Military Munitions Center of Expertise
Technical Update
March 2005

This technical update provides a tool for your reference and use when developing a Military Munitions Feasibility Study Report under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

Acknowledgments:

This tool has been developed as a joint effort between the U. S. Environmental Protection Agency (EPA) and the U. S. Army Corps of Engineers, Huntsville Engineering and Support Center, Military Munitions Center of Expertise (MM CX).

Existing USACE technical guidance is currently under revision to incorporate the standard format with explanatory notes contained in this document for developing a FS Report. While this document is focused on the Formerly Used Defense Sites Program, it may be useful when working on other programs such as Installation Restoration and Base Realignment and Closure.

Useful EPA and USACE References:

- ER 200-3-1, Formerly Used Defense Sites (FUDS) Program Policy, 10 May 2004,

- EPA/540/G-89/004, OSWER Directive 9355.3-01, Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, October 1988,

- EPA Directive 9355.3-01FS3, The Feasibility Study, Development and Screening of Remedial Action Alternatives, November 1989,

- EPA Directive 9355.3-01FS4, The Feasibility Study: Detailed Analysis of Remedial Action Alternatives, March 1990.

Helpful Web Sites:

HQ, U.S. Army Corps of Engineers: http://www.usace.army.mil/inet/usace-docs
MM CX: http://www.hnd.usace.army.mil/oew/techguid.asp
Environmental Protection Agency: http://www.epa.gov/superfund/index.htm)

For additional information: Email the MM CX thru our web site response specialist at: mailto:OEResponseSpecialist@HND01.usace.army.mil. Telephone the MM CX at 256-895-1540.

Standard Format for Feasibility Study Reports

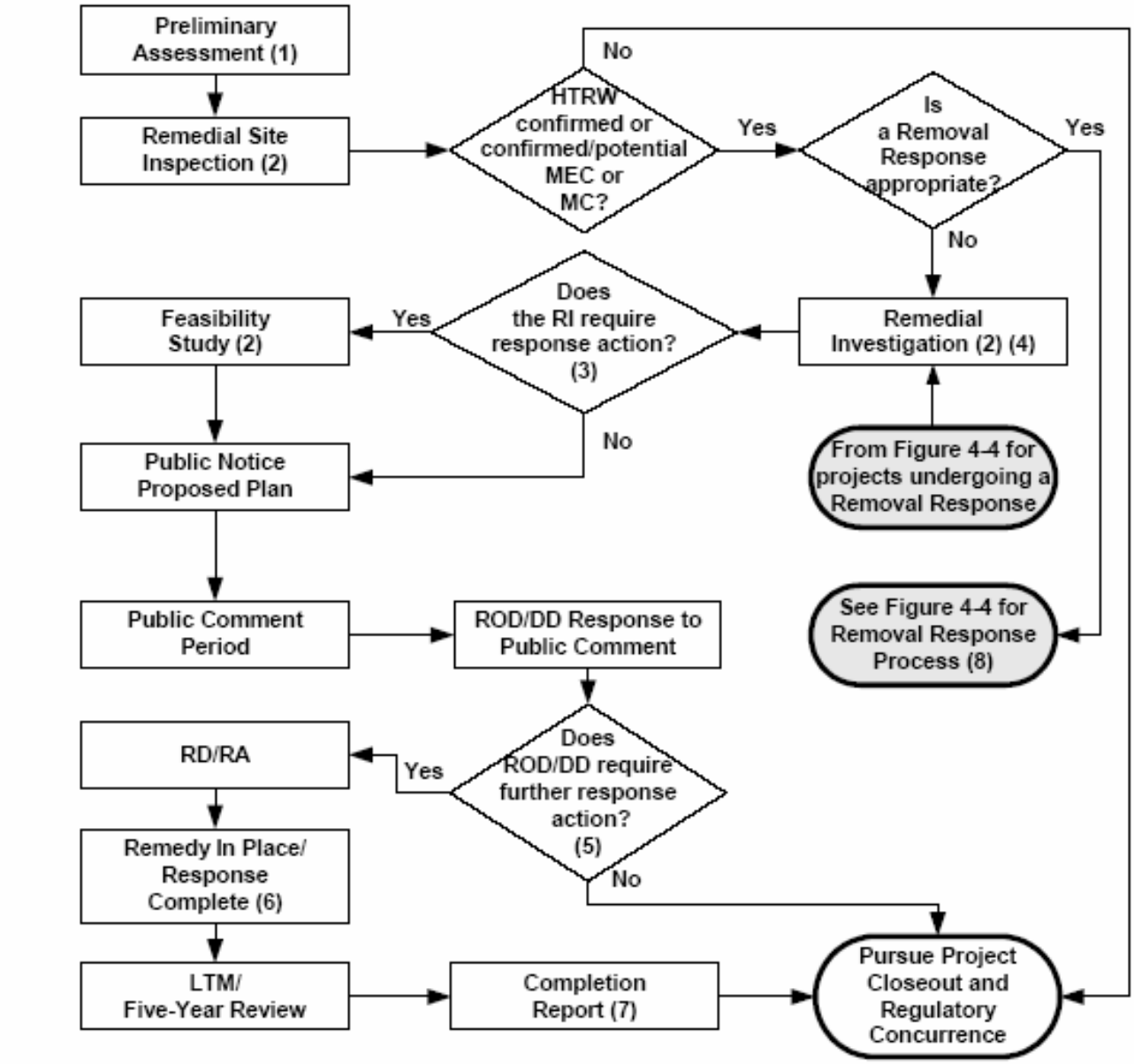
For Military Munitions Response Program

Standard Format for Feasibility Study Reports
For Military Munitions Response Program

1.0 EXECUTIVE SUMMARY

The executive summary of the Feasibility Study (FS) report provides an overview of the results of the development and analysis of alternatives. This section should provide a brief summary of the findings of the Remedial Investigation (RI), including nature and extent of Munitions and Explosives of Concern (MEC) that includes Recovered Chemical Warfare Material (RCWM) configured as a munition, and Munitions Constituents (MC), media to be addressed, and pathways of concern. The section should also identify the remedial action objectives (e.g., the Preliminary Remedial Goals (PRGs), depth of removals, exposure pathways of concern, land use controls that may be implemented, etc.) Finally, this section should summarize the results of the detailed analysis of alternatives, concentrating on the comparative analysis of alternatives. The purpose of the FS is not to select a remedy, but instead is to develop remedial alternatives and then to provide decision makers the information needed to select from among the developed alternatives. This last sentence is very critical. This is an area where DOD and other federal agencies that undertake a lot of National Environmental Policy Act (NEPA) activities bring their NEPA experience into CERCLA. This is one of the key differences between how the two statutes are implemented in terms of alternative analysis and decisions.

This section should also note whether the FS report has been developed as a separate document or as a combined RI/FS report. Refer to Figure 1-1 that shows where the FS phase occurs in the CERCLA process. Refer to ER 200-3-1 to review the Figures referenced in Figure 1-1 and the footnotes.



Notes:
1. For new INPRs, a Preliminary Assessment will be performed for eligible FUDS properties. If no hazards are identified during the PA, pursue property closeout and regulatory concurrence.
2. A removal response may be performed at any time during the process up until the ROD/DD signature.
3. Response action may include land use controls.
4. If the removal response taken adequately addresses the risk or safety concerns at the project, the RI may be abbreviated. If LUC/5-Year Review/LTM are required, evaluate them in the FS.
5. LUC/5-Year Reviews/LTM are required to be documented in the RD.
6. See definitions in paragraph 4-4.7.2 and Figure 4-3.
7. Required by USACE FUDS policy.
8. Regardless of whether additional investigation/response is required following the removal action, the projects will transition back to the remedial response process.

Figure 1-1 CERCLA Response Process (ER 200-3-1)

2.0 INTRODUCTION

2.1 Purpose

This section should define the purpose of the FS. As stated, the purpose of the FS is not to select the remedy. Rather, its purpose is to provide decision makers with the data necessary to select an alternative. As such, the FS process should be designed to develop an appropriate range of potential alternatives to manage the hazards and risks, analyze those alternatives against the NCP nine criteria,[1] and then compare the alternatives against each other.

2.2 Summary of Remedial Investigation Findings

This section of the report should briefly summarize those key findings of the RI that were relevant in the development of the remedial action objectives and to the development and analysis of alternatives. These findings may include:

- Conceptual Site Model, (EM 1110-1-1200) including:
  - Property description and historical data;
  - Physical characteristics of the property that may be relative to remedy design (e.g., depth to bedrock, type and thickness of existing soil cover, physical features);
  - MEC source characteristics (e.g., quantities, type, condition (fired, armed, fuzed, low orders, etc.), aerial extent, depth and distribution of UXO and DMM);

[1] The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) contains several statutory provisions with which all remedies must comply. These include protection of human health and the environment, compliance with applicable or relevant and appropriate requirements (ARARs), cost effectiveness, and a preference for permanence, and treatment that reduces toxicity, mobility, or volume. In order to satisfy these CERCLA requirements, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP 300.430) identifies nine criteria against which potential remedies are judged. These are: protection of human health and the environment, compliance with ARARs; long-term effectiveness and permanence; reduction of toxicity, mobility or volume through short-term treatment; short-term effectiveness; implementability; cost; State acceptance; and community acceptance.

- MEC exposure pathways (potential) (receptors, activities, potential interaction with source MEC)
- MC pathways of concern
    - MC contaminants of concern;
    - Type of media contaminated;
    - Volume of media contaminated.

- Baseline MEC Hazard Characterization Summary (EM 1110-1-4009).
- Baseline MC Risk Assessment Summary (EPA Risk Assessment Guidance).

[Note: for sites where the RI and FS reports are developed as one document, Section 2.2 would not be required since the information would be addressed in the sections described in the Standard Format for Remedial Investigation Report.]

3.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES FOR MEC AND MC

This section should discuss the process that was used in developing and screening technologies. Figure 1-2 presents a flow diagram of the steps (with the exception of the last two steps in the diagram) involved in the development of alternatives from various technologies.

3.1 Remedial Action Objectives

This section should present the remedial action objectives resulting from the remediation action goals that were developed during the Remedial Investigation (RI). Remedial action objectives should address the goals for reducing the explosives safety hazards or contaminants of concern to ensure protection of human health, safety and the environment.

CERCLA Process for the Development of Remedial Action Alternatives

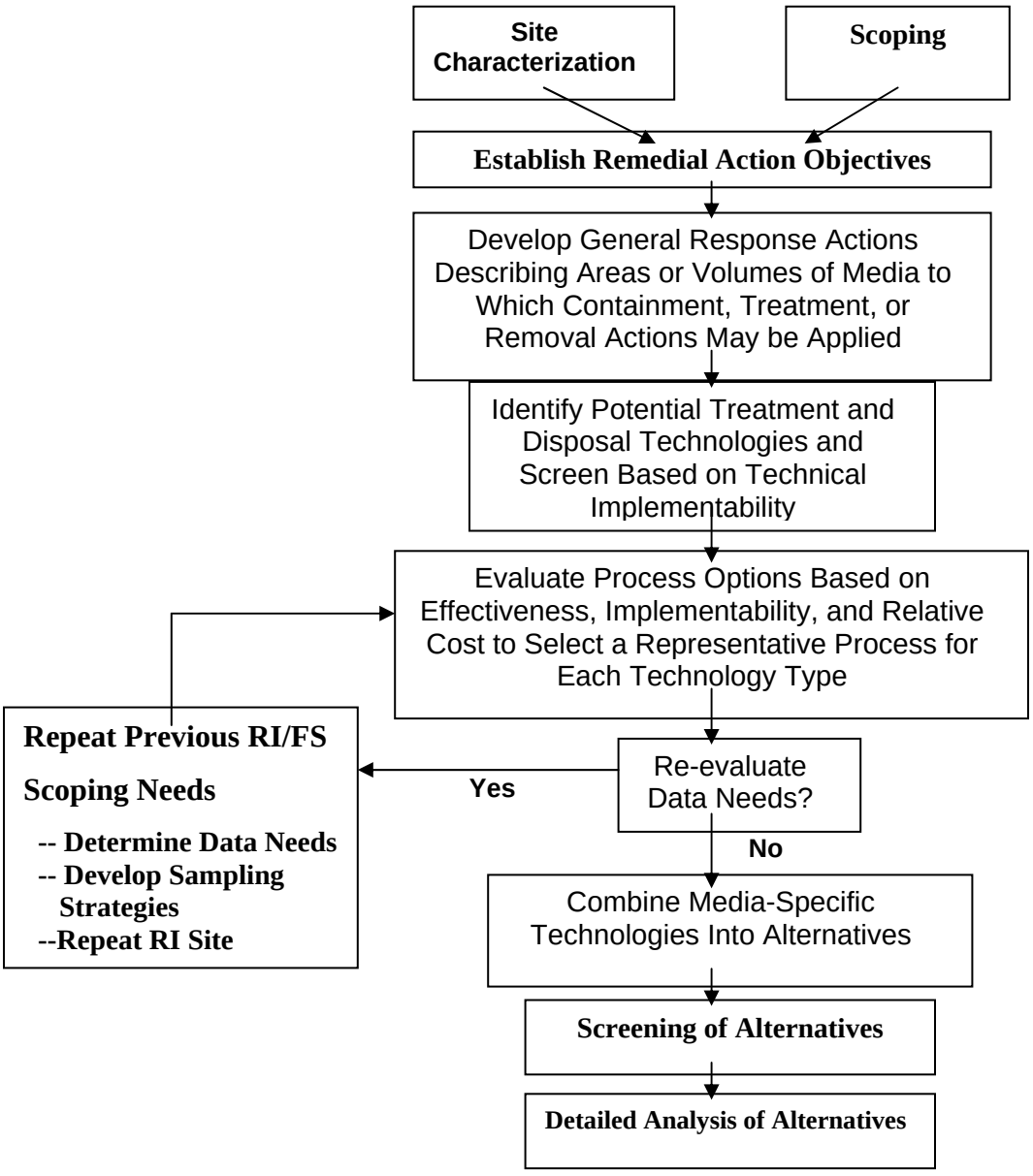


Figure 1-2 Development of Remedial Action Alternatives

The remedial action objectives should be as specific as possible without unnecessarily limiting the range of alternatives and include the following:

- Explosives safety hazards or contaminants of concern;
- Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) information;
- Exposure pathways;
- Receptors and potential receptors; and
- A preliminary remediation goal (PRG) for each exposure pathway that was identified during the RI.

Both the PRG and the exposure pathways should be identified because alternatives for MEC typically involve reducing the extent of MEC and/or minimizing exposure. For MC the alternatives may involve reducing or eliminating exposure as well as reducing contaminant levels.

3.2 General Response Actions (ER 200-3-1)

This section should identify the general response actions for both MEC and MC. General response actions are those actions that will achieve the remedial action objectives and may include treatment, containment, excavation, extraction, disposal, land use controls, or combinations of these. This section should also discuss the relationship of MEC response actions with MC response actions, as well as issues related to sequencing actions.

3.3 Identification and Screening of Remedial Technologies

The identification and screening of technologies must comply with the requirements specified in paragraphs 3.3.1 and 3.3.2 below. This section should contain a summary of the information previously reviewed by the Technical Project Planning (TPP) (EM 200-1-2) group and provide a sufficient level of detail and documentation for the public to understand and compare alternatives. The level of detail must also be sufficient to

support the decision-making process. Two separate Technology Assessment Reports for MEC and MC concerns are currently under development. These reports will be made available on the MM CX website when finalized. As an interim measure, the enclosed tables on identifying and screening of technologies have also been provided to assist in these determinations. For more detailed information on the identification, screening, and evaluation of technologies, contact the Military Munitions Center of Expertise (MM CX).

The discussions in this section and subsections should be organized and presented in the following three categories for MEC:

- Detection technologies
- Recovery technologies
- Disposal technologies

The discussions in this section for MC technologies should follow existing EPA guidance for developing the RI/FS (EPA/540/G-89/004, OSER Directive 9355.3-01) and EPA Directive 9355.3-01FS3 and 9355.3-01FS4). These documents can be located on EPA's website at http://www.epa.gov/superfund/index.htm).

3.3.1 Identification and Screening of Technologies

While site-specific conditions will determine the range of technology options available at a given project site, there could be cases where there may be so few realistic options that a screening process is not needed and only a detailed analysis is conducted.

If screening is conducted, this section should address all potentially applicable technologies that were considered, as well as the criteria used to identify them. It should also identify those apparently reasonable technologies that were eliminated from further consideration. Decisions on eliminating technologies should only be based on technical implementability (i.e., only those technologies that are clearly ineffective or unworkable should be eliminated). This section should also provide the rationale for each technology eliminated. This section will typically include a summary figure identifying the universe

of technologies considered and indicating those that were "screened out", and provide a reference to: http://www.hnd.usace.army.mil/oew/techguid.asp for the MM CX Technology Assessment Report for MEC and MC discussed in section 3.3.

3.3.2 Evaluation of Technologies

Once the universe of technically implementable technologies has been identified, the next step is to perform a more detailed evaluation of each technology based on effectiveness, implementability,[2] and cost. This section should discuss the results of the evaluation for each technology considered and identify those technologies that have been retained for the development of alternatives. A rationale should be included for those technologies that were excluded from further analysis based on this evaluation. This section should also include a figure summarizing the results of the evaluation and indicating those that were eliminated from further consideration.

Tables 1 through 6 are provided for illustrative purposes to demonstrate how to approach this screening step and how to document the results. The number of technologies screened should make sense based on the needs of the project site and should have already been discussed by the Project Delivery Team (PDT) during the TPP process initiated during the RI phase.

4.0 DEVELOPMENT AND SCREENING OF ALTERNATIVES

4.1 Development of Alternatives

This section should discuss how the technologies and general response actions were combined to form remedial alternatives for the project site. This section should include a general description of each alternative, and the rationale for creating each alternative

[2] Because the technical implementability of the technologies is judged in the initial screening step, this evaluation focuses on the administrative and institutional implementability of the technology (e.g., likelihood of community and or regulator acceptance or resistance based on concerns about the safety of the proposed technology, availability of treatment, storage, or disposal options, etc.).

should be clearly stated. The section should also include a summary table identifying the alternatives.

4.2 Screening of Individual Alternatives

4.2.1 Introduction

As with the technology screening process, depending on the number of alternatives, preliminary screening may not be necessary. If preliminary screening is conducted however, this section should discuss the screening process and the criteria used. The criteria are effectiveness, implementability, and cost as discussed in ER 200-3-1 and the NCP. This section should summarize the results of the screening, present the State's response to the preliminary screening results provided to them for review and identification of State ARARs, and identify those alternatives retained for detailed analysis as discussed in Section 5.0. The section should also include a summary table that presents the results of the screening.

4.2.2 Alternative #1[3]

4.2.2.1 Description of Alternative. This section should contain a general description of the alternative.

4.2.2.2 Evaluation of Alternative.

Discussion in this section should focus on the results of the screening process. Specifically, it should discuss the effectiveness of the alternative in terms of achieving the remedial action objectives, the implementability of the alternative, and the relative cost of the alternative. It should also indicate whether the alternative was retained for detailed analysis and, if the alternative was not retained, the rationale for exclusion should be clearly and thoroughly stated.

[3] The results of the screening for each alternative should be presented in a separate subsection.

5.0 DETAILED ANALYSIS OF ALTERNATIVES

The National Contingency Plan (NCP), at 40 CFR Part 300, states that the primary objective of the FS is to "ensure that appropriate remedial alternatives are developed and evaluated." It also states that the FS "shall include an alternative screening step, when needed, to select a reasonable number of alternatives for detailed analysis," and that "the number and type of alternatives to be analyzed shall be determined at each site, taking into account the scope, characteristics, and complexity of the site problem that is being addressed." [emphasis added]

5.1 Introduction

This section should describe the detailed analysis of alternatives against seven of the nine criteria from the NCP, Section 300.430. The criteria for State acceptance and community acceptance cannot be fully evaluated and assessed until comments on the RI/FS and the proposed plan are received. Refer to the discussion on Modifying Factors in Section 5.2.1.2 for more information on what should be documented in the FS on these factors. This section should also summarize the results for each alternative as well as the comparative analysis. A summary table of the results should be included. Table 3 is included as a sample format for use for this purpose.

5.2 Individual Analysis of Alternatives

5.2.1 Alternative #1[4]

5.2.1.1 Description. This section should contain a detailed description of the alternative. The description should be sufficiently detailed to allow a citizen to understand and compare alternatives and should include, as appropriate, data on the technology components (including use of innovative technologies), types and quantities of MEC or

[4] The results of the detailed analysis of each alternative should be presented in a separate subsection.

MC the alternative is designed for, how long it will take to implement the alternative, what will be required in order to implement the alternative, e.g., reaching agreement on who will be responsible for managing and enforcing any LUCs that form a part of the alternative, and any assumptions made about the alternative. The discussion should also identify the significant ARARs for the alternative.

5.2.1.2 Assessment.

The detailed results of the analysis of each alternative against the nine criteria should be presented in this section. The discussion should focus on how, and to what extent, the various factors within each criterion are addressed. Uncertainties should also be discussed, especially when changes in assumptions made about the project site or the alternative could affect the results of the analysis.

There is no fixed number of alternatives that must be considered in the detailed analysis process. The assessment of each alternative is completed to the degree appropriate to the alternative and as required to complete a comparative analysis. All alternatives must be evaluated to the same degree and level of detail. The No DoD Action Indicated alternative may not be discussed to any great extent if it is clear that there is a risk and that some kind of cleanup action will be considered. However, the "no action" alternative must be evaluated against the threshold criteria and balancing factors as must all alternatives at this phase of the process. Finally, in the case of presumptive remedies, a determination has already been made that absent other factors, certain remedies are the ones to be considered for specific project sites.

In general, specific issues described below (in relation to the nine criteria) should be addressed for each alternative for which a detailed analysis is appropriate. Because this discussion will form the basis for the proposed plan and the Decision Document (or Record of Decision for a National Priorities List (NPL) site), it is important that the discussion provide an understanding to support the rationale for the final remedy selection. Some issues to be addressed for each alternative include:

- **Threshold Factors:**

The NCP calls the two factors below "threshold factors." The NCP requires that all project sites have protective remedies and meet ARARs, or that an ARAR waiver be utilized. Determinations as to what is protective for a Military Munitions project site must be made on a case-by-case basis. Because protectiveness is associated with particular use scenarios, it is necessary for the protectiveness discussion to focus on the reasonably anticipated future land use, and the exposure pathways addressed by the candidate remedies forwarded from Section 4.

- Protectiveness:

  - Any selected alternative must adequately protect human health and the environment, in both the short and long term, from unacceptable risks posed by MEC or MC.
  - Remedial Action Objectives (RAOs) to be achieved by the remedy.
  - Point of compliance (e.g. removal depths to support land use) associated with the RAOs.
  - Land use assumption used to establish the RAOs.
  - Exposure pathways addressed by the remedy. The exposure pathways should be consistent with the CSM for the project site.
  - Ecological risk posed by MC
  - Other pertinent information

- Compliance with ARARs (specific requirements to be cited, including whether they are State or Federal ARARs):

  - Reference ARARs or To Be Considered (TBC) information documented in Section 3.1.
  - Chemical Specific ARARs to be met by the remedy,
  - Action specific ARARs to be met by the remedy

- Any location-specific ARARs that affect remedy selection.
- TBCs – (e.g. federal or state laws or regulations and DOD policy and guidance for MEC/MC)

- **Balancing Factors:**

CERCLA requires that alternatives be developed for treating principal threats at the project site through reductions in toxicity, mobility, or volume. In addition, remedies are required to be permanent, e.g., removal of MEC, to the maximum extent practicable, and to be cost effective. The five balancing factors described below are weighed against each other to determine which remedies are cost effective and are "permanent" to the maximum extent practicable. The NCP explains that in general preferential weight is given to alternatives that offer advantages in terms of the reduction of toxicity, mobility, or volume through treatment, and achieve long-term effectiveness and permanence. However, the NCP also recognizes that some contamination problems will not be suitable for treatment and permanent remedies. The balancing process takes that preference into account, and weighs the proportionality of costs to effectiveness to select one or more remedies that are cost effective. The final risk management decision in the Decision Document is one that determines which cost-effective remedy offers the best balance of all factors to achieve permanence to the maximum extent practicable.[5]

Refer to ER 200-3-1 on the Headquarters, U. S. Army Corps of Engineers web site at http://www.usace.army.mil/inet/usace-docs for more information on the application of these requirements to Formerly Used Defense Sites. Various EPA guidance documents are also available to assist in the detailed analysis required during the FS phase. EPA's documents may be viewed on their web site at http://www.epa.gov/superfund/index.htm).

- Reduction of Toxicity, Mobility, and Volume Through Treatment:

[5]A detailed description of items that may be addressed in analyzing each criterion is laid out in the NCP, 40 CFR 300.430(e)(9)(iii) . The decision-making process (and criteria and standards) for selection of remedies is located at 40 CFR 300.430(f)(4). The discussion above is meant to provide a platform for understanding the appropriate type and level of analysis required by each criterion.

- What volume of MEC or MC contaminated media may be removed or reduced?
- How will the management of the hazards and/or risks reduce the toxicity or mobility of the MEC and/or MC?
- The degree to which the treatment is irreversible.

- Short-term Effectiveness:

- Risk due to cleanup activity (e.g., worker protection required, short-term impact to local residential populations and the environment) and activities that can be taken to mitigate potential adverse effects.

- Removal of the MEC is short term when interim actions such as Time Critical Removal Actions have been conducted or when a removal action was conducted to remove all MEC reasonably possible to detect but due to certain natural phenomena such as erosion or frost heave, or other human activities, such as beach replenishment causing MEC to relocate, that would require additional response actions to be conducted.

- Long-term Effectiveness and Permanence:

- Does the remedy rely on exposure control or a more permanent cleanup (e.g., treatment or removal)?

- If the remedy relies upon some sort of exposure control how long will that be in place? What kind of maintenance is required?

- Will the chemical characteristics of any of the munitions constituents be changed due to treatment or stabilization?

- Is the project site suitable for unrestricted use? (i.e., for what land uses is the remedy protective?)

- Implementability:

- Are there any factors that are likely to affect the implementability of the remedy? By this step in the process, there should only be candidate alternatives that can be

implemented. At this step, implementability should be a discussion of the ease or difficulty of implementation of the alternatives in terms of technical and administrative aspects, and the availability of necessary services, materials, specialists, and equipment.

- Cost:

  - The present worth costs of the remedy, including capital costs and LTM costs. LTM will be conducted consistent with DERP Management Guidance, ER 200-3-1 and EP 75-1-4. The activities to be conducted during LTM, their duration and frequency will be documented by the PDT.

- **Modifying Factors:**

Community and State acceptance of the remedy can play a role in weighing the balance between remedies that are cost effective and meeting other criteria of the law. Use of the TPP process and other public involvement techniques will help the PDT to have a better understanding of these factors even though the Proposed Plan has not yet been issued. These factors should only be addressed in the FS to the degree appropriate based on the degree of knowledge and the stage of the process. Final evaluation of modifying factors should be completed after the proposed plan and public comment period on that Plan in the Decision Document or Record of Decision.

The TPP process includes the substantive involvement of regulators, local community members, and other stakeholder participation. In addition, there are various other communications techniques that may be utilized to ensure sustained participation of all interested parties throughout the process. These communications techniques are identified in the Public Involvement Plan for a given project, (e.g., Restoration Advisory Boards, public meetings, news releases, fact sheets, information repositories, etc.). Therefore, meaningful state and community input is expected to be part of the entire response process. However, as previously stated, final evaluation of the community and state acceptance will occur after the Proposed Plan and public comment period have been completed. This process is in accordance with the requirements of CERCLA and the NCP and will guard

against any perceived pre-selection of the remedy by DOD.

5.3 Comparative Analysis of Alternatives

The results of the comparative analysis of the alternatives are discussed in this section. Specifically, the section should describe the strengths and weaknesses of the alternatives relative to one another with respect to each of the nine criteria, and how changes to key assumptions and uncertainties could alter the expectations of their relative performance. The presentation of differences can be measured either qualitatively or quantitatively, as appropriate, and should identify substantive differences (e.g., higher cost, better long-term effectiveness). Any quantitative information used to assess the alternatives should also be included (e.g., cost estimates, levels of residual hazards or contamination, etc**.).** Refer to the enclosed Table 7 that provides a comparison of alternatives against the nine NCP criteria when applied to MEC and MC**.** This table has been provided as an example for reference when documenting the FS Report.

Ideally, this section should focus the risk management considerations for the decision-maker. For example, it should discuss the results of the comparative analysis for the reasonably anticipated land use, or under the various future land use scenarios considered; when applicable, the cost implications associated with incremental risk reductions within the risk range, etc.

6.0 REFERENCES

This section presents the references used in the development of the feasibility study.