N00129.AR.000769
NSB NEW LONDON
5090.3a

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF WATER MANAGEMENT
PERMITTING, ENFORCEMENT & REMEDIATION DIVISION
FEDERAL REMEDIATION PROGRAM

November 29, 1999

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

Re: State Comments re: Draft *Feasibility Study for Soil and Ground Water at the Lower Subase, Naval Submarine Base New London, Groton, Connecticut*

Dear Mr. Evans:

The Department has received and reviewed the Draft *Feasibility Study for Soil and Ground Water at the Lower Subase, Naval Submarine Base New London, Groton, Connecticut.* The document was prepared on behalf of the Navy by EA Engineering, Science and Technology of Newburgh, New York. The report was dated July 1999 and the Department received this document on July 26, 1999.

General Comments

The State is disappointed that the Feasibility Study does not adequately consider the requirements of the Remediation Standard Regulations (RSRs), particularly the requirements regarding pollutant mobility. The study does not list all of the contaminants present at concentrations greater than the RSR criteria in every zone. The pollutant mobility criteria apply to all soils above the seasonal high water table. TPH, lead, and other contaminants are present in numerous locations at concentrations greater than the pollutant mobility criteria. However, the Navy does not propose alternatives for Zones 2 and 6 that would address the pollutant mobility criteria.

The Feasibility Study eliminates from consideration in any zone several technologies that might be useful for addressing some of the contaminants on the Lower Base. In addition, the Feasibility Study does not appear to consistently evaluate specific technologies in each of the seven zones. Technologies are retained in some zones and eliminated in other zones, for no apparent reason, or for inappropriate reasons.

For example, the Navy eliminates capping from further consideration in any of the zones. This decision is based on concerns over the large amount of buildings and pavement in the Lower Base, and on statements that capping would not comply with ARARs. However, the report discusses only an "engineered cap", and does not consider other, less elaborate caps. An asphalt pavement cap could be used to render soil inaccessible and comply with the direct exposure criteria. A cap that meets the RSR definition of "engineered control" could be used in selected areas to comply with both the direct exposure and pollutant mobility requirements.

Monitored natural attenuation is inappropriately eliminated from consideration in Zones 2, 3, 5, 6, and 7

despite the fact that organic contaminants are present in each of these zones. Selective excavation is eliminated from consideration in Zones 2 and 6 despite the fact that selective excavation might be useful in addressing some or all of the contaminants in these zones. Some technologies are eliminated because they cannot address all types of contaminants in a given zone. This decision should be reconsidered given the diversity of contaminants present in the Lower Base. It is unlikely that any single technology, other than an engineered control, will address all contaminants present at a given site. It is more likely that several different technologies will be required to deal with all the contaminants at a given site.

The report uses the current industrial and future residential land use scenarios as an overall framework for discussion. This approach is confusing because these scenarios were only meant for use in risk assessment. The reader is left with the mistaken impression that the Remediation Standard Regulations may be applied differently depending upon which of the two scenarios is being considered. This confusion is compounded by the fact that the Regulations include residential and direct exposure criteria, as well as pollutant mobility criteria. These requirements are different from, and have nothing to do with, risk assessment scenarios. The Remediation Standard Regulations apply regardless of which risk assessment scenario is being discussed.

Specific Comments

Page 1-1 Section 1 Introduction

Please delete the last sentence in the second paragraph. This report is not required by the Remediation Standard Regulations and does not by itself satisfy the requirements of those Regulations.

Page 1-1 Section 1.1 Purpose

The last sentence states the Navy, EPA, and the State will select the remedy. Please revise to state that the Navy selects the remedy, and seek EPA's and the State's concurrence.

Page 1-6 Section 1.2.4 Zone 3

Please re-write the third sentence in the second paragraph to clarify the fact that batteries, rather than submarines, were serviced in Building 31. This building is located on dry land.

Page 1-9 Section 1.2.6 Zone 5

Please indicate in the text whether the Tanks in Building 175 were used to store fresh or waste battery acid. Please specify when the tanks and associated piping were removed. Please specify that the 1,000 gallon tank discussed in the third paragraph was used to store fuel oil.

Page 1-11 Section 1.2.9 Fuel Oil Distribution System

Please clarify that the tank farm was located in the southern section of the Upper Base, near the baseball fields.

Page 1-12 Section 1.2.10 Steam, Condensate and Electrical Ducts

What happens to the unrecovered steam condensate that goes to the piers? Is this discharge covered in any of the Navy's state or NPDES water discharge permits? Please specify this information in the report.

Page 1-16 Section 1.3.3.2 Surface water Quality and Designation

In the first sentence of the second paragraph, "US Geologic Survey" should be "US Geological Survey".

Page 1-22 Section 1.3.8.2 Ground- Water Quality

CTDEP Ground- Water Classifications

In the second sentence, please delete "and the ground water is not used as a drinking water source", and replace it with "and where public water supply service is available". The State does not prohibit the use of ground water as a drinking water source in a GB area. The Water Quality Standards specify that public water service must be available throughout an area with a ground water classification of GB.

Pages 1-26 to 1-31 Section 1.4 Nature and Extent of Constituents of Concern

This section discusses the distribution of contaminants in soil and ground water in each of the seven zones. The report gives the general locations where contaminants were found in high concentrations, such as "southwest of building 174, just south of a catch basin". The report does not always list the specific wells or test borings where the corresponding samples were collected. In some cases, the wells and test borings that are discussed are not depicted on the corresponding figures (Figures 1-4 to 1-10 and Figures 2-1 to 2-11). Please revise the text to identify the specific wells or borings upon which conclusions are based. It may also be useful to outline upon the maps the boundaries of areas where soil or ground water contamination was detected at concentrations in excess of applicable criteria.

Page 1-43 Section 1.7.2 Ecological Risk Assessment Summary- Zone 2

The last paragraph states that "only limited interpretation" of data from macroinvertebrate sampling "can be conducted due to temporal fluctuations". Please provide more information regarding the specific nature of the temporal fluctuations. Was the concentration of contaminants observed in macroinvertebrates fluctuating, or was some other parameter fluctuating? This comment applies also to the subsequent discussions regarding Zone 3 (page 1-44), and Zone 5 (Page 1-46).

Page 1-48 Section 1.7.7 Ecological Risk Assessment Summary- Zone 7

The last paragraph states that sediment at Piers 15 and 17 was replaced with clean fill after dredging. This statement does not appear to be correct since the dredging was done to accommodate the *Seawolf*

submarines. It is unlikely that the Navy would dredge sediment from the berthing areas and replace it with clean fill. Please clarify.

Figure 1-7 Zone 4 Boundaries

Well WE-1 is discussed on page 1-29 but is not shown on this figure. Please correct.

Figure 1-10 Zone 7 Boundaries

Please show on this figure the location of the transformers at Building 157 Vault 31.

Table 1-1 Background Concentrations of Thames River Surface Water

This table provides non- site specific, literature based background values for inorganic substances in surface water. While this information is useful, if the Navy intends to apply background concentrations for making decisions regarding remediation of the ground water plume, then the Navy must develop site specific background concentrations in the ground water plume.

Page 2-1 Section 2.2 Applicable or Relevant and Appropriate Requirements

In the last sentence, please add that a selected action must also comply with more stringent state regulations.

Page 2-4 Section 2.2.5.1 Chemical Specific Applicable or Relevant and Appropriate Requirements

Human Health Risk Calculations for Soil and Sediment are not a statute or regulation, and should not be listed as an ARAR. They should, however, be included on the list of To Be Considered Guidance.

Please provide citations for each of the statutes and regulations cited.

Page 2-5 Section 2.2.5.1 Chemical Specific Applicable or Relevant and Appropriate Requirements

Federal Safe Drinking Water Act

The second paragraph discusses the State's EPA endorsed Comprehensive Ground Water Protection Program. It states that because ground water at the Subase is classified as GB, which is the equivalent of national Contingency Plan Class III, the aquifer has a low use and value. This conclusion directly contradicts the USEPA Region draft 1996 Guidance on Groundwater Use and Value Determinations, which is also cited in the text. The 1996 Guidance states on page 2 that EPA "will no longer rely on" ground water classifications "in setting goals for ground water remediation and in making decisions on the level of cleanup necessary". EPA has not requested, and the State has not prepared, a site specific Ground Water Use and Value Determination for the Subase. It would be inappropriate to draw any conclusion regarding

the use and value of ground water at the Subase. The State agrees, however, that MCLs are not an ARAR at this site.

Page 2-6 Section 2.2.5.1 Chemical Specific Applicable or Relevant and Appropriate Requirements

CTDEP Remediation Standards for Soil and Groundwater

The first full paragraph paraphrases Section 22a-133k-2(e)(1)(A) of the Remediation Standard Regulations, but does not discuss Section (e)(1)(B). Please discuss Section (e)1(B), which states that compliance with a direct exposure criteria is achieved when the results of all laboratory analyses of samples from the release area are less than or equal to the applicable direct exposure criterion.

The third sentence in the second full paragraph is confusing. It should be re- written to more clearly state that for inorganic and PCBs, compliance with the pollutant mobility criteria is based on the results of leachate analysis by TCLP or SPLP. This section discusses the circumstances under which compliance with the pollutant mobility criteria **may** (but is not required to) be evaluated. This is accomplished by comparing the results of TCLP or SPLP analysis to the groundwater protection criteria multiplied by 10, or by an alternative dilution or dilution and attenuation factor. The specific circumstances are discussed in Section 22a-133k-2(c)(2) of the Regulations.

The third full paragraph should more completely describe the requirements of Section 22a-122k-2(e)(2) of the Regulations regarding methods for determining compliance wit the pollutant mobility criteria. The text only discusses subsection A. It does not state this section applies only if the release area has not been remediated by means of excavation and removal of polluted soil. The text should use the full term "95 percent upper confidence level of the arithmetic mean". The text should also discuss subsection B, which applies when the site has not been remediated by excavation, and when less than 20 soil samples have been collected. It should also discuss subsection C, which applies when the site has been remediated by excavation.

The last sentence of the last paragraph should more completely discuss the requirements for determining compliance with the surface water protection criteria, as specified in section 22a-133k-3(f)(2) of the Regulations. In addition to regulatory option (A) discussed in the text, compliance with the surface water protection criteria may also be achieved when the concentration of the substance in the portion of the plume immediately upgradient of the point at which the ground-water discharges to the receiving surface-water body is equal to or less than the applicable surface-water protection criterion, provided that the areal extent of the plume is not increasing over time and that, except for seasonal variations, the concentration of the substance in the plume is not increasing, except as a result of natural attenuation, at any point over time (Option B).

This paragraph incorrectly states that the volatilization criteria apply to ground water which discharges to a surface water body. Section 22a-133k-3(c)(1) specifies that the volatilization criteria apply to ground water polluted with a volatile organic substance within 15 feet of the ground surface or a building. The volatilization criteria do not necessarily apply to all ground water which discharges to surface water. Please

correct the text.

Page 2-7 Section 2.2.5.1 Chemical Specific Applicable or Relevant and Appropriate Requirements

CTDEP Remediation Standards for Soil and Groundwater

The first paragraph discusses options for determining compliance with the volatilization criteria, as specified in Section 22a-133k-3(f)(3) of the Regulations. The text discusses only one of the two options (Option A) available for determining compliance. Option B should be discussed also. In the last sentence, please specify that the 95 percent UCL is the 95 percent UCL of the arithmetic mean.

Page 2-9 Section 2.2.5.3 Action Specific Applicable or Relevant and Appropriate Requirements

The Connecticut Hazardous Waste Management Regulations (RCSA § 22a-449(c)100 to 110) should be listed as relevant and appropriate. These regulations would be applicable to any investigation-derived waste. The Water Discharge Permitting Regulations (RCSA § 22a-430-1 to 8, should be listed as applicable. The Air Pollution Control Regulations (RCSA §22a-174-1 to 29), the Regulations for the Well Drilling Industry (RCSA §25-128-33 to 64) and the Registration and Permitting Requirements for Wells and Well Drillers (CGS §25-126 to 25-131 should be listed as Applicable. The Guidelines for Soil Erosion and Sediment Control, which were adopted as required by CGS §22a-328, should be listed as Applicable. In the fourth bullet point, the "Connecticut Pollutant Discharge Elimination System is more properly referred to as the Connecticut Water Discharge Permitting Program. The applicable statutes and regulations include RCSA §22a-430-1 to 8 (discussed above) and CGS § 22a-430 (discussed in the text).The reference to Section 22a-436 of the General Statutes, should be deleted because that section is not an applicable requirement.

The last bullet should refer to the Connecticut Water Quality Standards.

Page 2-11 Section 2.2.5.3 Action Specific Applicable or Relevant and Appropriate Requirements

Connecticut Pollutant Discharge Elimination System

Please change the title of this section to "Connecticut Water Discharge Permitting Program". As described in the previous comment, CGS § 22a-430 and RCSA § 22a-430-1 to 8 are the applicable requirements for this program. The program includes NPDES permits, which regulate discharges to surface water, and State discharge permits, which regulate discharges to a municipal sewer system.

Connecticut Water Quality Standards

The last sentence states that a permit for re- injection of treated ground water would set concentration limits that are protective of Class GA ground water. Please note that the ground water classification of the Subase is GB. The GA classification applies only to a very small undeveloped area at the northern- most portion of the base.

Page 2-12 Section 2.2.5.3 Action Specific Applicable or Relevant and Appropriate Requirements

Connecticut Air Pollution Control Act

In the first sentence, please replace "Connecticut General Regulations" with "Connecticut General Statutes".

Page 2-14 Section 2.3.3.3 Connecticut Department of Environmental Protection Remediation Standards Constituents of Concern

The second paragraph states that the surface water protection criteria were developed by multiplying the Ambient Water Quality Criteria by a factor of 10. This statement should be revised to reflect the fact that the dilution factor applied in calculating the surface water criteria varied depending on the type of pollutant. The 10x dilution factor was not used for all pollutants.

The text states that a site specific dilution factor of 118 was calculated for the surface water protection criteria. This dilution factor does not appear to have been calculated in accordance with Section 22a-133k-3(b) (3) of the Remediation Standard Regulations which discusses alternative surface water protection criteria.

Page 2-15 Section 2.4.1 Development of Preliminary Remedial Goals

The first paragraph states incorrectly that definitive cleanup criteria will be developed after selection of a remedial alternative in the signed Record of Decision (ROD). The text should be revised to state that cleanup criteria are listed in the Proposed Plan, and included in the ROD. The clean up criteria are set when the ROD is signed.

Page 2-17 Section 2.4.1 Development of Preliminary Remedial Goals

Direct Exposure Criteria

The second paragraph paraphrases section 22a-133k-2(e)(1), which discusses two methods for determining compliance with the direct exposure criteria. The text only discusses option A. It should also discuss option B.

The third paragraph notes that the direct exposure criteria do not apply to inaccessible soil. The text should also specify that this exception applies only if an environmental land use restriction (or the Navy equivalent) is in place. The environmental land use restriction must ensure that the soils will not be exposed as a result of excavation, demolition, or other activities, and that pavement which is necessary to render the soil inaccessible is maintained in good condition.

Pollutant Mobility Criteria

The first paragraph discusses methods for determining compliance with the pollutant mobility criteria, as specified in Section 22a-133k-2(e)(2) of the Regulations. The text should specify that the methods discussed apply only if the soil has not been remediated by excavation and removal. The text should discuss option C, which applies if the soil has been remediated by excavation and removal. In this case, the results of all soil samples must be equal to or less than the pollutant mobility criteria.

The second paragraph discusses a site specific dilution factor, which was based on flow rates in the Thames River. This is not appropriate, as the pollutant mobility criteria are designed to be protective of ground water, rather than surface water. The site specific dilution factor calculated for the pollutant mobility criteria is different from the site specific dilution factor that would be calculated for the surface water protection criteria. Please propose an appropriately calculated site specific or alternative dilution factor. The calculated factor should be based on ground water flow rates and aquifer characteristics, rather than on flow rates or other properties of the Thames. In the last sentence of this paragraph, I believe the author meant to refer to Sections 22a-133k-2(d)(5)(D)(5 to 6), rather than to section 22a-133k-2(c)(5)(D)(5 to 6).

Page 2-18 Section 2.4.1 Development of Preliminary Remedial Goals

Ground- Water Remediation Standards

The third paragraph states that the surface water protection criteria were developed by multiplying the Ambient Water Quality Criteria by a factor of 10. This statement should be revised to reflect the fact that the dilution factor applied in calculating the surface water criteria varied depending on the type of pollutant. The 10x dilution factor was not used for all pollutants.

The 118x dilution factor discussed here does not appear to have been calculated in accordance with the requirements of Section 22a-133k-3(b)(3). It is unlikely that this dilution factor would be the same as the alternative dilution factor calculated for determining compliance with the pollutant mobility criteria. The 118x dilution factor is not appropriate for use in proposing an alternative surface water protection criteria.

Page 2-19 Section 2.4.2 Accommodations of Preliminary Remediation Goals and ARARs

The second paragraph should be revised to note that a selected remedy must comply with all ARARs unless a specific waiver is invoked. In addition, it is possible to design a cap that would comply with all ARARs, particularly the Remediation Standard Regulations requirements regarding the use of an engineered control to contain contaminated soil.

The third paragraph should be revised or deleted. Total excavation would undoubtedly pose a greater risk to subsurface utilities than other alternatives. However, this does not mean that total excavation would also pose a greater danger to the environment than other alternatives.

Page 2-19 Section 2.4.3 Comparison of Analytical Data to Preliminary Remediation Goals

Please note that the criteria in the Remediation Standard Regulations apply regardless of the current or future land use.

Page 2-21 section 2.4.3.1.3 Zone 3

Ground Water

The text states that the mean concentration of total lead, 134 µg/L, is less than the surface water protection criterion. The surface water protection criterion for lead is 13 µg/L. Please correct this statement.

Page 2-22 Section 2.4.3.1.5 Zone 5

Shallow Soil

The report states that matrix interference resulted in dilution of three samples analyzed for PAHs. This caused high detection limits for these samples, which in turn caused an artificially high 95 % UCL mean value for PAH. If the Navy wishes to assert that matrix interference effects prevented the laboratory from achieving detection limits lower than the pollutant mobility criteria, then the Navy must present the information required under Section 22a-133k-2(e)(3) of the Regulations.

Page 2-22 Section 2.4.3.1.6 Zone 6

Shallow Soil

The text states that although the TPH concentration slightly exceeded the industrial commercial direct exposure criterion, TPH was not chosen as a COC because no TPH exceeded twice the criterion. It is not appropriate to exclude a contaminant as a COC on this basis.

Page 2-26 Section 2.4.3.2.4 Zone 3

Lead was detected in 95 out of 96 ground water samples collected outside the remediation area for Building 31. Did the lead concentrations exceed the HHRA based PRGs?

Page 2-24 Section 2.4.3.2 Future Residential Land Use Scenario

Information regarding the pollutant mobility criteria was presented in the previous section, which discusses the current industrial land use risk assessment scenario. This information is therefore not repeated in this section. However, information regarding the direct exposure criteria is repeated in this section. This is confusing, and implies that the direct exposure criteria were treated differently for the two risk assessment scenarios. The direct exposure, pollutant mobility, and ground water criteria apply regardless of the risk assessment scenario being used. It is somewhat misleading to discuss compliance with the Remediation

Standard Regulations under the Current Industrial Land Use scenario or the Future Residential land use scenario. It would be more appropriate to discuss compliance with the Remediation Standard Regulations in a separate section.

Page 2-29 Section 2.5 Areas of Attainment

The text states that environmental land use restrictions "will prohibit further residential land use of the area without further actions to actions to achieve compliance with residential PRG". This sentence should be revised since environmental land use restrictions, by themselves, do not achieve compliance with the Remediation Standard Regulations. Environmental land use restrictions are used to assure that other measures, such as engineered controls remain effective. They may also be used to ensure that contaminated soil is not disturbed, or to ensure that contaminated ground water is not used as a source of drinking water.

This section only discusses areas where PRGs are exceeded under the current industrial land use scenario. Areas where PRGs are exceeded under the future residential land use scenario should also be discussed here.

Page 2-30 Section 2.6 Remedial Action Objectives

This section presents remedial action objectives for the current industrial land use scenario, but does not present any remedial action objectives for the future residential land use scenario. Remedial action objectives should be presented for both land use scenarios. An additional remedial action objective for both scenarios should be: "Prevent human and environmental exposure to contaminants at concentrations which exceed applicable criteria in the remediation standard regulations.

Table 2-1 Summary of Chemical Specific ARARs

In the Status column, a particular requirement can only be an ARAR or a TBC. It cannot be both.

The first citation under the Remediation Standard Regulations should be to Section 22a-133k-3 of the Regulations. The Synopsis of the ground water related Remediation Standard Regulations must be revised. These regulations do not establish beneficial uses for water, nor do they establish an anti-degradation policy. These objectives are accomplished by the Water Quality Standards, which were adopted under section 22a-426 of the General Statutes. The volatilization criteria do not establish criteria for volatilization from ground water. They apply to ground water, not to pollutants which volatilize from ground water. The volatilization criteria for soil vapor (Appendix F of the Regulations) do not apply unless a volatilization criterion for ground water (Appendix E of the Regulations) is exceeded.

The discussion regarding the soil related portions of the Remediation Standard Regulations must be revised. PRGs are developed only for soil above a depth of 2 feet in paved areas, and above 4 feet in unpaved areas. The direct exposure criteria apply to all soils above a depth of 15 feet, and PRGs should be developed for all such soils.

Citations should be provided for all listed laws and regulations, including the Connecticut Coastal Management Act, the Federal and State Endangered Species Acts, and the National Historic Preservation Acts. The Federal and State Endangered Species Acts are Applicable requirements.

Table 2-3 Summary of Action Specific ARARs

State Discharge Requirements

Please replace "Connecticut Pollutant Discharge Elimination System" with "Connecticut water Discharge Permitting Statutes". These statutes prohibit discharges to the waters of the State without a permit. Please also add a section for "Connecticut Water Discharge Permitting Regulations", which should be cited as RCSA §22a-430-1 to 8.

Under the Remediation Standard Regulations, the row that begins with "To Be Considered" should be eliminated. This row discusses the applicability of drinking water standards at the Subase.

Please specify that the Water Quality Standards were adopted under CGS §22a-426.

Please add the Connecticut Hazardous Waste Management Regulations (RCSA §22a-449(c)-100 to 110.

Please provide a citation for the State's Air Pollution Control Regulations.

Please include the Regulations for the Well Drilling Industry (RCSA §25-128-33 to 64) and the statutes regarding Registration and Permitting of Wells and Well Drillers (CGS §25-126 to 131) as Applicable Requirements.

Please list the State's Guidelines for Soil Erosion and Sediment Control, which were adopted pursuant to CGS §22a-328, as Applicable requirements.

Table 2-6 Preliminary Remedial Goals for Soil

Please indicate in the table which criteria are from the appendices in the Remediation Standard Regulations and which were proposed by the Navy and approved by the Commissioner in accordance with the regulations. This comment applies also to Table 2-7 (Preliminary Remedial Goals for Ground Water).

Table 2-8 Summary of Constituents of Concern Exceeding Preliminary Remedial Goals by Land Use, Matrix, and Zone at Lower Subase

This table includes lists exceedances of the pollutant mobility criteria and surface water protection criteria under the current industrial land use scenario, but not under the future residential land use scenario. The table does not indicate that the volatilization criteria were considered. All three criteria are applicable regardless of the land use scenario being considered. The various land use scenarios were considered for risk assessment purposes. It is appropriate to include as contaminants of concern pollutants that exceed

acceptable concentrations calculated under one of these scenarios. However, it is misleading to say that a particular pollutant exceeded Remediation Standard Regulation criteria under a given risk assessment scenario. Please revise the table to ensure that it considers all criteria in the Remediation Standard Regulations, including the direct exposure, pollutant mobility, surface water protection, and volatilization criteria. The table should have a separate section, which lists for each zone and media the pollutants that exceed the criteria specified in the Regulations.

The footnotes state that for some pollutants, the 95% UCL of the arithmetic mean exceeded the criteria. However, these pollutants were not retained as a COC because the maximum concentration was less than twice the criteria. This is not an appropriate method for selecting contaminants of concern. Any pollutant detected at a concentration exceeding risk assessment based or ARAR based criteria must be retained as a contaminant of concern.

Table 2-9 Summary of Constituents of Concern Addressed by the Remedial Alternatives

This table includes pollutant mobility criteria, which were calculated by applying a site specific dilution factor as specified in subsection 22a-133k-2(c)(2)(E)(i) of the Regulations. This subsection E(ii) of the Regulations specifies the formula that must be used in calculating a site specific dilution factor. This formula is based on Darcy's Law, and it considers the hydraulic conductivity, hydraulic gradient, and other aquifer characteristics. The 118x dilution factor used by the Navy was calculated by considering the water flow in the Thames River. In addition, the Navy did not provide the information or submit the notice required under the Regulations. This factor was not calculated in accordance with the regulations and should not be used in calculating site specific pollutant mobility criteria. The same dilution factor may not be applicable at each of the seven zones because the dilution calculation considers the length of the release area.

The Regulations specify that for a GB area, the results of a *mass analysis* (for organics) *may be compared to the GA pollutant mobility criteria* multiplied by the site- specific dilution factor. The results of a *TCLP or SPLP analysis* (for inorganic and PCBs*) may be compared to the ground water protection criteria* multiplied by the site specific dilution factor. The pollutant mobility criteria presented for lead appears to have been calculated by multiplying the GB pollutant mobility criteria, rather than the groundwater protection criteria, by the 118x dilution factor. This is not acceptable under the Regulations because in effect, it applies two dilution factors in calculating the pollutant mobility criteria.

Please replace the numbers in the "ARAR PRG-PMC" column with either the pollutant mobility criteria specified in Appendix B of the Regulations or proposed by the Navy and approved by the Commissioner. Alternatively, the Navy may calculate site specific dilution factors as specified in Section 22a-133k-2(c)(2)(E)(ii) of the Regulations. Please compare the properly calculated pollutant mobility criteria to the sampling data for each of the seven zones. It is likely that additional contaminants of concern will be identified when this is done.

Please specify in the Upper Confidence Limit Concentration column that this is the 95% UCL of the arithmetic mean. Please specify in the "ARAR PRG" column that this column lists the pollutant mobility

criteria. This table should list all of the Remediation Standard Regulation criteria, for both soil and ground water.

Page 3-1 Section 3.1 Identification and Screening of Technologies

The term "COC" is often used generically in placed of "contaminants". The term "COC" has a very specific meaning within the context of CERCLA. It should only be used when discussing the specific contaminants of concern at this site. When discussing contaminants in a generic sense, as in this section, the term "contaminants" should be used instead.

Page 3-2 Section 3.1 Identification and Screening of Technology Types and Process Options

Implementability

The report does not properly consider the "potential for obtaining regulatory approval" in the case of the "No Action" alternative. In several cases, the report states that the "No Action" alternative would not achieve remedial objectives and therefore would be unlikely to obtain regulatory approval. The "potential for obtaining regulatory approval" is meant to evaluate whether permits or other regulatory requirements can be met for a particular option. It is not meant to evaluate whether regulatory agencies are likely to accept or reject a particular remedial option.

Page 3-2 Section 3.1.1.1 Monitoring

Please revise the text to state that another purpose of monitoring is to verify the effectiveness of the selected remedial option. Please also state that monitoring may involve collection of ground water or surface water level data. Under section 22a-133k-3(g)(3) of the Regulations, continued monitoring will be required in any zone where contamination will remain.

Page 3-3 Section 3.1.1.2 Site Use Restrictions

Although the acronym "ELUR" may have been defined in a previous chapter, it would be helpful to define it again here. Please note that the term "environmental land use restriction" means a land use restriction as described in Section 22a-133q-1 of the Regulations. An environmental land use restriction has four parts. These include: 1) a declaration of environmental land use restriction approved either by the Commissioner or by a Licensed Environmental Professional, 2) a class A-2 survey, 3) a certificate of title demonstrating that the required subordination agreement has been recorded, and 4) a copy of the decision document. This is different from the term "ELUR" as used by the Navy in this report. The Navy appears to use the term more generically, to describe land use controls of any sort. It would be more appropriate to avoid the use of the term "ELUR", except when describing an environmental land use restriction as defined in the Regulations. Environmental land use restrictions run with the land and remain in effect unless released by the Commissioner.

The Navy states that "ELUR are readily" implementable, and notes that a deed restriction could be

implemented if property use changes in the future. As long as the property remains under the control of the Navy, it is unlikely that the Navy could record an environmental land use restriction. Other types of institutional controls, such as signs, and amendments to the base master plan, would be used instead. We have discussed informally on several recent occasions what measures can be used on the base in lieu of formal environmental land use restrictions. I would like to meet with the Navy as well as EPA to discuss more specifically how institutional controls can be implemented at the Lower Base site, as well as at other sites on the base. If the base is closed, then the State would require that formal environmental land restrictions be recorded where necessary.

Page 3-3 Section 3.1.1.3 Point-of-Entry/ Point of Use Treatment, and
Page 3-4 Section 3.1.1.4 Alternative Water Supply

These sections should be deleted since ground water is not used as a source of drinking water on the lower base.

Page 3-5 Section 3.1.2.1 Capping

There are other types of barriers in addition to an "engineered cap". The type of barrier selected would depend on the nature of the contaminants, and upon the requirement driving the use of the cap. A soil or asphalt cap might be sufficient to render soil inaccessible and comply with the Remediation Standard Regulation requirements regarding direct exposure criteria. A more elaborate, multi- layer cap might be necessary to comply with the requirements for use of an engineered control, or with the requirements of RCRA subtitle C. It is inappropriate to dismiss the use of capping on the basis that asphalt or soil caps "would not comply with the ARAR". It is also inappropriate to make this conclusion based on the fact that much of the base is paved or covered by buildings. The presence of asphalt or cement does not present an insurmountable engineering challenge that would prevent the installation of a cap in certain parts of the base.

Pages 3-5 to 3-6 Section 3.1.2.3 Physical Barriers

Please delete the first sentence of the second bullet point. The installation of vertical barriers might be feasible in limited areas, such as at the edge of the Thames.

Page 3-7 Section 3.1.2.4 Hydraulic Controls- Extraction Wells

The first bullet point states that extraction wells could be designed to work in conjunction with the eastward flow of ground water. Please add a discussion of the fact that during half of every tidal cycle, the direction of ground water flow is reversed in the portion of the site immediately adjacent to the river.

In the second bullet point, it is unclear why the installation of extraction wells would have to be "coordinated with DEP". Is the Navy referring to the State's Water Diversion Regulations? It is not clear why the report concludes, in the last paragraph, that ground water extraction is not warranted in Zones 1 to 3 and 5 to 7. Ground water extraction should be retained as an alternative for each of the seven zones.

Page 3-9 Section 3.1.3.1 Soil Excavation

Soil excavation should be retained as an alternative for all seven zones since contaminants in excess of the Remediation Standard Regulation criteria and other ARARs were detected in all zones.

Page 3-10 Section 3.1.3.2 Ground- Water Extraction

Please state more clearly the distinction between ground water extraction as discussed here, and extraction wells as discussed on page 3-7. Does the discussion in this section refer to ground water extraction for the purposes of actively remediating an aquifer?

Page 3-11 Section 3.1.3.3 Light, Non Aqueous Phase Liquid

Please include a contingency for recovery of LNAPL, should it be encountered in the future.

Page 3-12 Section 3.1.4.1 Monitored Natural Attenuation

Organic contaminants were detected in soils in all seven zones at concentrations exceeding cleanup criteria. It is therefore unclear why monitored natural attenuation was not retained for all zones.

Page 3-13 Section 3.1.4.2 Aerobic Bioremediation

It is not appropriate to eliminate this technology from consideration simply because it would be ineffective against inorganics. Aerobic bioremediation could be used to treat organic contaminants as one component of a treatment train of several technologies.

Page 3-22 Section 3.1.4.10 Chemical Fixation/ Solidification

Chemical fixation/ solidification is eliminated from consideration "due to the extensive subsurface utility network and because the long- term effectiveness is uncertain". This is inappropriate since this process has already been used by the Navy to remediate lead contaminated soil at Building 31 in Zone 3.

Page 3- 24 Section 3.1.4.13 Vacuum Vapor Extraction

The explanation of this technology is somewhat confusing. Please define a "pinhole plate". Please clarify that ground water pumping is caused by the reduced air pressure in the top of the well, rather than by air bubbles. The bubbles serve to strip volatile contaminants from the dissolved phase to the gaseous phase.

In the first bullet point regarding effectiveness, please clarify the statement regarding "... larger saturated zones (i.e. approximately 50 feet to groundwater...)". The text should refer here to larger unsaturated zones. A large saturated zone is unlikely to be found in an area with a depth of 50 feet to ground water.

Page 3-30 Section 3.1.5.5 (*Ex Situ-*) Chemical Fixation/ Solidification

This technology is eliminated due to the potential for damage to subsurface utilities. This is *an ex-situ* technology which would be used to treat soil removed by excavation or other means. It is therefore unclear why this technology has any more potential to damage subsurface utilities than excavation. This technology should be retained for further consideration.

Page 3-31 Section 3.1.5.8 (*Ex Situ-*) Chemical Reduction/ Oxidation

This technology is eliminated because it would not be effective against TPH and PAH. However, it would be effective against other site contaminants, such as lead. This technology might be effective as part of a treatment train. Chemical oxidation/ reduction should therefore be retained for further consideration.

Page 3-41 Section 3.1.6.8 Ultraviolet Oxidation

Like many of the other technologies discussed, UV oxidation would most likely be used as part of a train of treatment technologies. When high concentrations of VOCs are present, an additional polishing step may be required to achieve discharge limits. In addition, pH adjustment and flocculation may be necessary to remove metals prior to treatment by UV oxidation. This comment applies also to the discussion on page 3-42 regarding air stripping.

Page 3-45 Section 3.1.7.1 Discharge to Atmosphere

The last sentence states that no off- gas treatment will be required for ground water treatment. This directly contradicts the statement at the bottom of page 3-44 that off gas treatment will be considered for Zone 4. Please note that the substantive requirements of the State's Air Pollution Control Regulations apply to any air discharge.

Table 3-1 Summary of Initial Screening of Technologies and Process Options

Page 1

Monitoring- Monitoring should be retained for each of the seven zones, since contaminants may remain at concentrations in excess of remediation criteria. In some circumstances, the Remediation Standard Regulations require monitoring to evaluate the effectiveness of remedial actions, and to demonstrate compliance with the Regulations.

Access/ Use Restrictions- The use of physical barriers or notices should be retained for each of the seven zones. The text should also note that environmental land use restrictions will be recorded as specified in the Regulations if the based is ever closed and transferred to another entity as specified in the Regulations.

Capping should be retained as an option for each of the seven zones. An asphalt cap could be used to comply with the Remediation Standard Regulation requirements regarding direct exposure.

Page 4-1 Section 4.1 Development of Remedial Alternatives

Lead and arsenic were also detected at concentrations in excess of the pollutant mobility criteria.

Page 4-2 Section 4.2 Description of Evaluation Criteria

This section is repeated verbatim for each of the seven zones. This section should be presented only once.

Page 4-4 Section 4.3.1.2 Evaluation (Zone 1, Alternative 1)

Please add that lead and arsenic were detected at concentrations in excess of the pollutant mobility criteria.

Page 4-6 Section 4.3.2.1 Description

Monitored Natural Attenuation

In the second paragraph, please provide an estimate of how long it would take for natural attenuation to achieve compliance with cleanup criteria.

Tiered Monitoring Program

The Navy would conduct quarterly sampling until baseline conditions had been established. Once baseline conditions are established, the State would require monitoring to be conducted, at a minimum, on an annual basis. The report states that monitoring would continue as long as contaminants remained at concentrations in excess of "current industrial land use PRG". Please clarify that monitoring would continue as long as contaminants remain at concentrations in excess of any cleanup criteria, regardless of the land use scenario. This comment applies also to the second paragraph on Page 4-11.

Page 4-7 Section 4.3.2.1 Description

Environmental Land Use Restriction

The title of this section should be changed to "Institutional Controls". This change should be made throughout the FS wherever the term "Environmental Land Use Restriction" is used in the title of a remedial alternative. The Navy uses the term "environmental land use restriction" generically, to describe land use controls of any sort. It would be more appropriate to avoid the use of this term except when describing an environmental land use restriction as defined in the Regulations. Please see my comments above regarding site use restrictions on Page 3-3 (Section 3.1.1.2). As long as the Subase remains under the Navy's control, institutional controls would be used instead of environmental land use restrictions. Institutional controls might include notations to the base master plan and base instructions, coordination with the base excavation permitting system, use of signs, and other methods. If the base is closed and transferred, the State would require that the Navy file environmental land use restrictions as prescribed by

the Remediation Standard Regulations. This comment applies in each of the subsequent chapters to discussions regarding environmental land use restrictions.

The report states that a deed restriction prohibiting residential land use would be put in place if contamination remained in shallow soil at concentrations exceeding the residential direct exposure criteria. If inaccessible soil exceeds the industrial/ commercial direct exposure criteria, residential use and excavation would have to be restricted. Please note that for this purpose, shallow soil should be defined as: soil at a depth of less than four feet below ground surface, or more than two feet below an asphalt surface with a minimum thickness of six inches. The regulations provide that such soil is considered inaccessible. The direct exposure criteria do not apply to inaccessible soil if an environmental land use restriction is in place to prevent the soil from being disturbed as the result of excavation, demolition, or other activities. The Navy may take advantage of the exemption from the direct exposure criteria provided for inaccessible soil. To do so the Navy must maintain a minimum of four feet of clean fill in unpaved areas, or two feet of clean fill in areas with asphalt pavement. The pavement must have a minimum thickness of 6 inches, and the pavement must be maintained in good condition.

Page 4-7 Section 4.3.2.2 Evaluation

Overall Protection of Human Health and the Environment

Monitored Natural Attenuation also would not address lead and arsenic at concentrations in greater than the pollutant mobility criteria.

Page 4-8 Section 4.3.2.2 Evaluation

Compliance with ARAR

This alternative would not comply with the Remediation Standard Regulation requirements regarding pollutant mobility.

Page 4-12 Section 4.3.3.2 Evaluation

Overall Protection of Human Health and the Environment

The report states that it is unlikely the site would be used for residential purposes. However, if the base is closed, residential use could occur. An environmental land use restriction to prevent residential use of the property would be required if contamination were detected at concentrations exceeding the residential direct exposure criteria or volatilization criteria. Please revise the text.

Compliance with ARAR

This alternative would not address lead and arsenic at concentrations in excess of the GB pollutant mobility criteria.

Page 4-14 Section 4.3.4.1 Description (Zone 1 Alternative 4)

Selective Excavation/ Offsite Disposal

This section discusses options to address contaminants detected at concentrations greater than remedial criteria "under the current industrial land use scenario. This terminology is confusing since it implies that only the industrial direct exposure criteria are applicable. In fact, the soil and ground water criteria in the Remediation Standard Regulations apply regardless of the hypothetical risk assessment scenario being used by the Navy.

This alternative must also address lead and arsenic, which were detected at concentrations greater than the pollutant mobility criteria.

The Navy proposes to place a plastic liner in the hole prior to backfilling "if additional impacted soil is suspected". This is unacceptable. The Navy will be required to demonstrate compliance with all the requirements of the Remediation Standard Regulations before remediation may be considered complete.

The Navy proposes to screen for PAH and TPH using a photoionization or flame ionization detector. PIDs and FIDs are designed to detect volatile organics. They are not suitable for screening for TPH or PAHs. The Navy should propose and use a more suitable method to screen for these contaminants. This change should be made throughout the report where the Navy proposes to use a PID or FID to screen for TPH or PAHs. The Navy proposes on page 7-11 to use a portable XRF to screen soils in Zone 4 for lead. If this technique is used in Zone 4, it would be appropriate to also use it in Zone 4, as well as all other zones where lead in soil is to be addressed.

Page 4-16 Section 4.3.4.1 Description (Zone 1 Alternative 4)

Tiered Monitoring Program

Monitoring must continue as long as contaminants remain at concentrations greater than cleanup criteria. Please see section 22a-133k-3(g)(3) for requirements regarding discontinuation of ground water monitoring.

Page 4-17 Section 4.3.4.2 Evaluation

Overall Protection of Human Health and the Environment

Would lead and or arsenic remain at concentrations greater than the pollutant mobility criteria? Please note that the pollutant mobility criteria apply only to soils located above the seasonal high water table. Please clarify. This comment applies also to the discussion in the next paragraph regarding compliance with ARARs.

Page 4-18 Section 4.3.4.2 Evaluation

Reduction of Toxicity, Mobility, and Volume

The text states that in- situ biodegradation would not address arsenic in soil. It should also state that it would not address lead in soil.

Page 4-21 Section 4.4.1 Overall Protection of Human Health and the Environment

This paragraph discusses mercury and PAHs in Zone 1 soil. Previous discussions regarding Zone 1 discussed lead and arsenic, not mercury. Mercury is not listed on Figures 2-1 or 2-2, which depict the location of contaminants in Zone 1. Please clarify. This comment applies also to the discussion on page 4-21 in Section 4.4.4, and to the discussion on page 4-22 in Section 4.4.5.

Page 4-21 Section 4.4.2 Compliance with Applicable or Relevant and Appropriate Requirements

Alternatives 1, 2 and 3 would not comply with the pollutant mobility requirements for metals.

Page 4-21 Section 4.4.4 Reduction of Toxicity, Mobility, and Volume Through Treatment

The discussion implies that toxicity, mobility, and volume would be reduced through treatment. None of the alternatives would include treatment of soil. Please revise the text accordingly. Please make this change throughout the document, since none of the alternatives considered for any of the zones include treatment of contaminated soil.

Page 4-23 Section 4.4.6 Implementability

The text states that Alternative 1 (No Further Action) can't be implemented because remedial action objectives would not be met. Whether or not an alternative meets remedial objectives is not a criteria for determining whether it can be implemented. The ability of an alternative to meet remedial action objectives would be evaluated under other criteria. This comment applies to the comments in each of the subsequent chapters regarding implementability.

Page 4-23 Section 4.4.7 Cost

The first paragraph states that preliminary cost estimates are supposed to be within –30% to +50% of actual costs. Preliminary cost estimates are, in fact, expected to meet actual costs within a range of –50% to +30%.

Table 4-2 Summary of Comparative Analysis of Remedial Alternatives- Zone 1

Overall Protectiveness- Environment, and
Compliance with Applicable or Relevant and Appropriate Requirements

Alternatives 1 to 3 would not meet pollutant mobility criterion for lead. No of the alternatives would involve treatment of soil.

Long Term Effectiveness and Permanence

Alternatives 1, 2, and 3 would not meet pollutant mobility criteria for lead and arsenic.

Reduction of Toxicity, Mobility, and Volume Through Treatment

None of the alternatives include treatment and none would satisfy the statutory preference for treatment.

Page 5-1 Section 5.1 Development of Remedial Alternatives (Zone 2)

Additional remedial alternatives, including selective excavation, must be evaluated. Contaminants are present at concentrations greater than the direct exposure and pollutant mobility criteria, as well as other ARARs.

Lead was also present at concentrations greater than the pollutant mobility criterion. Please discuss in the text.

Page 5-5 Section 5.3.2.2 Evaluation

Overall Protection of Human Health and the Environment

This section should discuss the presence of contaminants other than TPH at concentrations greater than cleanup criteria.

Table 5-1 Comparison of Feasible Remedial Alternatives

Additional alternatives to address the requirements of the Remediation Standard Regulations must be considered.

Table 5-2 Summary of Comparative Analysis of Remedial Alternatives- Zone 2

Overall Protectiveness- Environment

Alternatives 1 and 2 would not address pollutant mobility risks posed by lead in soil.

Compliance With Applicable or Relevant and Appropriate Requirements

Please revise this table to acknowledge that none of the listed alternatives would comply with the requirements of the Remediation Standard Regulations regarding pollutant mobility.

Reduction of Toxicity, Mobility, and Volume Through Treatment

Alternative 2 would not satisfy the statutory preference for treatment.

Implementability- Ability to Obtain Approvals and Coordinate with Other Agencies

Delete the language under Alternatives 1 and 2 and replace with, "No permits or other regulatory approvals required".

Page 6-1 Section 6.1 Development of Remedial Alternatives (Zone 3)

The second paragraph states that it is unlikely that the property would be used for residential purposes. However, if the base is closed, then it is possible the site might be used for residential purposes. The FS must consider this possibility. The text also states that PAH concentrations in shallow soil "are below typical non- industrial urban background soil concentrations for New England". This fact is irrelevant. The Remediation Standard Regulations do not allow the use of regional, non- site specific data in setting cleanup objectives. Please see the definition of "background concentration for soil", which is listed in Section 22a-133k-1 (a)(6) of the Regulations.

Page 6-7 Section 6.3.2.2 Evaluation

Long Term Effectiveness and Permanence

The text states that "remediation of lead concentrations beneath Building 31 has been completed". This remediation was completed as a Removal Action in 1994, prior to the adoption of the Remediation Standard Regulations. The cleanup criteria used during the Removal Action (5 mg/L TCLP lead and 500 mg/kg total lead) did not comply with DEP policy at the time the work was done, or the subsequently adopted requirements of the Remediation Standard Regulations. Compliance with the Regulations is required under the current Remedial Action.

Implementability

Alternative 2 does involve the use of institutional controls. Please revise this paragraph.

Page 6-8 Section 6.3.3.1 Alternative 3- Description

The Navy proposes to use a PID or FID to monitor for PAHs. Please propose a more suitable method to monitor for PAH as well as TPH.

The Navy proposes to place a plastic liner in the hole prior to backfilling "if additional impacted soil is suspected". This is unacceptable. The Navy will be required to demonstrate compliance with all the requirements of the Remediation Standard Regulations before remediation may be considered complete.

Table 6-2 Page 3

Implementability

The "ability to obtain approvals..." criterion refers to the ability to obtain permits and other approvals to carry out an alternative. It does not refer to whether or not the regulators will accept or reject a particular alternative.

Reduction of Toxicity, Mobility, and Volume Through Treatment

None of the alternatives includes treatment, and none would satisfy the statutory preference for treatment.

Page 7-1 Section 7.1 Development of Remedial Alternatives

Please revise the text to acknowledge that if the site were ever to close, then residential land use is possible.

Page 7-6 Section 7.3.2.1 Description

Monitored Natural Attenuation

The second paragraph states that VOC concentrations can be slow to biodegrade. I believe the author meant to more specifically state that chlorinated VOCs may biodegrade slowly. Please see the second paragraph of the section entitled "Monitored natural Attenuation" on page 7-12.

Page 7-6 Section 7.3.2.1 Description

Tiered Monitoring Program

Please clarify that second tier monitoring would be carried out if specific criteria were exceeded. The plan should also specify that actual remediation will be conducted if warranted.

Page 7-9 Section 7.3.2.2 Evaluation

Compliance with ARAR

The text states that "lead concentrations in excess of industrial land use PRG would be addressed through ELUR". Please add that this option would not comply with the pollutant mobility criteria.

Reduction of Toxicity, Mobility, and Volume Through Treatment

This option does not involve any treatment of soil or ground water. The last two sentences of this paragraph appear to contradict each other. If physical and chemical processes will reduce the concentration of inorganic compounds in ground water, then natural attenuation would be *likely* to reduce the toxicity, mobility or volume of these contaminants.

Page 7-11 Section 7.3.3.1 Description

Selective Excavation and Offsite Disposal

The Navy proposes to use a PID or FID to screen for PAHs and TPH. These instruments would not be effective for this purpose. The Navy appropriately proposes to use portable XRF to screen for lead in soil this zone. XRF should be used to screen for lead and other inorganic wherever excavation will be conducted. Please refer to the attached New England Waste Management Official's Organization advisory opinion regarding the use of XRF.

The report notes that lead, measured by TCLP, was detected near Building 80 "at concentrations above industrial land use PRG". Please clarify that lead was detected at concentrations greater than the GB pollutant mobility criterion. Were any samples analyzed for lead using the SPLP method?

Page 7-12 Section 7.3.3.1 Description

Monitored Natural Attenuation

The Navy speculates that lead concentrations in ground water would decrease as a result of physical processes such as dispersion, adsorption, and dilution. It is unlikely that this would occur in an acceptable time frame unless the source of the lead was removed from soil or made immobile. The statement that natural attenuation will decrease the concentration of inorganic compounds contradicts earlier statements that natural attenuation would not be effective on inorganics.

Page 7-15 Section 7.3.3.2 Evaluation

Reduction of Toxicity, Mobility, and Volume Through Treatment

This option does not involve any treatment of contaminated soil or ground water.

Page 7-17 Section 7.3.4.1 Description- Alternative 4

A PID or FID would not be effective in screening for PAH or TPH.

Soil would be excavated to a minimum depth of 4.5 feet to comply with the pollutant mobility criteria. Please note that the pollutant mobility criteria do not apply to soils below the seasonal high water table in a GB area. What is the depth of the water table in this area? Were any soil samples from this area analyzed for lead using the SPLP method?

The Navy proposes to place a plastic liner in the hole prior to backfilling "if additional impacted soil is suspected". This is unacceptable. The Navy will be required to demonstrate compliance with all the requirements of the Remediation Standard Regulations before remediation may be considered complete.

Page 7-18 Section 7.3.4.1 Description- Alternative 4

Ground- Water Extraction and Treatment

Please specify what is meant by UCL slightly above the volatilization criteria. The term "UCL" should not be used generically in placed of the term "concentration". The term UCL should only be used in describing the results of statistical evaluation of the results of analytical data for a group of samples. Where analytical results for individual samples are being discussed, the term "concentration" should be used.

Page 7-19 Description- Alternative 4

Ground- Water Extraction and Treatment

In the third paragraph, delete "CTPDES" and replace it with "Connecticut Water Discharge".

The third paragraph states that the selective excavation program "may substantially reduce or eliminate the source areas for COC migration to ground water", likely resulting in "decreased COC concentrations in ground water". The areas where soil will be removed to address "hot spot" contamination have no apparent relationship to the proposed location of ground water extraction wells. The hot spots do not appear to be upgradient of or in close proximity to proposed locations for ground water extraction wells. It is difficult to see how excavation in the locations shown would, by itself, cause lead concentrations to decrease in the areas where the wells would be installed.

Tiered Monitoring Program

Please clarify that second tier monitoring would be carried out if specific criteria were exceeded. The plan should also specify that actual remediation will be conducted if warranted.

Page 7-24 Section 7.4.3 Long Term Effectiveness and Permanence

Please delete the first sentence. Alternatives 2 and 3 would be less effective than Alternatives 3 and 4 because alternatives 2 and 3 would leave in place material with contaminant concentrations greater than the Remediation Standard Regulation criteria.

Page 7-25 Section 7.4.4 Reduction of Toxicity, Mobility, and Volume Through Treatment

None of these alternatives involves treatment of soil. Only Alternative 4 involves treatment of ground water.

In the second paragraph, the Navy proposes to expand ground water monitoring if contaminants remain at concentrations greater than the surface water protection criteria. Please note that the volatilization criteria apply also. The Navy must propose additional remedial action if contamination is detected at concentrations greater than the surface water protection or volatilization criteria.

Table 7-2 Summary of Comparative Analysis of Alternatives- Zone 4

Compliance with Applicable or Relevant and Appropriate Requirements

Alternative 2 would not address lead concentrations that exceed the direct exposure criterion.

Reduction of Toxicity, Mobility, and Volume Through Treatment

None of the alternatives would involve treatment of soil, and only Alternative 4 would involve treatment of ground water. Only Alternative 4 would satisfy the statutory preference for treatment.

Implementability- Ability to Obtain Approvals and Coordinate with Other Agencies

Delete the language under Alternative 1, and replace with: "No permits or other regulatory approvals required".

Page 8-1 Section 8.1 Development of Remedial Alternatives

Lead was also detected at concentrations greater than the pollutant mobility criteria.

Page 8-5 Section 8.3.3.2 Evaluation

The text states that residential use of the base is unlikely. However, if the base is closed, then residential use is a possibility.

Page 8-6 Section 8.3.3.2 Evaluation

Compliance with ARAR

Alternative 2 would not comply with the pollutant mobility criteria of the Remediation Standard Regulations.

Reduction of Toxicity, Mobility, and Volume Through Treatment

Please delete the last sentence. Alternative 2 would not address the pollutant mobility criterion for lead.

This alternative does not involve any treatment.

Page 8-7 Section 8.3.3.1 Selective Excavation and Offsite Disposal

The Navy proposes to use a PID or FID to screen for TPH. Neither of these instruments is suitable for this purpose. Since lead is also present in the soil, the Navy should also propose a suitable method to screen the soil for lead.

Page 8-8 Section 8.3.3.1 Selective Excavation and Offsite Disposal

The Navy proposes to place a plastic liner in the hole prior to backfilling "if additional impacted soil is suspected". This is unacceptable. The Navy will be required to demonstrate compliance with all the requirements of the Remediation Standard Regulations before remediation may be considered complete. If the Navy wishes to provide a marker to identify the extent to which excavation took place, orange snow fence would be more suitable. Snow fence was successfully used for this purpose at the Raymark Industries NPL site in Stratford, Connecticut.

Page 8-9 Section 8.3.2.2 Evaluation

Compliance with ARARs

The text notes that contaminants were found in soil at concentrations greater than the "CTDEP industrial criteria", and that the alternative would be carried out "in accordance with location- specific and action-specific ARAR". Please revise the text to note that contaminant concentrations were also greater than the GB pollutant mobility criteria. Will this alternative comply also with chemical specific ARARs?

Reduction of Toxicity, Mobility, and Volume Through Treatment

Alternative 3 would not address the pollutant mobility criterion for lead.

Page 8-10 Section 8.4.2 Compliance with ARARs

Alternative 2 would not comply with the pollutant mobility criteria of the Remediation Standard Regulations.

Page 8-11 Section 8.4.3 Long- Term Effectiveness and Permanence

Alternative 2 would be less effective in achieving Remedial Action Objectives than Alternative 3.

Page 8-11 Section 8.4.4 Reduction of Toxicity, Mobility, and Volume Through Treatment

None of these alternatives involves treatment of soil or groundwater.

Page 8-12 Section 8.4.5 Short Term Effectiveness

In the second paragraph, lead should be discussed also. This alternative does not comply with the pollutant mobility requirements for lead.

Table 8-2 Summary of Comparative Analysis of Alternatives- Zone 5

Compliance with Applicable or Relevant and Appropriate Requirements

Alternative 2 would not comply with the pollutant mobility criteria.

Reduction of Toxicity, Mobility, and Volume Through Treatment, Page 2

Please revise to indicate that none of the proposed alternatives includes treatment of soil or ground water. Alternative 3 does not satisfy the statutory preference for treatment.

Implementability- Ability to Obtain Approvals and Coordinate with Other Agencies

Delete the language under each alternative and replace with, "No permits or other regulatory approvals required".

Page 9-1 Section 9.1 Development of Remedial Alternatives

The report must consider contaminants that exceed remedial criteria under all land use scenarios, not just the industrial land use scenario. For this reason, additional alternatives that actively address the contamination must also be developed.

Page 9-6 Section 9.3.2.2 Evaluation

Compliance With ARAR

Alternative 2 would not address lead at concentrations greater than the GB pollutant mobility criteria. This alternative would not comply with ARARs.

Reduction of Toxicity, Mobility, and Volume Through Treatment

Please revise to indicate that Alternative 2 does not include treatment of soil or ground water.

Page 9-7 Section 9.4.1 Overall Protection of Human Health and the Environment

Alternative 2 would not be protective because it does not address lead and TPH which were detected in soil at concentrations greater than the pollutant mobility criteria and direct exposure criteria.

If the base is closed, then residential land use would be more likely. Please revise the text.

Page 9-7 Section 9.4.2 Compliance with Applicable or Relevant and Appropriate Requirements

Alternative 2 would not comply with the pollutant mobility criteria or direct exposure criteria.

Page 9-7 Section 9.4.3 Long Term Effectiveness and Permanence

Alternative 2 would not comply with ARARs, and would not achieve remedial action objectives.

Page 9-9 Section 9.4.7 Cost

The report should say that capital costs are highest for Alternative 2, and lowest for Alternative 1.

Table 9-2 Summary of Comparative Analysis of Remedial Alternatives- Zone 6

Overall Protectiveness- Environment

For both alternatives, please delete the statement that "COC does not exceed Pollutant Mobility" and replace it with "Lead is present at a concentration greater than the pollutant mobility criterion". For Alternative 1, delete the language under Potential Onsite Receptors, and replace it with "TPH exceeds direct exposure criterion".

Reduction of Toxicity, Mobility, and Volume Through Treatment

Alternative 2 would not satisfy the statutory preference for treatment.

Implementability

Under "Ability to obtain approvals…", delete the language under Alternative 1 and replace with, "No permits or other regulatory approvals required".

Implementability

Under "Ability to obtain approvals…", delete the language under both alternatives and replace with, "No permits or other regulatory approvals required".

Page 10-7 Section 10.3.2.2 Evaluation

The first paragraph states that it is unlikely the property would be transferred for residential reuse. If the base is closed, residential use cannot be discounted.

The second paragraph states the contaminated sediment was dredged, and later replaced with clean fill. The dredging referred to was done to prepare for home porting the *Seawolf* class submarines at the Subase. It is unlikely, therefore, that clean fill was placed following dredging.

Page 10-9 Section 10.3.3.1 Description ¶ 1

The Navy proposes to screen for PAHs using a PID or FID. Neither of these instruments is suitable for this purpose. Please propose another technique to screen for the presence of PAHs in soil.

Page 10-10 Section 10.3.3.1 Description ¶ 1

Please clarify that monitoring would continue as long as contaminants remain at concentrations in excess of any cleanup criteria.

Page 10-11 Section 10.3.3.2 Evaluation

Compliance with ARAR

Institutional controls equivalent to an environmental land use restriction will be required if contaminants remain at concentrations exceeding the direct exposure or pollutant mobility criteria. The last sentence states that Alternative 3 would be conducted in accordance with action and location specific ARARs. Would it also be conducted in accordance with chemical specific ARARs?

Page 10-12 Section 10.3.3.2 Evaluation

Reduction of Toxicity, Mobility and Volume Through Treatment

None of the proposed alternatives make use of treatment.

Page 10-13 Section 10.4.1 Overall Protection of Human Health and the Environment

The second paragraph states that it is unlikely that the site would be used for residential purposes. However, if the base is closed, then it is possible the Lower Base might be used for residential purposes.

Page 10-14 Section 10.4.2 Compliance with Applicable or Relevant and Appropriate Requirements

Please delete the first sentence. Replace it with "Alternatives 1 and 2 would not comply with ARARs. Alternative 3 would comply with ARARs, including the pollutant mobility criteria of the State's

Remediation Standard Regulations.

Table 10-2 Summary of Comparative Analysis of Remedial Alternatives- Zone 7

Overall Protectiveness- Environment

Alternatives 1 and 2 would not comply with the pollutant mobility criteria requirements and would not protect potential offsite receptors.

Compliance with Applicable or Relevant and Appropriate Requirements

Alternatives 1 and 2 would not comply with the pollutant mobility requirements and therefore would not comply with chemical specific ARARs.

Reduction of Toxicity, Mobility, and Volume Through Treatment

None of the alternatives would satisfy the statutory preference for treatment, since none of them include treatment.

Implementability- Ability to Obtain Approvals and Coordinate with Other Agencies

Delete the language under Alternative 1 and replace with, "No permits or other regulatory approvals required".

Page 11-1 Section 11.1 Summary of Remedial Alternatives

Monitored natural attenuation and tiered monitoring should be retained for selected contaminants in all seven zones. Selective excavation should be retained for Zones 2 and 6.

Page 11-3 Section 11.2.3 Tiered Monitoring Program

Monitoring will be required in all zones where contaminants remain at concentrations greater than cleanup criteria.

Page 11-3 Section 11.2.4 Monitored Natural Attenuation

Monitored natural attenuation should be retained for organic contaminants in all zones.

The Navy proposes in the third paragraph to conduct coordinated monitoring that would look at the Lower Base as a whole, rather than considering it as a group of isolated sites. The State agrees that this is a useful approach.

Page 11-4 Section 11.2.5 Selective Excavation and Offsite Disposal

Contaminants are present in the soil in all seven zones at concentrations greater than cleanup criteria. Selective excavation and offsite disposal should be retained for all seven zones.

Appendix B Preliminary Remedial Goal Calculations

The source of the analytical data used in the calculations is unclear. The UCL data provided for various pollutants does not agree with the UCL data presented in Appendix D-1.

Appendix C Dilution Factor Calculations

The dilution factors presented here were not calculated in accordance with either Section 22a-133k-2(c)(2)(E) of the Remediation Standard Regulations (site specific dilution for the pollutant mobility criteria), or with Section 22a-133k-3(b)(3) (alternative surface water protection criteria). The site specific dilution factor for the pollutant mobility criteria considers the hydrogeologic characteristics of the aquifer. Since the pollutant mobility criteria protect ground water, this dilution factor does not consider flow characteristics of a surface water body.

If you have any questions regarding this letter, please contact me at (860) 424-3768.

Sincerely,

Mark R. Lewis

Mark R. Lewis
Senior Environmental Analyst
Federal Remediation Program
Permitting, Enforcement & Remediation Division
Bureau of Water Management

Enclosure
cc: Kymberlee Keckler, US EPA New England, Federal Facilities Section
Darlene Ward, NSBNL Environmental Department
EA Engineering, Science and Technology

NEWMOA Technology Review Committee
Advisory Opinion
Innovative Technology: X-Ray Fluorescence Field Analysis
Date of Opinion: September 21, 1999

The purpose of this Advisory Opinion is to raise awareness of x-ray fluorescence (XRF) technology and its application in the Northeast.(1) This Advisory Opinion is intended to communicate Technology Review Committee (TRC) interest in the use of XRF technology to potential users of hazardous waste site characterization technology, such as consultants, as well as to project managers within the various state site cleanup programs. The Advisory Opinion is also intended to educate consultants and the state regulators who oversee projects about the factors that can affect the proper use of XRF technology.
All seven of the Northeast states participated in the development of this Advisory Opinion consensus statement. In addition, the technical information was reviewed by U.S. EPA Region I and a vendor of XRF technology. However, it should be noted that this Advisory Opinion is not intended to be an "approval" of this technology. The appropriateness of the use of XRF technology will need to be determined on a site-by-site basis. Potential users should contact officials in the state in which the project is located to determine if there are any state-specific requirements that could apply.

Project Background:

Regulatory and institutional barriers to the adoption of innovative hazardous waste site assessment technologies can result in increased expenditures to evaluate and remediate contaminated sites. Because innovative technologies have the potential to clean up and protect the environment and the public's health in a more cost-effective and efficient manner, finding ways to encourage their increased use is crucial.
Recognizing the need to overcome barriers to the acceptance of technology innovation, the six New England States, EPA Region I - New England, the Northeast Waste Management Officials' Association (NEWMOA) and the New England Governors' Conference signed a Memorandum of Agreement (MOA) in March 1998 to promote interstate regulatory cooperation for waste site assessment and cleanup technologies. Subsequently, NEWMOA has worked closely with EPA Region I and the Northeast Hazardous Substances Research Center (NHSRC) to increase the understanding of the factors that discourage the use of innovative technologies. NEWMOA held meetings and conference calls with NEWMOA's Waste Site Cleanup Workgroup and co-sponsored, with NHSRC, a Stakeholders Workshop held in May 1998 called "Increasing the Use of Innovative Technologies on Small Hazardous Waste and Petroleum Sites." The focus of this Workshop was on building consensus among the stakeholders regarding measures to reduce or eliminate obstacles to the use of innovative site assessment technologies.
At the May 1998 Stakeholder Workshop, participants identified the lack of an interstate forum in the Northeast to actively review technologies and communicate both public and private sector use of innovative technologies as a major impediment to the overall marketability of the newer field analytical, characterization and monitoring technologies. To address this need, NEWMOA has established the TRC, made up of one or more staff members from each of the Northeast states to coordinate state review, issue advisory opinions and disseminate information on the use of innovative technologies.

Overview of Technology:

XRF is a non-destructive analytical technique used to determine the metals composition of environmental samples, primarily soils. XRF can also be used to determine the metals concentration in water or air by filtering a known quantity and then using XRF to analyze the dried filter medium. The

primary advantage of XRF analysis over laboratory analysis is that analytical results can be generated in real-time allowing decision-making in the field regarding the need for additional sampling or further remediation (provided that proper data validation procedures are followed). The time required for analysis depends upon the element(s) targeted; the concentration of a single element is typically determined in 30 seconds or less, and the analysis of several elements usually requires 2-5 minutes. Another advantage of XRF analysis over standard laboratory analysis is that the procedure does not involve altering the soil sample (other than mixing and possibly grinding) so no investigation derived wastes are generated as they are when extraction with solvent or acid is performed. Because the sample is not destroyed by the analysis, the same sample that was analyzed in the field can be sent to the laboratory for confirmatory analysis.

XRF analyzers emit X-rays that irradiate the sample and excite the electrons of the element(s) present. As these excited electrons return to their normal state they give off energy that is detected by the XRF equipment and the pattern is analyzed to determine the element. Generally, XRF technology can detect elements with an atomic number of 16 (sulfur) through 94 (plutonium). Different XRF analyzers use different elements to generate x-rays, with some using iron-55, cobalt-57, cadmium-109, or americium-241. The metals that can be detected by a particular XRF analyzer depend upon the element used to generate the x-rays:

- cobalt-57 is used to detect lead
- iron-55 is used to detect calcium, chromium, potassium, sulfur, titanium and vanadium
- cadmium-109 is used to detect arsenic, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, plutonium, rubidium, selenium, strontium, uranium, vanadium, zinc and zirconium
- americium-241 is used to detect antimony, barium, cadmium, silver and tin

Some analyzers have more than one x-ray source and are thus able to detect a wider array of elements. Typical arrangements are cadmium-109 and americium-241, or iron-55, cadmium-109 and americium-241. When properly utilized, field XRF analyzers provide semi-quantitative or quantitative analysis of specific metal elements in the 20 -100 parts per million (ppm) range, depending on the analyte. Field XRF instruments can have difficulty with chromium measurements and therefore the detection limit is typically higher, in the 200 - 900 ppm range, depending upon the particular instrument and sample characteristics. Actual method detection limits (MDLs) are determined at each particular site and for each sample media at the site.

Field XRF analyzers are generally relatively lightweight hand held instruments that gather data. After data collection, the analyzer is connected to a computer for data analysis and storage. XRF units utilize sophisticated software for internal calibration, to account for the natural decay of the radioactive *x-ray* source over time, and to analyze the data input from the probe. The software is all menu driven and can output the data in several formats so the user does not need to manipulate the data. Generally field XRF units utilize solid state detectors of lithium drifted silicon (Si(Li)), mercuric iodide or silicon pin-diode, with Si(Li) detectors the most precise. However, instruments that have a Si(Li) detector require liquid nitrogen to cool the detector, which can add time and expense to a project because of the need to: locate a source of the liquid nitrogen near the site; purchase the liquid nitrogen each day; and fill the internal dewar of the instrument and allowing the Si(Li) detector to cool down prior to analysis.

Some field XRF analyzers can be placed directly on the soil surface for in situ measurements. The analyzer measures the metal content of the sample over a surface area of approximately one square centimeter (1 cm^2) area to a depth of approximately 2 millimeters (2 mm). Other field XRF analyzers require that soil samples are collected and placed in a sample cup that is then placed in a covered

sample chamber for analysis. Most field XRFs can perform both in situ and ex situ analysis. In situ analysis provides qualitative data. Ex situ analysis can provide semi-quantitative or quantitative data depending upon the amount of soil preparation and the calibration standards used. Due to the inherent heterogeneity of soil, ex situ analysis is the preferred method because the soil can be homogenized to provide a sample that is more representative of the location from which it was collected. Average sample throughput for ex situ analysis generally varies from 50 to 100 samples per day, depending on the number of analytes, the particular analyzer used and the amount of soil preparation performed. In situ analysis allows a greater number of analyses at a given site because little or no sample preparation is performed.

Several different XRF analyzers have been evaluated in the EPA's Environmental Technology Verification (ETV) Program. The Technology Verification Statements for the evaluated XRF analyzers as well as more information about the ETV Program itself can be obtained at http://www.epa.gov/etv or by calling U.S. EPA Region I at (617) 575-CEIT. XRF technology has been used for site characterization or cleanup monitoring at over 35 Superfund sites, including several Department of Defense (DOD) and Department of Energy (DOE) facilities.(2) U.S. EPA Region I has used XRF technology at several sites in New England and published *Standard Operating Procedure for Elemental Analysis Using the X-MET 920 Field X-Ray Fluorescence Analyzer* in October 1996. The guidelines can be obtained at http://www.epa.gov/ region01/measure/xray/xrayfluor.html or by calling (617) 575-CEIT. In addition, several Northeast states have successfully used XRF technology during site characterization and/or remediation, including Massachusetts, New Hampshire, New York and Vermont.

Recommendations:

The TRC has determined that, if used properly, XRF technology can provide useful data that should improve site characterization and/or cleanup verification. Potential users of XRF technology are strongly urged to consult U.S. EPA Region I's *Standard Operating Procedure for Elemental Analysis Using the X-MET 920 Field X-Ray Fluorescence Analyzer* (October 1996) and technology vendors prior to planning the field effort. Although the EPA Region I document was developed for the specific make of analyzer they owned at the time,(3) much of the information *in it* is relevant to XRF in general. The project planning methodology outlined in Figure 1 of the document is attached to this Advisory Opinion. The intended use of the data and data quality objectives (DQOs) must be determined prior to the field event and agreed to by the appropriate regulatory authority. The TRC recommends the following items to improve or insure product performance; however, users should recognize that a particular XRF analyzer might have additional requirements:

1. Personnel who use XRF analyzers must be qualified and receive formal training including an explanation of XRF theory, how the specific analyzer works, quality assurance/quality control requirements and methods, and how to interpret the results. Most operators can be trained in one or two days. XRF vendors typically offer this type of training for a fee. Users should carefully follow the manufacturers instructions. In addition, because the analyzers use a form of radiation, a specific operator license is required by some states and includes a license fee. Typically, XRF vendors can guide the user through the required licensing procedure.
2. Soil samples must be collected and handled following standard procedures to promote consistency and comparability of results. In situ analysis requires that any nonrepresentative debris, such as rocks and leaves is removed and the soil surface is smooth so the probe window can make good contact with the soil surface. For semi-quantitative analysis every effort should be made to homogenize the soil. At a minimum, the moisture content of the soil must be low

(see Item #5 below), large nonrepresentative debris removed, and the soil sample placed in a plastic bag for hand mixing prior to analysis. For quantitative data the sample must be oven dried, ground with a mortar and pestle and passed through a 60-mesh sieve. Sections 11 and 12 of EPA Region I's *Standard Operating Procedure for Elemental Analysis Using the X-MET 920 Field X-Ray Fluorescence Analyzer* (October 1996) detail sample preparation requirements.

3. QA/QC requirements vary with different DQOs and regulatory authorities and should be agreed upon prior to the field event. Users are expected to record the results of the QA/QC sample analyses and evaluate them daily to ensure that the analyses and QA/QC checks meet the criteria established in the vendor literature and the project DQOs. In order to meet U.S. EPA QA/QC standards for semi-quantitative and quantitative data, the following QA/QC measures are usually required.(4)
    - Energy calibration check should be performed at the beginning and end of each work day, and also after the batteries are changed or the instrument was shut off, or under any other circumstances recommended by the manufacturer. A pure element such as iron, lead or copper is analyzed to determine whether the characteristic x-ray lines are shifting.
    - An instrument blank should be analyzed once a day or every 20 samples, whichever is more frequent. The instrument blank can be silicon dioxide, a Teflon block, a quartz block, "clean" silica sand or lithium carbonate.
    - When sample preparation is performed using non-dedicated equipment (i.e. the grinding and sieving required for quantitative analysis), a method blank should be analyzed once a day or every 20 samples, whichever is more frequent. The method blank can be "clean" silica sand or lithium carbonate that undergoes the same sample preparation procedures as the environmental samples.
    - A calibration verification check should be performed at the beginning and end of each day. The verification check standard(s) should contain all of the target elements at concentrations that are preferably near the action levels for the site. For semi-quantitative analysis, standard reference materials (SRM) obtained from the National Institute of Standards and Technology (NIST) are preferred. However, if the SRM does not contain a primary metal of concern, or if the concentration of the SRM is below the detection limit or not reasonably close to the concentration range of concern, then a commercially prepared standard containing the appropriate elements(s) at the appropriate concentration(s) should be used. The results of the calibration verification check should be within the limits specified for the SRM standard or ±30 percent of the value specified for the commercially prepared standard. For quantitative analysis, site specific calibration standards (SSCS) are required. Section 8.1 of EPA Region I's *Standard Operating Procedure for Elemental Analysis Using the X-MET 920 Field X-Ray Fluorescence Analyzer* (October 1996) details SSCS preparation requirements.
    - A precision test should be performed at least once a day by calculating the relative standard deviation (RSD) between 7 to 10 replicate measurements of a standard. The standard analyzed for the precision test should contain the primary target element(s) for the site at a concentration near the action level. The RSD for the precision test should be less than 20 percent for each element, provided that the action level is suitably above the method detection limit.

- Duplicate samples should be analyzed (with the field XRF) at a minimum frequency of 1 per 20 or once per day, whichever is more frequent. Duplicates are two portions of the *same* sample that have been prepared and homogenized together, and then split and analyzed in the same manner.
- Field duplicate samples should be analyzed (with the field XRF) at a minimum frequency of 1 per 20 or once per day, whichever is more frequent. Field duplicates are two *different* samples taken from the same location that are prepared and homogenized separately, but using the same equipment and technique.
- A confirmatory sample should be collected and sent for laboratory analysis at a minimum frequency of 1 per 20 or once per day, whichever is more frequent. The confirmatory sample can be a split of the homogenized soil or the actual sample that underwent XRF analysis.

4. The half life of cadmium-109, iron-55 and cobalt-57 is relatively short (1.3, 2.7 and 0.75 years, respectively). Therefore, these source units must be replaced or reconditioned on a regular basis according to the manufacturers recommended schedule. The half-life of americium-241 is 458 years and therefore, replacement is not required.
5. A high moisture content can interfere with the analysis. In situ analysis cannot occur if there is ponded water. For ex situ semi-quantitative analysis, if the moisture content is greater than approximately 20 percent, then the sample should be air dried, or preferably dried in a convection or toaster oven. Oven drying is always part of the sample preparation protocol for quantitative analysis. Microwave drying should not be used because it can increase the variability of results and arcing can occur when metal fragments are present in the sample.
6. The presence of certain metals can interfere with the analysis of certain other metals. For example, iron tends to absorb copper x-rays, while chromium levels are enhanced in the presence of iron. The user should be aware of these types of matrix effects. Vendors can typically provide the necessary information during the planning stage to anticipate matrix effects. Moreover, the effects can be corrected mathematically through the software of the XRF instrument.

The NEWMOA Technology Review Committee has issued this Advisory Opinion on this 21st day of September 1999.

For More Information Please Contact:

In Connecticut:	**In Maine:**
Christine Lacas	Mark Hyland
Department of Environmental Protection	Department of Environmental Protection
Bureau of Water Management	Bureau of Remediation and Waste Management
79 Elm Street	17 State House Station

Hartford, CT 06106 (860) 424-3766	Augusta, ME 04333 (207) 287-7673
In Massachusetts: Dorothy Allen Department of Environmental Protection Bureau of Waste Site Cleanup One Winter Street Boston, MA 02108 (617) 292-5795	**In New Hampshire:** Robert Minicucci Department of Environmental Services Waste Management Division 6 Hazen Drive Concord, NH 03301 (603) 271-2941
In New York: James Harrington Department of Environmental Conservation Division of Environmental Remediation 50 Wolf Road Albany, NY 12233 (518) 457-0337	**In Rhode Island:** Laurie Grandchamp Department of Environmental Management Office of Waste Management 235 Promenade Street Providence, RI 02908 (401) 222-2797
In Vermont: Richard Spiese Department of Environmental Conservation Waste Management Division 103 South Main Street Waterbury, VT 05671 (802) 241-3888	**At NEWMOA:** William Cass NEWMOA 129 Portland Street, 6th Floor Boston, MA 02114 (617) 367-8558, ext. 301
At EPA Region I: Carol Kilbride U. S. EPA Center for Environmental Industry and Technology One Congress Street, Suite 1100 Boston, MA 02114 (617) 918-1831	

Footnotes:

1. In this document, the Northeast states are: Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island and Vermont.
2. U.S. EPA, *Field Analytical and Site Characterization Technologies, Summary of Applications*, EPA-542-R-97-011, November 1997.
3. Note: U.S. EPA Region I has subsequently purchased additional XRF analyzers from other manufacturers.
4. QA/QC requirements for qualitative data are less extensive and should be agreed upon with regulatory authorities prior to the field event. In some instances, less rigorous QA/QC might be accepted by regulatory authorities for semi-quantitative data.