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Case study - US handling of UXO and MEC on former military bases

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1. Summary

This report is the final product of a 10-week inquiry into the US Department of Defense's (DoD) handling of Unexploded Ordnance (UXO) and Munitions and Explosives of Concern (MEC), as part of an internship at the *Swedish EOD and Demining Centre*. The purpose of this inquiry is to survey the DoD process of conducting Munitions Response Activities. The study was delimited to focus on how the activities addressing UXO were addressed and portrayed on a policy and guidance level. The documents and guidance found relevant during the collection of empirical data were processed with the aim of identifying the documents themselves, but also with the aim of mapping the central actors and the management structure during munitions response activities. When processing the material, the policy and positions on the distribution of responsibilities during the munitions response process were identified, as well as the position and policy on what the DoD considers an acceptable level of residual UXO risk and hazards to human health. Even though an initial screening of the documents suggested that the management structure on the distribution of responsibilities were clearly stated, there were ambiguities regarding who shall be held accountable should there be an accident after a restoration activity as been conducted. And even though an initial screening suggested that the DoD used risk assessments throughout its munitions response activities, there were some questions arising, concerning the level of acceptable residual risk levels. Reflecting on the contents of policy documents, it became clear that the DoD does not have any standards on UXO clearance levels, negatively impacting the safety effects of the program and cost estimations.

2. Introduction

2.1. Background

This report is the final result of a 10-week internship at the *Swedish EOD and Demining Centre* (SWEDEC). The area of interest, and the focus of the work assignment, during the internship has been the management of Unexploded Ordnance (UXO) by the U.S government.

During the last 30 years the Swedish Defense Forces have abandoned over 300 sites, most of which have been used as military training grounds. As some of these sites are up for sale and redevelopment there is a need to clarify the distribution of responsibilities between different governmental agencies and departments, as many of these sites are littered with large amounts of UXO and Discarded Military Munitions (DMMs). As the Swedish Defense Forces and the Swedish government are yet to develop a policy or guidance regarding risk-assessments and distribution of responsibilities before, during and after restoration activities, this study is conducted with the aim of surveying the American approach to the problem. Hopefully, this overview of the American policy concerning UXO and DMMs can help build a knowledge base for a possible future collaboration with the U.S Department of Defense (DoD). Both in terms of information exchange regarding the complicated issues of risk assessment and responsibilities during UXO and DMM restoration activities, but also in developing a coherent Swedish policy for UXO and DMM management at former defense sites.

This report summarizes the findings of an oversight of policy documents from various U.S government agencies and departments, concerning the responsibilities and risk-assessments regarding the management and restoration activities undertaken to handle UXO throughout the United States of America.

2.2. Method

Report supervisor, Lt. colonel Fredrik Johnson, was referred to the Department of Defense Environmental, Safety and Occupational Health Network and Exchange (DENIX) for information about the Military Munitions Response Program (MMRP) when inquiring about the U.S policy for restoration activities concerning UXO and DMMs at former military ranges.

This inquiry commenced through an examination of the documents available on DENIX regarding the MMRP. Through examination of the documents about the MMRP on DENIX, various other DoD programs and guidance documents were discovered that were deemed to be of interest to this study. When these documents were not found on DENIX, they were accessed through various agencies and departments' databases. After the documents that seemed to be of interest were located and accessed, they were initially screened to see whether they were of relevance to the study. Those that were deemed to be of relevance were downloaded and processed. The relevance of the documents was initially assessed by examining their issuance date and whether they were up-to-date and currently in use.

One should note that this study does not focus on the long term negative environmental effects that UXO, DMM and Munitions Constituents (MC) might cause. The focus of this study is to examine and reflect on the position of the U.S government on the distribution of responsibilities, and what constitutes acceptable risk, when it comes to response actions directed at the explosives hazards that pose an immediate risk and danger to human health. Therefore, documents and material that did not treat these two areas of interest were deemed not to be of relevance to the purpose of this study. Due to this fact, the overall DoD policy for environmental restoration within the Defense Environmental Restoration Program (DERP) is only presented and processed in brief, while the policy and guidance concerning Munitions and Explosives of Concern (MEC), UXO and DMMs, is the main focus of this report.

2.3. Source material

Documents concerning the MMRP were mostly downloaded from DENIX. Other DoD documents and policy guidance were also found on or through the DENIX database. Documents deemed relevant for this study were in large part discovered by examining the references of already processed documents, and these were in general accessed through the various agencies' databases, e.g. documents issued by the U.S Environmental Protection Agency (EPA) were accessed through searches in the EPA online database.

However, searching for documents using non-governmental search engines was common practice due to the fact that documents of interest, referenced in already processed documents of relevance, sometimes were difficult to find through the various government databases. Access to documents through the use of non-governmental sites is not considered to have affected the validity of the findings, as these documents often were located on U.S government domain sites. Those that were not were reviewed on an individual basis regarding their validity and reliability. The documents were, for instance, crosschecked against the references in which they were discovered regarding their issuance date and issuance-number.

2.4. Outline of the report

In section 3, the American case will be introduced with a short background description concerning how and why the problem of UXO and DMMs have been discussed in the U.S.

Thereafter, section 4 will first provide an overview of the most central policy and guidance documents. In subsection 4.2 the management structure within the U.S government will be presented, as outlined and described in the various policy documents. In subsection 4.3, the process of conducting munitions response activities in accordance with the policy and guidance will be outlined and described.

In section 5, the Environmental Restoration programs will be analyzed using the identified policy documents in order to assess the U.S government's positions on acceptable risk and responsibilities (subsection 5.1 and 5.2 respectively) with regard to accidents or fatalities resulting from restoration activities, or the lack thereof. The U.S government's position on program funding, financial liabilities resulting from (or lack of) restoration activities, and program and project cost estimations will be reflected upon in subsection 5.3.

Finally, the conclusions will be presented under section 6.

3. The American case

3.1. Why is it considered a problem, and why/how is it on the agenda?

In the USA, the military has been downsizing and been made more efficient. As a result of this, numerous bases and former training ranges and facilities have been closed. Just like in Sweden, the ultimate plan for these sites is to have them be returned to civilian use, be it for public or private use. Before land can be sold and transferred to civilian actors, however, there is a need to address the risks posed by remnants from earlier military activities (MacDonald & Mendez, 2005, p.xi). Within the Department of Defense, the Defense Environmental Restoration Program (DERP) is designed to address the remnant environmental hazards posed by previous DoD activities. This includes addressing unsafe buildings, debris and chemical pollutants (ODUSD, 2001, p.1). Within the DERP, there is also a program category, the MMRP, addressing Unexploded Ordnance (UXO) and Discarded Military Munitions (ODUSD, 2001, p.5). The reason why there is a need to address UXO at former military sites is because the presence of UXO is widespread. As MacDonald and Mendez phrases it *“All types of ordnance have a failure rate, ranging from a few percent to 30 percent. As a result, unexploded munitions that could still detonate at some future time are inevitably present on any land where the military has trained with or tested weapons”* (2005, p.xi). In 2003, the DoD suspected that 15 million acres were contaminated by military munitions, with many of these sites already being transferred from DoD control (EPA, n.d). The fact that the presence of UXO is so widespread is problematic due to the fact that UXO pose obvious dangers to human health in case of detonation, but also by long-term exposure to chemicals from munitions constituents. By 2008, the DoD had identified 3,600 sites that they knew, or suspected, to be contaminated with military munitions from previous DoD activities (GAO, 2010, p.1-6). Of these sites, 45 % were classified as FUDS, meaning that there are large areas of land not controlled by the US government where UXO possibly pose a real danger to human health and the environment (GAO, 2010, p.6).

4. Mapping of

4.1. Central policy and guidance documents

4.1.1. Regulatory Documents

Due to the limited time and scope of this inquiry, focus will not be placed on a detailed reading of the laws governing the Military Munitions Response Program (MMRP). The laws governing the response actions concerning UXO and DMMs will therefore be presented briefly in this subsection to give an introduction to the regulatory context in which the guidance presented under the other subsection exists.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

Throughout all of the policy and guidance documents discovered and processed, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (and its amended 1986 version SARA) is consistently referenced.

The CERCLA provided the federal government greater authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment (EPA, n.d). This law is the preferred regulatory authority of the DoD and EPA when conducting munitions response actions (EPA, 2010).

4.1.2. Department of Defense Documents

In accordance with section 211 of SARA (10 U.S.C. 2701-2707 and 2810), the DoD launched the Defense Environmental Restoration Program (DERP) to provide funding for the cleanup activities at sites contaminated by the DoD (DoD, 1996a, p.14).

DoD Directive 4715.1

On February 24, 1996, the DoD issued Directive 4715.1, which replaced an old directive (5100.50) from 1973 about the “Protection and Enhancement of Environmental Quality”. Directive 4715.1 established policy for environmental security within the DoD.

Short summary of its content

The directive mentions that the DoD policy is to display environmental security leadership within DoD activities by; ensuring that environmental factors are integrated into DoD decision-making processes and; reducing risk to human health and the environment by identifying, evaluating, and when necessary, remediate contaminations resulting from past DoD activities. The document also outlines responsibilities concerning the environmental security programs. (DoD, 1996b)

DoD Instruction 4715.7

On April 22, 1996, the DoD issued Instruction 4715.7, which is set to implement Directive 4715.1 with respect to the Defense Environmental Restoration Program (DERP) and consistent with CERCLA. The instruction assigns responsibilities for planning, programming budgeting, executing and reporting for the DERP (and BRAC).

Short summary of its content

- Assigns responsibilities for planning, programming budgeting, executing and reporting for the DERP.
- Establishes requirements for evaluating the relative risk posed by a site and for using that information for program planning and execution.
- Designates the Secretary of the Army as the DoD Executive Agent for the Formerly Used Defense Sites (FUDS) Program. (DoD, 1996a)

Management Guidance for DERP 2001

This document, published September 21 2001, provided additional and guidance on implementation of the Defense Environmental Restoration Program (DERP), consistent with the DoDD 4715.1 and DoDI 4715.7. This guidance superseded all previously issued versions of the Management Guidance for the Defense Environmental Restoration Program.

This guidance manual was replaced in 2012 by an updated guidance document, DoD Manual 4715.20.

Short summary of its contents

The document gives guidance on issues regarding the DERP, its categories (IRP & MRP) and the other factors and regulations concerning DERPs application, including;

- The applicability and scope of the program.
- The DERP goals.
- The risk management approach that is employed.
- The program categories (IRP and MMRP) (but also building demolition/debris removal)
- Funding Eligibility (what conditions are necessary for program activities to be funded. (ODUSD(I&E), 2001)

DERP Management Guidance– DoD Manual 4715.20

Published March 9 2012, this manual cancels the DERP management guidance from 2001. The purpose of this manual is to implement policy, assign responsibilities, and provide guidance for managing DERP. It is applicable to all organizational entities within the DoD, and all Environmental Restoration activities undertaken by a DoD component within the US.

Short summary of its contents

The document gives guidance on;

- Distribution of responsibilities among DoD components
- DERP eligibility (what activities that are included in the DERP).
- The program categories (MMRP and IRP)
- The process of DERP and MMRP response activities. From the conditions and regulations guiding the site discovery phase to the conditions and regulations of the response complete phase.
- The administrative process and regulations, and the need for community involvement.
- Planned goals and cost-estimation. (DoD, 2012)

DoD Instruction 4715.07

This instruction, published May 21 2013, reissues and thereby cancels *DoD Instruction 4715.7*. The document reiterates the established policy, assigned responsibilities, and provides procedures for implementing the DERP. The instruction applies to all organizational entities within the DoD, and the environmental restorations undertaken by a DoD component within the USA

Short summary of its contents

The document;

- Reiterates the distribution of responsibilities within the DoD concerning the DERP and MMRP.
- Provides a short overview of the procedures and regulations concerning the DERP and MMRP.
- Establishes the DoD Cleanup Committee in order to identify, discuss, and provide recommendations to resolve DERP programmatic issues. (DoD, 2013a)

4.1.3. Military Munitions Response Program

DoD White Paper – Destruction in Place - *Blow-in-Place*

This DoD White Paper, released September 23 2004, describes the DoD preferred action for the management of recovered UXO, which is to destroy it in place

using detonation. The White Paper provide the rationale for using on site detonation when handling recovered UXO and DMMs, but also outline and describe the conditions for exceptions to this rule, and the procedures when opting for alternative actions. (Munitions Response Committee, 2003)

Munitions Response Site Prioritization Protocol (MRSPP)

Published and effective October 5, 2005. This protocol implements the requirement established in section 311(b) of the National Defense Authorization Act for Fiscal Year 2002 for the DoD to assign a relative priority for munitions responses to each location (MRS) in the Department's inventory of defense sites known or suspected of containing unexploded ordnance (UXO), discarded military munitions (DMM).

Short summary of its contents

The MRSPP is the protocol to be used by DoD components when sequencing which MRSs are of the highest priority. The protocol provides;

- The protocol's applicability and scope,
- The policy of the DoD in how the users should apply the protocol.
- What responsibilities the different actors involved in munitions response actions have.
- The detailed procedures on the sequencing and prioritization of MRSs. Including which conditions might affect the prioritization and sequencing process. (MRSPP, 2005)

MRSPP Primer

Published in April 2007, this primer to the MRSPP was developed to assist the personnel that are responsible for applying the MRSPP on munitions response sites. This document provides the responsible personnel with a step-by-step guide for applying the MRSPP.

Short summary of its contents

The Primer;

- Provide a background on the MRSPP, including a description on how the protocol was developed.
- Give an overview of the MRSPP process. Including the requirements for reporting and involving stakeholders.
- Guides the user through determining the rating of the different Hazard modules in the MRSPP.
- Guides the user through compiling the information obtained to determine a priority for the munitions response site. (ODUSD(I&E), 2007)

Army Policy for Sequencing Munitions Response Sites (MRS) for Munitions

Responses This memorandum - published on November 30, 2011 – provides the U.S Army policy and procedures for sequencing munitions response sites for munitions responses. It is consistent with the MRSPP and DoD policy, Army activities, including U.S Army Corps of Engineers activities when executing Army responsibilities under the FUDS program.

Short summary of its contents

- The document gives a brief introduction on how the MRSPP prioritizing takes place.
- The document centers around;
 - o The sequencing process of MRS based on Relative Priority
 - o The consideration of Risk-Plus factors during sequencing
 - o The documentation of MRS sequencing decisions
 - o The responsibilities within the U.S army divisions and groups concerning MRSs. (DA, 2011)

4.1.4. Formerly Used Defense Sites Program – FUDS

FUDS Program Policy

This regulation - published May 10, 2004 – provides specific policy and guidance for all U.S Army Corps of Engineers (USACE) elements engaged in the FUDS program, including planning, programming, budgeting, execution, management and reporting.

Short summary of its contents

- The document provides a background to the program and places the FUDS within the DERP and its regulatory context.
- It assigns authorities and responsibilities within USACE.
- It provides the conditions for FUDS program eligibility.
- It describes the process of the restoration responses within the program, as well as the internal practices and procedures of the FUDS program.
- Finally, the document outline and describe the policy for public involvement and how to coordinate with other regulatory agencies. (USACE, 2004)

4.1.5. Environmental Protection Agency - EPA

DoD and EPA Management Principles for Implementing Response Actions at Closed, Transferring, and Transferred (CTT) Ranges.

This guidance document - issued on March 7, 2000 – was created with the intention of assisting DoD personnel, regulators, local stakeholders and EPA regulators to achieve a common approach for investigating and responding to hazards on CTT ranges. The principles were to provide interim guidance for ongoing response actions and will be in effect until the final Range Rule guidance is presented.

As of 2003, the term CTT ranges is not in use anymore, but when encountered in documents published prior to 2003 it is used to refer to military ranges that are non-operational (EPA, 2005, p.xix).

Short summary of its contents

The document provides general principles for the cooperation between DoD and EPA when conducting research or response actions on CTT/former defense ranges. These principles address:

- The terms and condition for state, tribal and local stakeholder participation.
- The regulatory authorities under CERCLA.
- The process of site characterization and the response selection, including principles of public participation.
- The difficulties when implementing land use controls, and how enforcement of the response actions must be seen as an important factor when selecting the appropriate action. (DoD & EPA, 2000)

Munitions and Explosives of Concern – Hazard Assessment Methodology (MEC HA)

This guidance, published in October 2008, is intended for use by project teams within the MMRP program, to help them assess what site-specific responses are needed to handle the site-specific explosives hazards to human health on munitions response sites (MRSs).

Short summary of its contents

The document provides a detailed methodology to use at MRS for site-specific assessments regarding the risk that MEC Hazards pose to human health. The document provides:

- An introduction and an overview of the MEC HA.
- Guidance on how to use the MEC HA methodology and when to apply it in the CERCLA removal and remedial processes.
- The elements and input factors used to make the MEC Hazard assessments.
- How to interpret the results and scores of the MEC HA, and how the MEC HA results are to be used in the CERCLA response processes. (EPA, 2008)

EPA Munitions Response Guidelines

This document, published 27 July 2010, provides the EPA regional offices with a framework for overseeing responses involving MEC and MC at non-operational locations and ranges where explosive and environmental hazards are known or suspected to be present. These guidelines primarily address situations where a DoD component (e.g. USACE) is conducting munitions response actions as lead agency with EPA responsible for regulatory oversight.

This guidance builds on the *DoD and EPA Management Principles for Implementing Response Actions at Closed, Transferring, and Transferred (CTT) Ranges* from 2000.

Short summary of its contents

These Guidelines address:

- The regulatory authorities invoked when conducting munitions responses
- The use of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Resource Conservation and Recovery Act (RCRA), and other authorities for regulating and authorizing munitions response actions.
- Involvement of State and Tribal environmental regulators and the public
- Explosives safety principles.
- Site characterization principles.
- Transfer of ranges.
- Land use and institutional controls.
- Oversight and Enforcement principles. (EPA, 2010)

4.2. Management structure and the distribution of responsibilities

The assignments and responsibilities for the process of identifying Munitions Response Areas (MRAs), planning, implementing and reviewing potential and appropriate response actions are briefly described in the documents outlined in section 4.1. of this report. What follows in this subsection is a short overview of

the management structure when it comes to addressing hazardous substances released by the DoD.

As mentioned in several of the documents referenced above, the DoD is responsible for the environmental restoration activities at “(A) *each facility or site owned by, leased to, or otherwise possessed by the United States and under the jurisdiction of the Secretary. (B) Each facility or site which was under the jurisdiction of the Secretary [of Defense] and owned by, leased to, or otherwise possessed by the United States at the time of actions leading to contamination by hazardous substances.*” (ODUSD (I&E), 2001)

Since the DoD is a large government agency, and there are different sources within the Department being responsible for the releases of hazardous substances, the DoD has delegated and assigned responsibilities to different DoD components concerning environmental restoration activities.

4.2.1. General overview over management structure

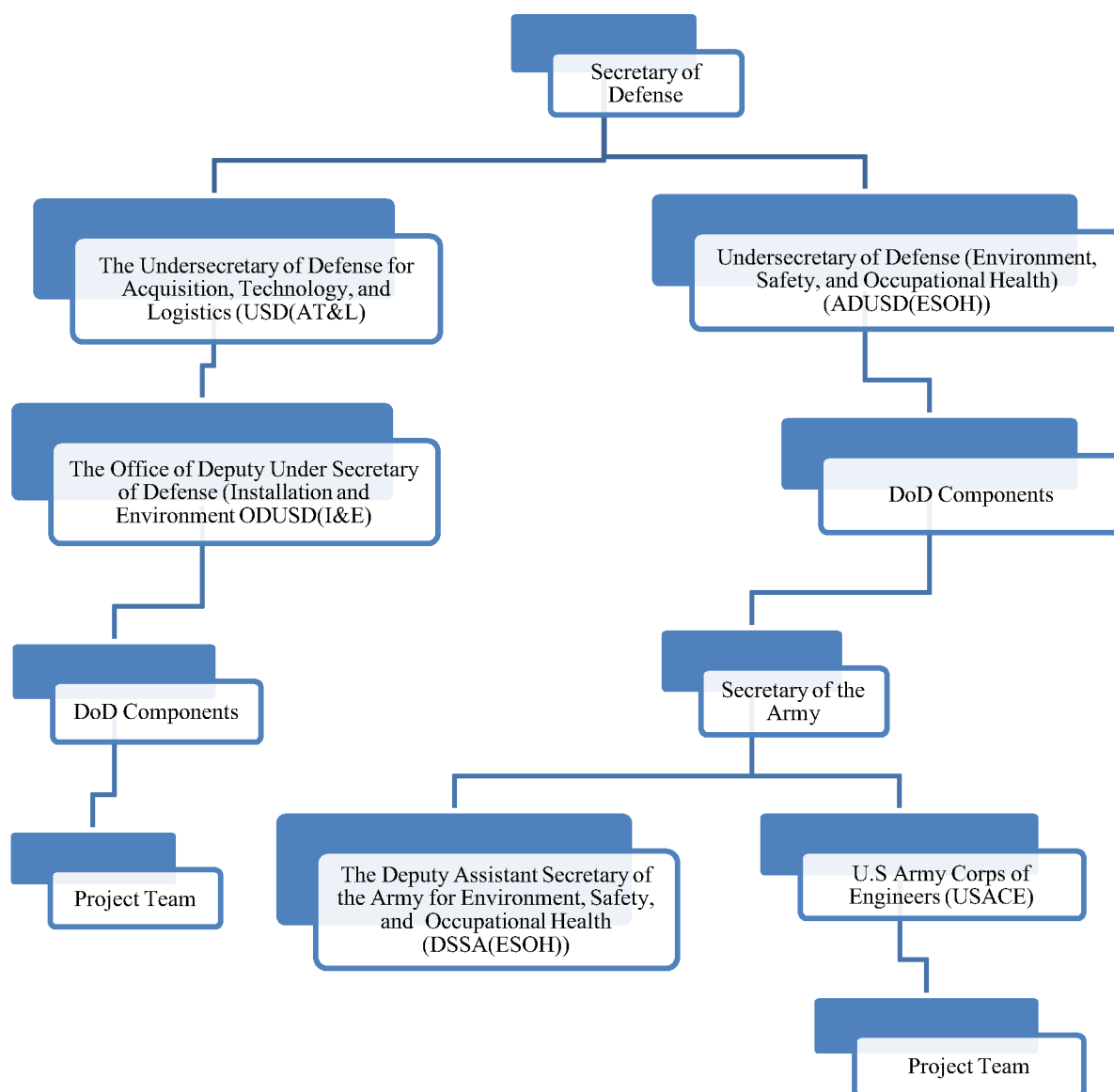


Figure 4.2.1: Organizational structure when conducting Munitions Response Actions

Figure 4.2.1. shows a graphic overview of the organizational structure of the Department of Defense (concerning the handling of MEC). The branch on the left-hand side shows the organizational structure of the DERP in general, while the branch on the right-hand side shows the organization structure when sites are handled under the FUDS program.

The DoD has been handed the authority to act as lead agency for DERP, and shall carry out this responsibility in accordance with CERCLA and other environmental laws and regulations. The Office of the Secretary of Defense (OSD) is the highest authority within the DoD. As can be seen on the left-hand side in the figure, the authority to issue policy and guidance for the DERP is delegated to the Undersecretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L)). Within the USD(AT&L) this is delegated further, and the Office of the Deputy Undersecretary of Defense for Installations and Environment ODUSD(I&E) is responsible for issuing policy and guidance, planning, programming, providing metrics and goals, as well as conducting oversight and reviews. The DoD Components are responsible for executing the response actions, and conducting these in accordance with the authority and guidance of the ODUSD(I&E). (DoD, 2013a, p.8-9)

On the right-hand side, we see the organizational structure and actors involved in the management and execution of the FUDS program category. In addition to the DERP-wide guidance and policy, issued by the ODUSD(I&E), the Assistant Deputy Undersecretary of Defense (Environment, Safety, and Occupational Health) (ADUSD(ESOH)) is responsible for developing FUDS-specific guidance, and conducting an overview of FUDS activities. The authority and responsibility to execute activities under the FUDS program is bestowed upon the U.S Army, through which the U.S Army Corps of Engineers (USACE) becomes the party responsible for managing and conducting munitions response activities at FUDS sites. The planning and programming for the FUDS is done at USACE Headquarters, and budgeting is done in coordination with Army Headquarters (HQDA), and the DoD.

The project team that is conducting the investigation and the response actions is usually composed of officials from the lead agency, regulatory authorities (e.g. EPA, state and/or tribal officials), land owner/manager, and the technical and

supporting staff associated with the lead and regulatory agencies. (ODUSD(I&E), 2007, p.C-8)

4.2.2. Responsibilities regarding policy and guidance

DERP

The OSD/DoD is responsible for conducting environmental restoration activities due handle hazards to human health and the environment caused by previous DoD activities. This is done through the DERP, managed by the USD(AT&L) which serves as the decision authority for DERP, and delegates authorities it as appropriate. With the assistance of DoD Components, the USD(AT&L) shall develop environmental security program guidance, and establish environmental security requirements and priorities for use in DoD Component environmental security planning, programming, and budgeting (DoD, 1996b).

Within the USD(AT&L), the DUSD(I&E) is responsible for establishing policy and issuing guidance for DERP activities, not only guiding the actual response activities, but also for the planning, budgeting, reviewing and administrative requirements. (DoD, 2013a, p.8) The (DUSD(I&E)) “*[provides] goals, guidance, metrics, procedures, and reporting and eligibility requirements needed for consistent and effective accounting, acquisition, budgeting, execution, oversight, and planning of DERP activities by the DoD Components*” (DoD, 2013a, p.8). The DUSD(I&E) is also responsible for reviewing program execution, as well as for providing oversight, including guidance, planning, programming, and budgeting, to the Secretary of the Army as lead agent for the FUDS program (DoD, 2013a, p.9).

The *General Counsel of the Department of Defense* provides authoritative legal advice and counsel to OSD organizations and, as appropriate, other DoD Components, as well as determines the DoD position on specific legal problems and matters of legal policy related to environmental restoration, including litigation and defenses raised (DoD, 2013a, p.11).

MMRP

Although there are some specific guidance and manuals related to the execution of Munitions Response Actions, the MMRP is a program category within the DERP to characterize response actions addressing military munitions (UXO, or DMMs) (ODUSD (I&E), 2001, p.5). Therefore, the management structure when conducting Munitions Response Actions is usually no different from the management structure already outlined for the DERP in general. However, the responsibilities when conducting Munitions Response Actions might differ slightly, with some program-specific requirements when it comes to prioritizing and reporting.

FUDS policy and guidance

The policy and guidance for the FUDS program/category is established and reviewed by the Assistant Deputy *Undersecretary of Defense (Environment, Safety, and Occupational Health)* (ADUSD(ESOH)). ADUSD(ESOH) is also the responsible party for providing oversight of the FUDS program, the development and defense of the ER-FUDS account, and ensuring that the budgets support the Defense goals and other program objectives and targets. (USACE, 2004, p.2-2).

Within the Department of the Army, the *Deputy Assistant Secretary of the Army for Environment, Safety, and Occupational Health* (DASA(ESOH)) has been delegated authority and serves as the executive agent for the FUDS program. This includes establishing policy and priorities, providing oversight, and approving budgets and annual work plans (USACE, 2004, p.2-2). The USACE will develop field manuals and guidance to assist the safe and efficient execution of response actions addressing MEC.

4.2.3. Responsibilities regarding response activities

Executing DERP

When executing response activities under DERP authority, the DoD Components have a responsibility to act according to CERCLA, the Presidential authorities in CERCLA, the NCP, and all regulations, guidance, and requirements established by the OSD. The DoD Components carry the responsibilities of being lead agency for environmental restoration activities, which includes maintaining an inventory of all eligible DERP sites, investigating, prioritizing and sequencing the potential sites (DoD, 2013a, p.12-14). The DoD Components shall be understood as all organizational entities within the DoD, and in the case of executing response actions within the DERP this generally means the different armed branches of the DoD (the Army, the Navy, and the Air Force).

The Components shall plan, program, and budget their ERA, as well as oversee the execution and progress of each of their DERP activities, and use the Relative Risk Site Evaluation Primer (RRSE) and the Munitions Response Sites Prioritization Protocol (MRSPP) to determine the sequence of funding actions at DERP sites by evaluating the relative risks and explosives hazards to human health and the environment. The Components are also responsible for collecting and maintaining data and documentation for each DERP site under their control, and submit it to the DUSD(I&E) to maintain a central database on DERP activities. (DoD, 2013a, p.12)

The Components shall oversee the restoration activities by developing Management Action Plans (MAP) for each property or area, identifying all the DERP sites present, planned activities, schedules, and costs. Program and response progress will be measured in the reduced risk to human health and the environment, fulfilling milestones established in the MAPs, having remedies in place and preparing records for program and financial audit (DoD, 2013a, p.15). The Components also have a responsibility to provide regulators and stakeholders notice on planned action, and give them opportunity for review and comment on

the proposed response action(s). When required in agreements with other organizational entities, the Components shall execute the agreed responsibilities to support DERP execution (DoD, 2012, p.13).

If more than one DoD Component is involved at the Third-party-sites (TPS), and those DoD Components cannot agree on the division of responsibilities, the DUSD(I&E) will evaluate the claim to determine which DoD Component will take the lead. Generally, the DoD Component determined to have the most potential liability will take the lead. The DUSD(I&E) can assign a lead, if necessary. (DoD, 2012, p.52)

Property where there is a known or suspected presence of MEC shall not be transferred out of DoD control until appropriate protective measures have been taken to ensure that there are restrictions on, or conditions for, land use, and that the recipient is aware of the potential and actual hazards on the property. An already transferred site might receive additional response actions should a remedy wholly or partially fail; if a Land Use Control (LUC) proves ineffective; or if an additional contamination attributable to DoD activities is found.
(DoD, 2012, p.60-61)

Executing Munitions Response Activities

Any DERP site suspected of containing UXO, DMM, or MC at different locations shall be divided into separate Munitions Response Sites (MRS) by the Component, as “an MRS shall represent a discrete location within an MRA that is known or suspected to require a munitions response” (DoD, 2012, p.22). “*The DoD components shall include all MRAs and MRSs that require munitions response in the MMRP [category]*” (DoD, 2012, p.219. The Components shall maintain an inventory for MMRP sites, which shall be reviewed and updated on an annual basis in order to incorporate new available information (DoD, 2013a, p.14).

If UXO is classified as a hazardous substance, written approval for any response action is needed from DUSD(I&E). In the case of an immediate risk of uncontrolled detonation, where the Component determines that a emergency response is needed, there is no need to wait for DUSD(I&E) approval. The DoD Component is required to submit an munitions response explosives safety submission (MRESS) to their explosives safety organization, and thereafter to the *Chair of the DoD Explosives Safety Board* (DDESB) for approval. This shall be done prior to response actions that involve intentional physical contact with the MEC, or ground-intrusive activities in areas suspected of containing MEC. When executing a munitions response, the DoD Component shall comply with applicable guidance, standards, and regulations for explosives safety. (DoD, 2012, p.26)

If UXO is actively managed (e.g. excavated) for treatment (e.g. destruction), it may be viewed as a hazardous substance according to the RCRA, which automatically also makes it a CERCLA hazardous substance. Pursuant to the EPA and DoD management principles for UXO (EPA & DoD, 2000), however, CERCLA is the preferred response mechanism and authority for addressing UXO on former defense sites (DoD, 2012, p.22).

Executing FUDS

In addition to performing the DERP responsibilities as lead agency on DERP sites under its control, the Secretary of Army shall act as the lead agent for the FUDS program. This includes identifying to the DUSD(I&E) to funding required for the FUDS program, and conducting the restoration activities deemed necessary at FUDS properties that are eligible for the program. (DoD, 2013a, p.13-14)

This responsibility is accompanied with the requirements to maintain an inventory of all FUDS, tracking activities, and documenting and reporting on program progress (DoD, 2012, p.14). The Army is given the authority to determine the eligibility of a property to be included in the program, as well as

being delegated the responsibility to implement FUDS policy and conduct restoration activities at eligible properties on behalf of the DoD Component (DoD, 2012, p.14).

Acting on behalf of the Army, the *U.S Army Corps of Engineers* (USACE) is the party responsible for the overall FUDS management and execution. The Headquarters of the USACE (HQUSACE) issue regulations and manuals, provide guidance and consultation on legal matters, and manage all the FUDS planning, programming, budgeting in coordination with Army Headquarters (HQDA), and DoD (USACE, 2004, p.2-4). USACE districts and geographic division assist the Headquarters with these tasks, while the project teams consisting of USACE engineers perform the actual site-evaluation and response actions.

4.2.4. Responsibilities of Regulatory Agents

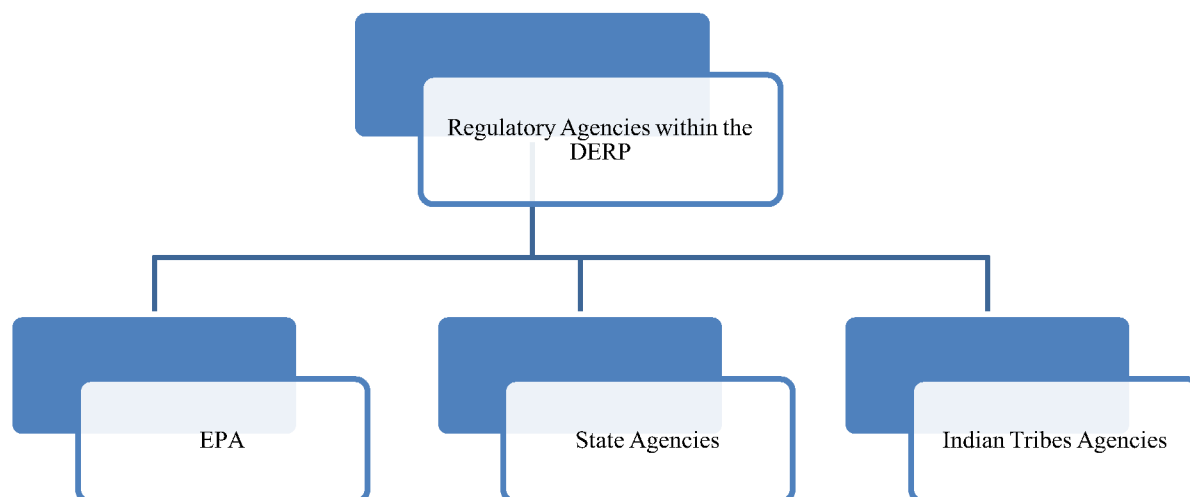


Figure 4.2.4.a: Regulatory agencies and actors in the DERP

Regulatory guidance

Apart from the federal and State-specific legal framework (e.g. CERCLA, NCP, etc.), the regulators can use DoD-issued guidance to oversee munitions response actions and assess whether they are conducted according to legal and procedural

standards. In addition to this, EPA issues guidance for Project Managers and EPA Regions to assist in the regulatory oversight (EPA, 2010, p.8). Furthermore, there are various technical guidance documents by other actors that can be of use to regulators when conducting oversight of munitions responses - including the *Munitions Response Historical Records Review*, which help regulators oversee the review of historical records on munitions response sites (EPA, 2010, p.19-20).

Conducting regulatory oversight

Depending on the Munitions Response Site, the constellation of regulators at the site and their interrelationship usually differ on a site-specific basis. It is usually the EPA, State Environmental Regulators, Tribal Land Regulators or Federal Land Managers that occupy the Lead Regulator role.

When the FUDS-site is located on or affecting tribal lands, officials from the affected tribe usually take the lead regulator role. State or Tribal officials usually serves as the lead regulator for FUDS-sites that are not on the National Priority List (NPL). At these sites, however, the EPA can assume the lead regulator role if requested to do so by the other regulators, or if the EPA deem it necessary to take regulatory charge during a Munitions Response process. For sites that are listed on the NPL, or proposed for inclusion, the EPA will serve as the lead regulator. (USACE, 2004, p.9-2.)

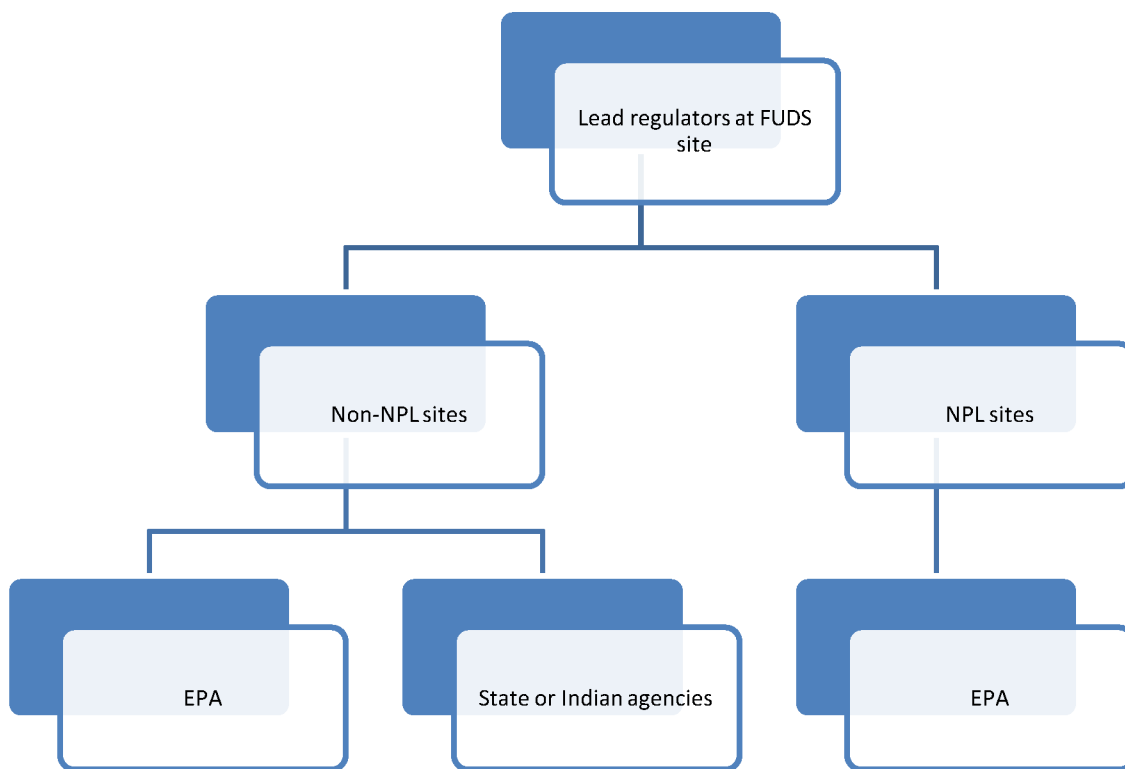


Figure 4.2.4.b: Regulatory agencies for FUDS sites

4.2.5. Funding and resource allocation

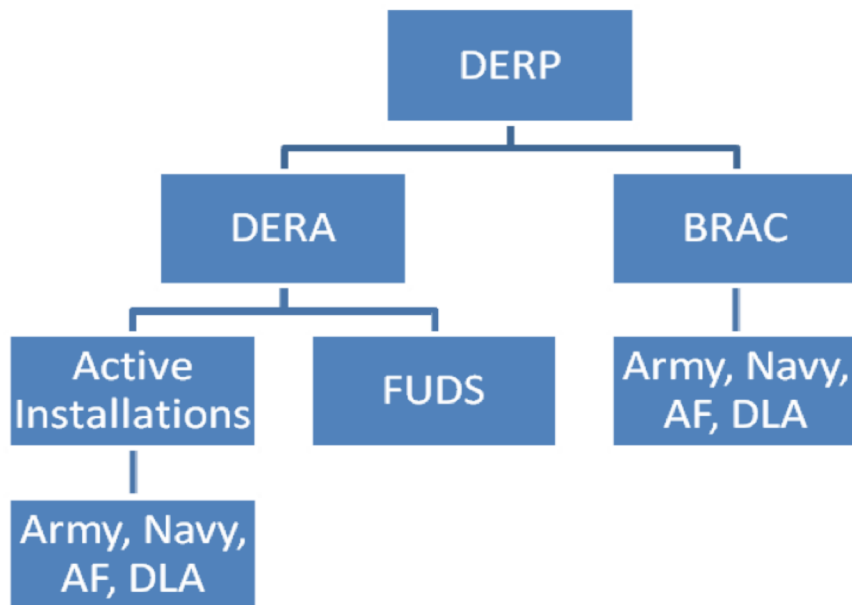


Figure 4.2.5: DERP Funding Accounts (NGA, 2008, p.2)

The activities under the DERP can be funded from two different distinct appropriations funds, the BRAC accounts, which is solely used to fund BRAC program activities, and the Defense Environmental Restoration Accounts (DERA) (NGA, 2008, p.1). According to 10 USC §2703(a) the DoD shall establish, maintain, and appropriate resources to 5 separate *Environmental Restoration Accounts* (ERA). These are known as; ERA-Defense-wide; ERA-Army; ERA-Navy; ERA-Air-Force; and ERA-FUDS. Where a site is controlled by a single Component, the funding for investigation, removal and/or remedial actions shall be requested from the appropriate Component ER Account (or in the case of FUDS, the ERA-FUDS) (ODUSD(I&E), 2001, p.3;6). As the MMRP can be applied to sites on active, BRAC and formerly used defense sites, funding for its activities can be requested from both DERA and BRAC accounts.

The DoD Component shall develop a Cost-to-Complete estimate for all DERP-eligible projects/sites under its responsibility in order to support the DERP planning, programming, budgeting and execution (PPBE) process, environmental

liabilities estimates, and the Defense Environmental Program Annual Report to Congress (DEP ARC). This shall mainly be done with site-specific data and comparisons, as well with the use of historical data to assess possible costs. (DoD, 2012, p.67)

Funding eligibility

Activities under the MMRP category, that address the presence of MEC on MRSs, are conducted with those funds requested for environmental restoration purposes that were appropriated to the Component ER or BRAC accounts. Given that; (1) The release occurred prior to September 30, 2002 and; (2) The release is at a site that is not a FUDS, an operational range, an active munitions demilitarization facility and; (3) The site was not identified or included in the RMIS prior to September 30, 2000.

Munitions response activities under the MMRP category can also be funded through the ER-FUDS account, given that it meets FUDS-ERA eligibility, including that; (1) The release occurred prior to October 17, 1986 and; (2) The property was transferred from DoD's control prior to October 17, 1986 and; (3) The property or project meets other ER-FUDS funding eligibility criteria (ODUSD, (I&E), 2001, p.7). This entails that the project site must be known or suspected to contain hazardous materials resulting from previous DoD activities. (ODUSD, (I&E), 2001, p.17 & DoD, 2012, p.65).

Allocating funds

The heads of the DoD Components with CERCLA responsibilities are responsible for deciding the sequence in which the DERP sites receive funding, by assessing the risks the sites pose, using the Relative Risk Site Evaluation (RRSE) Primer, or the Munitions Response Site Prioritization Protocol (MRSPP) (DoD, 2012, p.13).

The DUSD(I&E) review and evaluates the ERA and budget submissions from the DoD Components with the help from Undersecretary of Defense (Comptroller)/Chief Financial Officer (USD(O)/CFO), and adjust them when necessary (DoD, 2013a, p.10).

"The DoD Comptroller provides funds, as directed by Congress and as detailed in the Components' financial plan, to the appropriate Component ER or BRAC accounts (or for FUDS to the ER FUDS account)." (ODUSD(I&E), 2001, P.35).

"Funds appropriated to the Component ER accounts or the ER-FUDS account are appropriated to a transfer account. Funds in this transfer account are subsequently transferred to the appropriate operating account(s) of the Components. Components can request transfers at any time during the year. When this occurs, the funds take on the characteristics and limitations of the accounts to which they are transferred" (ODUSD(I&E), 2001, p.36 & DoD, 2012, p.71)

As the Army serves as the lead agent for the FUDS program, it has the responsibility to identify, and request funds from the OSD for the FUDS program (ODUSD(I&E), 2001, p.15 & DoD, 2012, p.14). However, the DUSD(I&E) retains oversight, including programming and budgeting responsibilities for FUDS (DoD, 2012, p.65).

Responsibility for Litigation Defense at TPS

The DoD Component that generated the hazardous substance release is responsible for defending and resolving its potential liability at the TPS, given that the hazardous substance was not processed through the Disposition Services of the Defense Logistics Agency (DLA). Should the site still be eligible for DERP funding, the Component may use its ERA for these efforts. (DoD, 2012, p.52)

The Defense Logistics Agency (DLA) will assume responsibility should the original DoD generator have correctly identified the hazardous substance and available documents establish that the hazardous substance has been processed through the Disposition Services of the DLA. This responsibility entails defending and resolving the DoD potential liability at the TPS. Should DERP-eligibility requirements be met for the site, the DLA can use funds from the ERA-Defense-wide for these efforts. (DoD, 2012, p.52)

Where there are more than one DoD Component responsible for generating hazardous substances at a TPS, and the involved parties cannot agree on a division of responsibilities, the DUSD(I&E) will evaluate to determine which Component that shall be assign responsibility. In most cases, the Component with the highest (estimated) potential liability will take the lead. (DoD, 2012, p.52)

4.3. The process of environmental restoration activities

4.3.1. Overview of the process of managing a DERP site

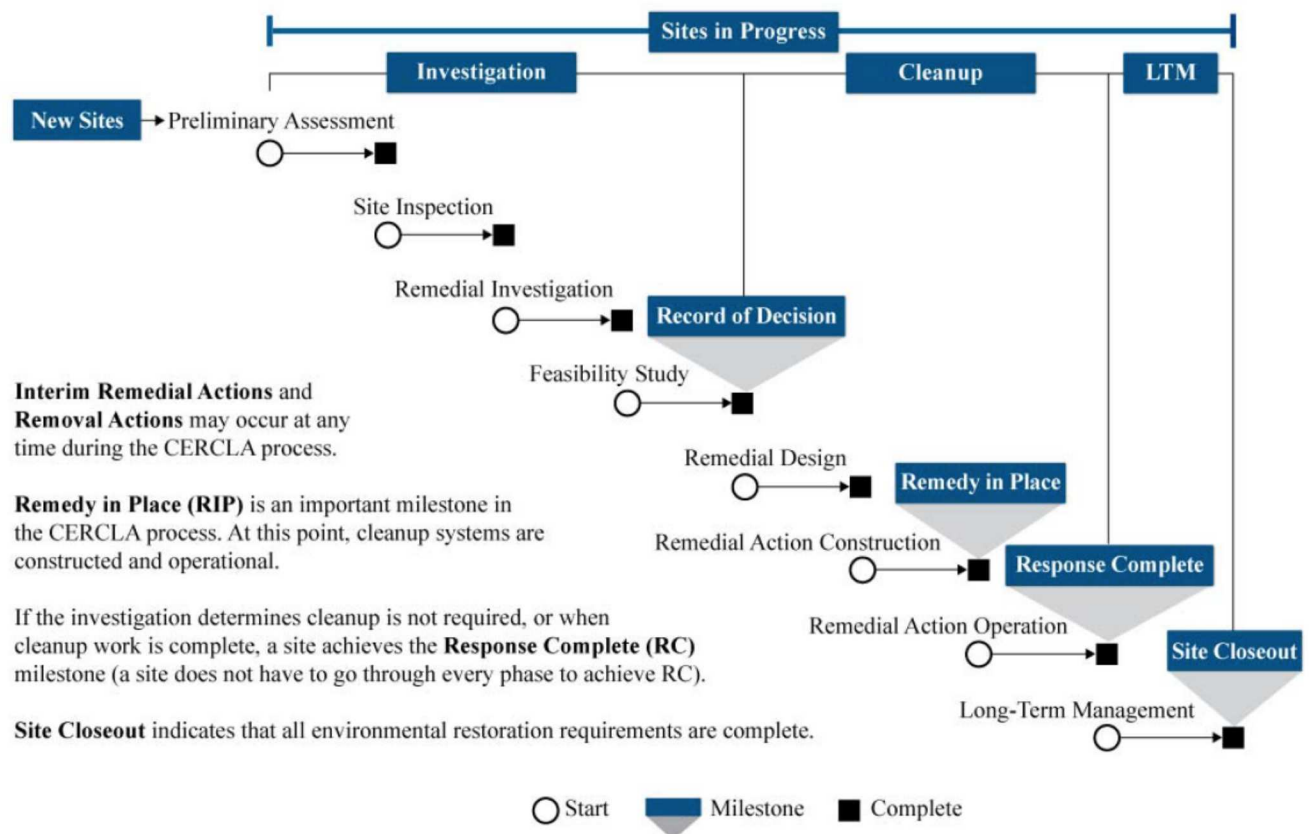


Figure 4.3.1: Environmental Restoration Process - Phases and Milestones (DoD, 2012, p.27).

As can be seen in figure 4.3.1, an excerpt from the updated management guidance manual for DERP 2012, the environmental restoration process under DERP can be divided into 3 phases and 4 milestones. After a preliminary site assessment, which leads to the inclusion on the list of DERP sites, the first phase is initiated. The first phase is *Investigation* and includes site inspection, prioritization and sequencing, followed by remedial investigation and a feasibility study. During the second phase, the *Cleanup*-phase, the remedial design and remedial action construction takes place. When the remedial action has been constructed,

implemented and is operating functionally, we have reached the *Remedy-in-Place* milestone (RIP), followed by the *Response Complete* (RC) milestone. After the RC, there is usually a need for Long-Term-Management (LTM) as non-restricted use of the site after the response actions is uncommon. This phase is simply called *LTM*. However, when there is no need for usage and public restrictions, the site can be classified as closed, and at this point the *Site Closeout* milestone has been achieved. (DoD, 2012, p.27-45)

4.3.2. Investigation

During the Preliminary Assessment/Site Inspection (PA/SI) the Component shall review historical records and other information sources, and determine whether there is need for additional investigation or action. When a need for further investigation and action has been identified, the Component shall document the reasoning behind this decision (DoD, 2012, p.27-28)

Thereafter, the Component shall use the MMRP to assess the risks posed by MEC to human health and environment in order to give it a priority number for funding and execution which will serve as the basis for site-sequencing, along with future land use plans and concerns from stakeholders.

During the Remedial Investigation (RI) the Component shall characterize the site in order to be able to assess and evaluate alternative remedial. When conducting the RI/FS, the Component shall collect information in order to characterize the site conditions, and make an assessment on the nature and extent of the contamination, and thereby evaluate the risks posed to the environment and to human health. In this risk assessment, the Component shall consider current and future land use and exposure risks. (DoD, 2012, p.30-31)

When conducting a feasibility study, the Component will develop, screen, and evaluate remedial alternatives in detailed, assessing the performance and efficiency of the remediation alternatives. The Component needs to consider

alternatives that include either; no action at all; action to remediate the site that would allow unrestricted access and use by the public or; an action that would ensure protectiveness of human health that necessitates land use restrictions (e.g. land use controls). These alternative remedial actions also need to be assessed in the light of being fiscally, socially and environmentally sustainable, as well as being technically feasible. (DoD, 2012, p.31-34)

If the RI and FS lead to the assessment that the conditions on-site is not protective of human health and pose a risk, the Component shall develop remedial goals that establish acceptable exposure levels. This is, however, more complicated in the case for MEC than for MC/chemical contaminants as there are no clear standards as to what level of MEC exposure is acceptable.

The investigation-phase is nears its finish when the Component proposes its plan, which highlights the conditions and considerations taken into account when selecting the remedial action(s). This plan shall be published in order to get public opinion on the proposed plan and feedback/review on the rationale for the chosen action. The final Decision Document (DD) shall be prepared and submitted before implementing the response actions, and shall contain the objectives of the remedial action, and all the information, facts and technical data underlying the rationale for the chosen remedial action. The exception to this rule being that there was a need to conduct an emergency response in order to protect human health and the environment. (DoD, 2012, p.35-37)

4.3.3. Cleanup

During the start of the cleanup process the Component shall develop a Remedial Design (RD), meaning that the Component shall develop design plans and specifications for the selected remedial action(s) proposed in the DD. In the Remedial Action Work Plan (RAWP) the Component shall document how the remedial action will be staged and implemented in order to have the remedy to be fully operating according to the goals set out in the design process. This phase

and the implementation is called the Remedial Action-Construction (RA-C).
(DoD, 2012, p.39)

When the remedy has been constructed, implemented, functioning and operating according to plan, as well as being expected to meet the remedial action goals, then the Remedy-in-Place (RIP) milestone has been reached. During the Remedial Action-Operation (RA-O) phase, the Component operates, maintain, and monitor the remediation system and site conditions until the objectives of the remedial action set out in the DD has ben met. The RA-O phase may also include the continuing existence and operation of Land Use Controls (LUCs), if these are set out as a part of the remedial actions selected for the site. As long as there are restriction on land use and accessibility to the site following the remedial actions, the Component shall conduct 5-year reviews to evaluate the implementation and protectiveness of the remedy. (DoD, 2012, p.39-40; 93)

The Response Complete (RC) milestone signifies that the Component has met the remedial action objectives for the site, and has sought regulatory agreement. According to the DoD DERP Manual from 2012, the *“RC signifies that DoD has determined at the end of the PA/SI or RI that no additional response action is required; achieved RIP and the required RA-O has achieved the remedial action objectives; or where there is no RA-O phase, then RA-C has achieved the remedial action objectives.”*

A Remedial Action Completion Report (RACR) shall be produced for sites both on and not on the NPL, and it shall formally document the decisions and data claiming that the remedial action objectives has been met. At sites on the NPL, however, the RC cannot be claimed before the EPA has reviewed and approved the document detailing the remedial action process and the achievement of the objectives. When a munitions response action has been conducted, and it has involved a DDESB-approved MRESS, the component shall prepare an After Action Report (ARR) to go with this RACR. (DoD, 2012, p.40-41)

Given that the remedy is in place and is operating properly and successfully, the Component may transfer the property before actually meeting the remedial action objectives. This can only be done provided that the remedial actions undertaken are sufficient enough to be protective of human health and the environment. If the EPA shares this assessment, the Component may provide a covenant allowing property transfer before the actual achievement of remedial action objectives. (DoD, 2012, p.39-40)

Site Closeout (SC) shall take place when the DoD has completed the required response actions at the site, the remedies are protective of human health, and when there is no need for additional environmental restoration funds applied to the site (e.g. no further LTM, including LUC, is required). (DoD, 2012, p.43)

4.3.4. Long-Term Management

Following the achievement of the RC milestone there may be need for long-term-management of the site, requiring the Component to monitor the protectiveness of the remedy. As long as “*the remedial action objectives do not allow unrestricted use of the property*” the LTM-phase is required (DoD, 2012, p.41). Actions under the LTM include conducting 5-year reviews, implementing and managing LUCs, and monitoring site conditions. “*The DoD Component shall put appropriate mechanisms in place to manage LUCs for which they are responsible*”, and clarify the responsibilities in the land use management, as well as ensuring that the LUCs are made applicable to future owners, when transferring the property out of DoD control (DoD, 2012, p.41).

If the property transfer already has taken place, the primary responsibility for LUC management and maintenance rests with the property owner, unless the restoration activities are continuing and the Component has retained responsibility for it. Should the land owner fail to manage and maintain the LUCs properly, and cannot be convinced to do so, the DoD Component may need to

take actions to maintain the protectiveness of the remedy. In the case of FUDS, the DoD may, with consent from the current property owner, establish LUCs affecting the owner's property. In this case, the DoD may be responsible for drafting, planning, implementing, reviewing, and monitoring property-related LUCs. (DoD, 2012, p.42-43)

5. Reflections on

5.1. Acceptable risk

When processing the documents that are providing regulatory, and general, background and guidance on the Defense Environmental Restoration Program (DERP) several questions regarding the view on risk appear necessary. In the following subsections, the stance and views of the DoD on what constitutes risks, and acceptable risks, are reflected upon.

5.1.1. For a restoration action to be conducted

Throughout the policy and guidance provided for the DERP and its program categories, there is a recurring reference to CERCLA. For example, the DoD shall conduct restoration activities according to CERCLA, at sites that are (or were) under the control of the DoD, to make sure that any previous activities conducted by the DoD and its components are processed in order to “*protect human health and the environment*” from the risks posed by hazardous material (DoD, 2012, p.12). Talking about risks posed to human health and the environment might seem straightforward and clear. Within the guidance for the DERP, however, there is vagueness as to what constitutes a risk.

There are several thousand sites that fall under DERP eligibility, with many thousand of these eligible for munitions response action under MMRP or FUDS-MMRP, as there are residual UXO and DMMs from previous DoD activities potentially present on these sites. In order for the DoD to be able to make priority and sequencing decisions on which sites should be attended and funded first it developed the MRSPP.

As mentioned earlier in the report, the MRSPP is intended to function as a protocol to apply to all eligible sites in order to make preliminary risk assessments, which will assign them a priority rating, and thereafter this rating will be weighted against local stakeholders’ concerns in order to decide the sequence for resource allocation between different sites.

While not dwelling on the technical details of the MRSP, it is important to clarify that the protocol does not provide a single standard for what constitutes risks to human health. Especially as the protocol assigns the site a relative risk priority rating, determined by comparing the three hazard modules; Explosive Hazard Evaluation (EHE), Chemical Hazard Evaluation (CHE), and Health Hazard Evaluation (HHE) module. However, when there isn't sufficient data to determine a value for a module, the overall priority rating for the MRS is made by combining the modules to which sufficient data is available to assign module rating. (ODUSD(I&E), 2007, p.107)

Although it would be possible to isolate the EHE module to assign a priority rating solely based on the potential explosion risks, it could be counter-productive to the overall effort of ensuring the well-being of the environment and human health to do so. To use this module to create a standard for what shall constitute a risk, and what constitutes an acceptable or nonexistent risk, is an ill-conceived idea. The MRSP was developed with the intention of providing the DoD with material and data to help decide which sites need further investigation, and which sites should get resources first. It is not intended for use as an assessment tool deciding what munitions response actions should be taken. Furthermore, the module is based on an initial assessment of historical records and site conditions and therefore it cannot be used to thoroughly assess all the potential explosives risks at the sites and make a determination that the site is risk-free.

When applying the MRSP the site will be assigned a priority rating based on the hazard module with the highest score, and sequenced accordingly. While conducting response actions on sites that pose the highest risks (according to the MRSP) seems to be the most logical method to protect human and public health, it could be argued that this method is problematic due to lack of UXO-clearance standards. Let say that site A scores a rating of 2 based on the EHE module, while site B scores a rating of 3 based on the HHE module. According to the MRSP,

site A should be prioritized first. However, how do we know that attending to site A before site B would be more protective of human health and the environment? There are currently no standard levels of acceptable risk posed by UXO, while there is one for hazards posed by chemicals and pollutants. Should the levels of residual risk posed by UXO or chemicals after a response action factor into the decisions on site sequencing? One could argue that it should be a factor as the lack of UXO clearance standards might leave a site with a higher MRSPP rating (e.g. 2) with more residual risks than those restoration activities dealing with chemicals and pollutants (of a HHE rating of 3). If this line of thinking were to factor into the sequencing decisions, the DoD and the EPA would have to develop some sort of index for comparing the different kinds of risks posed by UXO and chemical pollutants, both before and after the implementation of a response action. This, however, would first necessitate the development of a UXO clearance standard providing a baseline for acceptable residual UXO risks (similar to what exists with acceptable concentrations of hazardous chemicals and pollutants).

Lastly, at this (investigation) stage in the restoration process of MRSs, the risks posed by explosives cannot be the only factor taken into consideration when deciding whether a site can be classified as risk-free or home to an acceptable amount of risk. At the same time, one can ask oneself whether it would be effective to have and apply this standard at this early stage in a restoration process, as it might increase the time and resources needed to assess all possible MRSs in great enough detail to be able to make the assertion that a site is risk free. Therefore, the present vagueness in the policy documents and the current form of the MRSPP, concerning what constitutes unacceptable and acceptable levels of explosives risks, seems to work in the favor of the overall program goals of the DERP.

5.1.2. During restoration activities

When the DoD/USACE and regulators are conducting the actual munitions response activities, there is an awareness of the risks and hazards of dealing with MEC. For instance, there are several documents and manuals providing guidance on safety issues and conduct when processing MEC. Furthermore, the EOD and other explosives experts shall be given deference when it comes to the handling of MEC and they will take lead in case they perceive that the MEC/UXO suffers an imminent risk for detonation (EPA, 2000). In addition to this risk-awareness, the project teams at each MRS are responsible for submitting documents on planned response actions to the Department of Defense Explosives Safety Board (DDESB) as *“DDSEB policy requires, except in emergency situations, that explosives safety submissions and the explosives safety aspects of any transfer be reviewed and approved by the DDESB”* (EPA, 2010, p.17).

During the actual response activities the DoD also has a policy of using on-site-destruction of the munitions (especially UXO), a practice called Blow-in-Place (BIP). This practice is common and generally the preferred method for disposing UXO because MEC pose such a grave danger to the personnel working on the MRS (EPA, 2010, p.16). However, if the UXO is considered safe enough for removal and disposal at another site, the DoD and the regulators might decide to do so. Render safe procedures (e.g. separating the components of the UXO) are rare due to extreme risks and danger posed to EOD personnel, and only ever occur when both BIP and off-site removal options are considered dangerous and unacceptably venturous (EPA, 2010, p.16).

From a reading of these documents and policies concerning safety issues when conducting munitions response activities it can be argued that there is an awareness of the risks and dangers of MEC, showcased by the consistent referencing to guidance and explosives and occupational safety standards. Apart from noting the existence of this awareness and guidance, not many things can be said about the DoD stance on risk and acceptable risk during the actual response

activities. While there are UXO depth clearance metrics for munitions responses developed by the DDESB, these are only to be used as guidelines. MacDonald and Mendez (2005, p.xii-xiii) criticize DDSEB depth clearance standards as they only work as guideline figures, and because they carry little weight as the project teams shall make site-specific assessments, causing the clearance depth and the extent of the munitions response activities to be negotiated between the DoD and regulators for each individual site.

Thus it becomes interesting to reflect on the DoD position on residual risks (levels of acceptable risks) after the response activities have occurred, and to analyze how this position on acceptable residual risks affect the actual response activities and the other aspects of the MMRP.

5.1.3. After restoration, acceptable residual risk

While one could argue that the DoD applies a risk-conscious method when implementing munitions response actions, this could perhaps only be said about the methods by which the activities are implemented. When reflecting on the DoD practice of munitions responses, several questions appear; *what constitutes a risk after the restoration activities have been conducted? What level of residual risk is acceptable? How clean is clean?*

When processing and analyzing all the documents outlined in section 4.1.1, it becomes apparent that neither the DoD nor the EPA (or any other regulators) have agreed a standard for what constitutes an acceptable residual risk after clearing UXO at MRSs. This lack of standard for assessing and determining acceptable levels of residual explosives risk after conducting/completing munitions response actions is something that Jacqueline MacDonald has criticized in several reports and studies. In a 2004 report, MacDonald describes the discrepancies that exist between the DoD and regulators concerning levels of acceptable risks. For instance, MacDonald mentions that the EPA has stated that nothing else than 0% risk is acceptable, while the DoD couldn't accept that

assessment as it was practically impossible due to restrictions in funding and technology (MacDonald et al., 2004a, p.33).

This critique came in 2004, but since then there hasn't been any major changes in the way that the DoD and regulatory actors conduct munitions response actions. The MEC HA of 2008, for instance, is to be used by project teams to make site-specific decisions on what response activities should take place. The MEC HA help transfer responsibility to the on-site project teams to decide the extent to which the UXO should be cleared, and which methods should be used to do so. While the intention and purpose of this policy is benign, trying to provide a methodology that address UXO while leaving room for considering the complexity in various site-conditions, it comes with some disadvantages.

5.1.4. In relation to other societal aspects/risks

The lack of clearance standards for UXO and MEC has an impact on several important aspects of the munitions response process. First of all, it has an impact on the safety of both the public and on the personnel of the project teams. A study by MacDonald et al. suggest that there are statistically significant differences in the estimates about the probability of UXO detonation of various types of UXO under different scenarios, even between EOD experts with a mean EOD experience of 24 years (MacDonald et al., 2008). Taking this into consideration makes the on-site assessments of UXO risks problematic, given the fact that decisions on response actions to UXO is in large part based on the estimates and assessments of EOD experts. Even if this is mitigated by the fact that there are guidance and manuals to help make assessments (e.g. MEC HA), the results of the study are still relevant as the manuals available are just tools to help make the assessments.

In the MEC HA it is clearly stated that it *“does not answer the question of “How clean is clean?”* and that *”Site-specific project teams will determine “How clean is clean?” by selecting the alternative to be implemented to meet CERCLA*

requirements” (EPA, 2008, p.xiii). This vagueness and this consideration to site-specific conditions do have positive benefits such as the fact that the project teams can assess and respond to conditions that might otherwise have been overlooked or ignored by a universal standard. However, there need not be a universal depth to which UXO should be cleared nor just one method when conducting response actions. There should rather be some sort of policy guidance/manuals outlining; what the baseline depth clearance is for future land use scenario X; an acceptable percentage of UXO left unattended in scenario Y and; what methods should be used to best achieve this in scenario X, Y, and so forth. Otherwise there might be a risk that the public at different locations with similar conditions will be exposed to varying degrees of risk to their health after the response activities has been implemented, as EOD experts do make different estimates and assessments on the risk of detonation by UXO (MacDonald et al., 2008).

5.2. Responsibilities

5.2.1. Before restoration activities

As outlined in section 4.2, the management structure and the responsibilities of the actors before the commencement of restoration activities include: developing policy, guidance and manuals, providing metrics and goals for the DERP and its program categories (FUDS, MMRP), as well as conducting program oversight and review. The DUSD(I&E) is the office within the DoD responsible for these tasks. It is, however, worth noticing the fact that the descriptions on what these responsibilities actually incline are quite vague. The goals and metrics of the DERP and its program categories are an interesting example, especially when keeping the reflections of subsection 5.1.1 in mind.

The latest update on DERP program goals and metrics was published in 2013, and the goals provided are in the same form as the following example; “*Assign a numeric MRSP score, or alternative rating of “no longer required” or “no known or suspected hazard,” to 95% of MRSs by the end of FY 2014*” (DoD,

2013b). The goals and metrics provided by the DoD is thus only focusing on the completion rate, not the actual results of the finished activities. Clearly, these goals and metrics are based on the assumption that the Components and the project teams will conduct restoration activities that are protective of the environment and of human health. However, combining this sort of metrics with the vagueness of the guidance documents, the decentralized responsibility of on-site risk assessment and site-specific remedial actions, one could argue that the responsibility for ensuring that the DERP meets its goal is implicitly transferred to the project teams. In addition to this, the nature of the metrics and goals provided could make it hard to review and make quality controls on overall program progress, as the percentage of sites having achieved the RIP milestone does not provide any qualitative data on how the DoD has remediated risks. In essence, these metrics only provide the DUSD(I&E) with data for conducting oversight on program completion rates, while the metrics does not provide the DUSD(I&E) with any data that can be used to analyze and discuss the effectiveness and the quality of the overall program performance.

5.2.2. During restoration activities

The responsibilities of planning, programming, and executing munitions response activities are delegated to the DoD Components, in the role of lead agency. For munitions response activities on FUDS sites, these responsibilities are delegated to the USACE (DoD, 2013a, p.12-14). The project teams acting on the authority of these two organizational entities usually consists of EOD experts, EPA, State, Tribal and Local officials (ODUSD(I&E), 2007, p.C-7).

An interesting detail about the guidance for DERP activities is that there are several guidance documents determining baseline risk levels for hazardous chemicals and pollutants. In contrast to explosives risks posed by UXO, there are standard levels of risks posed by chemicals. For instance, the project teams might measure the concentration of pollutants and the cumulative carcinogenic risk they pose to an individual, based on the maximum level of exposure of present and

future land use (EPA, 1991, p.1). What is interesting here is the fact that these exposure levels and carcinogenic risks are clearly defined in quotas, with a site containing carcinogenic risks higher than value X will trigger a response, while a site containing levels lower than X need not be attended and remediated. As noted earlier, there are no such levels, standards or quotas of UXO presence and risks.

This leaves the individual MRS project teams with a large share of the responsibility to ensure that the restoration activities on site containing UXO and MEC are effective enough to protect human health. A question that arises from this complexity is the question of liability; *who can be held accountable in the case of an accident?* As of now, searching through the policy documents and guidance it is already unclear who could be held accountable. Adding the complexity of site-specific assessments and responses, and the lack of UXO clearance standard, it is unclear whether the DoD Component is liable, or whether the members of the project team that made the risk assessments, decided and implemented response actions are the ones legally liable for compensation.

5.2.3. *After restoration activities*

As mentioned in subsection 4.3.4, there is usually a need for some sort of long-term management of the MRS to ensure the safety and health of the new owner or of the public. This usually includes some sort of LUCs (DoD, 2012, p.41). Furthermore, the DoD shall conduct 5-year reviews to ensure that the remedial action is still effective in protecting human health and the environment until it is decided that the site can be exposed and used without restrictions (DoD, 2012, 45). As the DoD is responsible for implementing and managing LUCs on sites under their control (pre-remediation, during, and post- remediation), until there can be unrestricted public access or use, one might wonder what fiscal considerations are taken when deciding to combine LUCs with clearance activities. Outlined in guidance documents, cost-to-complete (CTC) estimates for LTM and LUCs continuing indefinitely shall be included in the budget according to a finite period up to a 30-year period. Should the period of LTM be finite, but

longer than 30 years, the CTC in the budget plan for the site shall take all of the finite period into consideration (DoD, 2012, p.68). However, there is little in the processed guidance documents that provide the reader or the responsible DERP actors with information on what fiscal considerations shall be taken when deciding what the remedial activities shall be. This will be reflected upon in the subsection 5.3.1.

Outlined in the DERP manual of 2012, the guidelines on how to distribute responsibilities for implementing and maintain LUCs during different phases of the restoration process is quite clear. For instance, prior to transfer the DoD shall, in association with regulators and potential landowners, decide and delineate the distribution of responsibilities for maintaining LUCs. These responsibilities shall be clearly documented and distributed to the relevant parties at transfer. Post-transfer, the responsibility for maintaining LUCs is generally bestowed upon the landowner. Exceptions to this are when the DoD has retained responsibility or when there are ongoing restoration activities at the site. Should the landowner fail to effectively manage the LUCs, and cannot be compelled to do so, the DoD Component may take action to address the protectiveness of the remedial actions(s). At FUDS sites, the DoD may establish LUCs with the consent of the current property owner. (DoD, 2012, p.42-43)

In the case of sites that have been transferred, the responsibility for ensuring human health seems to be rested on the current land/property owner (with the occasional exceptions). However, the documents do not assign legal liability in case of a lethal accident or injury caused by UXO where the LUC has been managed according to decision and transfer documents. Does responsibility for the incident rest with; (1) the DoD that decided and implemented the LUC?; (2) the regulators which provided feedback and approval of the LUC management plan?; (3) with the current landowner, or (4) with the affected parties for potentially ignoring the LUCs? Instinctively, given the scenario above (with the LUC managed according to decision documents), neither the current landowner

nor the affected party can be held responsible. Instead, the responsibility should rest with the DoD or the regulators for designing, approving and implementing a LUC which obviously failed to be 100% protective of human health. However, *“private landowners could be held legally liable, either on a negligence theory or based on strict liability, if they take title to UXO-contaminated property and someone gets injured, according to Barry Steinberg, former head of the Army Environmental Law Division”* (MacDonald et al., 2004a,p.32). In addition to establishing standard UXO clearance levels, and a consistent position on what constitutes an acceptable UXO risk, there seems to be a need for clarification on the distribution of responsibilities and liabilities after a response action has been implemented.

5.3. Financing

5.3.1. Estimating program costs

As presented by MacDonald and Mendez (2005), there are several difficulties in assessing total program costs. One reason why it is so is the fact that the lack of UXO clearance standards, including standards on what constitutes an acceptable level of residual UXO risk post-remediation. The current methodology of site-specific risk-assessments and site-specific remediation activities makes total program cost estimations in large part a guessing game. This is due to the fact that the lack of UXO clearance standards contributes to a wide array of different methods addressing UXO remediation, as different project teams assess risks differently and thereby suggest and decide on different methods. As MacDonald and Mendez (2005) show, the remediation costs for clearing UXO to a depth of 4 feet can vary between 67 million and 1,100 millions USD due to the different methods that may be applied to reach this remediation goal (MacDonald & Mendez, 2005, p.xvii). Putting this in relation to studies that suggests that even highly experienced EOD experts provide various different (statistically significant) estimates of UXO detonation probabilities, adds to the complex issue of making accurate program cost estimates (MacDonald et al., 2008). The lack of UXO clearance standards mixed with differing UXO risk assessments, as well as

a lack of agreed methodology for addressing a certain kind of site conditions makes program cost estimations difficult at best, but most likely inaccurate.

Adding to the complexity of estimating program costs is the fact that many of the FUDS site included in the inventory are added there simply on the basis on being eligible for FUDS restoration activities. A GAO report from 2010 suggests that out of the 1,318 sites classified as having achieved Response Complete (RC) by 2008, most were not in need of any remedial action (1,234). This kind of reporting the report authors called administrative closing, as there was no actual activity but only an administrative process of classifying the site as having been remediated. This was partly due to the fact that many sites had been included in the FUDS inventory because it was assumed they contained firing ranges, which they did not. (GAO, 2010, p.15-17)

Classifying these sites as RC can make MMRP cost estimates more difficult as the DoD does not clarify how many of these RC-sites actually were submitted to munitions response activities, possibly giving the impression that a certain amount of funds will cover remediation of X number of sites, while the total costs for actual remediation will be much higher. The GAO report suggests that this lack of clarity in reporting program progress makes it look like the program is more efficient than it really is. An additional factor to so many sites FUDS-MRSs being administratively closed is the fact that they might not be determined to be MMRP-eligible (e.g. through handling in another program), or because the contamination was not caused by the DoD While not only lowering the estimates of MMRP program costs, it can cause some confusion on the actual costs of UXO clearance as the handling of UXO through other program categories hides the actual cost of UXO clearance. . (GAO, 2010, p.15-17)

5.3.2. In relation to selection of response activities

The reasoning behind making RC-classifications (by administrative closing) can also be argued to be problematic out of a risk-perspective. Determining a site to be RC as there is no need for remedial actions by looking at historical records that show no activities that could have left UXO and DMMs on-site, might be problematic if there is lack of documentation on the testing/firing, and dumping, of munitions (GAO, 2010, p.15-17). In Sweden, on-site risk assessments and UXO clearance is often problematic as sites can be found where there are no historical records of munitions use, and undocumented uses of munitions, most likely leaving UXO, have been common in the past (F., Johnsson, personal communication, January 23, 2016). Should there be similar cases on former US defense site, it might be problematic to close down sites without further investigations.

As UXO clearance can be very costly, depending on the level of ambition and the methods used, LUCs as part of the response activities are common (MacDonald & Mendez, 2005). The 2012 DERP management guidance states that the selection of remedial alternatives need to be assessed in the light of being socially, environmentally and fiscally sustainable (DoD, 2012, p.33). However, there is little guidance providing assistance in determining what constitutes a social, environmental and fiscal sustainable remedial action, nor does the guidance provide conditions on whether LUCs should be part of the initial response activities, or mainly a tool in the LTM. It is unclear on what fiscal and risk assessment considerations project teams decide on LUCs, and what the relationship between fiscal considerations and site-specific risk assessments are. Should the DoD provide guidance documents, standards, or an index for weighing and comparing costs-benefits with the levels of residual UXO risk of action X and Y, there might be a larger program wide coherency in the response activities chosen and the application of LUCs.

An index like this might not only help estimate total program costs, but it might also function as a substitute to a program-wide accepted UXO risk level when deciding on response activities. Taking nationwide economic benefits into consideration, one could possibly decide whether to conduct an UXO-removal action or restricting access to a site and close it down, basing the decision on comparing what the costs and what the economic benefits of the various alternatives would be. On the other hand, this proposed policy would probably be difficult to implement effectively and coherently in reality, as there usually has to be some sort of compromise between LUCs and clearance, which once again would necessitate some sort of standard level of accepted residual UXO risks. Adding to the difficulty of such a proposal is the fact that sites under the FUDS category already have been transferred out of DoD control, thus making it impossible to completely close down the site as it might already be in use by the current landowner, as well as possible resistance from the landowner on certain remedial proposals.

6. Conclusions

6.1. Final remarks

Surveying the policy and guidance documents of the DERP, MMRP and FUDS programs, it becomes apparent that while the process of munitions response actions is described relatively clear and methodically, there are ambiguities as well. Although the division of responsibilities and the funding eligibility might seem quite clear-cut when performing the actual munitions responses, there are ambiguities on what levels of cleanup can be considered safe. As of now, there is no accepted standard on residual UXO risks, or any standard methods for locating and addressing the encountered UXO. This is causing confusion regarding the total program costs, as well as it puts the responsibilities of ensuring the protectiveness and efficiency of remedial action in the hands of individual project teams. While the site-specific risk assessments and remedial actions are allowing project teams to cope with the complexity of UXO clearance, it might also have a negative impact as studies show that EOD experts have various different perceptions of detonation risks by UXO. Apart from the aforementioned problem of estimating budget costs, this might also lead to varying levels of actual UXO removal for sites with similar conditions, causing uneven risk distribution among MRSs after remedial actions. In addition to this not being in accordance with the overall DERP goal of protecting the environment and human health, the division of responsibilities is unclear regarding who bares the responsibility should there be an accident caused by a residual UXO detonation, possibly making the members of individual project teams liable for compensation or legal action.

While some kind of cost-benefit analyses would not be developed easily, it would come in handy in the present day situation as there are no UXO clearance methodology standards yet, nor any accepted risk value from UXO, which means that there could be a need to factor in economic deliberations when selecting restoration activities. A better scenario, however, would be to see the DoD and EPA develop accepted baseline levels of residual UXO risk (similar to what

exists for chemicals and pollutants), along with some form of manual with a range of predefined (approved of) combinations on acceptable UXO risk and the methods used to most efficiently reach that level. Should the DoD and the EPA agree on a level of acceptable residual UXO levels for site use scenario A, B, and so forth, it will likely be easier to develop a applicable combinations of different search methods and remediation alternatives to help achieve the agreed upon risk level. A more narrow range of possible options when deciding how to search, locate and clear UXO might also lead to more accurate cost estimations for each individual site, as well as for the MMRP and FUDS subcategories within DERP.

6.2. Suggestions for further study

Concerning the ambiguities concerning the distribution of responsibilities and liabilities in the case of UXO accidents causing human harm, a more extensive study of the legal framework would likely help bring more clarity on the issue. An interesting starting point would be to explore how liability would be cast in the case an accident would occur after a response activity, where the current property owner was charged with managing the LUCs did so in accordance to transfer documents. It would be interesting to see whether the same federal laws and regulations apply to all cases, or whether there are differences in state property laws governing which party bear responsibility.

Furthermore, it would be of interest to reach out to the personnel doing the fieldwork during munitions response activities to get their input into how they experience the policy and guidance available. Regarding the reflections presented in this report, it would be interesting to examine what kind of professional praxis exists for weighing the different localization and clearance methods with the estimated costs those methods would imply, as well as how they put those deliberations in relation to their risk assessments and their assessments on what residual UXO levels would be deemed acceptable.

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