00	2,700.00	UG/KG	N	N	NO
4,4'-DDE	6	1	17.5	52	39.70	17,000.00	1,900.00	UG/KG	N	N	NO
4,4'-DDT	6	4	10	60	38.60	17,000.00	1,900.00	UG/KG	N	N	NO
ALPHA-CHLORDANE	6	1	6.4	6.4	14.52	4,400.00	490.00	UG/KG	N	N	NO
ENDOSULFAN SULFATE	6	2	6.8	7.6	26.11	12,000,000.00	--	UG/KG	N	N	NO
ENDRIN	6	3	10	18	25.21	610,000.00	23,000.00	UG/KG	N	N	NO
ENDRIN ALDEHYDE	6	2	17.5	140	86.48	--	--	UG/KG	N	N	NO
GAMMA-CHLORDANE	6	1	7	7	14.48	4,400.00	490.00	UG/KG	N	N	NO
HEPTACHLOR	6	1	2.8	2.8	15.59	1,300.00	140.00	UG/KG	N	N	NO
METHOXYCHLOR	6	1	37	37	147.57	10,000,000.00	390,000.00	UG/KG	N	N	NO

Notes: IRBC = Region III Industrial Risk Based Concentrations, RRBC = Region III Residential Risk Based Concentrations, UCL = 95% Upper Confidence Limit
COC = Contaminants of concern.
Maximum concentrations were compared to the Region III Industrial Risk Based Concentrations for the full-time employee and construction worker scenarios and to the Residential Risk Based Concentrations for the future resident scenario.

APPENDIX A.3 SELECTION OF SEDIMENT CONTAMINANTS OF CONCERN EXCEEDING RISK-BASED PRELIMINARY REMEDIATION GOALS
SITE 20 - AREA A WEAPONS CENTER, NEW LONDON, CONNECTICUT

SCENARIO	PARAMETER	FRACTION	Samples	Positive	UCL (MG/KG)	RISK	Risk Exceed 10^-6	RISK BASED PRG (MG/KG)	UCL Exceed PRG	COC Retained
FULL-TIME EMPLOYEE										
	ARSENIC	M	17	17	8.86	3.04E-06	Y	2.91	Y	NO*
	BENZO(A)PYRENE	OS	17	14	1.69	5.74E-06	Y	0.29	Y	YES
	DIBENZO(A,H)ANTHRACENE	OS	17	6	0.47	1.61E-06	Y	0.29	Y	YES
CONSTRUCTION WORKER										
	ARSENIC	M	17	17	8.86	4.36E-07	N	NC	--	NO
	BENZO(A)PYRENE	OS	17	14	1.69	4.97E-07	N	NC	--	NO
	DIBENZO(A,H)ANTHRACENE	OS	17	6	0.47	1.39E-07	N	NC	--	NO
FUTURE RESIDENT										
	ARSENIC	M	17	17	8.86	9.32E-06	Y	0.95	Y	NO*
	BENZO(A)ANTHRACENE	OS	17	16	1.37	1.07E-06	Y	1.27	Y	YES
	BENZO(A)PYRENE	OS	17	14	1.69	1.32E-05	Y	0.13	Y	YES
	BENZO(B)FLUORANTHENE	OS	17	16	2.42	1.90E-06	Y	1.27	Y	YES
	BERYLLIUM	M	15	4	0.78	4.21E-06	Y	0.19	Y	YES
	DIBENZO(A,H)ANTHRACENE	OS	17	6	0.47	3.71E-06	Y	0.13	Y	YES
	INDENO(1,2,3-CD)PYRENE	OS	17	16	1.31	1.03E-06	Y	1.27	Y	YES
	IRON	M	17	17	32,482.71	0.00E+00	N	NC	--	NO
	MANGANESE	M	17	17	882.43	0.00E+00	N	NC	--	NO

Notes: NC = Not calculated. PRG = Preliminary Remediation Goals. UCL = 95% Upper Confidence Limit. M = Metals. OS = Organic Semivolatiles.
PRG were only developed if incremental risk > 10^-6
* Arsenic did not exceed the site background concentration of arsenic (3 mg/kg).
** UCL exceeded PRG; however, no individual sample exceeded the PRG.

RME PRELIMINARY REMEDIATION GOALS FOR SEDIMENT

FULL-TIME EMPLOYEE

Chemical	Route-Specific Cancer Risks Ingestion	Dermal	Inhalation	Total Risk	Concentration	Preliminary Remediation Goals (mg/kg) 1.00E-06
ARSENIC	**2.787E-06**	**2.584E-07**	**0.00**	**3.0449E-06**	**8.9**	**2.910**
BENZO(A)PYRENE	**2.581E-06**	**3.157E-06**	**0.00**	**5.74E-06**	**1.7**	**0.294**
DIBENZO(A,H)ANTHRACENE	**7.235E-07**	**8.85E-07**	**0.00**	**1.61E-06**	**0.5**	**0.294**
Totals	6.09E-06	4.30E-06	0.00 **Total**	1.04E-05		

Chemical	Route-Specific Hazard Index Ingestion	Dermal	Inhalation	Total HI	Concentration	Preliminary Remediation Goals (mg/kg) 1.0
ARSENIC	0.0173	0.0016	0.00	0.0189	8.9	NC
BENZO(A)PYRENE	0.0000	0.0000	0.00	0.0	1.7	NC
DIBENZO(A,H)ANTHRACENE	0.0000	0.0000	0.00	0.0	0.5	NC
Totals	0.0173386	0.001607	0.00 **Total**	0.019		

CONSTRUCTION WORKER

Chemical	Route-Specific Cancer Risks Ingestion	Dermal	Inhalation	Total Risk	Concentration	Preliminary Remediation Goals (mg/kg) 1.00E-06
ARSENIC	4.28E-07	8.268E-09	0.00	4.3628E-07	8.9	NC
BENZO(A)PYRENE	3.964E-07	1.01E-07	0.00	4.974E-07	1.7	NC
DIBENZO(A,H)ANTHRACENE	1.111E-07	2.832E-08	0.00	1.3945E-07	0.5	NC
Totals	9.355E-07	1.376E-07	0.00 **Total**	1.0731E-06		

Chemical	Route-Specific Hazard Index Ingestion	Dermal	Inhalation	Total HI	Concentration	Preliminary Remediation Goals (mg/kg) 1.0
ARSENIC	0.0666	0.0013	0.00	0.0679	8.9	NC
BENZO(A)PYRENE	0.0000	0.0000	0.00	0	1.7	NC
DIBENZO(A,H)ANTHRACENE	0.0000	0.0000	0.00	0	0.5	
Totals	0.06658	0.0012856	0.00 **Total**	0.068		

FUTURE RESIDENT

Chemical	Route-Specific Cancer Risks Ingestion	Dermal	Inhalation	Total Risk	Concentration	Preliminary Remediation Goals (mg/kg) 1.00E-06
ARSENIC	**8.92E-06**	**4.07E-07**	**0.00E+00**	**9.32E-06**	**8.86E+00**	**0.950**
BENZO(A)ANTHRACENE	**6.69E-07**	**4.03E-07**	**0.00E+00**	**1.07E-06**	**1.37E+00**	**1.274**
BENZO(A)PYRENE	**8.26E-06**	**4.98E-06**	**0.00E+00**	**1.32E-05**	**1.69E+00**	**0.127**
BENZO(B)FLUORANTHENE	**1.18E-06**	**7.14E-07**	**0.00E+00**	**1.90E-06**	**2.42E+00**	**1.274**
BERYLLIUM	**0.00E+00**	**4.21E-06**	**0.00E+00**	**4.21E-06**	**7.80E-01**	**0.185**
DIBENZO(A,H)ANTHRACENE	**2.32E-06**	**1.40E-06**	**0.00E+00**	**3.71E-06**	**4.73E-01**	**0.127**
INDENO(1,2,3-CD)PYRENE	**6.42E-07**	**3.87E-07**	**0.00E+00**	**1.03E-06**	**1.31E+00**	**1.274**
IRON	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.25E+04	NC
MANGANESE	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.82E+02	NC
Totals	2.20E-05	1.25E-05	0.00E+00 **Total**	3.45E-05		

Chemical	Route-Specific Hazard Index Ingestion	Dermal	Inhalation	Total HI	Concentration	Preliminary Remediation Goals (mg/kg) 1.0
ARSENIC	0.0462361	0.0021121	0.00	0.05	8.9	NC
BENZO(A)ANTHRACENE	0.00	0.00	0.00	0.00	1.4	NC
BENZO(A)PYRENE	0.00	0.00	0.00	0.00	1.7	NC
BENZO(B)FLUORANTHENE	0.00	0.00	0.00	0.00	2.4	NC
BERYLLIUM	0.0006106	0.0011435	0.00	0.00	0.8	NC
DIBENZO(A,H)ANTHRACENE	0.00	0.00	0.00	0.00	0.5	NC
INDENO(1,2,3-CD)PYRENE	0.00	0.00	0.00	0.00	1.3	NC
IRON	0.1695119	0.00	0.00	0.17	32482.7	NC
MANGANESE	0.0098678	0.0046204	0.00	0.01	882.4	NC
Totals	0.2262264	0.007876	0.00 **Total**	0.23		

NC = PRG not calculated because incremental risk did not exceed 1x10^-6.

RISK A[illegible]NT SPREADSHEET
FUTURE RESIDENT RESEASONAB[illegible]MUM EXPOSURE SCENARIO FOR SEDIMENT
SITE 20 - A[illegible] WEAPONS CENTER
NAVAL SUBMARINE BASE, NEW LONDON, CONNECTICUT

CANCER RISK

Ingestion Parameters		Dermal Contact Parameters		Inhalation Parameters	
IRc: Ingestion Rate-child (mg/day)	200	SAc: Skin Surface Area-child (cm^2/day)	2094	IR: Inhalation Rate-adult (m^3/hr)	0
EDc: Exposure Duration-child (years)	6	EDc: Exposure Duration-child (years)	6	ET: Exposure Time (hours/day)	24
BWc: Body Weight-child (kg)	15	BWc: Body Weight-child (kg)	15	EF: Exposure Frequency (days/year)	350
IRa: Ingestion Rate-adult (mg/kg)	100	SAa: Skin Surface Area-adult (cm^2/day)	3800	ED: Exposure Duration (years)	30
EDa: Exposure Duration-adult (years)	24	EDa: Exposure Duration-adult (years)	24	BW: Body Weight-adult (kg)	70
BWa: Body Weight-adult (kg)	70	BWa: Body Weight-adult (kg)	70	AT: Averaging Time (days)	25550
Fi: Contaminant Fraction (decimal)	1	AF: Adherence Factor (mg/cm^2)	1		
EF: Exposure Frequency (days/year)	150	EF: Exposure Frequency days/year)	150		
AT: Averaging Time (days)	25550	AT: Averaging Time (days)	25550		
Ingestion Conversion Factor (CF)		**Dermal Contact Conversion Factor (CF)**		**Inhalation Conversion Factor**	
Ifadj=(IRcxEDc)/BWc + (IRaxEDa)/BWa	114.2857143	SAadj=(SAcxEDc)/BWc + (SAaxEDa)/BWa	2140.457143		
CF=(IFadjxFixEF)/(ATx1E6) (day^{-1})	**6.71E-07**	CF=(SAadjxAFxEF)/(ATx1E6) (day^{-1})	**1.26E-05**	CF=(IRxFixEFxED)/(BWxAT) (day^{-1})	**0.00E+00**

Exposure Route	Chemical	Concentration (mg/kg)*	Factor**	Lifetime Average Dose (mg/kg/day)	Cancer Slope Factor (kg-day)/mg	Cancer Risk
Ingestion						
	ARSENIC	8.9	1	5.94E-06	1.5	8.92E-06
	BENZO(A)ANTHRACENE	1.4	1	9.16E-07	0.73	6.69E-07
	BENZO(A)PYRENE	1.7	1	1.13E-06	7.3	8.26E-06
	BENZO(B)FLUORANTHENE	2.4	1	1.62E-06	0.73	1.18E-06
	BERYLLIUM	0.8	1	5.23E-07	0	0.00E+00
	DIBENZO(A,H)ANTHRACENE	0.5	1	3.17E-07	7.3	2.32E-06
	INDENO(1,2,3-CD)PYRENE	1.3	1	8.79E-07	0.73	6.42E-07
	IRON	32,482.7	1	2.18E-02	0	0.00E+00
	MANGANESE	882.4	1	5.92E-04	0	0.00E+00
Total						**2.20E-05**
Dermal Contact						
	ARSENIC	8.9	0.001	1.11E-07	3.66	4.07E-07
	BENZO(A)ANTHRACENE	1.4	0.01	1.72E-07	2.35	4.03E-07
	BENZO(A)PYRENE	1.7	0.01	2.12E-07	23.5	4.98E-06
	BENZO(B)FLUORANTHENE	2.4	0.01	3.04E-07	2.35	7.14E-07
	BERYLLIUM	0.8	0.001	9.80E-09	430	4.21E-06
	DIBENZO(A,H)ANTHRACENE	0.5	0.01	5.94E-08	23.5	1.40E-06
	INDENO(1,2,3-CD)PYRENE	1.3	0.01	1.65E-07	2.35	3.87E-07
	IRON	32,482.7	0.001	4.08E-04	0	0.00E+00
	MANGANESE	882.4	0.001	1.11E-05	0	0.00E+00
Total						**1.25E-05**
Inhalation						
	ARSENIC	8.9	1.80E-06	0.00E+00	15.1	0.00E+00
	BENZO(A)ANTHRACENE	1.4	1.80E-06	0.00E+00	0	0.00E+00
	BENZO(A)PYRENE	1.7	1.80E-06	0.00E+00	3.1	0.00E+00
	BENZO(B)FLUORANTHENE	2.4	1.80E-06	0.00E+00	0	0.00E+00
	BERYLLIUM	0.8	1.80E-06	0.00E+00	8.4	0.00E+00
	DIBENZO(A,H)ANTHRACENE	0.5	1.80E-06	0.00E+00	0	0.00E+00
	INDENO(1,2,3-CD)PYRENE	1.3	1.80E-06	0.00E+00	0	0.00E+00
	IRON	32,482.7	1.80E-06	0.00E+00	0	0.00E+00
	MANGANESE	882.4	1.80E-06	0.00E+00	0	0.00E+00
Total						**0.00E+00**
Cumulative						***3.45E-05***

Notes:
*95% UCL of all sediment
**Ingestion Bioavailability/ Dermal Absorption Factor/ Inhalation PM10 Factor

RISK ASSESSMENT SPREADSHEET
FUTURE RESIDENT RESEASONABLE MAXIMUM EXPOSURE SCENARIO FOR SEDIMENT
SITE 20 - AREA A WEAPONS CENTER
NAVAL SUBMARINE BASE, NEW LONDON, CONNECTICUT

NONCANCER RISK

Ingestion Parameters		Dermal Contact Parameters		Inhalation Parameters	
IRc: Ingestion Rate-child (mg/day)	200	SAc: Skin Surface Area-child (cm^2/day)	2094	IR: Inhalation Rate-adult (m^3/hr)	0
EDc: Exposure Duration-child (years)	6	EDc: Exposure Duration-child (years)	6	ET: Exposure Time (hours/day)	24
BWc: Body Weight-child (kg)	15	BWc: Body Weight-child (kg)	15	EF: Exposure Frequency (days/year)	350
IRa: Ingestion Rate-adult (mg/kg)	100	SAa: Skin Surface Area-adult (cm^2/day)	3800	ED: Exposure Duration (years)	30
EDa: Exposure Duration-adult (years)	24	EDa: Exposure Duration-adult (years)	24	BW: Body Weight-adult (kg)	70
BWa: Body Weight-adult (kg)	70	BWa: Body Weight-adult (kg)	70	AT: Averaging Time (days)	10950
Fi: Contaminant Fraction (decimal)	1	AF: Adherence Factor (mg/cm^2)	1		
EF: Exposure Frequency (days/year)	150	EF: Exposure Frequency days/year)	150		
AT: Averaging Time (days)	10950	AT: Averaging Time (days)	10950		
Ingestion Conversion Factor (CF)		**Dermal Contact Conversion Factor (CF)**		**Inhalation Conversion Factor**	
Ifadj=(IRcxEDc)/BWc + (IRaxEDa)/BWa	114.2857143	SAadj=(SAcxEDc)/BWc + (SAaxEDa)/BWa	2140.457143		
CF=(IFadjxFixEF)/(ATx1E6) (day^{-1})	**1.57E-06**	CF=(SAadjxAFxEF)/(ATx1E6) (day^{-1})	**2.93E-05**	CF=(IRxFixEFxED)/(BWxAT) (day^{-1})	**0.00E+00**

Exposure Route	Chemical	Concentration (mg/kg)*	Factor**	Adult Annual Dose (mg/kg/day)	Reference Dose (mg/kg/day)	Hazard Index
Ingestion						
	ARSENIC	8.9	1	1.39E-05	0.0003	4.62E-02
	BENZO(A)ANTHRACENE	1.4	1	2.14E-06	0	0.00E+00
	BENZO(A)PYRENE	1.7	1	2.64E-06	0	0.00E+00
	BENZO(B)FLUORANTHENE	2.4	1	3.78E-06	0	0.00E+00
	BERYLLIUM	0.8	1	1.22E-06	0.002	6.11E-04
	DIBENZO(A,H)ANTHRACENE	0.5	1	7.40E-07	0	0.00E+00
	INDENO(1,2,3-CD)PYRENE	1.3	1	2.05E-06	0	0.00E+00
	IRON	32,482.7	1	5.09E-02	0.3	1.70E-01
	MANGANESE	882.4	1	1.38E-03	0.14	9.87E-03
Total						**2.26E-01**
Dermal Contact						
	ARSENIC	8.9	0.001	2.60E-07	0.000123	2.11E-03
	BENZO(A)ANTHRACENE	1.4	0.01	4.00E-07	0	0.00E+00
	BENZO(A)PYRENE	1.7	0.01	4.94E-07	0	0.00E+00
	BENZO(B)FLUORANTHENE	2.4	0.01	7.09E-07	0	0.00E+00
	BERYLLIUM	0.8	0.001	2.29E-08	0.00002	1.14E-03
	DIBENZO(A,H)ANTHRACENE	0.5	0.01	1.39E-07	0	0.00E+00
	INDENO(1,2,3-CD)PYRENE	1.3	0.01	3.84E-07	0	0.00E+00
	IRON	32,482.7	0.001	9.52E-04	0	0.00E+00
	MANGANESE	882.4	0.001	2.59E-05	0.0056	4.62E-03
Total						**7.88E-03**
Inhalation						
	ARSENIC	8.9	1.80E-06	0.00E+00	0	0.00E+00
	BENZO(A)ANTHRACENE	1.4	1.80E-06	0.00E+00	0	0.00E+00
	BENZO(A)PYRENE	1.7	1.80E-06	0.00E+00	0	0.00E+00
	BENZO(B)FLUORANTHENE	2.4	1.80E-06	0.00E+00	0	0.00E+00
	BERYLLIUM	0.8	1.80E-06	0.00E+00	0.00000571	0.00E+00
	DIBENZO(A,H)ANTHRACENE	0.5	1.80E-06	0.00E+00	0	0.00E+00
	INDENO(1,2,3-CD)PYRENE	1.3	1.80E-06	0.00E+00	0	0.00E+00
	IRON	32,482.7	1.80E-06	0.00E+00	0	0.00E+00
	MANGANESE	882.4	1.80E-06	0.00E+00	0.0000143	0.00E+00
Total						**0.00E+00**
Cumulative						***2.34E-01***

Notes:
*95% UCL of all sediment
**Ingestion Bioavailability/ Dermal Absorption Factor/ Inhalation PM10 Factor

RISK ASSES PREADSHEET
CONSTRUCTION WORKER RESEASONAB UM EXPOSURE SCENARIO FOR SEDIMENT
SITE 20 - AREA APONS CENTER
NAVAL SUBMARINE BASE, NEW LONDON, CONNECTICUT

CANCER RISK

Ingestion Parameters		Dermal Contact Parameters		Inhalation Parameters	
IR: Ingestion Rate (mg/day)	480	SA: Skin Surface Area (cm^2/day)	3800	IR: Inhalation Rate-adult (m^3/hr)	0
ED: Exposure Duration (years)	1	ED: Exposure Duration (years)	1	ET: Exposure Time (hours/day)	8
BW: Body Weight (kg)	70	BW: Body Weight (kg)	70	EF: Exposure Frequency (days/year)	120
Fi: Contaminant Fraction (decimal)	1	AF: Adherence Factor (mg/cm^2)	1	ED: Exposure Duration (years)	1
EF: Exposure Frequency (days/year)	120	EF: Exposure Frequency (days/year)	120	BW: Body Weight-adult (kg)	70
AT: Averaging Time (days)	25550	AT: Averaging Time (days)	25550	AT: Averaging Time (days)	25550
Ingestion Conversion Factor (CF)		Dermal Contact Conversion Factor (CF)		Inhalation Conversion Factor	
CF=(IRxFixEFxED)/(BWxATx1E6) (day^{-1})	**3.22E-08**	CF=(SAxAFxEFxED)/(BWxATx1E6) (day-1)	**2.55E-07**	CF=(IRxFixEFxED)/(BWxAT) (day-1)	**0.00E+00**

Exposure Route	Chemical	Concentration (mg/kg)*	Factor**	Lifetime Average Dose (mg/kg/day)	Cancer Slope Factor (kg-day)/mg	Cancer Risk
Ingestion						
	ARSENIC	8.86	1	2.85E-07	1.5	4.28E-07
	BENZO(A)PYRENE	1.69	1	5.43E-08	7.3	3.96E-07
	DIBENZO(A,H)ANTHRACENE	0.47	1	1.52E-08	7.3	1.11E-07
Total						**9.36E-07**
Dermal Contact						
	ARSENIC	8.86	0.001	2.26E-09	3.66	8.27E-09
	BENZO(A)PYRENE	1.69	0.01	4.30E-09	23.5	1.01E-07
	DIBENZO(A,H)ANTHRACENE	0.47	0.01	1.21E-09	23.5	2.83E-08
Total						**1.38E-07**
Inhalation						
	ARSENIC	8.86	9.00E-08	0.00E+00	15.1	0.00E+00
	BENZO(A)PYRENE	1.69	9.00E-08	0.00E+00	3.1	0.00E+00
	DIBENZO(A,H)ANTHRACENE	0.47	9.00E-08	0.00E+00	0	0.00E+00
Total						**0.00E+00**
Cumulative						***1.07E-06***

NONCANCER RISK

Ingestion Parameters		Dermal Contact Parameters		Inhalation Parameters	
IR: Ingestion Rate (mg/day)	480	SA: Skin Surface Area (cm^2/day)	3800	IR: Inhalation Rate-adult (m^3/hr)	0
ED: Exposure Duration (years)	1	ED: Exposure Duration (years)	1	ET: Exposure Time (hours/day)	8
BW: Body Weight (kg)	70	BW: Body Weight (kg)	70	EF: Exposure Frequency (days/year)	120
Fi: Contaminant Fraction (decimal)	1	AF: Adherence Factor (mg/cm^2)	1	ED: Exposure Duration (years)	1
EF: Exposure Frequency (days/year)	120	EF: Exposure Frequency (days/year)	120	BW: Body Weight-adult (kg)	70
AT: Averaging Time (days)	365	AT: Averaging Time (days)	365	AT: Averaging Time (days)	365
Ingestion Conversion Factor (CF)		Dermal Contact Conversion Factor (CF)		Inhalation Conversion Factor	
CF=(IRxFixEFxED)/(BWxATx1E6) (day^{-1})	**2.25E-06**	CF=(SAxAFxEFxED)/(BWxATx1E6) (day-1)	**1.78E-05**	CF=(IRxFixEFxED)/(BWxAT) (day-1)	**0.00E+00**

Exposure Route	Chemical	Concentration (mg/kg)*	Factor**	Adult Annual Dose (mg/kg/day)	Reference Dose (mg/kg/day)	Hazard Index
Ingestion						
	ARSENIC	8.86	1	2.00E-05	0.0003	6.66E-02
	BENZO(A)PYRENE	1.69	1	3.80E-06	0	0.00E+00
	DIBENZO(A,H)ANTHRACENE	0.47	1	1.07E-06	0	0.00E+00
Total						**6.66E-02**
Dermal Contact						
	ARSENIC	8.86	0.001	1.58E-07	0.000123	1.29E-03
	BENZO(A)PYRENE	1.69	0.01	3.01E-07	0	0.00E+00
	DIBENZO(A,H)ANTHRACENE	0.47	0.01	8.44E-08	0	0.00E+00
Total						**1.29E-03**
Inhalation						
	ARSENIC	8.86	9.00E-08	0.00E+00	0	0.00E+00
	BENZO(A)PYRENE	1.69	0.01	3.01E-07	0	0.00E+00
	DIBENZO(A,H)ANTHRACENE	0.47	0.01	8.44E-08	0	0.00E+00
Total						**0.00E+00**
Cumulative						***6.79E-02***

Notes:
*95% UCL of all sediment
**Ingestion Bioavailability/ Dermal Absorption Factor/ Inhalation PM10 Factor

RISK ASSESSMENT SPREADSHEET

FULL-T LOYEE RESEASONABLE MAXIMUM EXPOSURE SCENARIO FOR SEDIMENT

SITE 20 - AREA A WEAPONS CENTER

NAVAL SUBMARINE BASE, NEW LONDON, CONNECTICUT

CANCER RISK

Ingestion Parameters		Dermal Contact Parameters		Inhalation Parameters	
IR: Ingestion Rate (mg/day)	100	SA: Skin Surface Area (cm^2/day)	3800	IR: Inhalation Rate-adult (m^3/hr)	0
ED: Exposure Duration (years)	25	ED: Exposure Duration (years)	25	ET: Exposure Time (hours/day)	8
BW: Body Weight (kg)	70	BW: Body Weight (kg)	70	EF: Exposure Frequency (days/year)	150
Fi: Contaminant Fraction (decimal)	1	AF: Adherence Factor (mg/cm^2)	1	ED: Exposure Duration (years)	25
EF: Exposure Frequency (days/year)	150	EF: Exposure Frequency (days/year)	150	BW: Body Weight-adult (kg)	70
AT: Averaging Time (days)	25550	AT: Averaging Time (days)	25550	AT: Averaging Time (days)	25550
Ingestion Conversion Factor (CF)		Dermal Contact Conversion Factor (CF)		Inhalation Conversion Factor	
CF=(IRxFixEFxED)/(BWxATx1E6) (day^{-1})	**2.10E-07**	CF=(SAxAFxEFxED)/(BWxATx1E6) (day-1)	**7.97E-06**	CF=(IRxFixEFxED)/(BWxAT) (day-1)	**0.00E+00**

Exposure Route	Chemical	Concentration (mg/kg)*	Factor**	Lifetime Average Dose (mg/kg/day)	Cancer Slope Factor (kg-day)/mg	Cancer Risk
Ingestion						
	ARSENIC	8.86	1	1.86E-06	1.5	2.79E-06
	BENZO(A)PYRENE	1.69	1	3.54E-07	7.3	2.58E-06
	DIBENZO(A,H)ANTHRACENE	0.47	1	9.91E-08	7.3	7.23E-07
Total						**6.09E-06**
Dermal Contact						
	ARSENIC	8.86	0.001	7.06E-08	3.66	2.58E-07
	BENZO(A)PYRENE	1.69	0.01	1.34E-07	23.5	3.16E-06
	DIBENZO(A,H)ANTHRACENE	0.47	0.01	3.77E-08	23.5	8.85E-07
Total						**4.30E-06**
Inhalation						
	ARSENIC	8.86	1.80E-06	0.00E+00	15.1	0.00E+00
	BENZO(A)PYRENE	1.69	1.80E-06	0.00E+00	3.1	0.00E+00
	DIBENZO(A,H)ANTHRACENE	0.47	1.80E-06	0.00E+00	0	0.00E+00
Total						**0.00E+00**
Cumulative						***1.04E-05***

NONCANCER RISK

Ingestion Parameters		Dermal Contact Parameters		Inhalation Parameters	
IR: Ingestion Rate (mg/day)	100	SA: Skin Surface Area (cm^2/day)	3800	IR: Inhalation Rate-adult (m^3/hr)	0
ED: Exposure Duration (years)	25	ED: Exposure Duration (years)	25	ET: Exposure Time (hours/day)	8
BW: Body Weight (kg)	70	BW: Body Weight (kg)	70	EF: Exposure Frequency (days/year)	150
Fi: Contaminant Fraction (decimal)	1	AF: Adherence Factor (mg/cm^2)	1	ED: Exposure Duration (years)	25
EF: Exposure Frequency (days/year)	150	EF: Exposure Frequency (days/year)	150	BW: Body Weight-adult (kg)	70
AT: Averaging Time (days)	9125	AT: Averaging Time (days)	9125	AT: Averaging Time (days)	9125
Ingestion Conversion Factor (CF)		Dermal Contact Conversion Factor (CF)		Inhalation Conversion Factor	
CF=(IRxFixEFxED)/(BWxATx1E6) (day^{-1})	**5.87E-07**	CF=(SAxAFxEFxED)/(BWxATx1E6) (day-1)	**2.23E-05**	CF=(IRxFixEFxED)/(BWxAT) (day-1)	**0.00E+00**

Exposure Route	Chemical	Concentration (mg/kg)*	Factor**	Adult Annual Dose (mg/kg/day)	Reference Dose (mg/kg/day)	Hazard Index
Ingestion						
	ARSENIC	8.86	1	5.20E-06	0.0003	1.73E-02
	BENZO(A)PYRENE	1.69	1	9.90E-07	0	0.00E+00
	DIBENZO(A,H)ANTHRACENE	0.47	1	2.78E-07	0	0.00E+00
Total						**1.73E-02**
Dermal Contact						
	ARSENIC	8.86	0.001	1.98E-07	0.000123	1.61E-03
	BENZO(A)PYRENE	1.69	0.01	3.76E-07	0	0.00E+00
	DIBENZO(A,H)ANTHRACENE	0.47	0.01	1.05E-07	0	0.00E+00
Total						**1.61E-03**
Inhalation						
	ARSENIC	8.86	1.80E-06	0.00E+00	0	0.00E+00
	BENZO(A)PYRENE	1.69	1.80E-06	0.00E+00	0	0.00E+00
	DIBENZO(A,H)ANTHRACENE	0.47	1.80E-06	0.00E+00	0	0.00E+00
Total						**0.00E+00**
Cumulative						***1.89E-02***

Notes:

*95% UCL of all sediment

**Ingestion Bioavailability/ Dermal Absorption Factor/ Inhalation PM10 Factor

Attachment 3

Revised Section 1.7

1.7 ECOLOGICAL RISK ASSESSMENT

To supplement the findings of the HHRA, a site-specific baseline ecological risk assessment (BERA) was performed at Site 20 in support of the RI (Brown & Root 1997). The methods, findings, and uncertainties of the BERA are summarized in Sections 1.7.1, 1.7.2, and 1.7.3. The procedure used for the BERA was equivalent to a Tier I screening in which conservative assumptions and parameters were consistently incorporated, resulting in a very conservative estimation of exposure and risk. This approach was taken in the BERA in order to maximize confidence that those constituents not retained as COC have negligible potential to represent a risk to ecological receptors. Even with these conservative assumptions, the predicted risk to ecological receptors from Site 20 COC was found to be relatively small. Under more probable conceptual model conditions and exposure scenarios, COC at Site 20 are likely to represent negligible risk to ecological receptors.

1.7.1 Representative Ecological Receptors and Exposure Pathways

The Site 20 Area A Weapons Center is extensively developed with buildings, weapons storage bunkers, paved surfaces, and maintained lawns which provide limited quality habitat for potential ecological receptors. Site 20 is surrounded by upland coniferous/deciduous forest, including a small area characterized as upland deciduous forest/shrub, and the Area A Wetland. The Area A Wetland is an emergent non-tidal freshwater marsh created during the 1950s by the placement of dredged material from the Thames River which was likely to have contained undocumented levels of chemical contaminants. Vegetation in this created wetland is dominated by the invasive common reed, *Phragmites australis*. To a lesser extent, managed lawn and impervious surfaces occur in the area adjacent to Site 20. These surrounding areas are likely to support ecological receptors that have the potential to encounter chemical constituents originating from the Area A Weapons Center.

The conceptual site model developed for the BERA evaluated the potential direct exposure to COC via ingestion or direct contact with sediment, surface water, and shallow soil or indirectly via ingestion of impacted prey. The ecological community in the vicinity of Site 20 was represented by two groups: aquatic receptors and terrestrial receptors.

While the industrialized nature of the site limits its value to populations of many terrestrial wildlife receptors, the BERA conservatively assumed that the site supports a large population of soil invertebrates that serve as prey for short-tailed shrews that inhabit and forage in the area. Short-tailed shrews were assumed to be the primary prey item for higher trophic predators (represented by the red-tailed hawk in the BERA). Exposure pathways for small mammals included direct contact with soil, incidental ingestion of soil while foraging, ingestion of surface water, and consumption of prey. Consumption of prey, ingestion of surface water, or incidental ingestion of soil constituted the expose pathways for large predators at the site.

Site 20 contains surface water runoff drainage ditches. Due to the shallow ground-water table, sediment in these drainage ditches is generally wet; however, the ditches typically contain flowing or standing water for only brief periods associated with precipitation and snowmelt runoff and, therefore, do not provide significant habitat for aquatic communities. The area contained within these ditches is also very small relative to aquatic habitat available in the Area A Wetland. During runoff periods, these ditches may be a source of drinking water for

terrestrial fauna. Although they do not currently support an aquatic community, for the purposes of the BERA, the RI conservatively assumed that the ditches were inhabited by aquatic organisms throughout the year. The BERA assumed that exposure of these aquatic receptors to COC occurred through direct contact with or ingestion of surface water and sediment, and indirectly through ingestion of prey.

Both maximum exposure point and average exposure scenarios were considered in evaluating potential risks to ecological receptors.

1.7.2 Risk Characterization

Risks to aquatic biota, terrestrial vegetation, soil invertebrates, and terrestrial vertebrates were evaluated in the BERA.

1.7.2.1 Aquatic Biota

Potential risks to aquatic biota were evaluated in the BERA by comparing the maximum and average surface water and sediment concentrations that exceeded background concentrations to selected ecotoxicological benchmarks protective of ecological receptors (Table 1-2). For surface water, the chronic effects benchmarks were selected from the following measurements listed in order of preference:

- CTDEP and EPA chronic AWQC
- No observed effect concentration from chronic test
- Acute test LC50 divided by 100
- Lowest observable effect concentration from chronic test
- EPA quantitative structure-activity relationship model.

When a constituent in surface water exceeded the chronic ecotoxicological benchmark the maximum and average concentrations were compared to acute benchmarks. For sediment, the following benchmarks were used to identify COC and estimate risk to ecological receptors:

- Inorganic Constituents

    1. Ontario Ministry of the Environment chronic Screening Level Concentration approach

    2. Ontario Ministry of the Environment acute Severe Effects Level

    3. Effects Range-Median (ER-M) and Effects Range-Low (ER-L) (Long et al. 1995)

- Organic Constituents

    1. Site-specific sediment benchmarks using the Equilibrium Partitioning model (EqP) (U.S. EPA 1993)

2. Ontario Ministry of the Environment Severe Effects Level

3. ER-M.

Maximum concentrations of cadmium, iron, lead, and zinc in surface water exceeded background concentrations and chronic exposure benchmark values indicating a potential risk to aquatic receptors that might potentially inhabit the drainage ditches in the Area A Weapons Center. The maximum concentration of iron (1.1. mg/L) was only slightly above the chronic federal AWQC for aquatic life (1.0 mg/L). The chronic criteria for iron is a questionable indicator of potential risk as it is based on several old field studies which do not adequately document the wide range of ambient water quality parameters that can strongly influence the valence state and toxicity of iron. The average concentrations of cadmium, lead, and zinc exceeded the benchmark values and were predicted to pose a potential risk to aquatic biota. Maximum and average concentrations of cadmium and zinc exceeded respective acute benchmarks. Concentrations of organic constituents detected in surface water samples were not predicted to represent a risk to aquatic biota.

Maximum sediment concentrations of arsenic, cadmium, chromium, copper, lead, manganese, mercury, nickel, selenium, and zinc exceeded background concentrations and their respective chronic sediment benchmark values. Only cadmium, chromium, copper, mercury, and selenium were predicted to represent a risk to aquatic organisms when average concentrations were compared to chronic sediment benchmarks. Maximum concentrations of cadmium, manganese, and selenium exceeded acute sediment benchmarks, but the average concentration of selenium was the only inorganic constituent that exceeded acute benchmark values.

The maximum concentrations of the pesticides 4,4'-DDE, 4,4'-DDT, and endrin aldehyde exceeded chronic sediment benchmarks and, therefore, were predicted to represent potential risk to aquatic biota, that might potentially inhabit the drainage ditches within Site 20. The average concentrations of 4,4'-DDE, endosulfan sulfate, endrin aldehyde, and methoxychlor were higher than chronic sediment benchmarks. Maximum and average concentrations of endosulfan sulfate and methoxychlor exceeded acute sediment benchmarks.

The BERA reported that maximum and average concentration of gamma-chlordane exceeded the chronic benchmark and that the Hazard Quotient (HQ), 3.6E+2 (Tables 8-20 and 8-21 in the RI), indicated that gamma-chlordane made the most significant contribution to the risk calculation for benthic invertebrates. However, the site-specific sediment quality benchmark (1.92E-5 mg/kg) reported in Appendix 1.4 of the BERA was incorrect. The correct site-specific sediment quality benchmark for gamma-chlordane is 9.6E-3 mg/kg, calculated as follows:

$$\text{Site-specific sediment quality benchmark} = \text{CAWQC} * f_{oc} * K_{oc}$$

where

CAWQC	=	Connecticut chronic ambient water quality criterion = 4.3E-6 mg/L
f_{oc}	=	Fraction of organic carbon = 0.016
K_{oc}	=	Organic carbon partitioning coefficient = 1.4E+5.

Using the correct sediment quality benchmark, the calculated HQ based on the maximum and average concentrations of gamma-chlordane (7.00E-3 mg/kg) is 7.27E-1. The maximum concentration does not exceed the site-specific sediment quality benchmark; thus, gamma-chlordane is not carried through the risk assessment for benthic invertebrates in the FS. With this correction, the HQ based on maximum contaminant concentration in the sediment at Site 20 is 1.5E+2; and cadmium, endrin aldehyde, and 4,4'-DDE account for approximately 60 percent of the risk to benthic invertebrates. The maximum concentrations of cadmium and endrin aldehyde occurred in sample 2WCSD5 collected from the edge of the Area A Wetland; 2WCSD1 (the northern end of the drainage ditch in Drainage Area 1 was the only location in which 4,4'-DDE was detected). The HQ calculated for average concentration is 5.1E+1 with the pesticides 4,4'-DDE, endrin aldehyde, methoxychlor, and endosulfan sulfate accounting for approximately 56 percent of the estimated risk to benthic invertebrates.

Although the BERA predicted potential risk to aquatic organisms inhabiting the drainage ditches within Site 20, it is unlikely that aquatic resources will actually be impacted. The onsite drainage ditches are not permanent water courses, but carry stormwater and snowmelt runoff, and are generally dry throughout much of the year. As such, they do not provide permanent habitat for significant populations of aquatic organisms. Some aquatic organisms may opportunistically invade these ditches from downstream wetlands during temporary periods of inundation; however, the duration of their use of this habitat and associated exposure would be relatively short and thus, the risk would be commensurately reduced from that predicted by the ERA.

1.7.2.2 Terrestrial Vegetation

Potential risks to terrestrial vegetation were evaluated in the BERA by comparing maximum and average chemical concentrations to conservative, phytotoxicity benchmarks (Will and Suter 1994) (Table 1-2). Hazard Quotients (HQs) (the ratio of the observed concentration to the benchmark concentration) were determined for each chemical constituent identified from the Area A Weapons Center; HQs that exceeded 1.0 were considered to represent a risk to terrestrial vegetation.

When maximum concentrations of inorganics detected in surface soil samples were compared to phytotoxicity benchmark values, the HQs for aluminum, chromium, vanadium, and antimony were greater than 1.0. Comparison of average surface soil inorganic concentrations to phytotoxicity benchmarks indicated that three of these four inorganics (aluminum, chromium, and vanadium) still had HQs greater than 1.0. Based on this conservative assessment, the BERA concluded that terrestrial vegetation associated with Site 20 may potentially be adversely impacted as a result of exposure to surface soil. However, the benchmark for aluminum is highly uncertain and likely overestimates the risk from soil aluminum on vegetation. The study on which this benchmark was based has been called into question by the federal inter-agency Soil Screening Level Committee as the soil pH was amended to increase availability of aluminum. The Committee is recommending that pH is a better predictor of aluminum toxicity and that pH above 5.5 aluminum will not be toxic. Furthermore, the Committee concluded that measurement of total aluminum is meaningless in evaluating aluminum toxicity.

In addition, the confidence level is also low for both vanadium and chromium soil benchmarks. There are no primary data available to support the vanadium value, and the single secondary reference provides none of the necessary information on test conditions to validate the conclusions. The chromium benchmark is based on only two studies that added hexavalent chromium into the soil as compared to total chromium measured for the RI.

1.7.2.3 Soil Invertebrates

Conservative benchmark values protective of earthworms were used in the ERA to evaluate potential risks to soil invertebrates. Maximum concentrations in surface soil samples were compared to benchmark values (Table 1-2) developed to be protective of soil invertebrates. The results of this comparison determined that the constituents detected at the site do not represent a risk to soil invertebrates (i.e., HQs were less than 1.0). However, because soil invertebrates such as earthworms are known to bioaccumulate heavy metal such as cadmium, it is possible that they may serve as a source of COC for some predatory animals.

1.7.2.4 Terrestrial Vertebrates

The short-tailed shrew and red-tailed hawk were selected for the BERA to be representative of the potential risks to terrestrial ecological receptors utilizing habitat at Site 20. Exposure pathways considered included the ingestion of prey, direct contact with the soil, incidental ingestion of soil, and ingestion of surface water.

HIs calculated using maximum surface soil and surface water concentrations indicated that short-tailed shrew was potentially at risk from exposure to antimony, barium, and phenanthrene. Incidental ingestion of soil followed by ingestion of prey were the primary sources of risk to terrestrial receptors. The same three analytes were also identified as sources of risk based on average soil concentrations. HIs calculated using average soil concentrations were generally lower compared to indices based on maximum soil concentrations. Use of acute toxicity benchmark values for the short-tailed shrew showed that all HIs were less than 1.0 for both maximum and average concentration exposure scenarios indicating that there is no significant acute risk to this receptor.

Comparing maximum and average soil and surface water concentrations to conservative benchmark values (Table 1-2) for the red-tailed hawk indicated that antimony was the only analyte that had an HI greater than 1.0. For both average and maximum concentrations, incidental ingestion of soil followed by ingestion of prey represented the primary sources of risk at the site. Similar to the short-tail shrew, the HI for red-tailed hawk based on acute toxicity benchmark values were less than 1.0 for both maximum and average concentration exposure scenarios indicating that there is no significant acute risk to the avian receptor. Considering that the Area A Weapons Center comprises less than 5 percent of the home range of a red-tailed hawk, potentially impacted soil, surface water, and prey from Site 20 would likely comprise less than 5 percent of the dietary uptake of this avian predator. When the size of the Area A Weapons Center is factored into the HI calculations for the short-tailed shrew and red-tailed hawk, the resulting values are less than 1.0. These considerations, coupled with the fact that this site does not provide high quality habitat, suggests that COC detected in this location are unlikely to represent an adverse risk to this receptor.

1.7.3 Risk Assessment Uncertainties

In addition to the conservative aspects of the conceptual model identified above, the BERA also made several other assumptions contributing further to the highly conservative nature of the assessment including:

- Ecological receptors were assumed to live and forage exclusively within the site boundaries
- Minimum body weights were used to calculate receptor dose
- Maximum ingestion rates were used to calculate receptor dose
- COC were assumed to be 100 percent biologically available
- Comparisons to ecotoxicological benchmarks were made assuming exposure to the most sensitive life stage
- Representative ecological receptors for each trophic level were assumed to consume only impacted prey.

Although the consistent application of multiple conservative assumptions in the risk assessment model significantly reduces uncertainty associated with eliminating many of the analytes from further consideration in the BERA, this process can significantly overestimate the potential adverse effects resulting from exposure of ecological receptors to those constituents retained as COC. An understanding of the magnitude and influence of these uncertainties is important in interpreting the results of the BERA.

The BERA assumes that receptors are exposed to and consume only impacted soil and prey from the site. However, receptors actually are not confined to live and forage only within the site boundaries. The home range of short-tailed shrews is approximately one tenth of the size of Site 20; thus, some shrews may utilize habitat only within the site. In contrast, the area within Site 20 constitutes less than 5 percent of the home range of one red-tailed hawk and can not be considered preferred or quality habitat for this receptor. Therefore, the majority of prey for a hawk is likely to come from offsite. In addition, Site 20 is likely to be included within the home territory of only a few individuals for a top terrestrial predator such as the red-tailed hawk; thus; the overall population effect is negligible. Furthermore, many avian predators such as red-tailed hawk are seasonal migrants, and would utilize the site for only a portion of the year the year.

While the BERA assumed that receptors consume only impacted prey, it is much more likely that ecological receptors including short-tailed shrew and red-tailed hawk feed on range of impacted to non-impacted prey. Thus, the ecological risk model overestimates the exposure to site COC and the associated risk to ecological receptors.

Body weight and ingestion rates are critical in the estimation of COC dose to a receptor. Any given population of receptors would exhibit a wide distribution of body weight and ingestion rates that would significantly reduce the overall calculated dose to receptor populations from that

based on minimum weight and maximum ingestion rate. The application of these two conservative factors has a compounding effect on overestimating exposure, in that it is unlikely that the smallest individuals have the largest ingestion rate.

The amount of a COC that is available to biological receptors and transfer through the food chain is affected by the chemical conditions in the matrix. A significant fraction of some COC can be bound to particulates in soil, sediment, and water, which, although ingested, are subsequently excreted without being metabolized by organisms. When a significant portion of a COC is bound in this manner, analytical results significantly overestimate the amount of COC biologically available and, thus, the dose to receptors. In contrast, ecotoxicological benchmarks are typically derived from laboratory tests in which the most of the measured constituent is biologically available. Thus, the results of such studies typically overestimate the actual toxicity of ambient matrix material.

Another source of uncertainty likely to result in overestimates of potential risk to ecological receptors is the process for selection of ecotoxicological benchmarks. These benchmarks are generated to be protective of the most sensitive receptors and life-stages. It is not uncommon that laboratory toxicity test data are not available for specific constituents, matrices, and receptors relevant to the conceptual site model for a specific ERA. In such cases, uncertainty factors (UF) are applied to available surrogate data to provide conservative protective benchmarks. For the Site 20 BERA, the UF were constructed using the following equation:

$$FinalUF = \frac{1}{(UF_a * UF_b * UF_c * ... UF_x)}$$

where

UF_{xx} are individual adjustments for specific sources of uncertainty. These include:

- Study duration of less than one full life cycle when the most sensitive stage of the lifecycle was not tested (UF = 10)

- To adjust from test endpoints to more sensitive endpoint; for example, LD50 to acute LOAEL (UF = 5), acute LOAEL to chronic LOAEL (UF = 5), chronic LOAEL to chronic NOAEL (UF = 5)

- Extrapolate among taxonomic groups; for example, within taxonomic order (UF = 2), between taxonomic orders (UF = 5), from Class Mammalia to Class Aves (UF = 10).

The test result is multiplied by the final UF to estimate a protective reference dose or benchmark. The derivation of chemical specific UF is summarized by species in the BERA in Tables 3-19 to 3-25. Thus, the benchmarks for antimony, which contributed most significantly to the HI calculated for short-tailed shrew and red-tailed hawk, are potentially very conservative having been adjusted using final UF of 8E-3 and 4E-3, respectively.

1.7.4 Ecological Risk Assessment Summary

The results of the BERA indicated that with the exception of soil invertebrates, most other ecological receptors, if present at Site 20, would potentially be at risk. However, Site 20 does not have high ecological habitat value, consisting primarily of impervious surfaces (buildings and pavement) with some maintained grass. Consequently, use of this area by ecological receptors is likely to be limited and the actual risks to ecological receptors would be lower than estimated by the BERA. Areas bordering Site 20, such as the wetlands and upland coniferous/deciduous forest, do represent desirable habitat for a variety of fauna and flora. Some of these fauna may be exposed to surface water and sediment in the Site 20 drainage areas, and soil in vegetated areas, as they move across the site between these adjacent wetlands or other upland areas. However, the fence that surrounds Site 20 probably limits such movement except for invertebrates, insects, birds, or small mammals that are able to move through the fence. Considering the relatively low use of Site 20 by terrestrial and aquatic organisms and the other very conservative characteristics and uncertainty adjustments of the BERA, it is likely that the potential ecological risk from soil, sediment, and surface water COC at Site 20 is low. When the size of the Area A Weapons Center is factored into the HI calculations for the short-tailed shrew, the resulting values are less than 1.0. These results, coupled with the fact that this site provides lower quality habitat, suggests that COC detected in this location are unlikely to represent an adverse risk to this receptor.

TABLE 1-2 SUMMARY OF CHEMICAL CONCENTRATIONS (MEAN AND MAXIMUM) AND ECOTOXICOLOGICAL BENCHMARKS FOR SEDIMENT, SHALLOW SOIL, AND SURFACE WATER AT SITE 20 – AREA A WEAPONS CENTER, NAVAL SUBMARINE BASE, NEW LONDON, CONNECTICUT

	Sediment			Soil				Surface Water			
Parameter	Mean	Maximum	Benchmark	Mean	Maximum	Invertebrate Benchmark	Vegetation Benchmark	Mean	Maximum	Chronic Benchmark	Acute Benchmark
Aluminum	11,591.43	18,700.00	27,000	**6,602.50**	**9,200.00**	NA	50	ND	ND	---	---
Antimony	9.43	15.00	NA	**5.05**	**5.40**	NA	5	ND	ND	---	---
Arsenic	**6.67**	**13.50**	6	1.89	3.00	NA	10	2.35	2.60	190	NA
Barium	**60.86**	**94.10**	20	38.63	60.80	NA	500	ND	ND	---	---
Beryllium	0.75	1.10	NA	0.32	0.41	NA	10	ND	ND	---	---
Boron	28.13	39.70	NA	**42.00**	**42.00**	NA	0.5	ND	ND	---	---
Cadmium	**10.53**	**29.50**	0.6	0.82	1.20	50	3	**6.10**	**6.60**	0.66	1.8
Chromium	**40.39**	**97.50**	26	**9.58**	**10.90**	25	**1**	ND	ND	---	---
Cobalt	5.99	14.40	50	4.33	4.60	NA	20	ND	ND	---	---
Copper	**30.41**	**57.20**	16	9.00	10.80	30	100	ND	ND	---	---
Iron	24,177.86	51,600.00	2,000,000	9,055.00	10,800.00	NA	NA	658.50	**1,100.00**	1,000	NA
Lead	**43.44**	**204.00**	31	6.93	12.30	59	50	**3.97**	**7.00**	**1.3**	30
Manganese	385.84	**2,640.00**	460	170.50	257.00	NA	500	33.60	48.00	80	NA
Mercury	**0.33**	**0.60**	0.2	ND	ND	---	---	ND	ND	---	---
Nickel	14.60	**31.50**	16	6.50	8.40	400	30	ND	ND	---	---
Selenium	**0.67**	**0.67**	0.1	ND	ND	---	---	ND	ND	---	---
Silver	1.80	1.90	4.5	ND	ND	---	---	ND	ND	---	---
Thallium	0.34	0.34	NA	ND	ND	---	---	ND	ND	---	---
Vanadium	33.32	56.70	NA	**14.58**	**17.50**	NA	2	ND	ND	---	---
Zinc	99.04	**292.00**	120	28.15	46.50	5,000	50	**127.50**	**135.00**	58.2	63.6
2-methylnaphthalene	31.00	31.00	1,760	54.00	54.00	2,300	NA	ND	ND	---	---
Acenaphthene	49.00	79.00	1,360	140.00	140.00	2,400	NA	ND	ND	---	---
Acenaphthylene	68.50	90.00	19,000	31.00	31.00	2,200	NA	ND	ND	---	---
Anthracene	140.43	400.00	24,600	303.00	540.00	1,900	NA	ND	ND	---	---
Benzo(a)anthracene	757.71	3,400.00	43,200	785.00	1,300.00	10,000	NA	ND	ND	---	---
Benzo(a)pyrene	980.92	4,400.00	87,400	785.00	1,300.00	10,000	NA	ND	ND	---	---
Benzo(b)fluoranthene	1,148.57	4,900.00	71,200	1,285.00	2,300.00	10,000	NA	ND	ND	---	---

NOTE: NA = Not available; ND = Not detected.
Dashes (---) indicate not applicable.
Bold indicates exceedance of ecotoxicological benchmark for that matrix.

Parameter	Sediment			Soil				Surface Water			
	Mean	Maximum	Benchmark	Mean	Maximum	Invertebrate Benchmark	Vegetation Benchmark	Mean	Maximum	Chronic Benchmark	Acute Benchmark
Benzo(g,h,i)perylene	484.82	3,500.00	317,000	485.00	770.00	10,000	NA	ND	ND	---	---
Benzo(k)fluoranthene	588.57	2,100.00	43,700	220.00	220.00	10,000	NA	ND	ND	---	---
Benzoic acid	114.22	190.00	11,400	ND	ND	---	---	ND	ND	---	---
Bis(2-ethylhexyl)phthalate	1,100.00	1,100.00	42,900	35.00	35.00	NA	NA	ND	ND	---	---
Butylbenzyl phthalate	ND	ND	---	ND	ND	---	---	2.00	2.00	19	NA
Carbazole	176.20	450.00	17,100	400.00	400.00	4,100	NA	ND	ND	---	---
Chrysene	918.46	4,300.00	43,200	840.00	1,400.00	NA	NA	ND	ND	---	---
Di-n-butyl phthalate	180.00	180.00	35,200	ND	ND	---	---	ND	ND	---	---
Di-n-octyl phthalate	49.00	72.00	5.65E+08	ND	ND	---	---	1.00	1.00	62	NA
Dibenzo(a,h)anthracene	310.50	790.00	54,900	450.00	450.00	10,000	NA	ND	ND	---	---
Dibenzofuran	65.50	86.00	1,850	57.50	84.00	2,300	NA	ND	ND	---	---
Fluoranthene	1,141.54	6,900.00	11,600	1,875.00	3,200.00	10,000	NA	ND	ND	---	---
Fluorene	85.50	140.00	414	132.50	180.00	2,200	NA	ND	ND	---	---
Indeno(1,2,3-cd)pyrene	612.86	3,300.00	839,000	465.00	760.00	10,000	NA	ND	ND	---	---
Naphthalene	94.33	160.00	407	ND	ND	---	---	ND	ND	---	---
Phenanthrene	498.08	**2,000.00**	1260	1,420.00	**2,400.00**	1,900	NA	ND	ND	---	---
Phenol	32.00	32.00	912	ND	ND	---	---	ND	ND	---	---
Pyrene	1,429.23	6,900.00	33,700	1,530.00	2,500.00	10,000	NA	ND	ND	---	---
1,1,1-trichloroethane	13.00	13.00	71.5	ND	ND	---	---	ND	ND	---	---
Methylene chloride	13.75	22.00	3030	ND	ND	---	---	ND	ND	---	---
Tetrachloroethene	8.00	8.00	330	ND	ND	---	---	ND	ND	---	---
Toluene	3.00	4.00	473	ND	ND	---	---	ND	ND	---	---
Trichloroethene	22.00	22.00	887	ND	ND	---	---	ND	ND	---	---
4,4'-DDD	**15.03**	**32.00**	6.39	ND	ND	---	---	ND	ND	---	---
4,4'-DDE	**52.00**	**52.00**	3.24	4.00	4.00	10,000	NA	ND	ND	---	---
4,4'-DDT	**26.00**	**60.00**	10	ND	ND	---	---	ND	ND	---	---
Aroclor-1260	ND	ND	NA	50.00	50.00	10,000	40,000	ND	ND	---	---
Alpha-chlordane	6.40	6.40	83,000	ND	ND	---	---	ND	ND	---	---
Endosulfan sulfate	**7.20**	**7.60**	1.43	ND	ND	---	---	ND	ND	---	---
Endrin	**14.33**	**18.00**	6.07	11.00	11.00	10,000	NA	ND	ND	---	---
Endrin aldehyde	**99.50**	**140.00**	6.07	7.00	7.00	10,000	NA	ND	ND	---	---
Gamma-chlordane	7.00	7.00	9.63	ND	ND	---	---	ND	ND	---	---
Heptachlor	**2.80**	**2.80**	0.664	ND	ND	---	---	ND	ND	---	---
Methoxychlor	**37.00**	**37.00**	6.25	ND	ND	---	---	ND	ND	---	---

Attachment 4

Revised Table 2-6

TABLE 2-6 SUMMARY OF CONSTITUENTS OF CONCERN FOR SOIL AND SEDIMENT EXCEEDING PRELIMINARY REMEDIATION GOALS AT SITE 20 – AREA A WEAPONS CENTER, NAVAL SUBMARINE BASE, NEW LONDON, CONNECTICUT

			Remedial Investigation Data					PRG			
			Frequency of Detects		Range of Detects						
Scenario	Media	Chemical	Detects	Samples	Minimum (mg/kg)	Maximum (mg/kg)	UCL Concentration (mg/kg)	HHRA PRG (mg/kg)	ARAR PRG-DEC (mg/kg)	ARAR PRG-PMC (mg/kg)	Exceedance
Current Industrial Land Use	Shallow Soil	Benzo(a)anthracene	6	10	0.175	1.3	1.017	--	7.8	1	(a)
		Benzo(a)pyrene	7	10	0.175	1.3	1.017	0.65	1	1	(a, b)
		Benzo(b)fluoranthene	6	10	0.175	2.3	1.757	--	7.8	1	(a)
		Chrysene	6	10	0.175	1.4	1.093	--	780	0.960	(a)
		Dibenzo(a,h)anthracene	2	10	0.175	0.450	0.3785	--	0.78	0.0165	(a)
	Sediment	Benzo(a)pyrene	14	17	0.073	4.4	1.69	0.29	--	--	(b)
		Dibenzo(a,h)anthracene	6	17	0.052	0.87	0.473	0.29	--	--	(b)
Future Residential Land Use	Shallow Soil	Benzo(a)anthracene	6	10	0.175	1.3	1.017	--	1	1	(a)
		Beryllium	9	10	0.11	0.41	0.39	0.14	2	--	(b)
		Benzo(a)pyrene	7	10	0.175	1.3	1.017	0.12	1	1	(a, b)
		Benzo(b)fluoranthene	6	10	0.175	2.3	1.757	--	1	1	(a,b,c)
		Chrysene	6	10	0.175	1.4	1.093	--	84	0.960	(a)
		Dibenzo(a,h)anthracene	2	10	0.175	0.450	0.78	0.127	0.084	0.0165	(a,b,c)
	Sediment	Beryllium	4	15	0.275	1.1	0.55	0.19	--	--	(b)
		Benzo(a)pyrene	14	17	0.073	4.4	1.69	0.13	--	--	(b)
		Benzo(a)anthracene	16	17	0.063	3.4	1.37	1.27	--	--	(b)
		Benzo(b)fluoranthene	16	17	0.14	4.9	2.42	1.27	--	--	(b)
		Indeno(1,2,3-cd)pyrene	16	17	0.049	3.3	1.31	1.27	--	--	(b)
		Dibenzo(a,h)anthracene	6	17	0.052	0.87	0.473	0.13	--	--	(b)

(a) Exceeds PMC.
(b) Exceeds HHRA PRG.
(c) Exceeds DEC.

NOTE: PRG = Preliminary remediation goals. UCL = Upper Confidence Limit.
HHRA = Human Health Risk Assessment. PMC = Pollutant Mobility Criteria.
ARAR = Applicable or relevant and appropriate requirements.
DEC = Industrial/Commercial Direct Exposure Criteria for current industrial scenario and Residential Direct Exposure Criteria for future resident scenario.

Attachment 5

Revised Table 3-1

TABLE 3-1 SUMMARY OF INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR SITE 20 – AREA A WEAPONS CENTER, NAVAL SUBMARINE BASE, NEW LONDON, CONNECTICUT

General Response Action	Remedial Technology	Process Option	Screening Comments
No Action	None	Not Applicable	Retained for consideration as required by the National Contingency Plan.
Institutional Controls	Monitoring	Monitoring of Impacted Environmental Media	Soil and sediment monitoring retained for consideration.
	Access/Use Restrictions	Physical Barriers or Notices	Not retained – access is already controlled by existing site fencing and base security.
		Land Use Restrictions	Retained for consideration.
Containment	Capping	Single Layer Cap/ Multilayer Cap	Not retained – impacted soil is already paved and capping would not be effective for drainage swale sediment or wetland sediment.
	Surface Water Control	Revegetation/Diversion/ Collection	Not retained – stormwater system is already in-place.
Source Removal	Soil Excavation	Mechanical Excavation	Selective excavation retained for consideration
In Situ Treatment	Natural Attenuation	Monitored Natural Attenuation	Not retained – the high molecular weight PAH COC would be slow to degrade.
	Biological	Aerobic Bioremediation	Not retained – may have limited effectiveness for the specific PAH and would be difficult to implement and control in the shallow soil/sediment.
		Bioventing	Not retained – not implementable and limited effectiveness due to the shallow ground-water table.
		Biosparging	Not retained – not effective for PAH and not implementable in the vadose zone.
		Anaerobic Bioremediation	Not retained – intermediate metabolites may display toxicity; PAH would be slow to degrade and the treatment system would be difficult to control.
		Phytoremediation	Not retained – impacted soil located below pavement and not implementable in drainage swale.
	Physical/Chemical	Soil Flushing	Not retained – less cost effective than other technologies and may mobilize COC to ground water.
		Soil Vapor Extraction	Not retained – not effective for PAH and difficult to implement due to shallow ground-water table.
		Electrokinetic Remediation	Not retained – not effective for PAH and not implementable due to soil type and ionic conditions at Site 20.
		Chemical Fixation/ Solidification	Not retained – long-term effectiveness is uncertain.
		Oxidation/Reduction	Not retained – limited effectiveness for PAH and may generate undesirable by-products.
		Vitrification	Not retained – not warranted for the COC types and concentrations at Site 20.

NOTE: Shading indicates technologies/options that are not retained for further consideration.
COC = Constituents of concern.
PAH = Polycyclic aromatic hydrocarbons.

General Response Action	Remedial Technology	Process Option	Screening Comments
Ex Situ Treatment (assuming soil excavation)	Biological	Bioslurry	Not retained – not cost effective compared to other *ex situ* options.
		Land Farming	Not retained – required area not available and not cost-effective compared to other *ex situ* options.
		Biopile	Not retained – not cost effective compared to other *ex situ* options
		Composting	Not retained – required area not available and not cost-effective compared to other *ex situ* options.
	Physical/Chemical	Chemical Fixation Solidification	Not retained – limited effectiveness for PAH.
		Thermoplastic Solidification/ Stabilization	Not retained – not cost effective for small volumes.
		Soil Washing/Solvent Extraction	Not retained – not cost effective for small volumes.
		Chemical Reduction/ Oxidation	Not retained – not cost effective compared to other *ex situ* options.
		Soil Vapor Extraction Treatment Cell	Not retained – not effective for PAH.
		Dewatering	Not retained – excavation of saturated soil/sediment not anticipated.
		Size Separation	Not retained – not warranted for small volumes of excavated soil/sediment.
		Crushing-Grinding-Shredding	Not retained – not warranted for small volumes of excavated soil/sediment.
	Thermal	Thermal Desorption	Not retained – limited effectiveness for PAH and not cost-effective for small volumes.
		Incineration (pyrolysis)	Not retained – not cost effective – not warranted by the COC types and concentrations.
		Vitrification	Not retained – not cost effective – not warranted by the COC types and concentrations.
Disposal (assuming soil excavation)	Onsite	Onsite Consolidation	Not retained – not warranted by small volume; no area available at Site 20.
		Engineered Disposal Cell	Not retained – not warranted by small volume; no area available at Site 20.
	Offsite	Treatment, Storage, and Disposal Facility	Retained for consideration for disposal of excavated soil and sediment.

RESPONSE TO COMMENTS FROM THE
STATE OF CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WATER MANAGEMENT
PERMITTING, ENFORCEMENT & REMEDIATION DIVISION
FEDERAL REMEDIATION PROGRAM ON THE
DRAFT FEASIBILITY STUDY, SITE 20 – AREA A WEAPONS CENTER
NAVAL SUBMARINE BASE – NEW LONDON, GROTON, CONNECTICUT

COMMENTOR: Mark R. Lewis **DATE: 20 August 1999**

GENERAL COMMENTS

1. The Department has received and reviewed the Draft *Feasibility Study Site 20 - Area A Weapons Center Naval Submarine Base-New London, Groton, Connecticut*. The plan was dated June 1999, and was received by the Department on 24 June 1999. The report was prepared for the Navy by EA Engineering, Science, and Technology. All references in this document to CGS mean the Connecticut General Statutes, while all references to RCSA mean the Regulations of Connecticut State Agencies. The Feasibility Study adequately considers the various options for addressing the contamination at the Area A Weapons Center. The remedial options which were retained include Alternative 1-No Action, Alternative 2-Land Use Restriction, and Alternative 3-Selective Excavation and Offsite Disposal. If Alternative 3 is selected, it may not be possible to completely remove all contaminated soil due to the presence of buildings or other structures within Site 20. If this is the case, then appropriate land use restrictions will also be necessary.

   Response—Comment noted. The following text will be added to the end of the first paragraph under "Selective Excavation and Offsite Disposal" on Page 4-8:

   > *If, during confirmatory sampling, it is determined that some impacted material cannot be removed due to the proximity to buildings or other structures, then ELUR would be implemented.*

   It should also be noted that the draft final FS will contain an Alternative 3a and 3b. Alternative 3a will be similar to the existing Alternative 3 in that soil/sediment would be excavated to industrial standards and an ELUR would be implemented to prevent residential reuse of the site. Alternative 3b will specify excavation to residential standards. Under Alternative 3b, no ELUR would be needed unless soil/sediment cannot be removed due to the proximity to buildings or other structures, as noted in this comment.

2. The Feasibility Study is printed in single-sided format. It is the policy of both EPA and the State that reports and other deliverables should be printed in double-sided format to conserve paper and filing space. In the future, please submit all reports in double-sided format.

   Response—Comment noted. Deliverables will be printed in double-sided format.

SPECIFIC COMMENTS

1. ***Page ES-1 Executive Summary, Section ES.1 Scope***—The last sentence of the second paragraph states that the FS report "satisfies the requirements of the State of Connecticut Department of Environmental Protection remediation Standard Regulations." Please delete this sentence. The FS simply outlines various options for addressing contamination detected at the Area A Weapons Center. The FS does not by itself satisfy the requirements of the regulations.

   Response—Comment noted. The sentence will be deleted.

2. ***Page 1-8, Section 1.3.4 Surface Water Features***—Please clarify the second sentence of the first paragraph, which discusses the origin of the Thames. The sentence should read: "The Thames River originates in the harbor in the City of Norwich...."

   Response—Comment noted. The second and third sentences of the paragraph will be switched so that the origin of the Thames River is clarified before the drainage area is described.

3. ***Page 1-9, Section 1.3.4 Surface Water Features***—The last sentence in the second paragraph states that no surface water classification has been assigned to surface water within Site 20 or the Area A Wetland. When no surface water classification has been specifically assigned to a body of water, the classification is, by default, A. This means the water is known or presumed to meet water quality criteria that support designated uses. Designated uses include potential drinking water supply, fish and wildlife habitat, recreational use, agricultural, industrial supply, and other legitimate uses. Please revise this paragraph.

   Response—Surface water classifications do not appear to be applicable to intermittent flow within a stormwater swale. Therefore, the last sentence will be replaced with the following text:

   Surface water within the Area A Wetlands has a default classification "A," which indicates that the water is known or presumed to meet water quality criteria that support designated uses (e.g., wildlife habitat).

4. ***Page 1-16, Section 1.6.1, Exposure Assessment***—The second paragraph states that it was assumed that future residents could come into contact with all soil to a depth of 10 ft. Please note that the Direct Exposure Criteria of the Remediation Standard regulations apply to all soil to a depth of 15 ft. However, under the regulations, soils at a depth greater than 4 ft or soil more than 2 ft below a paved surface comprised of a minimum of 3 in. of bituminous concrete or concrete are considered "inaccessible soil." The Direct Exposure Criteria do not apply to inaccessible soil provided that an environmental land use restriction is in effect. The environmental land use restriction must ensure that the soil will not be exposed as a result of excavation, demolition, or other activities, and that any pavement which is necessary to render the soil inaccessible is maintained in good condition. The assumption that future residents could come into contact with soil to a depth of 15 ft appears to be sufficiently conservative.

Response—The assumption of future residents coming into contact with soil from 0 to 10 ft bgs was used during the Human Health Risk Assessment as part of the Phase II Remedial Investigation (Brown & Root 1997). For purposes of the FS, the Direct Exposure Criteria will be considered for soil to a depth of 15 ft bgs. For remedial alternatives that include an Environmental Land Use Restriction, the Direct Exposure Criteria will be considered to a depth of 4 ft bgs or 2 ft below pavement.

5. ***Page 2-1, Section 2.2, Applicable or Relevant and Appropriate Requirements***—The last sentence of the second paragraph states that a selected action must comply with "promulgated state laws... if the state ARAR is more stringent than the federal ARAR." Please revise this sentence to indicate that a selected action must also comply with adopted State regulations.

   Response—It appears that this comment pertains to the last sentence of the third paragraph under Section 2.2. In response to this CTDEP comment and EPA's specific comment No. 30, the third paragraph under Section 2.2 will be modified to read as follows:

   The national goal of remedy selection is to protect human health and the environment, to maintain protection over time, and to minimize untreated waste (40 CFR 300.430 of the NCP [55 FR 8846]). The remedial alternative must attain ARARs under federal environmental laws and state environmental or facility siting laws or provide grounds for invoking one of the waivers permitted under the statute.

6. ***Page 2-4, Section 2.2.5.1, Chemical-Specific Applicable or Relevant and Appropriate Requirements***—This section lists "Human health risk calculations for soil and sediment" as an ARAR. Please delete this reference since such calculations are neither a law nor a regulation.

   Response—Comment noted. The human health risk calculations for soil and sediment will be moved to Section 2.2.5.4 (Other Guidance to be Considered).

7. ***Page 2-5, Section 2.2.5.1, Chemical-Specific Applicable or Relevant and Appropriate Requirements, CTDEP Remediation Standards for Soil***

   a. The first paragraph paraphrases Section 22a-133k-2(e)(A) of the regulations. That section of the Regulations discusses statistical approaches to determining compliance with the Direct Exposure Criteria. The text omits two key portions (i and ii) of Subsection A. The omitted sections specify that "I) a representative sampling program consisting of not less than 20 samples of soil located above the water table has been used to characterize the distribution and concentration of such substance at the subject release area or remaining at the subject release area following remediation, (ii) the release area has not been remediated by means of excavation and removal of polluted soil." Please revise the text accordingly. The text should also discuss Subsection (B), which applies if less than 20 samples have been collected and the release area has not been remediated by means of excavation and removal of polluted soil, and subsection (C), which applies if the subject release area has been remediated by means of excavation.

Response—Section 22a-133k-2(e)(A)(i) and (ii) pertain to the application of Pollutant Mobility Criteria and not the application of Direct Exposure Criteria, which is presented in the first and second paragraphs. However, Subsections (A), (B), and (C) will be added to the last paragraph of this section, which summarizes application of Pollutant Mobility Criteria.

b. The first sentence in the second paragraph uses the acronym "PMC" without defining it as the Pollutant Mobility Criteria. Please revise.

Response—The acronym "PMC" was defined for its first use in Section 1.4.1.

c. The third sentence of this paragraph refers to "mass sediment analyses." Please note that the Remediation Standard Regulations apply only to soil. The Regulations specifically exclude sediment from the definition of "soil."

Response—Comment noted. The word "sediment" will be deleted.

d. This paragraph misstates the requirements of RCSA 22a-133k-2(c)(2)(D), which concerns polluted soils in a GB area. This paragraph must be substantially revised, or preferably, deleted. The paragraph states that for contaminants other than inorganics and PCBs, the results of mass analysis are compared to the Pollutant Mobility Criteria listed in Appendix B of the Regulations. The paragraph also says that the results of TCLP or SPLP analysis are compared to the ground-water protection criteria multiplied by 10. Actually, for all substances, the Pollutant Mobility Criteria in Appendix B may be compared directly to analytical results from the appropriate EPA method. For substances other than inorganics or PCBs, the results of mass analysis are compared directly to the Pollutant Mobility Criteria listed in Appendix B. For inorganics and PCBs, TCLP or SPLP analysis must be used instead of mass analysis. Section 22a-133k-2(c)(2)(D) of the Regulations specifies that in a GB area for substances other than total petroleum hydrocarbons, the results of a TCLP or SPLP analysis *may* be compared to the ground-water protection criterion multiplied by 10, or by another site-specific dilution factor. This option is only available if no non-aqueous phase liquids are present, as determined in accordance with the Regulations.

Response—Comment noted. The paragraph will be modified to read as follows:

> *The CTDEP regulations use PMC to ensure that there is minimal potential for movement of COCs from soil into ground water. PMC are established based on ground-water classification, constituent class (inorganic, organic, TPH, and PCB), and type of analysis (mass or Synthetic Precipitation Leaching Procedure [SPLP]/TCLP extraction). For substances other than inorganics or PCBs, the results of mass analyses are compared directly to the corresponding PMC listed in Appendix B of the regulation. For inorganics and PCBs, the PMC are based on TCLP or SPLP analyses instead of mass analyses. Section 22a-133k-2(c)(2)(D) specifies that in a GB area for substances other than total petroleum hydrocarbons, the results of a TCLP or SPLP analysis may be compared to the Ground-Water Protection Criterion (Appendix C of the regulations) multiplied by a factor of 10, or by another site-specific*

dilution factor, provided no non-aqueous phase liquids are present. A site-specific dilution factor is calculated in accordance with the procedure provided in Section 22a-133k-2(c)(2)(E)(ii).

e. The second to last sentence of the second paragraph says that where no non-aqueous phase liquid is present and the background concentration of a substance in ground water is less than the ground-water protection criterion, the results of a TCLP or SPLP analysis may be compared to the ground-water protection criteria multiplied by a calculated site-specific dilution factor. Actually, the only restriction in Section 22a-133k-2(c)(2)(D) of the Regulations is that non-aqueous phase liquids may not be present. This section does not specify that the background concentration of a substance must be less than the ground-water protection criteria. This restriction applies to all of Section D of the Regulations. In other words, if the Navy does not want to directly use the Pollutant Mobility Criteria specified in Appendix B, it may compare the results of TCLP or SPLP analysis to the ground-water protection criteria multiplied by 10 or another appropriate dilution or dilution and attenuation factor. In order to do so, the Navy must demonstrate, in accordance with the Regulations, that non-aqueous phase liquids are present.

Response—See above response.

f. The last two sentences of the third paragraph discuss the exemption from the Pollutant Mobility Criteria which is provided for "isolated soil." Please use the full term "environmentally isolated soil." Please also use the full definition for environmentally isolated soil, as specified in RCSA 22a-133k-1(a)(15). This paragraph also discusses statistical approaches to determining compliance with the Pollutant Mobility Criteria. The approaches cited may be used only if the release area has not been remediated by means of excavation and removal of polluted soil. If the release area is remediated through excavation and removal of polluted soil, then the results of all laboratory analyses of samples from the subject release area must be equal to or less than the Pollutant Mobility Criteria.

Response—As stated above, a summary of Section 22a-133k-2(e)(A), (B), and (C) will be added to the last paragraph of this section. The last two sentences will be modified to read as follows:

PMC do not apply to "environmentally isolated soil," which includes soil located beneath a building or other permanent structure that would prevent the migration of pollutants, soil that is not a continuing source of pollution, soil that is not polluted with volatile organic substances, and soil that is above the seasonal high water table.

8. ***Page 2-5, Section 2.2.5.1, Chemical-Specific Applicable or Relevant and Appropriate Requirements, Human Health Risk Calculations for Soil and Sediment***—Please correct the last sentence. The correct reference is to the EPA Region III Risk-Based Concentration Tables, rather than Region II.

Response—Comment noted. The last sentence in the first paragraph of this section will be modified to read:

...and the current EPA Region III Risk-Based Concentration table was consulted.

9. ***Page 2-6, Section 2.2.5.1, Chemical-Specific Applicable or Relevant and Appropriate Requirements***—Please correct the typo at the end of the second sentence, first paragraph. "CFS" should be "CSF." The paragraph discusses the 10E-6 to 10E-4 lifetime incremental cancer risk range considered acceptable by EPA. It should also discuss the lifetime incremental cancer risk considered acceptable by the State. The Remediation Standard Regulations are based on an incremental cancer risk of 1E-6 for individual chemicals, and an incremental risk of 1E-5 for the cumulative effect of multiple chemicals.

   Response—The typo "CFS" will be corrected to read "CSF." The following text will be added to the end of the paragraph:

   Under the State of Connecticut Remediation Standard Regulations, incremental cancer risks are considered to be acceptable below 1×10^{-6} for individual chemicals and below 1×10^{-5} for the cumulative effect of multiple chemicals.

   Note that the section "Human Health Risk Calculations for Soil and Sediment" will be moved to Section 2.2.5.4 – Other Guidance to be Considered.

10. ***Page 2-6, Section 2.2.5.2, Location-Specific Applicable or Relevant and Appropriate Requirements***—Please include the Coastal Management Act (CGS 22a-90 to 112) as an applicable requirement here and in Table 2-2.

    Response—Comment noted. The Coastal Management Act will be added to Section 2.2.5.2 and the Location-Specific ARAR table for Alternative 3 which includes excavation of impacted soil/sediment (see revised ARAR tables in Attachment 1). Alternatives 1 and 2 include institutional controls and/or sampling only (no modifications within the coastal zone).

11. ***Page 2-7, Section 2.2.5.3, Action-Specific Applicable or Relevant and Appropriate Requirements***

    a. A number of additional state laws and regulations should be cited here and in Table 2-3. These include the State's Hazardous Waste Management Regulations (RCSA 22a-449(c)100 to 110), the State's Water Discharge Permitting Regulations (RCSA 22a-430-1 to 8), Water Pollution Control Statutes (CGS 22a-430, 22a-430b), Water Pollution Control Regulations (RCSA 22a-430-1 to 8), Inland Wetland Regulations (RCSA 22a-39-1 to 15), Air Pollution Control Regulations (RCSA 22a-174-1 to 29), Control of Noise Regulations (RCSA 22a-69-1 to 7.4), Well Drilling Regulations (RCSA 25-128-33 to 64), Well Drilling Statutes (CGS 25-126 to 25-131), and the Connecticut Council on Soil and Water Conservation Guidelines for Soil Erosion and Sediment Control. A complete list of ARARs is attached to this letter.

Response—Attachment 1 contains revised ARAR tables that are based on CTDEP and EPA comments. Many of the additional ARARs noted by CTDEP have been incorporated. However, some of the regulations noted by CTDEP do not apply to the remediation of Site 20. Regulations pertaining to well drilling are not included because no ground-water wells will be installed as part of the remedial alternative in this FS for soil and sediment (ground water at Site 20 is being addressed separately). EPA Comment No. 46 indicates that offsite transportation regulations (RCSA 22a-449[c]103) are not ARARs for Site 20. RSCA 22a-449(c)106 does not apply to Site 20 because there are no waste oils, spent lead acid batteries, etc. to be addressed. CGS 22a-454 does not apply because the Site 20 remedy does not pertain to oils or chemical liquids. As a guidance manual, Connecticut Guidelines for Soil Erosion and Sediment Control will have the status of "To Be Considered" rather than "Applicable."

b. The third bullet point should discuss more completely the Connecticut Water Quality Standards. The standards were adopted in accordance with CGS 22a-426. The Surface Water Quality Standards became effective on 15 May1992 while the Ground-Water Quality standards became effective on 12 April 1996.

Response—Comment noted. The third bullet will be modified as follows:

State of Connecticut Water Quality Standards (Connecticut General Statutes Section 22a-426).

The associated text following the bullets will be modified to read as follows:

Connecticut Water Quality Standards

The Connecticut Water Quality Standards were adopted in accordance with Connecticut General Statutes Section 22a-426. The Surface Water Quality Standards became effective on 15 May 1992. The Ground-Water Quality standards became effective on 12 April 1996. Connecticut Water Quality Standards will be relevant where remedial actions at Site 20 result in a discharge of treated water to surface or ground water. Discharge limits are set under the Connecticut Water Pollution Control regulations (Regulations of Connecticut State Agencies Sections 22a-430-1 through 8) for discharge to surface water to ensure that discharges do not result in non-compliance in the receiving waterbody with descriptive or numeric criteria for specific pollutants applicable to that surface water's classification. The specific surface water discharge limit may allow a designated zone of influence based on available dilution.

12. ***Page 2-9, Section 2.2.5.3, Action-Specific Applicable or Relevant and Appropriate Requirements***—The discussion regarding the Inland Wetlands and Watercourses Act states that the Subase "is exempt from the Wetlands and Watercourses Act within the Town of Groton, with exemption in the Town of Ledyard requiring approval." This statement is incorrect and must be revised. Under CERCLA, the Inland Wetlands and Watercourses Act

is an ARAR. As such, the work at Site 20 must comply with the substantive requirements of the Inland Wetlands and Watercourses Act. The Navy is not required to comply with administrative and procedural requirements.

Response—Comment noted. The text will be changed to read as follows:

Connecticut Inland Wetland and Watercourses Act

The Connecticut Inland Wetland and Watercourses Act may be applicable where remedial actions will result in alteration or use of a wetland or watercourses. The Connecticut Inland Wetland and Watercourses Act was established for the preservation and protection of wetlands and watercourses from random, unnecessary, undesirable, and unregulated uses, and disturbance or destruction. All remedial activities in wetlands or watercourses that involve filling, excavating, dredging, clear cutting, clearing, or grading or any other alteration or use of a wetland or watercourse not specifically permitted by Section 22a-40, and otherwise defined as a regulated activity by these regulations will meet the substantive requirements of these regulations.

13. ***Page 2-9, Section 2.2.5.4, Other Guidance to be Considered***—The Federal Clean Air Act is listed here as "To Be Considered." The Federal Clean Air Act, and the corresponding state regulations and statutes, are Action-Specific, Applicable Requirements. As such, they should be listed in Section 2.2.5.3, rather than here.

    Response—Comment noted. The Clean Air Act and Connecticut Air Pollution Control Act sections in Subsection 2.2.5.4 will be moved to Section 2.2.5.3, "Action-Specific ARARs." See also Response to EPA Specific Comment No. 50.

14. ***Page 2-13, Section 2.4.1, Development of Preliminary Remediation Goals***—The third paragraph discusses the criteria used in human health risk assessment. It states that the incremental cancer risk level of 1E-5 was used in screening potential cancer risks to develop preliminary remedial goals. It notes that 1E-5 is the State's threshold level. Please note that under the Remediation Standard Regulations, the acceptable incremental cancer risk due to individual chemicals is 1E-6. The 1E-5 risk level applies to the cumulative risk posed by multiple chemicals.

    Response—Comment noted. The individual risk-based PRG will be developed using a level of 1×10^{-6}. The remedial alternatives will be protective of human health for 1×10^{-6} risk for individual COC and 1×10^{-5} for cumulative effects. The text will be changed to read as follows:

    For each scenario, individual COCs which contributed at least 1×10^{-6} to the incremental cancer risk or 1.0 to the HI were selected. If the risk or hazard values approached these levels, the contributing COCs were also included in the PRG calculations.

15. ***Page 2-14, Section 2.4.1, Development of Preliminary Remediation Goals, Connecticut Preliminary Remediation Goals***—The fourth paragraph states that "shallow soil is defined as less than 4 ft below ground surface." Please clarify that this definition is made by the Navy. The regulations do not distinguish between shallow soil and deeper soil. The Direct Exposure Criteria apply to soil within 15 ft of the surface. However, the regulations specify that soil below a depth of 4 ft is considered "inaccessible." The Direct Exposure Criteria do not apply to inaccessible soil, providing that an environmental land use restriction is in effect to ensure that the soil will not be exposed as a result of excavation, demolition, or other activities. Therefore, 4 ft of clean fill are required above any soil with contamination which exceeds the Direct Exposure Criteria.

Response—Comment noted. The fourth paragraph will be modified to read as follows:

The regulations stipulate that, "direct exposure criteria for substances other than PCBs do not apply to inaccessible soil provide an ELUR is in effect," where "inaccessible soil" is defined as being more than 4 ft below the ground surface, 2 ft below a paved surface, or below a building or other permanent structure. For purposes of this FS, shallow soil is defined as less than 4 ft below ground surface and deep soil is defined as greater than 4 ft below ground surface.

16. ***Page 2-15, Section 2.4.2, Accommodations of Preliminary Remediation Goals and Applicable or Relevant and Appropriate Requirements***

a. The second paragraph states that in certain cases "technical limitations and costs may prevent the development of alternatives that comply with all ARAR and PRG." As an example, it states that in areas that pose relatively low risk, capping may be combined with institutional controls. The cited example is not relevant to the situation. Capping and institutional controls are often selected as a remedy, but selection of these options does not mean that any ARARs have been waived. If a selected remedy does not comply with Federal or State ARARs, then the Navy must obtain a specific waiver of those ARARs.

Response—Comment noted. The text in Section 2.4.2 will be modified to read as follows:

The PRGs differ between the two land use scenarios and their associated receptors. The PRGs for current industrial land use and its associated receptors (i.e., full-time employees and construction workers) are less stringent than the PRGs associated with the primary receptor under the future residential land use scenario (i.e., future residents).

Site 20 will remain industrial use. Therefore, soil PRGs were selected to comply with numerical soil cleanup standards established by the State of Connecticut for the protection of human health, that is, PMC and ICDEC for the current industrial land use. These standards and the associated exposure scenarios are not applicable to sediment. Consequently, human health risk-based PRGs were calculated for sediment in the drainage ditches and contiguous portion of the Area A Wetland at Site 20.

b. The third paragraph states that total excavation and disposal will not be considered because Site 20 is surrounded by extensive wetlands and has a shallow ground-water table, and excavation would involve greater risk to the environment than other options. This is not a valid reason for rejecting total excavation. The Navy is about to begin extensive excavation of pesticide-contaminated sediments and soil in the nearby Area A Downstream Watercourses (Site 3). As part of the remedy, the excavated area will be restored and improved. A more legitimate reason for not considering total excavation within the Area A Weapons Center is that total excavation would interfere with ongoing operations and would require that existing buildings be removed.

Response—See the preceding response regarding text revisions to Section 2.4.2. The rationale for not retaining total excavation will be presented in Section 3.1.3.1, and will include the rationale that whole-site excavation would interfere with ongoing base operations and would require that existing buildings be removed.

17. ***Page 2-16, Section 2.5, Area of Attainment***—The report states because an environmental land use restriction to prevent residential use of the property will be put into place, remedial alternatives will address contaminants above the water table. Please note that the Direct Exposure Criteria apply to all soils to a depth of 15 ft, whether those soils are above or below the water table. The regulations provide that the Pollutant Mobility Criteria do not apply to soils below the seasonal low water table in a GA area, or above the seasonal high water table in a GB area.

Response—Comment noted. The application of Direct Exposure Criteria and Pollutant Mobility Criteria is summarized in Sections 2.2.5.1 and 2.4.1 (see also responses to CTDEP Comments No. 7 and 15). Direct Exposure Criteria will be applied to a depth of 15 ft bgs for soil that is not "inaccessible." Pollutant Mobility Criteria will be applied to soil above the seasonal high water table (in this GB area) for soil that is not "environmentally isolated." Based on re-evaluation of the data with respect to risk-based and ARAR-based PRGs, Section 2.5 will be modified to read as follows:

2.5 AREA OF ATTAINMENT

The remedial alternatives developed in Chapter 4 will address COC concentrations that exceed risk-based and ARAR-based PRGs in sediment and soil at Site 20. Specific areas where COC concentrations exceeded PRGs for current industrial and future residential land use scenarios, and for which remedial alternatives will be developed, are summarized below:

Current Industrial Land Use

- ***Drainage Area 1***— *Soil with PAH concentrations in excess of PMC is located at 2WCTB2 from 0 to 2 ft under pavement. Sediment with COC concentrations in excess of HHRA risk-based PRGs occur along the drainage swales at 2WCSD2 and 2WCSD3 (0-1 ft bgs) and in the Area A Wetlands at 2WCSD14 from 0 to 1 ft bgs (Figure 2-1).*
- ***Drainage Area 2***—*No COC concentrations exceeded PRGs.*

- ***Drainage Area 3***—*Sediment with COC concentrations in excess of HHRA risk-based PRGs is concentrated outside of the Site 20 fenced area in the Area A Wetlands at 2WCSD4 and 2WCSD7 from 0 to 1 ft bgs (Figure 2-1).*

Future Residential Land Use

- ***Drainage Area 1***— *Soil with PAH concentrations in excess of PMC and RDEC is located at 2WCTB2 from 0 to 2 ft under pavement. Soil and sediment with PAH and inorganic concentrations in excess of HHRA risk-based PRGs occur along the drainage swales at 2WCSD1, 2WCSD2, and 2WCSD3 (0-1 ft bgs), and 2WCTB3 (4-6 ft bgs); under the pavement at 2WCTB2 (0-2 ft bgs), 2WCTB5 (6-8 ft bgs), and 2WCTB6 (8-10 ft bgs); and in the Area A Wetlands at 2WCSD14 (Figure 2-2).*
- ***Drainage Area 2***—*Sediment with a COC concentration in excess of HHRA risk-based PRGs occur in the drainage swale at 2WCSD10 from 0 to 1 ft bgs (Figure 2-2).*
- ***Drainage Area 3***—*Soil and sediment with COC concentrations in excess of HHRA risk-based PRGs is concentrated outside of the Site 20 fenced area in the Area A Wetlands at 2WCSD4 (0-1 ft bgs), 2WCSD5 (0-1 ft bgs), 2WCSD7 (0-1 ft bgs), 2WCMW1S (0-2 ft bgs), 2WCTB1 (0-2 ft bgs), 2WCTB4 (2-4 ft bgs), 2WCTB7 (8-10 ft bgs), and 2WCTB8 (10-12.6 ft bgs) (Figure 2-2).*

18. ***Table 2-1, Summary of Chemical-Specific Applicable or Relevant and Appropriate Requirements***—The table states that the direct exposure and Pollutant Mobility Criteria will be used to develop preliminary remediation goals for soils less than 2 ft below paved surfaces or less than 4 ft below unpaved surfaces. This approach does not consider the requirements of the Pollutant Mobility Criteria. The Regulations provide an exemption from the Pollutant Mobility Criteria for "environmentally isolated soils." Environmentally isolated soils are defined in part as soils that are "beneath an existing building or beneath another existing and permanent structure which the Commissioner has determined in writing would prevent the migration of pollution." The Department does not recognize soil that is beneath pavement as meeting the definition of "environmentally isolated soil." The Pollutant Mobility Criteria still apply to all soils beneath pavement and above the seasonal high water table.

    Response—Comment noted. The applicability of Direct Exposure Criteria to accessible soil and Pollutant Mobility Criteria to environmentally isolated soil will be corrected in Sections 2.2.5.1 and 2.4.1 (see also responses to CTDEP Comment Nos. 7 and 15). The "Action to be Taken to Meet ARAR" for the Connecticut RSR will be simplified to read as follows (see revised ARAR tables in Attachment 1):

    Direct exposure criteria and PMC will be used for the development of PRGs for soil.

19. ***Table 2-2, Summary of Location-Specific Applicable or Relevant and Appropriate Requirements***—This table should include statutory or regulatory citations of the listed laws and regulations. Please add the location specific ARARs in the attached table to Table 2-2.

    Response—Comment noted. The statutory or regulatory citations will be added (see revised ARAR tables in Attachment 1).

20. ***Table 2-3, Summary of Action-Specific Applicable or Relevant and Appropriate Requirements***

a. This table should include statutory or regulatory citations of the listed laws and regulations. Please add the action specific ARARs in the attached table to Table 2-3.

Response—Comment noted. The statutory or regulatory citations will be added (see revised ARAR tables in Attachment 1).

b. This table lists the State's Air Pollution Control Regulations as requirements To Be Considered. Please change the status of our regulations to Applicable. The Air Pollution Control Regulations would apply to any remedial option which would produce air emissions.

Response—Comment noted. The Connecticut Air Pollution Control Act will be moved to the "action-specific" table with the status of "applicable" (see revised ARAR tables in Attachment 1).

c. It is unclear why the State's Hazardous Waste Management Regulations are listed twice in this table.

Response—Comment noted. The first reference pertaining to onsite treatment will be deleted because no alternatives that include onsite treatment were developed.

d. For the Connecticut Inland Wetlands and Watercourses Act, please specify more clearly how "onsite treatment of soil will meet these requirements." If another remedial alternative is selected, will it meet the requirements of the act also? The Action to be Taken to Meet ARAR column should specify that any selected remedial action will comply with the substantive requirements of the act.

Response—Comment noted. The "action to be taken" will be changed to state that the remedial alternatives will meet the substantive requirements of this regulation (see revised ARAR tables in Attachment 1).

21. ***Table 2-5, Connecticut Preliminary Remediation Goals for Soil***

a. Please ensure that this table properly lists the units for the Pollutant Mobility Criteria for all contaminants. The Pollutant Mobility Criteria for volatile and semivolatile organic compounds, and pesticides are for a solid matrix and are expressed in mg/kg. The Pollutant Mobility Criteria for inorganics and PCBs are for a TCLP or SPLP leachate extract and are expressed in mg/l. This table does not list Pollutant Mobility Criteria for any of the metals. Appendix B to the Remediation Standard Regulations lists Pollutant Mobility Criteria for many metals. They should be included in this table. The Navy must propose and receive approval for Pollutant Mobility and/or Direct Exposure Criteria for any metals or other pollutants which are part of the release but for which criteria are not listed in the Regulations.

Response—The units for the PMC will be corrected to show mg/kg for VOCs, SVOCs, and pesticides, and mg/L (TCLP/SPLP) for inorganics and PCBs. PMC for inorganics will be added to the table (see revised table in Attachment 2).

b. Some of the criteria listed in the table are incorrect. They are not the criteria listed in the Appendices to the Remediation Standard Regulations or the list of Approved Criteria for Additional Polluting Substances which was released by the Department on 30 April 1999. The incorrectly listed criteria are listed in the table below, together with the correct criteria:

Parameter	Residential DEC Listed by Navy (mg/kg)	Residential DEC	Industrial Commercial DEC Listed by Navy	Industrial/ Commercial DEC	GB Pollutant Mobility Criteria Listed by Navy	GB Pollutant Mobility Criteria
2-methyl naphthalene	1,000	474	2,500	2,500	56	98
Benzo(g,h,i)perylene	1,000	1,000	2,500	2,500	56	42
Benzoic acid	0	1,000	0	2,500	0	1,000
Carbazole	31	31	290	290	0.36	1
Chrysene	84	84	780	780	0.96	1
Indeno(1,2,3-cd)pyrene	0.84	1	7.8	7.8	0.017	1
Phenanthrene	1,000	1,000	2,500	2,500	56	40
4,4'-DDD	2.6	2.6	24	24	0.029	**
4,4'-DDE	1.6	1.8	17	17	0.21	**
4,4'-DDT	1.6	1.8	17	17	0.21	**
Endrin	20	20	610	610	0*	*
Endrin aldehyde	20	20	610	610	0*	*
Cobalt	1,000	**	2,500	**	*	*
Manganese	1,600	*	47,000	*	*	*

* Navy must calculate and seek approval for criteria.
** Navy must submit calculated criteria for approval.

Please refer to Sections 22a-133k-2(b)(4) and 22a-133k-2(c)(5) of the regulations for information that must accompany a request for approval of criteria for additional polluting substances in soil.

Response—Comment noted. The criteria will be corrected (see Attachment 2 for the revised table).

22. ***Page 4-5, Section 4.3.2.1, Land Use Restriction***—The text states that if the base is transferred to a non-Federal owner, then a deed restriction would be put into place. Please specify here that an environmental land use restriction in the form prescribed by the regulations would be recorded.

Response—Comment noted. The text will be changed to read as follows:

Land Use Restriction

Institutional controls will be implemented to prevent/control future contact with elevated concentrations of COC in soil and sediment. Under the State Remediation Standards, ELUR cannot be established until a deed is created for the parcel. Because there are no deeds currently for NSB-NLON, the Base Master Plan would need to include a requirement that stated if the site was ever sold, that upon the creation of a deed, ELUR would be recorded in accordance with the applicable federal, state, and local standards. ELUR, recorded in the Base Master Plan and in any future property transfer documents, will be required to: (1) prevent future residential contact with COCs in sediment that exceed risk-based PRGs; (2) prevent future contact with COCs in soil that exceed direct exposure criteria; and (3) prevent removal of asphalt over areas where COCs in soil exceed PMC. ELUR would include limitations to construction activities at Site 20 to maintain the asphalt integrity and prevent infiltration of precipitation that could result in migration of COCs into ground water. ELUR would cover the extent of Site 20 and be maintained for as long as COCs are presented above standards. Unless additional remediation is undertaken, Site 20 could not be redeveloped for residential land use.

23. ***Table 4-2, Summary of Comparative Analysis of Remedial Alternatives, Reduction of Toxicity, Mobility, and Volume Through Treatment***—For alternative 3, in the "degree to which treatment is irreversible" row, replace "Selective excavation would be irreversible" with "No treatment included."

Response— The referenced text will be changed as follows:

Treatment processes used and material treated:
No treatment included. However, COCs in soil/sediment would be excavated and disposed at an offsite, licensed facility.

Hazardous material destroyed or treated:
No treatment included. However, COCs in soil/sediment would be excavated and disposed at an offsite, licensed facility.

Type and quantity of residuals remaining after treatment:
No treatment included. However, COCs in soil/sediment would be excavated to meet risk-based PRGs and PMC.

Degree to which treatment is irreversible:
No treatment included. However, excavation and offsite disposal of impacted soil/sediment would be irreversible.

Statutory preference for treatment:
Does not satisfy the preference for direct treatment of COCs. However, does satisfy the preference to remediate COC concentrations at the site.

24. ***References***—Please cite the most recent version of the State's Water Quality Standards. The Surface Water Quality Standards became effective 15 May 1992, while the Ground-Water Quality Standards became effective 12 April 1996.

    Response—ARARs are presented in Chapter 2; therefore, the Connecticut Water Quality Standards and the Connecticut Remediation Standard Regulations will be removed from the reference list. The reference list will include only previous investigation and guidance documents used to support the FS. The effective dates of the Surface Water Quality Standards and the Ground-Water Quality Standards will be added to Chapter 2 (see also Response to CTDEP Comment No. 11).

25. ***Appendix B-3, Alternative 3: Selective Excavation***—Please check the total costs for each line item. Several of the extended costs listed are not equal to the unit cost multiplied by the quantity.

    Response—Comment noted. The discrepancy was due to the unit costs being displayed in the table as rounded-off to the nearest whole dollar amount, whereas the calculations did not use rounded-off unit costs. The cost calculations will be corrected.

Attachment 1

Revised ARAR Tables

TABLE 4-2 ASSESSMENT OF CHEMICAL-, LOCATION-, AND ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND TO BE CONSIDERED GUIDANCE FOR ALTERNATIVE 1 – NO ACTION SITE 20 – AREA A WEAPONS CENTER, NAVAL SUBMARINE BASE, NEW LONDON, CONNECTICUT

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
FEDERAL				
Chemical-Specific				
Cancer Slope Factors		To Be Considered	These are guidance values used in risk assessment to evaluate the potential carcinogenic hazard caused by exposure to contaminants.	The No Action Alternative would provide no protection from risk posed by constituents of concern in the soil and sediment.
Reference Dose		To Be Considered	These are guidance values used in risk assessment to evaluate the potential carcinogenic or non-carcinogenic hazard caused by exposure to contaminants.	The No Action Alternative would provide no protection from risk posed by constituents of concern in the soil and sediment.
Location-Specific				
Clean Water Act, Section 404	33 USC 1344; 40 CFR Part 230 and 33 CFR parts 320-323	Applicable	These rules regulate the discharge of dredge and fill materials in wetlands and navigable waters. Such discharges are not allowed if practicable alternatives are available.	Includes potential monitoring activities within wetlands and ditches during the 5-year reviews. Measures will be taken to minimize adverse effects and to replace or restore protected wetland functions and values.
Executive Order 11990 RE: Protection of Wetlands	Executive Order 11990, 40 CFR Part 6, Appendix A	Applicable	This Order requires federal agencies to take action to avoid adversely impacting wetlands wherever possible, to minimize wetlands destruction and to preserve the values of wetlands, and to prescribe procedures to implement the policies and procedures of this Executive Order.	Includes potential monitoring activities within wetlands and ditches during the 5-year reviews. Measures to minimize adverse effects and to replace or restore protected wetland functions and values will be considered and incorporated into any plan or action wherever feasible.
Fish and Wildlife Coordination Act	16 USC Part 661 *et seq.* 40 CFR 122.49	Applicable	This order protects fish and wildlife when federal actions result in control or structural modification of a natural stream or body of water.	Appropriate agencies would be consulted prior to implementation to find ways to minimize adverse effects to fish and wildlife from potential monitoring activities within wetlands and waterways during the 5-year reviews.
Action-Specific				
None				

NOTE: ARAR = Applicable or relevant and appropriate requirements.
CFR = Code of Federal Regulations.
USC = United States Code.

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
STATE OF CONNECTICUT				
Chemical-Specific				
Remediation Standard Regulations	RCSA 22a-133k -1 through 3	Applicable	Adopted on 30 January 1996 under the statutory authority provided by CGS 22a-133k, these regulations contain numeric Direct Exposure Criteria and Pollutant Mobility Criteria for constituents in soil based on either industrial or residential use of the site. Requirements are based on ground water in the area being classified by the state as GB.	The No Action Alternative does not satisfy state standards for either site remediation nor for sufficient engineering controls to prevent risk to human health and the environment.
Location-Specific				
Inland Wetlands and Watercourses	CGS § 22a-36 through 45, RCSA § 22a-39-1 through 15 (Surface Water and Wetlands); CGS § 22a-45a (General Permit Requirements)	Applicable	These statutes regulate any operation in or affecting a wetland or watercourse involving removal or deposition of material or any obstruction, construction, alteration, or pollution of such wetlands. CGS § 22a-45a authorizes the Commissioner to adopt a general permit for various minor activities including installation of water quality monitoring equipment, excavation of test pits, and core sampling.	Monitoring activities within the Area A Wetlands will meet the substantive requirements of these statutes.
Action-Specific				
Hazardous Waste Management: Generator and Handler Requirements – General Requirements, Listing, and Identification	RCSA § 22a-449(c) 100-101	Applicable	Connecticut is delegated to administrate the federal Resource Conservation and Recovery Act statute through its state regulations. These sections establish standards for listing and identification of hazardous waste. The standards of 40 CFR 260-261 are incorporated by reference.	Hazardous waste determinations will be performed on all impacted material generated during monitoring activities conducted during the 5-year reviews to determine that the levels of regulated constituents do not exceed applicable limits. Constituents of concern which exceed applicable limits will be managed in accordance with requirements of these regulations, if necessary.

NOTE: RCSA = Regulations of Connecticut State Agencies.
CGS = Connecticut General Statutes.

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Hazardous Waste Management: Generator Standards	RSCA § 22a-449(c) 102	Relevant and Appropriate	This section establishes standards for various classes of generators. The standards of 40 CFR 262 are incorporated by reference. Storage requirements given at 40 CFR 265.15 are also included.	Investigation-derived waste from monitoring events will be handled in accordance with these requirements.
Hazardous Waste Management: TSDF Standards	RCSA § 22a-449 (c) 104	Applicable	This section establishes standards for treatment, storage, and disposal of hazardous waste, and establishes standards for closure and post-closure care. The standards of 40 CFR 264 are incorporated by reference.	Any hazardous waste which is temporarily stored on this site as part of the monitoring activities for the 5-year reviews will be managed in accordance with the requirements of this section.
Hazardous Waste Management: Interim Status Facilities and Ground-Water Monitoring Requirements, Closure, and Post-Closure Requirements	RCSA § 22a-449 (c) 105	Relevant and Appropriate	This section establishes interim status standards for treatment, storage, and disposal of hazardous waste, and establishes standards for closure, post closure, and ground-water monitoring. The standards of 40 CFR 265 are incorporated by reference. The Commissioner may require ground-water monitoring based on site-specific standards.	Investigation-derived waste from monitoring activities will be handled in accordance with these requirements.
Hazardous Waste Management: Permit Requirements	RCSA § 22a-449 (c) 110	Relevant and Appropriate	This section incorporates by reference the federal hazardous waste permitting requirements given at 40 CFR 270 and 124.	Handling of investigation-derived waste would comply with the substantive requirements of this section.

TABLE 4-3 ASSESSMENT OF CHEMICAL-, LOCATION-, AND ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND TO BE CONSIDERED GUIDANCE FOR ALTERNATIVE 2 – ENVIRONMENTAL LAND USE RESTRICTION SITE 20 – AREA A WEAPONS CENTER, NAVAL SUBMARINE BASE, NEW LONDON, CONNECTICUT

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
FEDERAL				
Chemical-Specific				
Cancer Slope Factors		To Be Considered	These are guidance values used in risk assessment to evaluate the potential carcinogenic or non-carcinogenic hazard caused by exposure to contaminants.	The Alternative would limit exposure to constituents of concern in the soil and sediment through institutional controls.
Reference Dose		To Be Considered	These are guidance values used in risk assessment to evaluate the potential carcinogenic or non-carcinogenic hazard caused by exposure to contaminants.	The Alternative would limit exposure to constituents of concern in the soil and sediment through institutional controls.
Location-Specific				
Clean Water Act, Section 404	33 USC 1344; 40 CFR Part 230 and 33 CFR parts 320-323	Applicable	These rules regulate the discharge of dredge and fill materials in wetlands and navigable waters. Such discharges are not allowed if practicable alternatives are available.	Includes potential monitoring activities within wetlands and ditches during the 5-year reviews. Measures will be taken to minimize adverse effects and to replace or restore protected wetland functions and values.
Executive Order 11990 RE: Protection of Wetlands	Executive Order 11990, 40 CFR Part 6, Appendix A	Applicable	This Order requires federal agencies to take action to avoid adversely impacting wetlands wherever possible, to minimize wetlands destruction and to preserve the values of wetlands, and to prescribe procedures to implement the policies and procedures of this Executive Order.	Includes potential monitoring activities within wetlands and ditches during the 5-year reviews. Measures to minimize adverse effects and to replace or restore protected wetland functions and values will be considered and incorporated into any plan or action wherever feasible.
Fish and Wildlife Coordination Act	16 USC Part 661 *et seq.* 40 CFR 122.49	Applicable	This order protects fish and wildlife when federal actions result in control or structural modification of a natural stream or body of water.	Appropriate agencies would be consulted prior to implementation to find ways to minimize adverse effects to fish and wildlife from potential monitoring activities within wetlands and waterways during the 5-year reviews.
Action-Specific				
None				

NOTE: ARAR = Applicable or relevant and appropriate requirements.
CFR = Code of Federal Regulations.
USC = United States Code.

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
STATE OF CONNECTICUT				
Chemical-Specific				
Remediation Standard Regulations	RCSA 22a-133k-1 through 3	Applicable	Adopted on 30 January 1996 under the statutory authority provided by CGS 22a-133k, these regulations contain numeric Direct Exposure Criteria and Pollutant Mobility Criteria for constituents in soil based on either industrial or residential use of the site. Requirements are based on ground water in the area being classified by the state as GB.	Land use controls would limit direct exposure to constituents of concern in soil to acceptable levels under industrial use. The Alternative does not meet residential use standards, but does prevent residential use of the site.
Location-Specific				
Inland Wetlands and Watercourses	CGS § 22a-36 through 45, RCSA § 22a-39-1 through 15 (Surface Water and Wetlands); CGS § 22a-45a (General Permit Requirements)	Applicable	These statutes regulate any operation in or affecting a wetland or watercourse involving removal or deposition of material or any obstruction, construction, alteration, or pollution of such wetlands. CGS § 22a-45a authorizes the Commissioner to adopt a general permit for various minor activities, including installation of water quality monitoring equipment, excavation of test pits, and core sampling.	Monitoring activities within the Area A Wetlands will meet the substantive requirements of these statutes.
Action-Specific				
Hazardous Waste Management: Generator and Handler Requirements – General Standards, Listing, and Identification	RCSA § 22a-449(c) 100-101	Applicable	Connecticut is delegated to administrate the federal Resource Conservation and Recovery Act statute through its state regulations. These sections establish standards for listing and identification of hazardous waste. The stndards of 40 CFR 260-261 are incorporated by reference.	Hazardous waste determinations will be performed on all impacted material generated during monitoring activities conducted during the 5-year reviews to determine that the levels of regulated constituents do not exceed applicable limits. Constituents of concern which exceed applicable limits will be managed in accordance with requirements of these regulations, if necessary.
Hazardous Waste Management: Generator Standards	RSCA § 22a-449(c) 102	Relevant and Appropriate	This section establishes standards for various classes of generators. The standards of 40 CFR 262 are incorporated by reference. Storage requirements given at 40 CFR 265.15 are also included.	Investigation-derived waste from monitoring events will be handled in accordance with these requirements.

NOTE: RCSA = Regulations of Connecticut State Agencies.
CGS = Connecticut General Statutes.

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Hazardous Waste Management: TSDF Standards	RCSA § 22a-449 (c) 104	Applicable	This section establishes standards for treatment, storage, and disposal of hazardous waste, and establishes standards for closure and post-closure care. The standards of 40 CFR 264 are incorporated by reference.	Any hazardous waste which is temporarily stored on this site as part of the remedy will be managed in accordance with the requirements of this section.
Hazardous Waste Management: Interim Status Facilities and Ground-Water Monitoring Requirements, Closure, and Post-Closure Requirements	RCSA § 22a-449 (c) 105	Relevant and Appropriate	This section establishes interim status standards for treatment, storage, and disposal of hazardous waste, and establishes standards for closure, post closure, and ground-water monitoring. The standards of 40 CFR 265 are incorporated by reference. The Commissioner may require ground-water monitoring based on site specific standards.	Investigation-derived waste from monitoring activities will be handled in accordance with these requirements.
Hazardous Waste Management: Permit Requirements	RCSA § 22a-449 (c) 110	Relevant and Appropriate	This section incorporates by reference the federal hazardous waste permitting requirements given at 40 CFR 270 and 124.	Handling of investigation-derived waste would comply with the substantive requirements of this section.

TABLE 4-4 ASSESSMENT OF CHEMICAL-, LOCATION-, AND ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND TO BE CONSIDERED GUIDANCE FOR ALTERNATIVE 3 – EXCAVATION/DREDGING OF SOILS/SEDIMENTS AND OFFSITE DISPOSAL SITE 20 – AREA A WEAPONS CENTER, NAVAL SUBMARINE BASE, NEW LONDON, CONNECTICUT

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
		FEDERAL		
Chemical-Specific				
Cancer Slope Factors		To Be Considered	These are guidance values used in risk assessment to evaluate the potential carcinogenic or non-carcinogenic hazard caused by exposure to contaminants.	The Alternative would eliminate exposure to constituents of concern in the sediment and soil through excavation and offsite disposal.
Reference Dose		To Be Considered	These are guidance values used in risk assessment to evaluate the potential carcinogenic or non-carcinogenic hazard caused by exposure to contaminants.	The Alternative would eliminate exposure to constituents of concern in the sediment and soil through excavation and offsite disposal.
Location-Specific				
Clean Water Act, Section 404	33 USC 1344; 40 CFR Part 230 and 33 CFR Parts 320-323	Applicable	These rules regulate the discharge of dredge and fill materials in wetlands and navigable waters. Such discharges are not allowed if practicable alternatives are available.	Remedial action includes excavation of soil sediment from the impacted wetlands and ditches and replacement/restoration with clean fill. Measures will be taken to minimize adverse effects and to replace or restore protected wetland functions and values.
Executive Order 11990 RE: Protection of Wetlands	Executive Order 11990, 40 CFR Part 6, Appendix A	Applicable	This Order requires federal agencies to take action to avoid adversely impacting wetlands wherever possible, to minimize wetlands destruction and to preserve the values of wetlands, and to prescribe procedures to implement the policies and procedures of this Executive Order.	Remedial action includes excavation of soil and sediment from the impacted wetlands and ditches and replacement/restoration with clean fill. However, measures to minimize adverse effects and to replace or restore protected wetland functions and values will be considered and incorporated into any plan or action wherever feasible.
Fish and Wildlife Coordination Act	16 USC Part 661 *et seq.* 40 CFR 122.49	Applicable	This order protects fish and wildlife when federal actions result in control or structural modification of a natural stream or body of water.	Appropriate agencies would be consulted prior to implementation to find ways to minimize adverse effects to fish and wildlife from potential monitoring activities within wetlands and waterways.

NOTE: ARAR = Applicable or relevant and appropriate requirements.
CFR = Code of Federal Regulations.
USC = United States Code.

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Clean Water Act, Section 402, National Pollution Discharge Elimination System	33 USC 1342; 40 CFR 122-125	Applicable	These standards govern the discharge of water into surface waters.	Ground and surface water removed from excavations, along with water from sediment/soil dewatering process will be treated, if necessary, to meet discharge criteria according to substantive requirements of National Pollution Discharge Elimination System if the discharge occurs onsite.
STATE OF CONNECTICUT				
Chemical-Specific				
Remediation Standard Regulations	RCSA 22a-133k-1 through 3	Applicable	Adopted on 30 January 1996 under the statutory authority provided by CGS 22a-133k, these regulations contain numeric Direct Exposure Criteria and Pollutant Mobility Criteria for constituents in soil based on either industrial or residential use of the site. Requirements are based on ground water in the area being classified by the state as GB.	The Alternative would eliminate exposure to constituents of concern in the soil through excavation and offsite disposal. The Alternative meets residential use standards.
Location-Specific				
Inland Wetlands and Watercourses	CGS § 22a-36 through 45, RCSA § 22a-39-1 through 15 (Surface Water and Wetlands); CGS § 22a-45a (General Permit Requirements)	Applicable	These statutes regulate any operation in or affecting a wetland or watercourse involving removal or deposition of material or any obstruction, construction, alteration, or pollution of such wetlands. CGS § 22a-45a authorizes the Commissioner to adopt a general permit for various minor activities including installation of water quality monitoring equipment, excavation of test pits, and core sampling.	Alternative 3 proposes to excavate soil and sediment from the impacted wetlands and watercourses and to restore the areas using clean fill. The substantive requirements of Connecticut standards will be met to address the alteration of wetlands and watercourses.
Coastal Management Act	CGS 22a-90-112	Applicable	This statute establishes Connecticut's enforceable coastal zone policies in accordance with the federal Coastal Zone Management Act.	Excavation and restoration activities will be coordinated with Connecticut Department of Environmental Protection in accordance with the requirements of this statute.

NOTE: RCSA = Regulations of Connecticut State Agencies.
CGS = Connecticut General Statutes.

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Connecticut Endangered Species Act	CGS § 26-303 through 314	Applicable	Regulates activities affecting state-listed endangered or threatened species or their critical habitat.	Two state-threatened plants, Golden Alexanders and Seaside Crowfoot, have been sighted in the NSB-NLON area. In addition, three state special concern species, Creeping Bush-clover, Crooked-stem Aster, and Carex *crawfordii,* have been documented in the NSB-NLON area. Excavation and restoration of the impacted area will be implemented so as to address potential negative impacts to the listed plant species or any of their critical habitat which might occur within the site.
Action-Specific				
Hazardous Waste Management: Generator and Handler Requirements – General Requirements, Listing, and Identification	RCSA § 22a-449 (c) 100-101	Applicable	Connecticut is delegated to administrate the federal Resource Conservation and Recovery Act statute through its state regulations. These sections establish standards for listing and identification of hazardous waste. The standards of 40 CFR 260-261 are incorporated by reference.	Hazardous waste determinations will be performed on all soil/sediment excavated to determine that levels of regulated constituents do not exceed applicable limits. Any constituents of concern in soil/sediment which exceeds applicable limits will be managed in accordance with requirements of these regulations, if necessary. Also, wastes produced from surface and ground water and dewatering treatment will be tested to determine whether levels of certain regulated constituents exceed Toxicity Characteristic Leaching Procedure limits.
Hazardous Waste Management: Generator Standards	RSCA § 22a-449(c) 102	Relevant and Appropriate	This section establishes standards for various classes of generators. The standards of 40 CFR 262 are incorporated by reference. Storage requirements given at 40 CFR 265.15 are also included.	Excavated soil/sediment and investigation-derived waste will be handled in accordance with these requirements.
Hazardous Waste Management: Treatment, Storage, or Disposal Facility Standards	RCSA § 22a-449 (c) 104	Applicable	This section establishes standards for treatment, storage, and disposal of hazardous waste, and establishes standards for closure and post-closure care. The standards of 40 CFR 264 are incorporated by reference.	Any hazardous waste which is treated or temporarily stored onsite as part of the remedy will be managed in accordance with the requirements of this section.

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Hazardous Waste Management: Interim Status Facilities and Ground-Water Monitoring requirements, Closure, and Post-Closure Requirements	RCSA § 22a-449 (c) 105	Relevant and Appropriate	This section establishes interim status standards for treatment, storage, and disposal of hazardous waste, and establishes standards for closure, post closure, and ground-water monitoring. The standards of 40 CFR 265 are incorporated by reference. The Commissioner may require ground-water monitoring based on site-specific standards.	Investigation-derived waste from excavation activities will be handled in accordance with these requirements.
Hazardous Waste Management: Land Disposal Restrictions	RCSA § 22a-449 (c) 108	Potentially Relevant and Appropriate	This section incorporates by reference the federal Land Disposal Restrictions given at 40 CFR 268.	The regulations would be complied with for the disposal of hazardous waste or investigation-derived waste.
Hazardous Waste Management: Permit Requirements	RCSA § 22a-449 (c) 110	Relevant and Appropriate	This section incorporates by reference the federal hazardous waste permitting requirements given at 40 CFR 270 and 124.	Remedial activities that constitute treatment, storage, or disposal of hazardous waste would comply with the substantive requirements of this section.
Air Pollution Control – Particulates	RCSA § 22a-174 1-20	Applicable	These regulations require permits to construct and to operate specified types of emission sources and contain emission standards that must be met prior to issuance of a permit. Pollutant abatement controls may be required. Specific standards pertain to fugitive dust (18b).	Emission standards for fugitive dust from excavation and restoration operations will be met with dust control measures. Emissions will be managed to comply with these standards.
Air Pollution Control – Odors	RCSA § 22a-174-23	Applicable	This section prohibits emission of any substance that constitutes a nuisance because of objectionable odor.	Potential odors from excavation activities will be managed to comply with these requirements.
Air Pollution Control – Control of Hazardous Air Pollutants	RCSA § 22a-174-29	Applicable	This section establishes testing requirements and allowable stack concentrations for many specific substances.	Remedial activities that result in the emission of substances identified as hazardous would comply with the substantive requirements of this section.
Control of Noise Regulations	RSCA § 22a-69-1 to 69-7.4	Applicable	These regulations establish allowable noise levels.	Excavation activities would be conducted in accordance with these requirements.
Water Pollution Control	RCSA § 22a-430-1 to 8 and §22a-430b	Potentially Applicable	These regulations establish permitting requirements and criteria for water discharge to surface water, ground water, and publicly-owned treatment works.	Discharge of any water from excavated soil/sediment would comply with the substantive requirements of this regulation.

Requirement	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain ARAR
Water Quality Standards	CGS §22a-426	Potentially Applicable	Connecticut's Water Quality Standards were adopted under this statue. They establish specific numeric criteria, designated uses, and anti-degradation policies for ground water and surface water.	Excavation activities (and any required dewatering activities) would be conducted in a manner consistent with the anti-degradation policies of the Water Quality Standards.
Connecticut Guidelines for Soil Erosion and Sediment Control	Connecticut Council on Soil and Water Conservation	To Be Considered	Technical and administrative guidance for development, adoption, and implementation of erosion and sediment control program.	Guidelines will be incorporated into the remedial design for the site to protect wetland and aquatic resources.

Attachment 2

Revised Table 2-5

TABLE 2-5 CONNECTICUT PRELIMINARY REMEDIATION GOALS[(a)] FOR SOIL AT SITE 20 – AREA A WEAPONS CENTER NAVAL SUBMARINE BASE, NEW LONDON, CONNECTICUT

Parameter	GB Pollutant Mobility Criteria	Industrial/Commercial Direct Exposure Criteria	Residential Direct Exposure Criteria
VOLATILE ORGANIC COMPOUNDS (mg/kg)			
2-Butanone	80	1,000	500
Acetone	140	1,000	500
1,1,1-Trichloroethane	40	1,000	500
Methylene chloride	1	760	82
Tetrachloroethene	1	110	12
Toluene	67	1,000	500
Trichloroethene	1	520	56
SEMIVOLATILE ORGANIC COMPOUNDS (mg/kg)			
2-Methylnaphthalene	98	2,500	474
Acenaphthene	84	2,500	1,000
Acenaphthylene	84	2,500	1,000
Anthracene	400	2,500	1,000
Benzo(a)anthracene	1	7.8	1
Benzo(a)pyrene	1	1.0	1
Benzo(b)fluoranthene	1	7.8	1
Benzo(g,h,i)perylene	42	2,500	1,000
Benzo(k)fluoranthene	1	78	8.4
Benzoic acid	1,000	2,500	1,000
Bis(2-ethylhexyl)phthalate	11	410	44
Butylbenzyl phthalate	200	2,500	1,000
Carbazole	1	290	31
Chrysene	1	780	84
Di-n-butyl phthalate	140	2,500	1,000
Di-n-octyl phthalate	20	2,500	1,000
Dibenzo(a,h)anthracene	1	0.78	0.084
Dibenzofuran	5.6	2,500	270
Diethyl phthalate	1,100	2,500	1,000
Fluoranthene	40	2,500	1,000
Fluorene	56	2,500	1,000
Indeno(1,2,3-cd)pyrene	1	7.8	1
Naphthalene	56	2,500	1,000
Phenanthrene	40	2,500	1,000
Phenol	800	2,500	1,000
Pyrene	40	2,500	1,000

(a) Criteria obtained from the State of Connecticut Department of Environmental Protection (CTDEP) Remediation Standard Regulations (1996).

Parameter	GB Pollutant Mobility Criteria	Industrial/Commercial Direct Exposure Criteria	Residential Direct Exposure Criteria
PESTICIDES/POLYCHLORINATED BIPHENYLS (mg/kg, unless otherwise noted)			
Aroclor-1260	0.005 mg/L (TCLP/SPLP)	10	1
4,4'-DDD	0.029[b]	24	2.6
4,4'-DDE	0.021[b]	17	1.6
4,4'-DDT	0.021[b]	17	1.6
Alpha-chlordane	0.066	2.2	0.49
Endosulfan sulfate	8.4	1,200	410
Endrin	---	610	20
Endrin aldehyde	---	610	20
Gamma-chlordane	0.066	2.2	0.49
Heptachlor	0.013	1.3	0.14
Methoxychlor	8	10,000	340

Parameter	GB Pollutant Mobility Criteria (TCLP/SPLP) (mg/L)	Industrial/Commercial Direct Exposure Criteria (mg/kg)	Residential Direct Exposure Criteria (mg/kg)
INORGANICS			
Aluminum	---	---	---
Antimony	0.06	8,200	27
Arsenic	0.5	10	10
Barium	10	140,000	4,700
Beryllium	0.04	2	2
Boron	---	---	---
Cadmium	0.05	1,000	34
Calcium	---	---	---
Chromium, hexavalent	0.5	100	100
Cobalt	22	2,500	1,000
Copper	13	76,000	2,500
Iron	---	---	---
Lead	0.15	1,000	500
Magnesium	---	---	---
Manganese	500	47,000	1,600
Mercury	0.02	610	20
Nickel	1	7,500	1,400
Potassium	---	---	---
Selenium	0.5	10,000	340
Silver	0.36	10,000	340
Sodium	---	---	---
Thallium	0.05	160	5.4
Vanadium	0.5	14,000	470
Zinc	50	61,0000	20,000

(b) Based on calculated CTDEP Remediation Standards submitted to CTDEP by Brown & Root Environmental on December 1997.

NOTE: Dashes (---) indicate that no criteria were calculated.
TCLP/SPLP = Toxicity Characteristic Leaching Procedure/Synthetic Precipitation Leachate Procedure.