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 Remedial Investigation 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 (USACE), 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 an RI 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 when conducting a Remedial Investigation:

- 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 9355.3-01FS2, The Remedial Investigation Site Characterization and Treatability Studies, November 1989,
- EPA Directive 9355.3-01FS1, Getting Ready Scoping the RI/FS, November 1989.

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

Standard Format for Military Munitions
Remedial Investigation Reports

APPENDICES:

A. Documentation of Disposition of Munitions Potentially Presenting an Explosive Hazard, Munitions Debris, and Wastes

B. Analytical Results Tables and QA/QC Evaluations

C. Institutional Analysis and Institutional Analysis Report

D. Demolition Activity Summation Tables

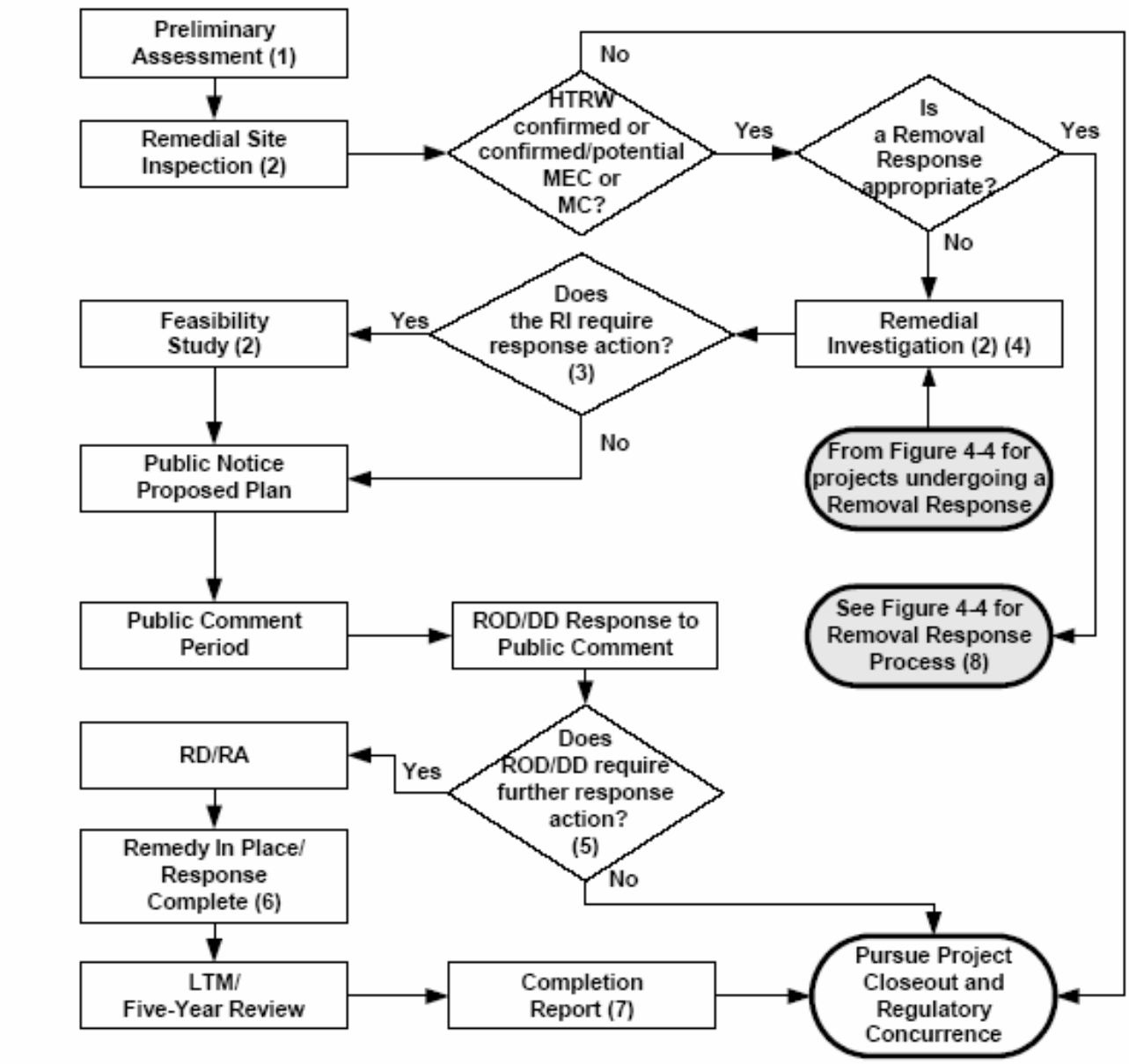
Standard Format for Military Munitions
Remedial Investigation Report

1.0 Executive Summary

The executive summary of the Remedial Investigation (RI) report should provide a brief overview of the findings of the RI. This information will inform decision-makers upfront of the nature and extent of the munitions issues, to include the explosives safety hazards and munitions constituents (MC) of concern. This could include recommendations for removal actions under the Non-Time Critical Removal Process or interim remedial actions when a response action will not address the entire property. The RI report will describe the methodologies used during the investigative or characterization process and identify what surface and subsurface hazards exist on the property. The characterization effort conducted under the RI should sufficiently characterize the property to support the development of the baseline risk assessment and follow-on feasibility study. The format of the RI report presented in this document is based on EPA's 1988 Guidance for Conducting an RI/FS. It is streamlined to address the specific characteristics associated with Military Munitions Response Program projects. This section should also note whether the RI report was developed as a stand-alone document or as a combined RI/FS report. Refer to Figure 1-1 that shows where the FS phase occurs in the CERCLA process.

2.0 Introduction

The introduction to the RI report describes the purpose of the report, provides a description of the property and the project being addressed when the property has been divided into more than one project, and provides some historical information on the property, including previous investigations. The process flow chart provided below reflects the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and National Oil and Hazardous Waste Pollution Contingency Plan (NCP) remedial action process. This chart highlights where the RI report fits into the 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)

2.1 Purpose

The RI is intended to adequately characterize the property (i.e., determine the nature and extent of contamination) for the purpose of developing and evaluating effective remedial alternatives. The primary purpose of the RI report is to present the results from the RI and provide information to assess the potential risks to human health, safety, and the environment. The RI should focus on collecting information to support the Feasibility Study (FS) so a decision on the remedy can be made. In addition to presenting the data from the RI, this report should indicate whether the characterization was "successful" -- Were the objectives of the study met? Were the data gaps filled? Can the questions developed in the work plan be answered?

2.2 Property Description and Problem Identification

This subsection should contain a brief description of the property, describe project-specific information on the location of buildings and other man-made features as well as known explosives safety hazards, physical characteristics of the property (geology, soil, surface features, meteorology, hydrology, and hydrogeology, etc.), land use, and potential human and ecological receptors in the area.

2.3 Historical Information

This subsection should provide a description of the history of the property including the types of activities that have taken place such as the manufacture of munitions, use, storage, and disposal of military munitions. This section should also contain maps, as appropriate, to highlight the location of the project within the total property and a map showing the project boundaries and surroundings as well as important features.

2.4 Previous Investigations

This subsection summarizes previous efforts to characterize the property (e.g., preliminary assessments, review of historical records, aerial photography, etc.). Previous MEC and MC investigations and the data that are available to supplement this RI should

be reviewed. In some cases, existing data are simply used qualitatively to scope the RI. For example, if previous investigations were limited in scope (e.g., a time-critical or non-time critical removal response was conducted), the RI may have been designed to supplement the existing data by filling in data gaps. In other cases, data may be of sufficient quality to be used quantitatively in the baseline risk assessment that is compliant with EPA Risk Assessment Guidance (RAGS) and EM 200-1-4, Volumes I and II. The data quality and utility of existing data should be explained in the context of their use as part of this investigation. If the review of the existing data quality revealed that it was suitable for use in the baseline risk assessment, discuss how this was incorporated into the planning process in identifying data needs/gaps for the RI workplan.

3.0 Project Remedial Response Objectives

This section should discuss the results of the Technical Project Planning (TPP) process covering both MEC and MC. It should include the overall project remedial response objectives that were developed based on the planned or reasonably anticipated future land use. Refer to EM 200-1-2 and Interim Guidance Document 01-02 for implementation guidance on the TPP process. This section should also provide a discussion of the revised preliminary conceptual site model for the project as discussed in EM 1110-1-1200, the project objectives, regulator and stakeholder concerns and input, data needed to make appropriate and supportable decisions, and identify the potential decisions to be made.

3.1 Conceptual Site Model (CSM) and Project Approach (EM 1110-1-1200)

This subsection should discuss the revised CSM (preliminary CSM developed during the Site Investigation phase) that provides a description of the project site and its environment based on existing knowledge. The CSM discussion should provide a summary of what is known about the site, show the relationship between the former military use of the site, current and proposed future land use, ways in which people may encounter MEC or MC, and geological and environmental features that may have an impact on proposed activities and decisions.

3.2 Preliminary Remediation Goals (NCP and EPA /540/G-89/004 OSWER Directive 9355.3-01)

This subsection should discuss the types of decisions to be made and identify the data and other information collected to support decisions. This should include an assessment of land use and institutional analysis aspects. Preliminary Remediation Goals (PRGs) are concentrations of contaminants for each exposure pathway that are believed to be protective based upon preliminary site information. A PRG for MC would be a concentration value believed to be protective based upon preliminary site information. A PRG for MEC would be a description of a method likely to be protective of the particular exposure pathway(s) identified at the site; e.g., levels of cleanup such as surface removal, removal to depth or the implementation of land use controls (LUCs). PRGs are refined throughout the process as new information becomes available

3.3 Preliminary Identification of ARARs and TBC Information (ER 200-3-1 and EP 1110-1-18)

This subsection should discuss the preliminary identification of chemical-, action-, and location-specific ARARs and To Be Considered (TBCs) information. This includes federal, state, and tribal promulgated laws and regulations that may be applicable, or relevant and appropriate (ARAR) to the circumstances at the project site. TBC information includes non-promulgated policies, guidance, and advisories. It is not necessary to spend a great deal of time on the location or action specific ARARs because they will be more completely analyzed in the Feasibility Study (FS). In particular, the chemical-specific ARARs identified in the RI are preliminary in nature. ARARs are selected or become final when the ROD or Decision Document is signed. This subsection should also describe how ARARs and TBCs relate to the information collected and should specify that further refinement of them will be accomplished in the FS phase.

3.4 Summary of Institutional Analysis

This subsection should summarize the Institutional Analysis Report that is developed as part of the characterization effort based on the requirements of EP 1110-1-24. This summary should identify the government agencies (federal, State, Tribal, and local level) having jurisdiction over properties that have a MEC presence and identify the basis of their authority including any limitations, how much control they can exercise, and any enforcement authority. The mission of the agencies should also be reflected, e.g., a public safety function, zoning, construction permits, etc., as well as their capabilities and willingness to participate in LUC implementation and maintenance. Any land use restrictions that may have been placed on the property in the past as a result of some other activity should be specified. LUC alternatives selected for further detailed analysis in the Feasibility Study should be described and should be based on their ability to satisfy the project's objectives. The cost and effectiveness of existing and proposed LUCs should also be documented. For projects being executed on National Priority Listing (NPL) sites, refer to the Principles and Procedures Agreement Concerning LUCs between EPA, Department of the Army and the Department of Navy. This document can be located on EPAs web site at: http://www.epa.gov/fedfac.

3.5 Data Needs and Data Quality Objectives (DQOs) (EM 1110-1-4009 and EPA/540/G-89/004, OSWER Directive 9355.3-01)

This subsection should discuss the evaluation of existing data, document determinations regarding what additional data was obtained to make appropriate and supportable decisions, identify data that was obtained to design the Geophysical Prove-Out (GPO) that was conducted during the RI, (EM 1110-1-4009) including resulting DQOs that were developed through the TPP process, and identification of new methods used for collecting that data. This section should also include an evaluation of MC methodology to ensure that any chemical specific DQOs were met. This discussion should include an evaluation of the usability of existing data, define the additional data needs that were identified, and specify how much additional data was needed to satisfy the DQOs.

Data collection options should be discussed including the evaluation, selection, and documentation of the field methods used. Methods that were used to collect existing data should also be discussed. This will involve finalizing and documenting the data collection alternatives and decisions, including documentation of the DQOs as defined in Interim Guidance Document 01-02 on implementing the TPP process. Additional EPA information on the establishment of DQOs can be found in Data Quality Objectives for Remedial Response Activities, OSWER Directive No. 9355.0-7B.

4.0 Characterization of MEC and MC Including RCWM[1]

This section should summarize the approaches used for the RI (e.g., geophysical investigations and mapping, footprint analysis, historical photo analysis, etc.) with emphasis on any deviations from approaches described in the work plan, including the sampling and analysis plans, field sampling plan (FSP), and quality assurance project plan (QAPP). (Note: The joint guidance on QAPPs being developed by DOD, EPA, and the Department of Energy is still in draft form at this writing.) Information does not need to be described in detail when the work plans previously described the overall approaches to be used and the characterization is conducted according to plan. For example, it may be adequate to state that the sampling strategy and the rationale for the type, location, number of samples to be collected and analytes to be sampled for were carried out in accordance with the work plan.

This section should address the nature and threats posed by the Military Munitions or MC based on the data gathered as a result of the established DQOs discussed in Section 3.5. In addition, this section should reflect that sufficient data was gathered to assess the extent to which the hazard or risks poses a threat to human health, safety, or the environment. It should discuss how the data gathered supports the analysis and design of potential response actions by assessing the following factors. Refer to EM 1110-1-1200, Table 2-1, Profile Types and Information Needs for additional information.

[1] MEC characterization includes all categories as defined under the term MEC, i.e., UXO, DMM, and MC in high enough concentrations to be explosive.

- Physical characteristics of the property and MEC items,
- Characteristics/classification of soil, air, surface water, and groundwater for MC,
- Characteristics of the military munitions,
- Site characterization approach necessary to meet DQOs,
- Actual and potential exposure pathways through environmental media,
- Actual and potential exposure routes (e.g., inhalation and ingestion); [note – cross check with CSM guidance for consistency] and,
- Other factors such as sensitive populations that pertain to the characterization of the site or support the analysis of potential remedial action alternatives.

4.1 MEC Characterization

This subsection should summarize the characterization activities that are undertaken to meet DQOs, and the types of data gathered such as:

- Type(s) of MEC, to include fill data (specify whether it is UXO, DMM, or MC and then specify the nomenclature for UXO, DMM, or MC in type and concentration required to be explosive),
- Condition of MEC (fuzed/unfuzed, etc.),
- Sensitivity of MEC (i.e. potential for functioning based on different interactions by receptors),
- Areal extent, depth, and distribution of MEC,
- The potential for the MEC to migrate to the ground surface (frost-heave, erosion, etc.).

4.2 MC Characterization

This subsection should summarize the characterization activities associated with determining the nature and extent of MC. These may include, but are not limited to the following:

- Soil and vadose zone investigations,
- Groundwater investigations,
- Surface water and sediment investigations.

RCWM requires concurrent characterization for both MEC and MC, including requirements such as headspace sampling and 3X material handling. In addition to the traditional MEC and MC characterization elements discussed above, air monitoring should also be discussed since it is used extensively during RCWM characterization efforts as a measure of potential contamination.

5.0 Revised Conceptual Site Model and RI Results

This section is the primary focus of the RI report. It presents information on the nature and extent of MEC at the project site, MC contamination of environmental media, and physical characteristics of the project site determined from the field studies conducted as part of the RI. Maps should be included, as appropriate, that portray important project site features, geophysical mapping data, etc., that would assist the reader. This section should also provide the results of the field sampling and laboratory analyses to characterize the level of MC in environmental media.

5.1 Munitions and Explosives of Concern (MEC)

The RI report will describe the nature and extent of MEC identified at the project site. This subsection should present the results of the field investigation that was conducted to characterize the MEC. Additional subsections may be appropriate for the presentation of results covering various types of MEC that may be present, the extent of the MEC, and benefits associated with removals and/or interim remedial actions. The report should also contain a discussion comparing the nature and extent of MEC detected with the information from any previous studies that may indicate the “success” of the RI in characterizing the extent of the explosives safety hazard. This subsection should also provide specific references to any maps, figures, or tables that have been included in the RI report showing the project site features, geophysical mapping data results and any other data captured concerning the identification and location of the MEC.

5.2 MC

The RI report will describe the nature and extent of contamination detected at the project site. This subsection should present the results of the field sampling and laboratory analyses that was conducted to characterize the nature and extent of MC in environmental media. Subsections may be appropriate for the presentation of results on contaminants detected in each medium (e.g., soil, ground water, surface water) and include results from any background sampling for metals that was conducted. The analytical data should be presented in summary data tables to include analytical results for all samples collected and the analytical results greater than the Method Detection Limit for all samples collected (see sample Tables in Appendix B). Typically the RI Report main text will contain summary tables showing results for contaminants of concern. The summary will include data fields like number of times sampled/number of times detected; concentration ranges; number of times detected above PRGs or preliminary ARARs, etc. The full data results typically will be in a technical appendix along with the QA/QC findings. The report should also contain a discussion comparing the types of contaminants detected with the information from previous studies (and knowledge of sources at the site) that may indicate the "success" of the RI in characterizing the extent of the contamination as well as locating hot spots or unknown sources.

When a project characterization for RCWM is conducted, this subsection should present the results of the RCWM characterization, such as chemical agent and agent breakdown product analysis, headspace sampling for 3X material handling, air monitoring data, and investigation derived wastes.

6.0 Contaminant Fate and Transport for MEC/MC

This section provides a discussion of fate and transport of contaminants detected at the project site. The discussion should include potential routes of migration, contaminant persistence, and contaminant migration. The fate and transport characteristics of the detected contaminants should be described in the context of the site's physical characteristics and include any naturally occurring phenomena such as erosion or frost

heave, or other human activities such as beach replenishment that could cause MEC to relocate.

As appropriate, historical contaminant migration as well as the expected movement and fate of contaminants may be described. Depending on the complexity of the project, media, and contaminants detected, the discussion can range from a qualitative discussion to a detailed quantitative assessment using fate and transport modeling.

7.0 Baseline Risk Assessment for MC and Hazard Assessment for MEC

This section should discuss the site-specific evaluations conducted for the hazards assessment for MEC. The level of detail and extent to which qualitative and quantitative inputs are used may vary. Several methods exist for performing MEC hazards characterization depending on the complexity and particular circumstances of the property. The MEC hazards assessment discussion should address the explosive hazards associated with MEC, i.e., the likelihood that MEC might detonate and potentially cause harm as a result of human activities. Refer to EM 1110-1-4009 for additional information on conducting the MEC hazards assessment.

The baseline risk assessment for MC that is conducted in accordance with EM 200-1-4 and EPA Risk Assessment Guidance (RAGS) should be discussed in this section. It should include both the Human Health Evaluation and the Environmental Evaluation.

8.0 Summary of Results

This should be a short section that summarizes the results of the RI. The summary of results will reiterate the knowledge of: (1) nature and extent of MEC and MCs at the project site; (2) whether the findings are consistent with known sources; and (3) the magnitude, direction, and if applicable, the rate of contaminant migration. Similar to the discussion presented in the executive summary, this concluding section should synthesize the information from the RI in a manner that supports risk assessment, risk management decision-making, and feasibility study activities. The purpose is to summarize the data collected, in terms of "success" of the study. It may be appropriate, prior to initiating the next steps, to have discussions with the regulators on the efficacy of the investigation

with respect to meeting the objectives and answering the questions posed in the work plan as well as in providing data for the feasibility study.

9.0 References

This section presents the references used in the study. The references should be presented in the following format consistent with applicable portions of OM 25-1-51. This manual is available at: http://www.hnd.usace.army.mil/techinfo/engpubs.htm

- ER 200-3-1, Formerly Used Defense Sites (FUDS) Program Policy,
- EM 1110-1-4009, Ordnance and Explosives Response,
- EPA 540-G-89-004, OSWER Directive 9355.3-01, October 1988, Interim Final,
- Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA.