OFFICE OF THE UNDER SECRETARY OF DEFENSE
3000 DEFENSE PENTAGON
WASHINGTON, DC 20301-3000

ACQUISITION,
TECHNOLOGY
AND LOGISTICS

JUN 13 2007

MEMORANDUM FOR DEPUTY ASSISTANT SECRETARY OF THE ARMY
(ENVIRONMENT, SAFETY, AND OCCUPATIONAL
HEALTH)
DEPUTY ASSISTANT SECRETARY OF THE NAVY
(ENVIRONMENT)
DEPUTY ASSISTANT SECRETARY OF THE AIR FORCE
(ENVIRONMENT, SAFETY, AND OCCUPATIONAL
HEALTH)

SUBJECT: Primer for the Munitions Response Site Prioritization Protocol

The Department of Defense (DoD) published the Munitions Response Site Prioritization Protocol (hereinafter the Protocol) as a final rule in the Federal Register on October 5, 2005, codified at 32 CFR Part 179. The Protocol provides a framework for implementing the requirement established by Section 311(b) of the National Defense Authorization Act for Fiscal Year 2002. The Components will use the Protocol to assign a relative priority to each defense site (a.k.a. munitions response site) in the Department's inventory of munitions response sites known or suspected to contain unexploded ordnance, discarded military munitions, and munitions constituents.

DoD produced the attached Primer as an instruction manual for munitions response project managers and other environmental personnel responsible for applying the Protocol. The Primer details the development of the Protocol, requirements for its application, opportunities for stakeholder involvement, and data management responsibilities. This technical guide also includes site evaluation tools, a glossary of Protocol-specific terms, and references to other munitions-related resources.

This document could not have been developed without the input and dedicated support of the Components. Your participation throughout the Primer's development and training continues to be of major value to the Department. The ability to systematically and consistently assign a relative priority to each munitions response site is an important step in achieving our environmental restoration objectives.

Copies of the Primer are available on the World Wide Web at:

https://www.denix.osd.mil/denix/Public/Library/Cleanup/CleanupOfc/index.html

My staff associate responsible for this Primer is Mr. Vic Wieszek, available at 703-571-9061 or victor.wieszek@osd.mil.

Alex A. Beehler

Alex A. Beehler
Assistant Deputy Under Secretary of Defense
(Environment, Safety, and Occupational Health)

Attachment:
As stated

OFFICE OF THE DEPUTY UNDER SECRETARY OF DEFENSE
(INSTALLATIONS AND ENVIRONMENT)
OFFICE OF ENVIRONMENTAL MANAGEMENT

MUNITIONS RESPONSE SITE PRIORITIZATION PROTOCOL PRIMER

APRIL 2007



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Munitions Response Site Prioritization Protocol Primer

Office of the Deputy Under Secretary of Defense (Installations & Environment)
Office of Environmental Management

April 2007

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About the Primer

This Primer is an instruction manual for munitions response project managers and other environmental personnel that are responsible for applying the Munitions Response Site Prioritization Protocol (hereinafter the Protocol). The Protocol is the methodology developed by the Department of Defense (DoD) to assign a relative priority to defense sites known or suspected of containing unexploded ordnance (UXO), discarded military munitions (DMM), or munitions constituents (MC). This document contains information about DoD's development of the Protocol and provides a step-by-step guide for applying the Protocol. Figure A.1 shows the organization of the Primer.

Figure A.1 Primer Contents

Chapter	Title	Description
1	What is the Protocol?	Explains the purpose of the Protocol and introduces key terms necessary for understanding and applying the Protocol.
2	Development of the Protocol	Provides a brief history of the Protocol's development, including DoD's workgroup process and consultation with stakeholders.
3	Overview of the Protocol	Describes the Protocol as codified in federal regulation, including the process to apply the Protocol and sequence sites for munitions response actions.
4	General Instructions	Provides instructions for the Protocol's application and how to complete the scoring tables.
5	Explosive Hazard Evaluation Module	Guides the user through determining a module rating.
6	Chemical Warfare Materiel Hazard Evaluation Module	Guides the user through determining a module rating.
7	Health Hazard Evaluation Module	Guides the user through determining a module rating.
8	Determining MRS Priority	Guides the user through compiling the information obtained in earlier chapters to determine a priority for the munitions response site.
9	Administrative Requirements	Provides an overview of additional reporting requirements.
10	Stakeholder Involvement	Describes stakeholder requirements and provides suggested outreach mechanisms.
	Appendix A: Primer Scoring Tables	Contains the Primer tables used to score the three hazard evaluation modules and determine the MRS Priority.
	Appendix B: Comparison Value Tables for the Contaminant Hazard Factor Evaluation	Contains comparison values used to determine the Contaminant Hazard Factor.
	Appendix C: Glossary	Provides a comprehensive list of terms and their definitions as related to the Protocol.
	Appendix D: Acronyms	Contains a list of acronyms used in the Primer.
	Appendix E: References	Offers suggestions for additional information.

This Primer contains features to aid in the successful application of the Protocol to a defense site. These features include:

- Icons throughout the Primer alert the user to important information concerning definitions, references, and tips for use during the Protocol's application. Icons are displayed in Figure A.2.

- Appendix C provides a comprehensive glossary of terms used in the Protocol. Terms defined in the Glossary are bold upon first use in the Primer and where they are significant to the discussion. Terms in the Glossary are listed under a Definitions icon on the page on which the term is used.

While this Primer contains information and instructions for the Protocol's application, it is not a substitute for the Protocol, nor is it a rule itself. This Primer does not modify any implementing regulations, policies, or guidance.

Figure A.2 Icons Used in the Primer

Definitions (See Appendix C)	The Definitions icon lists terms on each page that are defined in the Glossary in Appendix C.	
References	The References icon indicates additional sections of the Primer that should be consulted and provides citations or Web sites that may be useful.	
Tips and Tricks	The Tips and Tricks icon identifies helpful hints for applying the Protocol.	

Chapter 1: What is the Protocol?

BACKGROUND

The Department of Defense (DoD) conducted live-fire training and testing of weapon systems at active and former military installations throughout the United States to ensure force readiness and defend our nation. As a result, some properties that DoD used for munitions-related activities are known or suspected to contain **unexploded ordnance (UXO)**, **discarded military munitions (DMM)**, or **munitions constituents (MC)**. While DoD has made great progress in addressing the potential hazards associated with munitions-related activities, much remains to be done. In the Fiscal Year (FY) 2002 National Defense Authorization Act (NDAA), Congress directed DoD to develop, in consultation with representatives of the States and Indian Tribes, a protocol for assigning defense sites containing UXO, DMM, or MC a relative priority for response activities. DoD refers to these sites as **munitions response sites (MRSs).**

In response to the NDAA requirement, DoD developed the Munitions Response Site Prioritization Protocol (hereinafter the Protocol) as the methodology for prioritizing sites known or suspected to contain UXO, DMM, or MC for response actions. Each **Component** will apply the Protocol to determine a relative priority for MRSs located at active installations, **Base Realignment and Closure (BRAC)** installations, **Formerly Used Defense Sites (FUDS)**, or other properties no longer under DoD control. The priority assigned should be based on the overall conditions at each site, taking into consideration various factors relating to the potential environmental and safety hazards.

DoD developed the Protocol through a collaborative process with the States (states), **American Indian and Alaska Native Tribes** (tribes), and federal agencies, collectively known as **stakeholders**. The process DoD developed for the Protocol's application continues to afford opportunities for stakeholders to participate in the Protocol's application.

MILITARY MUNITIONS

For decades, DoD conducted military munitions-related activities at military installations (e.g., training, testing, demilitarization, disposal) to ensure the readiness of our Armed Forces and manage DoD's munitions stockpile. **Military munitions** means all ammunition products and components produced for or used by the Armed Forces for national defense and security, including ammunition products or components under the control of the DoD, the Coast Guard, the Department of Energy (DOE), and the National Guard. The term includes confined gaseous, liquid, and solid propellants; explosives, pyrotechnics, chemical and riot control agents, smokes, and incendiaries, including bulk explosives and chemical warfare agents; chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, and demolition charges; and devices and components of any item thereof. The term does not include **wholly inert** items, improvised explosive

Definitions
(See Appendix C)

Unexploded ordnance (UXO)

Discarded military munitions (DMM)

Munitions constituents (MC)

Munitions response site (MRS)

Components

Base Realignment and Closure (BRAC)

Formerly Used Defense Site (FUDS)

American Indian and Alaska Native Tribes

Stakeholders

Military munitions

Wholly inert

devices, and nuclear weapons, nuclear devices, and nuclear components, other than nonnuclear components of nuclear devices that are managed under the nuclear weapons program of DOE after all required sanitization operations under the Atomic Energy Act of 1954 (42 USC 2011 et seq.) have been completed.

Today, millions of acres that DoD once used for training and testing may contain UXO, DMM, or MC that resulted from activities DoD conducted to ensure the readiness of the Armed Forces. These munitions (i.e., UXO or DMM) present a potential risk of physical injury from detonation. **UXO** are military munitions that:

- Have been primed, fuzed, armed, or otherwise prepared for action;
- Have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and
- Remain unexploded, whether by malfunction, design, or any other cause.

Locations where DoD conducted munitions-related activities may also contain DMM. **DMM** are military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for the purpose of disposal. The term "DMM" does not include UXO, military munitions that are being held for future use or planned disposal, or military munitions that have been properly disposed of consistent with applicable environmental laws and regulations.

DMM may be found on the surface or subsurface of an MRS (e.g., burial pits). Although DMM are capable of functioning and pose an explosive hazard, they are not normally as hazardous as UXO. This is because DMM are not normally fuzed and, if fuzed, would not normally have experienced their firing sequence. However, because DMM have experienced unknown environments (e.g., effects of an attempted detonation or burial), they should always be treated as UXO until technically qualified personnel determine their condition and the hazard they present.

MC are any materials originating from UXO, DMM, or other military munitions, including explosive and nonexplosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions. MC (e.g., lead, royal detonation explosive [RDX]) may be discovered in locations where military munitions were disposed (e.g., burial sites), or demilitarized (e.g., sites used for open burning or detonation). MC can pose both acute and chronic health hazards, environmental hazards, and, if present in high enough concentrations, an explosive hazard.

Definitions
(See Appendix C)

Unexploded ordnance (UXO)

Discarded military munitions (DMM)

Munitions constituents (MC)

Munitions and explosives of concern (MEC)

Chemical agent (CA)

DoD uses the term **munitions and explosives of concern (MEC)** to distinguish specific categories of military munitions that may pose unique explosives safety risks, such as UXO as defined in 10 USC 101(e)(5); DMM, as defined in 10 USC 2710(e)(2); or MC (e.g., TNT, RDX), as defined in 10 USC 2710(e)(3), that is present in high enough concentrations to pose an explosive hazard.

Some military munitions contain a **chemical agent (CA)** fill that pose a unique set of hazards. CA is a chemical compound (to include experimental compounds)

that, through its chemical properties, produces lethal or other damaging effects on human beings, is intended for use in military operations to kill, seriously injure, or incapacitate persons through its physiological effects. Excluded are research, development, testing, and evaluation (RDT&E) solutions; riot control agents; chemical defoliants and herbicides; smoke and other obscuration materials; flame and incendiary materials; and industrial chemicals. Such munitions are **chemical warfare materiel (CWM)** and include material (e.g., glass vials used in research, containers) that contains CA. CWM is evaluated under the Protocol because DoD used CWM in training and testing at many active and former installations.

ADDRESSING THE EFFECTS OF PAST MUNITIONS USE

The process of addressing UXO, DMM, or MC is called a **munitions response**. Munitions response refers to response actions, including investigation, removal actions, and remedial actions:

- To address the explosives safety, human health, or environmental risks presented by UXO, DMM, or MC; or
- To support a determination that no removal or remedial action is required.

DoD undertakes munitions response actions under the **Military Munitions Response Program (MMRP)**. The MMRP is part of the **Defense Environmental Restoration Program (DERP)**. The DERP is the program under which DoD carries out environmental restoration at all facilities under its jurisdiction. For decades, DoD has been protecting human health and the environment at its active installations, closing installations, and property transferred out of its control (e.g., FUDS) by conducting environmental responses under the DERP. In September 2001, DoD established the MMRP as part of the DERP to address the unique hazards posed by past military munitions-related activities.

To establish its inventory, DoD has identified MRSs eligible for the MMRP that may require response activities. DoD's inventory of MRSs is updated annually and is available in the Defense Environmental Programs (DEP) Annual Report to Congress (ARC).

DoD has established a number of near-term goals focused on completing initial investigation activities at all MRSs. For MRSs at active installations, **preliminary assessments (PAs)** should be completed by the end of FY 2007 and **site inspections (SIs)** by FY 2010. DoD is currently working to develop goals for MRSs to achieve **response complete (RC)** at these installations. For installations impacted by the first four BRAC rounds, DoD should achieve **remedy in place (RIP)**/RC by the end of FY 2009.

To address locations where the Protocol is applicable, DoD developed two new terms, munitions response area (MRA) and MRS. An **MRA** is any area on a defense site that is known or suspected to contain UXO, DMM, or MC, while an **MRS** is a discrete location within an MRA that is known or suspected to

References

DEP ARC: https://www.denix.osd.mil/denix/Public/Library/Cleanup/CleanupOfc/arc/index.html

Definitions
(See Appendix C)

Chemical warfare materiel (CWM)

Munitions response

Military Munitions Response Program (MMRP)

Defense Environmental Restoration Program (DERP)

Preliminary assessment (PA)

Site inspection (SI)

Response complete (RC)

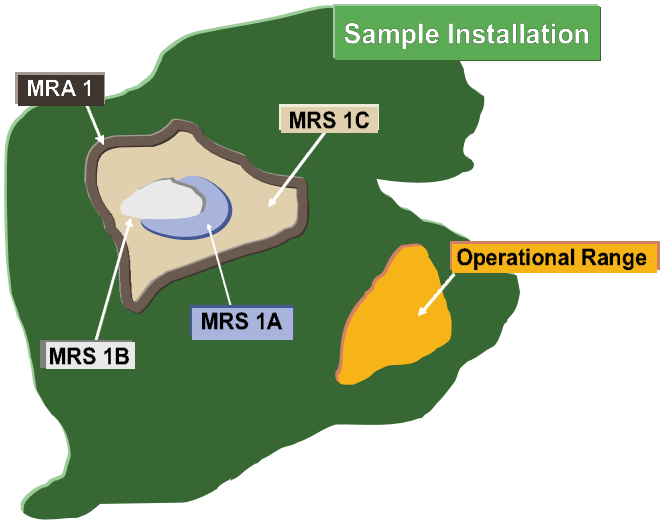
Remedy in place (RIP)

Munitions response area (MRA)

Munitions response site (MRS)

require a munitions response. MRAs are often large geographic areas that may encompass an entire former **military range** with thousands of acres. DoD may subdivide an MRA into one or more MRSs after the MRA is investigated and DoD better understands how the MRA was used and where the munitions-related activities occurred.

Figure 1.1 Interrelationship of an MRA and MRSs



For a subdivided MRA, the sum of all MRSs must equal the total acreage (area) of the MRA (Σ acreage of all MRSs = acreage of MRA)

Every MRA includes at least one MRS, but may include multiple MRSs. If an MRA contains only one MRS, the acreage of the MRS must equal that of the MRA. If an MRA is subdivided into multiple MRSs, the total acreage of the MRSs must equal the total acreage of the MRA.

In Figure 1.1, an entire installation is represented by the green area. Not all areas on an installation are subject to the Protocol. The orange area represents an operational range and is therefore excluded from the Protocol. Of the remaining installation areas potentially subject to the Protocol, only areas where UXO, DMM, or MC are known or suspected become MRAs. In Figure 1.1, only MRA 1 (outlined in brown) is known or suspected to contain UXO, DMM, or MC. MRA 1 is then further delineated into three discrete MRSs (MRS 1A through MRS 1C). MRS 1A and 1B are known to require a munitions response. The remaining acreage, which was not specifically identified as requiring a munitions response, but falls within the MRA area, is MRS 1C. This approach ensures that every acre of an MRA is addressed.

The Protocol provides the Components (i.e., Army, Navy, Air Force, Marine Corps, and Defense Logistics Agency [DLA]) a framework to use with stakeholders to determine the relative risks posed at each MRS within its MRS Inventory. The Protocol helps ensure that the Components consistently consider MRS-specific data for evaluating potential hazards (i.e., explosives, CWM, and human health)

Definitions
(See Appendix C)

Military range

at an MRS and for determining the MRS's relative priority. After the MRS is assigned a priority, the Component will sequence the MRS for response actions. As a matter of DoD policy, an MRS with higher relative risks will be addressed before an MRS with lower relative risks. However, other factors (e.g., community interests, value of land for development) may be considered in sequencing decisions. The Protocol also has administrative requirements to ensure consistency in each Component's sequencing decisions.

LOCATIONS WHERE THE PROTOCOL WILL BE APPLIED

The FY 2002 NDAA (10 USC 2710) requires DoD to apply the Protocol to defense sites:

- Currently or previously owned by, leased to, or otherwise possessed or used by DoD;
- Known or suspected to contain UXO, DMM, or MC; and
- Included in the inventory of defense sites.

Congress excluded from its definition of defense sites:

- **Operational ranges**;
- Locations that are not, or were not, owned by, leased to, or otherwise possessed or used by DoD (e.g., current and former ranges owned by a state's National Guard);
- Locations neither known to contain, or suspected of containing, UXO, DMM, or MC;
- Locations outside of the **United States**;
- Locations where the presence of military munitions results from combat operations (e.g., Civil War battlefields);
- Currently operating military munitions storage and manufacturing facilities; and
- Locations that are used for, or were permitted for, the treatment or disposal of military munitions.

Definitions
(See Appendix C)

Operational range

United States

References

DoD's MRS Inventory:
http://deparc.egovservices.net/deparc/do/mmrp

SUMMARY

The Protocol provides the Components a framework to use with stakeholders to determine the relative risks posed at each MRS within its MRS Inventory. Each MRS is a defense site known or suspected to contain UXO, DMM, or MC that may require a munitions response. Through application of the Protocol, each MRS is assigned a relative priority for munitions response actions based on its overall conditions. MRSs may be found on active installations and property that was, or may be transferred from DoD control.

Chapter 2: Development of the Protocol

ESTABLISHING THE PROTOCOL

As a result of past testing and training activities, some properties that DoD used to meet its defense mission are known or suspected to contain UXO, DMM, or MC. In the FY 2002 NDAA, Congress directed DoD to take several actions with regard to UXO, DMM, and MC. These actions included developing an inventory of all defense sites known or suspected to contain UXO, DMM, or MC, referred to as MRSs. It also included a requirement for DoD to develop, in consultation with representatives of the states and tribes, a Protocol for assigning a relative priority to each MRS, based on the potential hazards present and MRS conditions.

While DoD has been responding to properties that were known or suspected to contain UXO or DMM for many years, DoD policy established the MMRP in September 2001 to improve its overall approach for protecting human health and the environment, attain a better understanding of response requirements, and gain better visibility of total potential costs. DoD modeled the MMRP after its **Installation Restoration Program (IRP)**—the program DoD uses to conduct environmental restoration activities. This allowed DoD to apply lessons learned from its execution of the IRP to the MMRP.

Congressional Requirements

The FY 2002 NDAA (10 USC 2710), included several new requirements related to UXO, DMM, and MC. These new requirements directed DoD to:

- Develop an inventory of defense sites known or suspected to contain UXO, DMM, or MC, referred to as MRSs;
- Develop, in consultation with representatives of the states and tribes, a process for assigning to each MRS a relative priority for response actions; and
- Establish a program category to track munitions response costs.

Congress required DoD to consider specific factors in developing the Protocol. These factors are shown in Figure 2.1.

Definitions
(See Appendix C)

Installation Restoration Program (IRP)

Figure 2.1 Consideration Factors for Response Priority Assignments

Whether there are known, versus suspected, UXO, DMM, or MC on all or any portion of the defense site and the types of UXO, DMM, or MC present or suspected to be present
Whether public access to the defense site is controlled, and the effectiveness of the controls
The potential for direct human contact with UXO, DMM, or MC at the defense site and evidence of people entering the site
Whether a response action has been or is being undertaken at the defense site under the FUDS program or other program
The planned or mandated dates for transfer of the defense site from military control
The extent of any documented incidents involving UXO, DMM, or MC at or from the defense site, including incidents involving explosions, discoveries, injuries reports, and investigations
The potential for drinking water contamination or the release of munitions constituents into the air
The potential for destruction of sensitive ecosystems and damage to natural resources

(Note: DoD refers to defense sites as MRSs.)

Departmental Efforts

References

DERP Management Guidance: www.denix.osd.mil/denix/Public/ES-Programs/Cleanup/guida.html

CERCLA: www.access.gpo.gov/uscode/title42/chapter103_.html

Executive Order 12580: www.archives.gov/federal-register/executive-orders/1987.html

NCP: www.access.gpo.gov/nara/cfr/waisidx_00/40cfr300_00.html

The *Management Guidance for the Defense Environmental Restoration Program (DERP)* (hereinafter the *DERP Management Guidance*) provides guidance on DoD's environmental restoration program and serves as the DoD guidebook on how to implement and conduct environmental restoration activities at DERP sites, including MRSs. In September 2001, DoD revised the *DERP Management Guidance* to clarify that munitions responses are subject to the same requirements as other environmental responses under:

- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA);
- Executive Orders 12580 *Superfund Implementation* and 13016 *Superfund Amendments*; and
- The National Contingency Plan (NCP).

The revised *DERP Management Guidance* established the MMRP as a category under the DERP for munitions responses. The *DERP Management Guidance* required Components to: identify and establish an inventory of locations where munitions responses may be required, evaluate hazards posed at those locations, and conduct munitions responses when necessary.

THE WORKGROUP PROCESS

To develop the Protocol, the Office of the Deputy Under Secretary of Defense for Installations and Environment (ODUSD(I&E)) convened a DoD workgroup composed of Component representatives knowledgeable in explosives safety and/or environmental restoration. This DoD workgroup led the effort to develop the Protocol. The DoD workgroup gathered data (e.g., preliminary discussions and interviews), reviewed existing models, and constructed an outline for the Protocol. The DoD workgroup also reviewed publications and methods, including proposed and final rules, guidance documents, and risk assessment tools previously developed by DoD and other federal agencies.

Consultation with the States, Tribes, and Federal Agencies

Understanding the fundamental importance of communication and cooperation to the Protocol's success, the DoD workgroup proactively engaged with stakeholders in the Protocol's development. DoD identified groups and individuals who were interested in, concerned about, affected by, who had a vested interest in, or would be involved in the Protocol's application. The DoD workgroup consulted with representatives of the states and tribes, as required by the FY 2002 NDAA, but also consulted other federal agencies, including the Department of Agriculture (USDA), Department of the Interior (DOI), and Environmental Protection Agency (EPA). DoD notified all federally-recognized tribes of the Protocol's development. All tribes located on lands known or suspected to contain UXO, DMM, or MC were asked to participate in the Protocol's development effort. DoD engaged in consultation with those tribes that indicated an interest. The DoD workgroup also provided additional opportunities for interested members of the public to provide input. Figure 2.2 depicts DoD's consultation efforts throughout the Protocol's development.

Figure 2.2 DoD's Consultation Process

	Advanced Notice of Proposed Rulemaking published in *Federal Register* (Mar 2002) and distributed to stakeholders	Proposed Rulemaking published in *Federal Register* (Aug 2003) and distributed to stakeholders
States	- Meetings held with state governments (Nov 2002, Feb 2003) - State feedback sought through Munitions Response Committee meetings (Jan 2002, May 2002, Sept 2002) - Participated in Association of State Territorial Solid Waste Management Officials annual meetings (Oct 2002, Apr 2003) - Participated in National Association of Attorneys General meetings	
Tribes	- Notified and invited all the federally-recognized tribes to participate in the Protocol's development - Meetings held with tribal governments (Sept 2002, Feb 2003) - Participated in National Conference of American Indians, Native American Land Environmental Mitigation Program, and National Conference on Environmental Management meetings (Jun 2002, Nov 2002)	
Federal Agencies	- Meetings held with EPA, DOI, and USDA (Dec 2002, Feb 2003)	

Data Gathering

The DoD workgroup interviewed approximately 100 people within and outside DoD who were familiar with or interested in the prioritization of MRSs. Representatives included the Components, other federal and state agencies, the tribes, and the public. The intent of these preliminary interviews was to gather information from people with experience dealing with munitions or environmental response requirements, and to establish a baseline for the development effort. The interviews involved a standard questionnaire using a combination of multiple choice and narrative answers related to four areas:

- General characteristics of a protocol;
- The respondent's knowledge of the requirements for developing the Protocol, as those requirements were detailed in 10 USC 2710(b);
- The respondent's views on the importance of various data elements found in similar priority setting models; and
- Whether the respondent had any additional comments that were not covered by the structured questions.

The results of these interviews provided the DoD workgroup with characteristics that a protocol should and should not contain. The workgroup considered these characteristics throughout the construction of the Protocol, including during the review of selected priority-setting models. Specifically, the DoD workgroup determined that the Protocol should:

- Base each MRS's relative risk on site-specific data that describes the potential hazards and conditions at an MRS;
- Base sequencing decisions on the relative risk with consideration of other factors (e.g., environmental justice, economic development, programmatic);
- Ensure that decisions regarding priority do not dictate the type of response;
- Provide an appropriate distribution of MRSs in each priority category;
- Allow the Protocol's application to MRSs for which only limited site data were available;
- Maximize consistency with existing site evaluation methods, specifically the Risk Assessment Code (RAC) used by the US Army Corps of Engineers (USACE);
- Be accepted by internal and external stakeholders;
- Be simple to use and easy to understand;
- Recognize regulatory realities; and
- Use consistent factors, terminology, and definitions.

Review of Existing Models

DoD reviewed six existing site prioritization models for environmental restoration activities and evaluated the characteristics of each model to see how it compared to the characteristics identified by the DoD workgroup as essential for development of a protocol. The DoD workgroup sought to understand the means each model used to balance different concerns so that no one concern dominated the model and prevented sufficient differentiation among sites. The six models reviewed by the workgroup are shown in Figure 2.3.

Figure 2.3 Prioritization Models Reviewed by the DoD Workgroup

Model	Developed/ Used by	Developed/ Used to Prioritize	Brief Description
RAC	USACE	Munitions response (formerly referred to as ordnance and explosives response actions) at FUDS and BRAC sites	Examines exposure and hazards posed by munitions present to assign sites to one of five classes from high risk to negligible risk.
Range Rule Risk Methodology (R3M)	DoD (during its effort to promulgate the DoD Range Rule)	Sites on closed, transferred, or transferring (CTT) ranges to determine which sites require additional risk evaluation for explosive hazards	Involves three evaluations: Qualitative Risk Evaluation (QRE), Detailed Risk Evaluation (DRE), and Streamlined Risk Evaluation (SRE). QRE examines UXO density, frequency of entry to the site, and UXO type. DRE and SRE are then applied (if the site was not screened out by the QRE) to determine the probability of exposure.
Former Lowry Bombing and Gunnery Range Prioritization Tool	USACE and stakeholders	Sites that encompass a very large FUDS	Examines one factor with multiple data elements requiring extensive information and input from internal and external stakeholders.
Interim R3M Baseline Explosives Hazard Evaluation	DoD (derived from the R3M)	Sites on CTT ranges to determine which sites require additional risk evaluation for explosive hazards	Examines accessibility, overall hazard, and exposure to compare response alternatives against the amount of potential risk prior to response.
Native American Lands Environmental Mitigation Program (NALEMP) Model	DoD	Actions to be conducted under the NALEMP	Considers risk and non-risk-based factors (e.g., life ways, programmatic, government-to-government, economic considerations) unique to Indian lands; also uses Relative Risk Site Evaluation (RRSE) and RAC for risk evaluation components.
Hazard Ranking System (HRS)	EPA	Sites for inclusion on the National Priorities List	Assigns a numerical score to each site based on contaminant hazards in the groundwater, surface water, soil, and air.

The DoD workgroup ultimately determined that none of the reviewed models provided the characteristics necessary to meet all the requirements in 10 USC 2710(b). Although the RAC closely met the needs of the Protocol, it did not address all the necessary elements. The analysis of each model's strengths and weaknesses provided DoD with critical information regarding characteristics of a viable protocol. One characteristic that became readily apparent was the number of major factors that needed to be considered. The DoD workgroup recognized that the number of factors considered determined or limited the weight that can be applied to any one factor. They sought to determine the relevant factors and their relationships with each other to describe the potential risks at an MRS and determine a relative priority for the site.

Review of Existing and Draft Guidance

In addition to the models examined, the DoD workgroup reviewed DoD's lessons learned from its efforts to develop a proposed range rule. It also examined the *DERP Management Guidance* to identify any potential contributions to the Protocol.

When DoD updated the *DERP Management Guidance* in 2001, it expanded the discussion of munitions responses to clarify that such responses are subject to the same requirements as all other environmental responses conducted under the DERP. In addition, the *DERP Management Guidance* clarified specific policies and requirements related to munitions responses. The *DERP Management Guidance* provided a baseline for the Protocol structure by describing DoD's policy on both risk management approaches and priority setting and sequencing. The *DERP Management Guidance* outlines considerations that may impact sequencing, which include:

- The relative risk among sites;
- Findings of health, safety, or ecological risk assessments or evaluations;
- Concerns expressed by stakeholders;
- Reasonably anticipated land use;
- Programmatic (e.g., implementation and execution) considerations;
- The capability of technology to detect, discriminate, recover, and destroy military munitions;
- Economic considerations;
- Standing commitments;
- Reuse requirements;
- Established program goals and initiatives;

- Cultural, social, and economic factors; and
- Short-term and long-term ecological effects and environmental impacts.

The *DERP Management Guidance* also explains policy on the Relative Risk Site Evaluation (RRSE) framework and the RAC. In reviewing the *DERP Management Guidance*, the DoD workgroup found that almost every factor identified in Section 311 of the FY 2002 NDAA that authorized DoD to create a prioritization protocol was addressed in existing guidance. Based on information from this review and the preliminary interviews, the DoD workgroup began constructing a new model (i.e., the Protocol) to more effectively evaluate the potential explosive, CA, and environmental hazards posed by UXO, DMM, and MC at an MRS.

Protocol Construction and Testing

The workgroup developed the Protocol and tailored it to evaluate the primary hazards at an MRS posed by UXO, DMM, or MC. The workgroup developed three modules to evaluate the unique characteristics of each hazard type:

- The **Explosive Hazard Evaluation (EHE) Module** addresses explosive hazards posed by UXO, DMM, and MC in high enough concentrations to pose an explosive hazard;
- The **CWM Hazard Evaluation (CHE) Module** addresses hazards associated with the effects of CWM; and
- The **Health Hazard Evaluation (HHE) Module** addresses chronic health and environmental hazards posed by MC and incidental nonmunitions-related contaminants.

The DoD workgroup used a framework for each of these modules to ensure that each module evaluates three factors of information for the hazard: the source of the hazard, the exposure pathways, and the hazard receptors at each location. This framework limits the influence of any one factor on the outcome.

The workgroup conducted extensive testing on the Protocol to develop numeric values for factors and data elements within those factors, achieve consistent and repeatable results, ensure an appropriate spread of MRSs across priority outcomes, and to ensure that MRSs received the appropriate outcomes based on site conditions. DoD tested the Protocol during presentations to regulators and stakeholders, weekly internal workgroup meetings of DoD munitions response experts, and several concentrated testing sessions with DoD personnel. The DoD workgroup conducted a detailed data analysis of the testing results and an extensive modeling analysis.

Definitions
(See Appendix C)

Explosive Hazard Evaluation (EHE) Module

CWM Hazard Evaluation (CHE) Module

Health Hazard Evaluation (HHE) Module

Finalizing the Protocol

After incorporating the lessons learned from the Protocol's testing and further consultation with other federal agencies, states, and tribes, DoD published a draft Protocol in the *Federal Register* on August 22, 2003 (68 *FR* 50900). DoD accepted public comments on the draft Protocol until November 19, 2003.

DoD received over 300 comments from stakeholders, several federal agencies (e.g., EPA and USDA), state Departments of Environmental Protection or their equivalents, and the Association of State and Territorial Solid Waste Management Officials (ASTSWMO). All comments were reviewed for consideration and incorporated into the Protocol as DoD deemed appropriate. In response to these comments, the DoD workgroup made the following significant modifications:

- Revised the HHE Module to address the unique characteristics of an MRS and more closely mirror the other modules;
- Added new terms and definitions to help ensure consistency and understanding;
- Recognized the property owner's role in the process; and
- Modified the munitions types to better clarify the type of munitions included in each category.

After considering every comment and incorporating several suggested changes, DoD published the Munitions Response Site Prioritization Protocol in the *Federal Register* on October 5, 2005 (70 *FR* 58016). The Final Rule (referred to as the Rule) is codified at 32 CFR Part 179.

References

Protocol Final Rule:
www.denix.osd.mil/denix/Public/Library/Cleanup/CleanupOfc/whats_new/FinalProtocolRule.pdf

Chapter 3: Overview of the Protocol

The Protocol assigns a relative priority for munitions response actions based on the overall conditions at an MRS. The Protocol requires each Component to:

- Apply the Protocol to each MRS under its control and assign a relative priority;
- Use the MRS Priority and consider other factors (e.g., stakeholder, economic, programmatic) to sequence munitions response actions; and
- Fulfill specific procedural and administrative requirements (e.g., quality assurance [QA], documentation, reporting, reviewing).

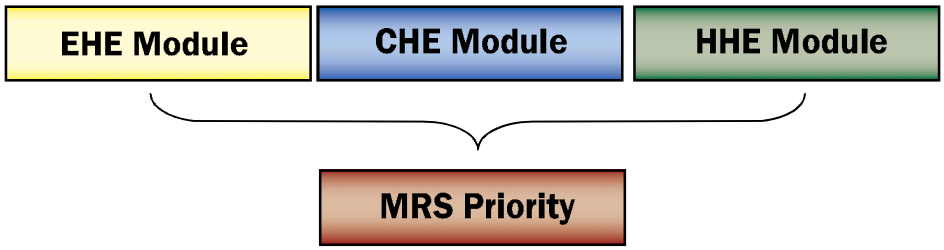
APPLICATION OF THE PROTOCOL

The Protocol structure includes three evaluation modules, each focusing on a specific hazard:

- The **EHE Module**.
- The **CHE Module**.
- The **HHE Module**.

The three hazard evaluation modules were developed specifically to address the unique characteristics of each hazard. The **MRS Project Team** will examine each hazard to determine the relative priority assigned to an MRS. See Figure 3.1 for a graphical depiction of the three modules.

Figure 3.1 General Protocol Structure



Each module is comprised of three categories of information, called factors that are used to derive the outcome of the module, as shown in Figure 3.2. The three factors, which are similar for each module, allow the MRS Project Team to examine the source of the hazard, how accessible the hazard is, and any receptors potentially affected by the hazard. This structure is important as it limits the influence of any one factor on the outcome. For example, in the EHE Module, the three factors are: Explosive Hazard, Accessibility, and Receptor.

References

See Chapter 5 for directions for completing the EHE Module.

See Chapter 6 for directions for completing the CHE Module.

See Chapter 7 for directions for completing the HHE Module.

Definitions
(See Appendix C)

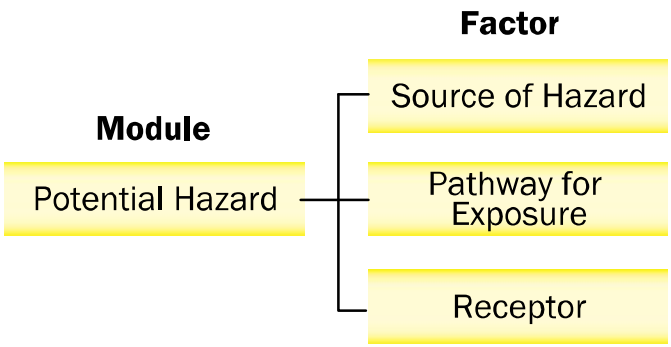
Explosive Hazard Evaluation (EHE) Module

CWM Hazard Evaluation (CHE) Module

Health Hazard Evaluation (HHE) Module

MRS Project Team

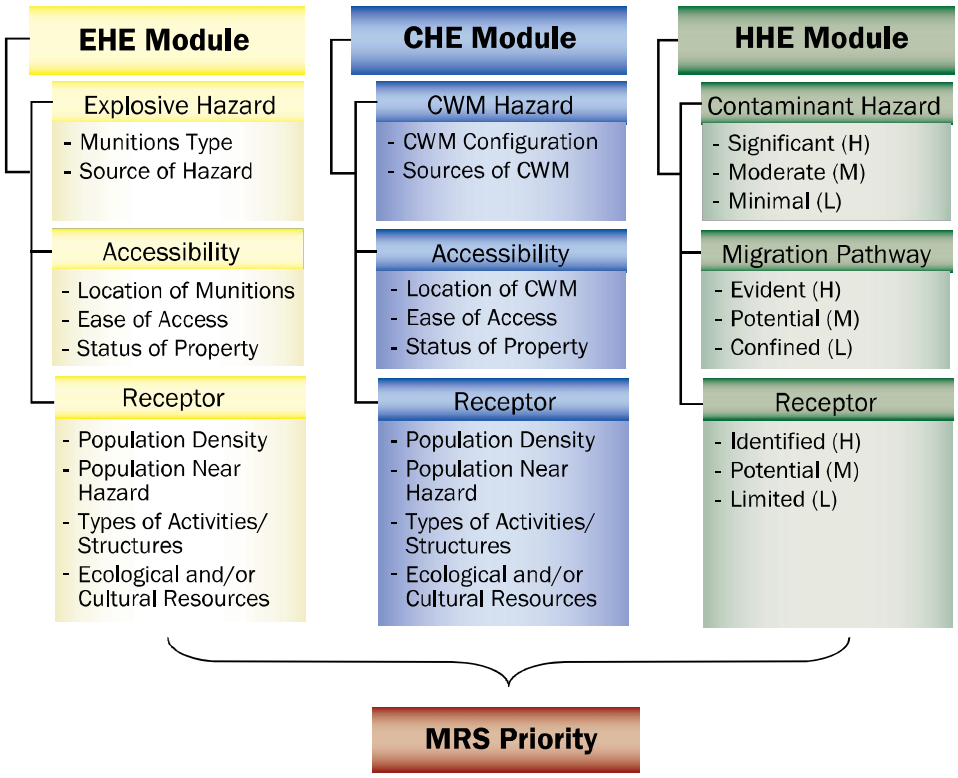
Figure 3.2 Three-Factor Structure of Modules



Each factor is comprised of multiple data elements that capture MRS-specific information. The data elements classify information essential for the characterization of conditions at the MRS. This information is easily collected during the early phase of the response process and allows for consistent and supportable results. This is necessary for consistency when determining the relative priority of all MRSs in DoD's inventory. Figure 3.3 identifies the modules, factors, and data elements that comprise the structure of the Protocol.

To apply the Protocol, the MRS Project Team inputs MRS-specific data into tables that are provided in Appendix A of this Primer. The tables guide the MRS Project Team through recording information for the data elements in each module. This ensures that the MRS Project Team considers each of the three primary hazards posed by UXO, DMM, or MC. These considerations include CWM regardless of configuration. Once the Project Team applies each of the modules to an MRS, they complete the last table to determine the MRS Priority.

Figure 3.3 Protocol Structure



DETERMINING THE MRS SEQUENCE

As a matter of policy, an MRS with a higher relative risk should be addressed before an MRS with a lower relative risk. However, when directing DoD to develop the Protocol, Congress recognized that other factors (e.g., environmental justice, economic development, programmatic) could influence sequencing decisions. Therefore, each Component should also consider these factors when determining the MRS's sequence for munitions response actions.

ADDITIONAL REQUIREMENTS

The Protocol requires certain actions to occur throughout its application to MRSs and after sequencing MRSs for munitions responses. Each Component is required to:

- Establish a QA Panel to help ensure the Protocol's consistent application;
- Submit the results of the Protocol's application to ODUSD(I&E) for publication in the annual report on environmental restoration activities for that fiscal year;

- Document sequencing decisions; and
- Conduct reviews of MRS Priority determinations at least annually, and reapply the Protocol, when necessary.

Quality Assurance Panel

References

For more information on the QA Panel, see Chapter 9.

The Protocol requires that the Components establish a QA Panel to ensure that the Protocol is applied appropriately and consistently across the MRS Inventory. The QA Panel will be comprised of Component personnel that did not participate in the Protocol's application for the MRSs under review. If a Component's QA Panel recommends a change to an MRS's relative priority that results in a different priority, the QA Panel will justify the change and allow the appropriate regulatory agencies and involved stakeholders to comment on the rationale for the change before the change is finalized. Each QA Panel's results and the rationale for any changes made to the Component's MRS Priority list will be provided to ODUSD(I&E).

Stakeholder Involvement

References

For more information on the stakeholders, see Chapters 9 and 10.

Application of the Protocol is an inclusive process. Components will ensure that stakeholders have opportunities to provide input for the Protocol's application by:

- Notifying stakeholders of the opportunity to participate in the application of the Protocol and seeking their involvement;
- Publishing announcements in local community publications about public participation in the initial application of the Protocol and requesting information pertinent to prioritization or sequencing;
- Including a copy of all public notices and announcements in the **Administrative Record** and **Information Repository** for the MRS, once the repository is established;
- Incorporating stakeholder comments in the prioritization and sequencing decisions and documenting the decisions in the **Management Action Plan (MAP)**, or its equivalent;
- Including information provided by stakeholders in the Administrative Record and the Information Repository; and
- Providing stakeholders with information for prioritization and sequencing changes and requesting their comments.

Definitions
(See Appendix C)

Administrative Record

Information Repository

Management Action Plan (MAP)

Documentation of Results

The MAP, or its equivalent, must document all aspects of both the Protocol's application and sequencing decisions. The Components must maintain copies of reference documents (e.g., field logs, data from preliminary assessments, site inspections, Primer Scoring Tables) used to evaluate and record the Protocol results. Any information that may have influenced the MRS Priority or MRS sequencing decision must be included in the Administrative Record and the Information Repository.

References

For more information on the documentation requirements, see Chapter 9.

Annual Review of the Protocol

The Components will review each MRS Priority at least annually and reapply the Protocol as necessary to reflect new information. The Components are required to reapply the Protocol under any of the following circumstances:

- Upon completion of a response action that changes MRS conditions in a manner that could affect the evaluation under the Protocol;
- To update or validate a previous evaluation at an MRS when new information is available;
- To update or validate the priority assigned where that priority has been previously assigned based on evaluation of only one or two of the three hazard evaluation modules;
- Upon further delineation and characterization of an MRA into multiple MRSs; or
- To categorize any MRS previously classified with the alternative MRS rating of Evaluation Pending.

If, at the time of annual review, no new data are available, the Protocol need not be reapplied. An updated list of MRSs will be submitted to ODUSD(I&E) and published annually.

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Chapter 4: General Instructions

This chapter contains general instructions on how to apply the Protocol to an MRS. The Protocol consists of three modules that contain tables to collect MRS-specific information. The following sections provide step-by-step directions on how to complete the tables in each hazard evaluation module. For more detailed instructions on each module, see:

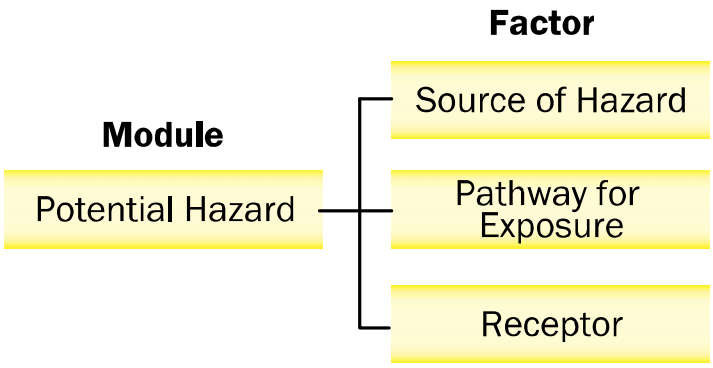
- Chapter 5 for the EHE Module.
- Chapter 6 for the CHE Module.
- Chapter 7 for the HHE Module.

REVIEWING THE MODULE STRUCTURE

The Protocol requires Components to assign a relative priority to each MRS known or suspected of containing UXO, DMM, or MC. The Protocol consists of three hazard evaluation modules, each focusing on a primary hazard associated with the known or suspected presence of UXO, DMM, or MC. The first hazard evaluation module, EHE, evaluates explosive hazards, while the second module, CHE, evaluates CWM hazards. The third module, HHE, evaluates health and environmental hazards posed by MC and incidental nonmunitions-related contaminants.

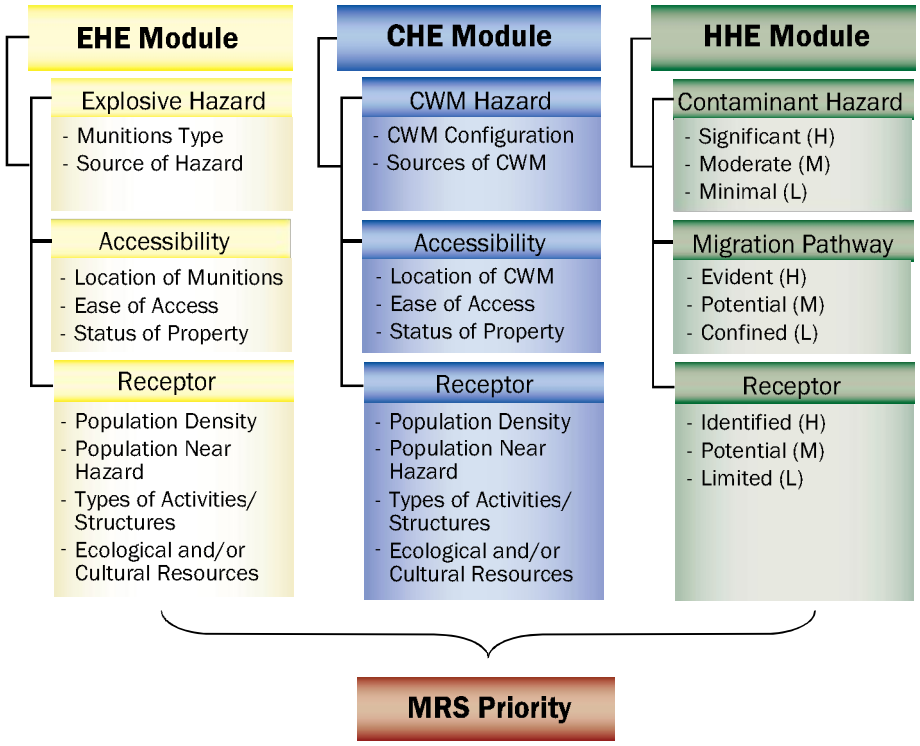
Each module is composed of three categories of information, called factors, that are used to assess the potential hazards posed by UXO, DMM, or MC. For example, in the EHE Module, the Explosive Hazard Factor captures information on the munitions-related activities that occurred and the type of munitions posing a hazard. The Accessibility Factor evaluates a receptor's ability to encounter a hazard, while the Receptor Factor evaluates the exposure to potential receptors. The three factors are designed to create a structure that limits the influence of any one factor on the outcome, as shown in Figure 4.1.

Figure 4.1 Three-Factor Structure of Modules



Each factor is comprised of multiple data elements that capture MRS-specific information. The data elements classify information essential for the characterization of conditions at the MRS. For example, the Explosive Hazard Factor is broken into two data elements, the Munitions Type Data Element and the Source of Hazard Data Element, as shown in Figure 4.2. The Munitions Type Data Element is further divided into classifications that characterize the explosive hazard potential of the material present at an MRS.

Figure 4.2 Protocol Structure



Tips and Tricks

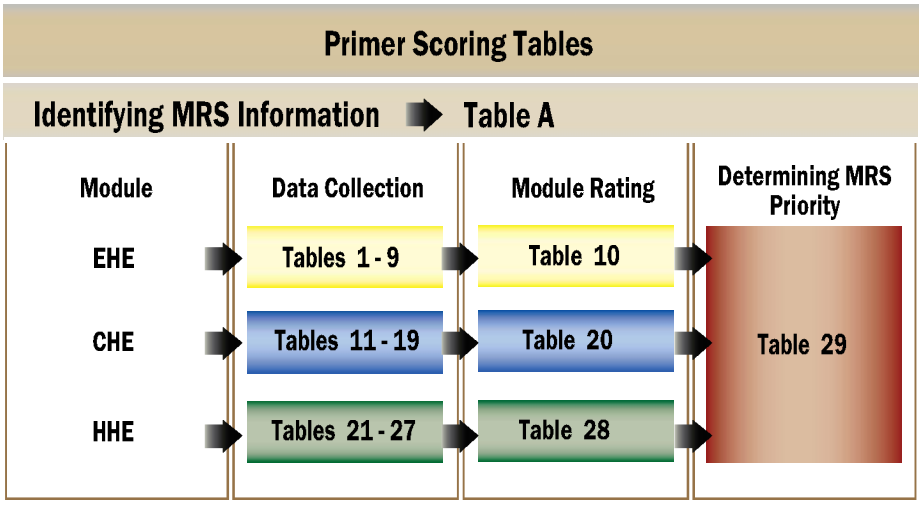
The Primer Scoring Tables are similar to the Protocol scoring tables but are not identical. The scoring tables for the EHE and CHE Modules contain the classifications, descriptions, and scores for each data element extracted directly from the Protocol. The HHE Module scoring tables are based on a combination of the Protocol and *Relative Risk Site Evaluation Primer*.

PRIMER SCORING TABLES

MRS Project Teams use MRS-specific information applicable to the data elements, factors, and modules to complete the Primer Scoring Tables. The tables allow the Project Teams to develop a "score" for data elements, a "value" for factors, and a "rating" for each module. Completion of all the tables leads to a "priority" for the MRS under evaluation. The Primer Scoring Tables serve several functions, which include capturing MRS-specific information and providing a consistent methodology to determine each hazard module rating and the MRS Priority.

DoD developed the associated point values for each table in consultation with munitions experts, states, regulators, and stakeholders. Appendix A contains the 30 Primer Scoring Tables that the MRS Project Teams will use to apply the Protocol. The organization of the tables is shown in Figure 4.3. Each Component is responsible for developing its own data system to track the MRS Priorities.

Figure 4.3 Primer Scoring Tables



References

All Primer Scoring Tables can be found in Appendix A.

DETERMINING IF SUFFICIENT DATA EXIST TO APPLY THE PROTOCOL

The Components are required to apply the Protocol at an MRS when there are sufficient data available to populate all the data elements in at least one of the three hazard modules (EHE, CHE, or HHE). MRS Project Teams should use the most current and supportable data from existing restoration documents or databases to complete the tables. Documents that may contain pertinent data include but are not limited to: explosive ordnance disposal (EOD) incident reports, site inspection and remedial investigation reports, feasibility studies, engineering evaluations/cost analysis (EE/CA) studies, and equivalent types of information, as shown in Figure 4.4. End-use documents, such as Records of Decision (RODs) or decision documents may also be useful.

Figure 4.4 Examples of MRS Data Documents

Examples of MRS Data Documents

- ✓ Site inspection reports
- ✓ Remedial investigation reports
- ✓ Feasibility studies
- ✓ Engineering evaluation/cost analysis studies
- ✓ Records of Decision
- ✓ Decision documents
- ✓ Design documents
- ✓ Performance monitoring reports
- ✓ Preliminary assessments
- ✓ Risk assessment code reports
- ✓ Environmental baseline studies

The Protocol, which was designed to maximize the use of existing data, is to be applied early in and throughout the response process. Additional data-gathering activities may be required, but previously-collected reliable analytical, historical, or observational data should be used first.

If there is insufficient information to complete one of the hazard modules for an MRS, the MRS Project Team will assign that module an alternative module rating of Evaluation Pending and determine the MRS Priority based on the ratings for the modules completed. The MRS Project Team will reapply the Protocol to the MRS as soon

Tips and Tricks

The MRS Project Team needs to agree on the sufficiency of the data.

as sufficient data become available to evaluate any module that was assigned Evaluation Pending.

USING TABLE A TO RECORD MRS BACKGROUND INFORMATION

The first step in applying the Protocol is to complete Table A. This table provides relevant background information about the MRS. Much of this information may be available in existing DoD and Component databases. Background information will aid in understanding the quality of information used in an MRS's evaluation, the level of uncertainty associated with the data used, and the potential need for additional information. It will also assist in explaining munitions response actions at an MRS to stakeholders. The MRS Project Team will record the following information:

- MRS Name;
- Component;
- Installation/Property Name;
- Location;
- Site/Project Name;
- Date Information Entered/Updated;
- Contact Person;
- Project Phase;
- Media Evaluated; and
- MRS Summary.

In the MRS Summary section of Table A, the MRS Project Team should briefly describe the MRS's conditions (e.g., geological conditions and geographic setting), any known or suspected munitions hazards and/or hazardous incidental nonmunitions-related contaminants (e.g., benzene, trichloroethylene), and any potentially exposed human or ecological receptors. If available, a map of the MRS should be included.

Figure 4.5 Directions for Completing Table A

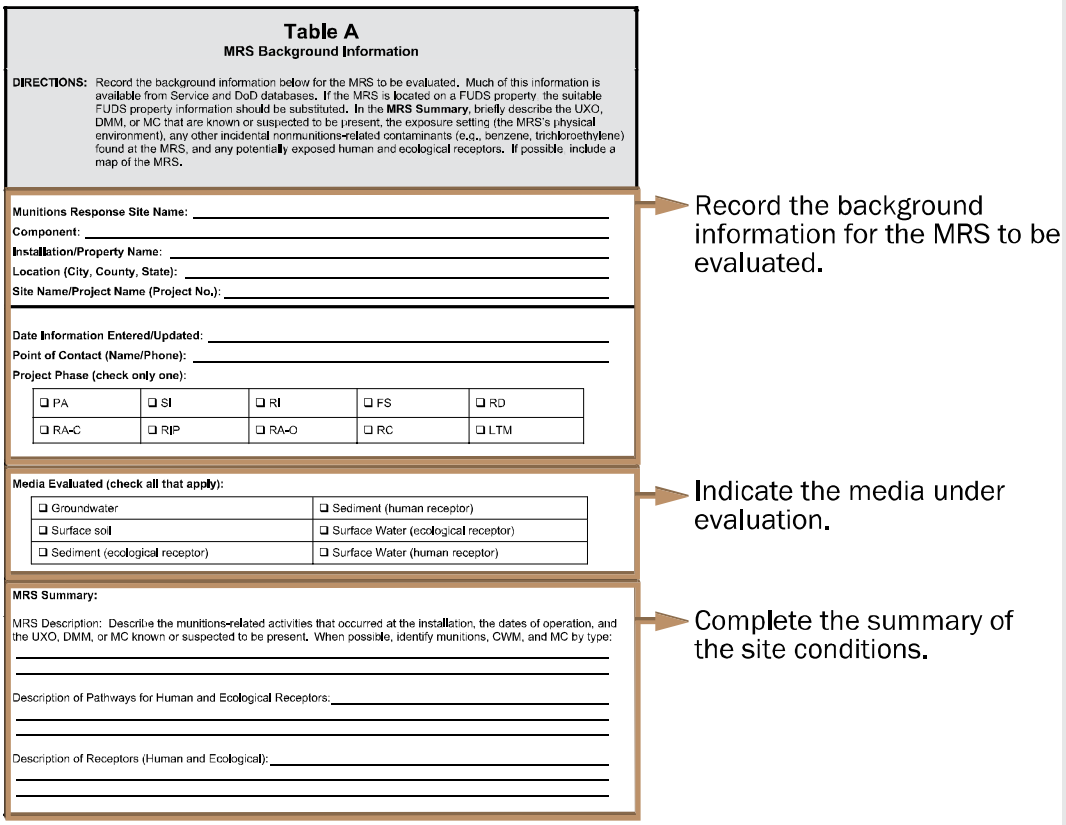


Table A
MRS Background Information

DIRECTIONS: Record the background information below for the MRS to be evaluated. Much of this information is available from Service and DoD databases. If the MRS is located on a FUDS property the suitable FUDS property information should be substituted. In the **MRS Summary**, briefly describe the UXO, DMM, or MC that are known or suspected to be present, the exposure setting (the MRS's physical environment), any other incidental nonmunitions-related contaminants (e.g., benzene, trichloroethylene) found at the MRS, and any potentially exposed human and ecological receptors. If possible include a map of the MRS.

Munitions Response Site Name: _____
Component: _____
Installation/Property Name: _____
Location (City, County, State): _____
Site Name/Project Name (Project No.): _____

Date Information Entered/Updated: _____
Point of Contact (Name/Phone): _____
Project Phase (check only one):

❑ PA	❑ SI	❑ RI	❑ FS	❑ RD
❑ RA-C	❑ RIP	❑ RA-O	❑ RC	❑ LTM

Media Evaluated (check all that apply):

❑ Groundwater	❑ Sediment (human receptor)
❑ Surface soil	❑ Surface Water (ecological receptor)
❑ Sediment (ecological receptor)	❑ Surface Water (human receptor)

MRS Summary:

MRS Description: Describe the munitions-related activities that occurred at the installation, the dates of operation, and the UXO, DMM, or MC known or suspected to be present. When possible, identify munitions, CWM, and MC by type: _____

Description of Pathways for Human and Ecological Receptors: _____

Description of Receptors (Human and Ecological): _____

Record the background information for the MRS to be evaluated.

Indicate the media under evaluation.

Complete the summary of the site conditions.

USING THE TABLES TO COMPLETE THE EHE MODULE

The EHE Module provides a consistent DoD-wide approach for assigning a relative priority to an MRS where MEC are known or suspected to be present. The MRS Project Team uses Tables 1 through 9 located in Appendix A to classify potential explosive hazards at an MRS. Each data element has a corresponding table. Each table includes a list of classifications that reflect a range of potential MRS-specific conditions for that data element and their corresponding scores.

As shown in Figure 4.6, MRS-specific data are used to score each data element. The MRS Project Team should circle the score for each classification applicable to the MRS under evaluation. The higher the classification score, the greater the potential risk. After all the applicable classifications are recorded, the largest single score is recorded in the box, as shown in Figure 4.6. The largest single classification score becomes the data element score.

Figure 4.6 Directions for Completing Tables 1-9

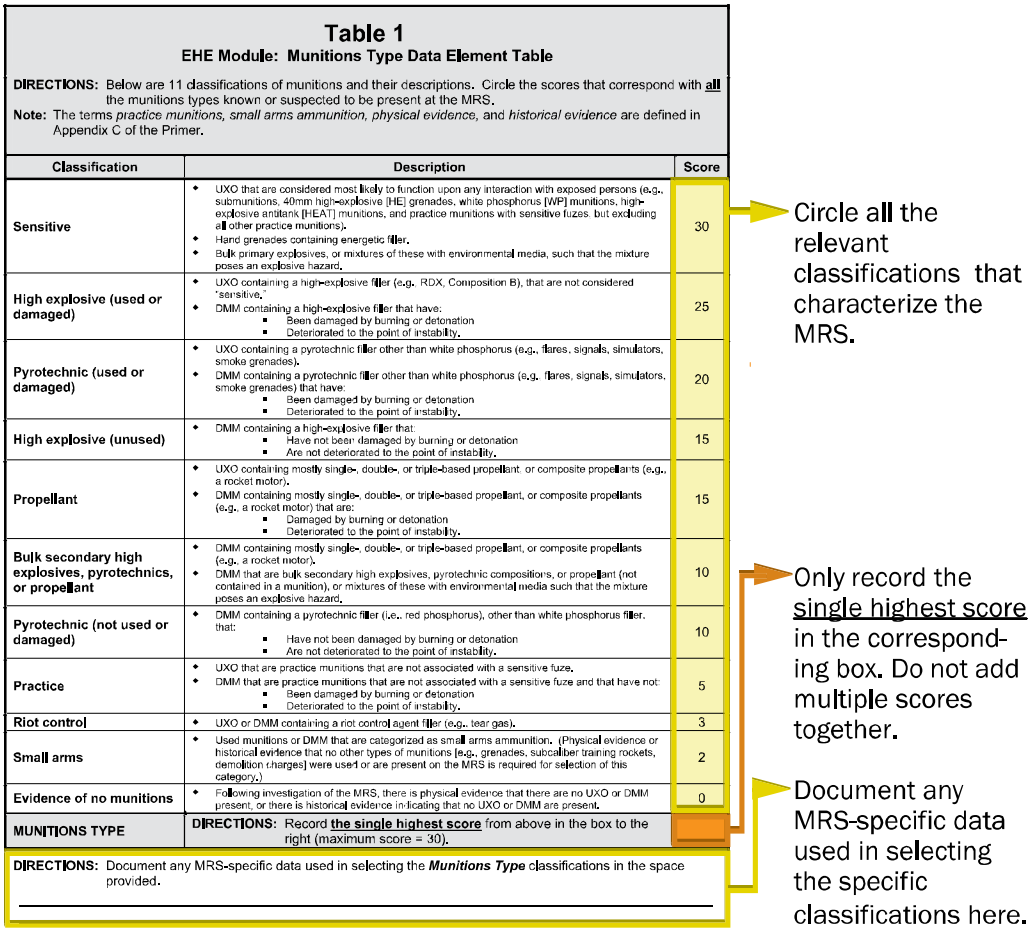


Table 1
EHE Module: Munitions Type Data Element Table

DIRECTIONS: Below are 11 classifications of munitions and their descriptions. Circle the scores that correspond with **all** the munitions types known or suspected to be present at the MRS.
Note: The terms *practice munitions, small arms ammunition, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score
Sensitive	◆ UXO that are considered most likely to function upon any interaction with exposed persons (e.g., submunitions, 40mm high-explosive [HE] grenades, white phosphorus [WP] munitions, high-explosive antitank [HEAT] munitions, and practice munitions with sensitive fuzes, but excluding all other practice munitions). ◆ Hand grenades containing energetic filler. ◆ Bulk primary explosives, or mixtures of these with environmental media, such that the mixture poses an explosive hazard.	30
High explosive (used or damaged)	◆ UXO containing a high-explosive filler (e.g. RDX, Composition B), that are not considered "sensitive." ◆ DMM containing a high-explosive filler that have: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	25
Pyrotechnic (used or damaged)	◆ UXO containing a pyrotechnic filler other than white phosphorus (e.g., flares, signals, simulators, smoke grenades). ◆ DMM containing a pyrotechnic filler other than white phosphorus (e.g. flares, signals, simulators, smoke grenades) that have: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	20
High explosive (unused)	◆ DMM containing a high-explosive filler that: ▪ Have not been damaged by burning or detonation ▪ Are not deteriorated to the point of instability.	15
Propellant	◆ UXO containing mostly single-, double-, or triple-based propellant or composite propellants (e.g., a rocket motor). ◆ DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor) that are: ▪ Damaged by burning or detonation ▪ Deteriorated to the point of instability.	15
Bulk secondary high explosives, pyrotechnics, or propellant	◆ DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). ◆ DMM that are bulk secondary high explosives, pyrotechnic compositions, or propellant (not contained in a munition), or mixtures of these with environmental media such that the mixture poses an explosive hazard.	10
Pyrotechnic (not used or damaged)	◆ DMM containing a pyrotechnic filler (i.e., red phosphorus), other than white phosphorus filler, that: ▪ Have not been damaged by burning or detonation ▪ Are not deteriorated to the point of instability.	10
Practice	◆ UXO that are practice munitions that are not associated with a sensitive fuze. ◆ DMM that are practice munitions that are not associated with a sensitive fuze and that have not: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	5
Riot control	◆ UXO or DMM containing a riot control agent filler (e.g., tear gas).	3
Small arms	◆ Used munitions or DMM that are categorized as small arms ammunition. (Physical evidence or historical evidence that no other types of munitions [e.g., grenades, subcaliber training rockets, demolition charges] were used or are present on the MRS is required for selection of this category.)	2
Evidence of no munitions	◆ Following investigation of the MRS, there is physical evidence that there are no UXO or DMM present, or there is historical evidence indicating that no UXO or DMM are present.	0
MUNITIONS TYPE	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30).	

DIRECTIONS: Document any MRS-specific data used in selecting the ***Munitions Type*** classifications in the space provided.

_____

Circle all the relevant classifications that characterize the MRS.

Only record the single highest score in the corresponding box. Do not add multiple scores together.

Document any MRS-specific data used in selecting the specific classifications here.

To evaluate the known or suspected explosive hazards present at an MRS, Tables 1 through 9, as identified in Figure 4.7, should be completed.

Figure 4.7 EHE Data Element Tables

Factor	Tables
Explosive Hazard Factor	Table 1: Munitions Type Table 2: Source of Hazard
Accessibility Factor	Table 3: Location of Munitions Table 4: Ease of Access Table 5: Status of Property
Receptor Factor	Table 6: Population Density Table 7: Population Near Hazard Table 8: Types of Activities/Structures Table 9: Ecological and/or Cultural Resources

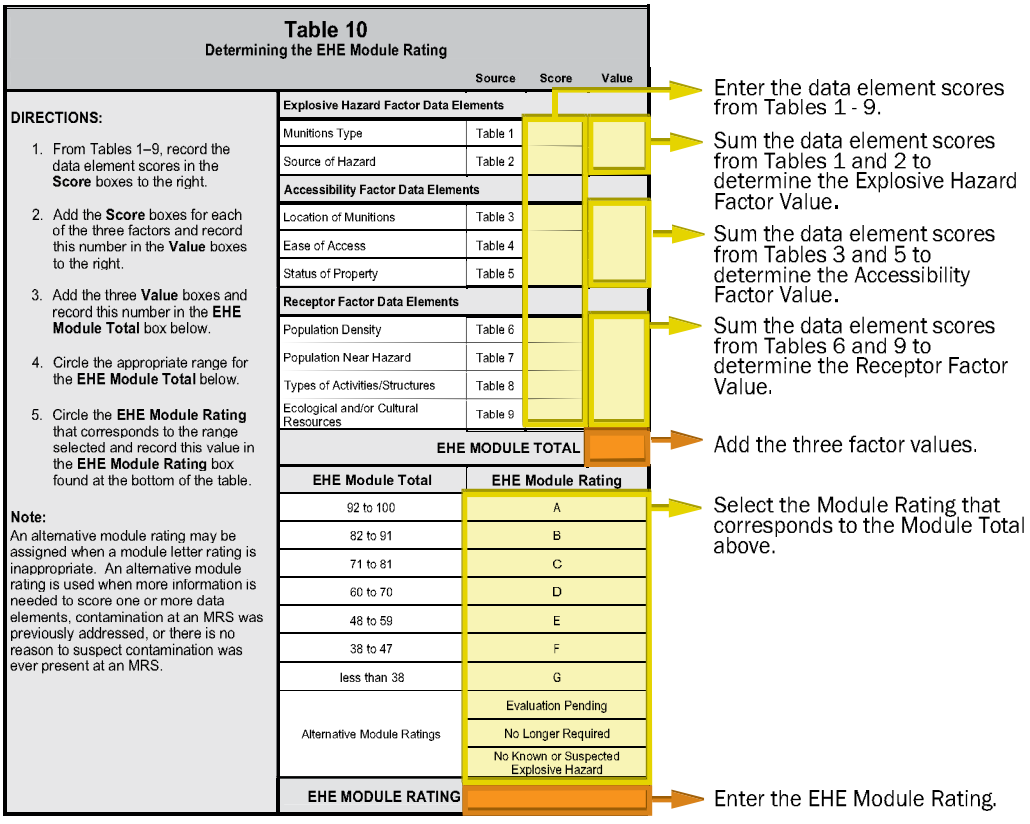
The data element scores for each table are summed to determine their associated factor values. For example, for the Explosive Hazard Factor, the Munitions Type and Source of Hazard Data Elements together characterize the potential explosive hazard at an MRS. Each factor may contribute a specific point total for the EHE Module Rating as shown in Figure 4.8. The maximum total for the EHE Module is 100 points.

Figure 4.8 EHE Module Factor Values

Explosive Hazard Factor	40 points
Accessibility Factor	40 points
Receptor Factor	20 points
Maximum Total	**100 points**

Table 10 is used to determine the EHE Module Rating. As described in Figure 4.9, data element scores from Tables 1 though 9 are recorded. After all the data elements are recorded, their scores are summed together to determine their associated factor values. The sum of the factor values is recorded in the EHE Module Total box. The MRS Project Team will then compare the EHE Module Total with the ranges provided, determine the range within which the EHE Module Total falls, circle the EHE Module Rating (letters A through G) associated with the appropriate range, and record the EHE Module Rating in the appropriate box. In cases where a letter rating is not appropriate, the module may be given one of three alternative module ratings (i.e., **Evaluation Pending**, **No Longer Required**, or **No Known or Suspected Explosive Hazard**). The EHE Module Rating will be evaluated with the other module ratings and used to determine an MRS's relative priority.

Figure 4.9 Directions for Completing Table 10



Definitions
(See Appendix C)

Evaluation Pending

No Longer Required

No Known or Suspected Explosive Hazard

USING THE TABLES TO COMPLETE THE CHE MODULE

The CHE Module provides a consistent DoD-wide approach for assigning a relative priority to an MRS where CWM hazards are known or suspected to be present. The MRS Project Team uses Tables 11 through 19, located in Appendix A to classify potential CWM hazards at an MRS. Figure 4.10 highlights the CHE Module data element tables to be completed.

Figure 4.10 CHE Data Element Tables

Factor	Tables
CWM Hazard Factor	Table 11: CWM Configuration Table 12: Sources of CWM
Accessibility Factor	Table 13: Location of CWM Table 14: Ease of Access Table 15: Status of Property
Receptor Factor	Table 16: Population Density Table 17: Population Near Hazard Table 18: Types of Activities/Structures Table 19: Ecological and/or Cultural Resources

Directions for completing the CHE Module tables are identical to the instructions for completing the EHE Module tables. Figure 4.11 provides a summary of the directions on how to complete Tables 11 through 19.

Figure 4.11 Directions for Completing Tables 11-19

Table 11
CHE Module: CWM Configuration Data Element Table

DIRECTIONS: Below are seven classifications of CWM configuration and their descriptions. Circle the scores that correspond with **all** the CWM configurations known or suspected to be present at the MRS.
Note: The terms *CWM/UXO, CWM/DMM, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score
CWM, that are either UXO, or explosively configured damaged DMM	The CWM known or suspected of being present at the MRS are: • CWM that are UXO (i.e., CWM/UXO) • Explosively configured CWM that are DMM (i.e., CWM/DMM) that have been damaged.	30
CWM mixed with UXO	• The CWM known or suspected of being present at the MRS are undamaged CWM/DMM or CWM not configured as a munition that are commingled with conventional munitions that are UXO.	25
CWM, explosive configuration that are undamaged DMM	• The CWM known or suspected of being present at the MRS are explosively configured CWM/DMM that have not been damaged.	20
CWM/DMM, not explosively configured or CWM, bulk container	The CWM known or suspected of being present at the MRS are: • Nonexplosively configured CWM/DMM either damaged or undamaged • Bulk CWM (e.g., ton container).	15
CAIS K941 and CAIS K942	• The CWM/DMM known or suspected of being present at the MRS are CAIS K941-toxic gas set M-1 or CAIS K942-toxic gas set M-2/E11.	12
CAIS (chemical agent identification sets)	• CAIS, other than CAIS K941 and K942, are known or suspected of being present at the MRS.	10
Evidence of no CWM	• Following investigation, the physical evidence indicates that CWM are not present at the MRS, or the historical evidence indicates that CWM are not present at the MRS.	0
CWM CONFIGURATION	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30).	

DIRECTIONS: Document any MRS-specific data used in selecting the ***CWM Configuration*** classifications in the space provided.

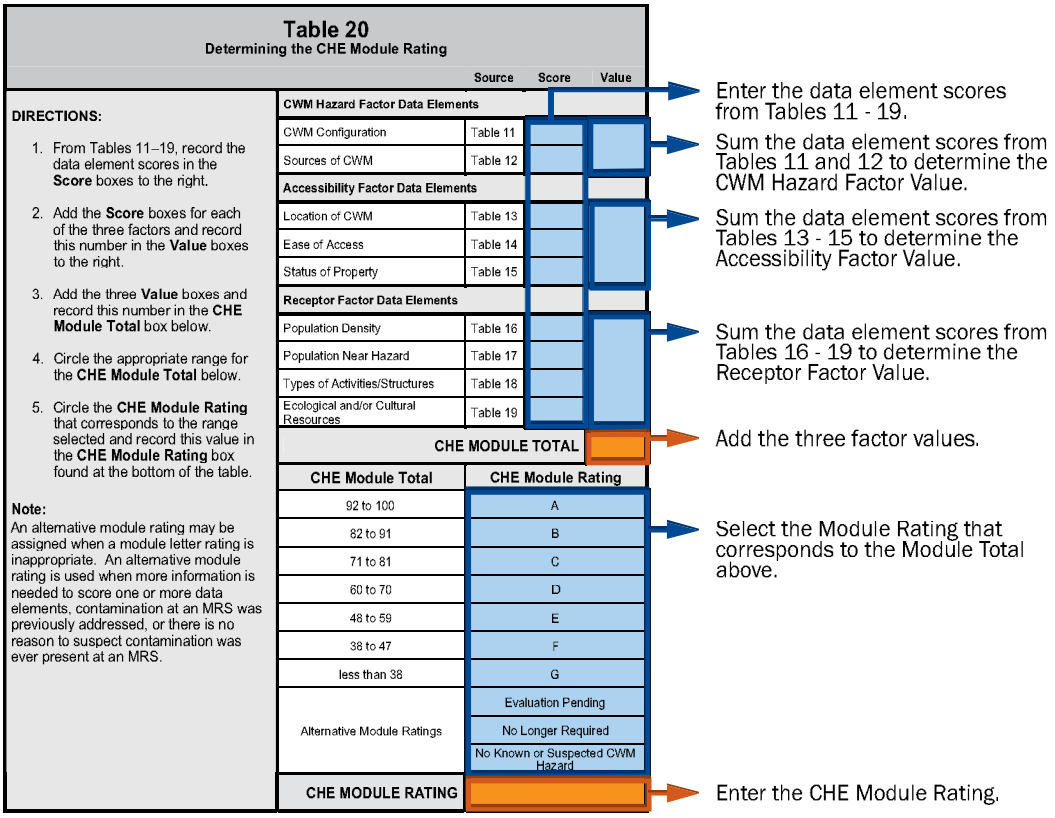
Circle all the relevant classifications that characterize the MRS.

Only record the single highest score in the corresponding box. Do not add multiple scores together.

Document any MRS-specific data used in selecting the specific classification here.

Table 20 is used to determine the CHE Module Rating. Directions for determining the CHE Module Rating are identical to those for the EHE Module Rating. If the MRS Project Team determines that a numerical value is inappropriate to be the module rating, the Team must choose one of the three alternative module ratings (i.e., Evaluation Pending, No Longer Required, or **No Known or Suspected CWM Hazard**). Figure 4.12 provides a summary of how to determine the CHE Module Rating.

Figure 4.12 Directions for Completing Table 20



USING THE TABLES TO COMPLETE THE HHE MODULE

The HHE Module provides a consistent DoD-wide approach for assigning a relative priority to an MRS where MC and incidental nonmunitions-related contaminants are known or suspected to be present. The HHE Module considers the environmental media and the corresponding receptors that are most likely to be affected by MC at an MRS. If incidental nonmunitions-related contaminants are present at the MRS, they may also be evaluated through the HHE Module.

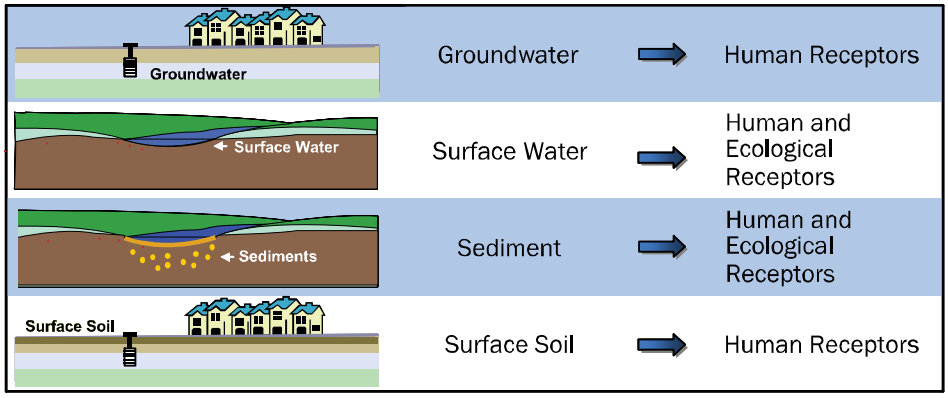
Similar to the EHE and CHE Modules, the HHE Module has three factors that limit the influence of any one factor on the HHE Module Rating. However, unlike the EHE and CHE Modules, the three factors are used to evaluate four distinct environmental media—groundwater, surface water, sediments, and surface soils—as illustrated in Figure 4.13. Only human receptors are evaluated for

Definitions
(See Appendix C)

No Known or Suspected CWM Hazard

groundwater and surface soils, while surface water and sediments are evaluated for both their human and ecological receptors. The four environmental media and their receptors are discussed in greater detail in Chapter 7.

Figure 4.13 HHE Environmental Media and Receptors



Unlike the EHE and CHE Modules, each medium addressed by the HHE Module has a specific table associated with it. The three factors are scored on the same table; however, human and ecological receptors for surface water and sediments are evaluated on separate tables because the two receptors consider different contaminant hazard values. Figure 4.14 lists the HHE Module tables to be completed.

Figure 4.14 HHE Data Element Tables

HHE Tables
Table 21: Groundwater Data Element Table
Table 22: Surface Water - Human Endpoint Data Element Table
Table 23: Sediment - Human Endpoint Data Element Table
Table 24: Surface Water - Ecological Endpoint Data Element Table
Table 25: Sediment - Ecological Endpoint Data Element Table
Table 26: Surface Soil Data Element Table

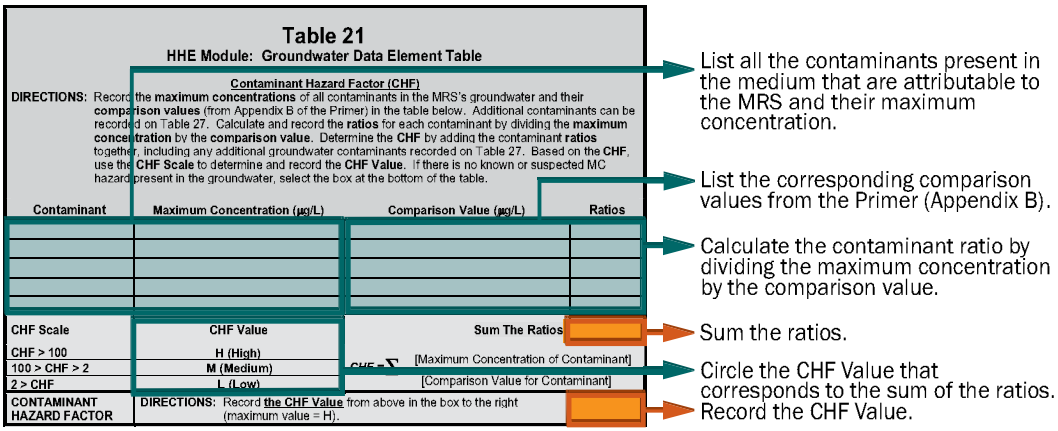
Scoring the factors in the HHE Module also differ from how the EHE and CHE factors are scored. Factors are given a value of High (H), Medium (M), or Low (L) based on established classifications within the factor. Values for the three factors are then grouped into a three-letter combination, such that the letter ratings are ranked from Highest (H) to Lowest (L). Examples of three letter combinations include HHL and MLL. The three-letter combinations are used to determine the HHE Module Rating and will be discussed later in this section.

The Contaminant Hazard Factor in the HHE Module assesses the hazards to receptors from MC and incidental nonmunitions-related contaminants for the four environmental media. This factor is scored differently than any other factor in the Protocol. As shown in Figure 4.15, MC and any incidental nonmunitions-related contaminants present at the MRS should be listed with their maximum concentration.

Tips and Tricks

Naturally occurring compounds that are detected within established background concentration ranges are not included. See Chapter 7 for more information.

Figure 4.15 Directions for Determining the Contaminant Hazard Factor Value



To determine the risk posed by contamination, the concentrations of MC and any incidental nonmunitions-related contaminants must be compared to accepted hazard values called comparison values. For each MC and any incidental nonmunitions-related contaminant present at the MRS, the MRS Project Team will record the maximum contaminant concentration at the MRS and then look up and record the associated comparison value from the appropriate Comparison Value Table found in Appendix B. As shown in Figure 4.16, the contaminant ratio is then calculated by dividing the maximum contaminant concentration by the comparison value. Ratios for all the contaminants present at the MRS are then summed. The resulting value should be compared against the CHF Scale to determine the CHF Value that is then recorded in the appropriate box.

Figure 4.16 Formula for Determining the Contaminant Hazard Factor Value

$$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$$

If there are more than five contaminants present at the MRS, the additional contaminants should be listed on the supplemental Table 27 shown in Figure 4.17.

Figure 4.17 Supplemental Table for the Contaminant Hazard Factor

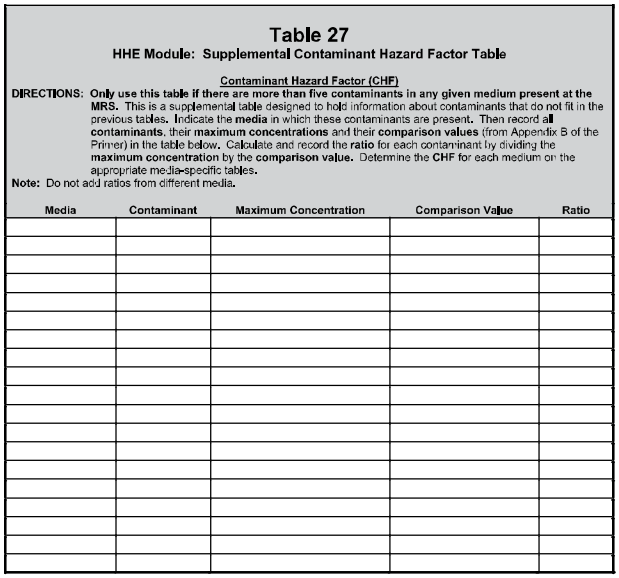


Table 27
HHE Module: Supplemental Contaminant Hazard Factor Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: **Only use this table if there are more than five contaminants in any given medium present at the MRS.** This is a supplemental table designed to hold information about contaminants that do not fit in the previous tables. Indicate the **media** in which these contaminants are present. Then record all **contaminants**, their **maximum concentrations** and their **comparison values** (from Appendix B of the Primer) in the table below. Calculate and record the **ratio** for each contaminant by dividing the **maximum concentration** by the **comparison value.** Determine the **CHF** for each medium on the appropriate media-specific tables.

Note: Do not add ratios from different media.

Media	Contaminant	Maximum Concentration	Comparison Value	Ratio

Use Table 27 to record additional contaminants if more than five are present at the MRS.

As shown in Figure 4.18, for the Migration Pathway Factor and Receptor Factor, the classification that most appropriately describes the MRS conditions should be selected. Specific directions on how to evaluate Contaminant Hazard, Migration Pathway, and Receptor Factors are found in Chapter 7, which provides additional details on completing the HHE Module.

Figure 4.18 Directions for Completing Tables 21-26

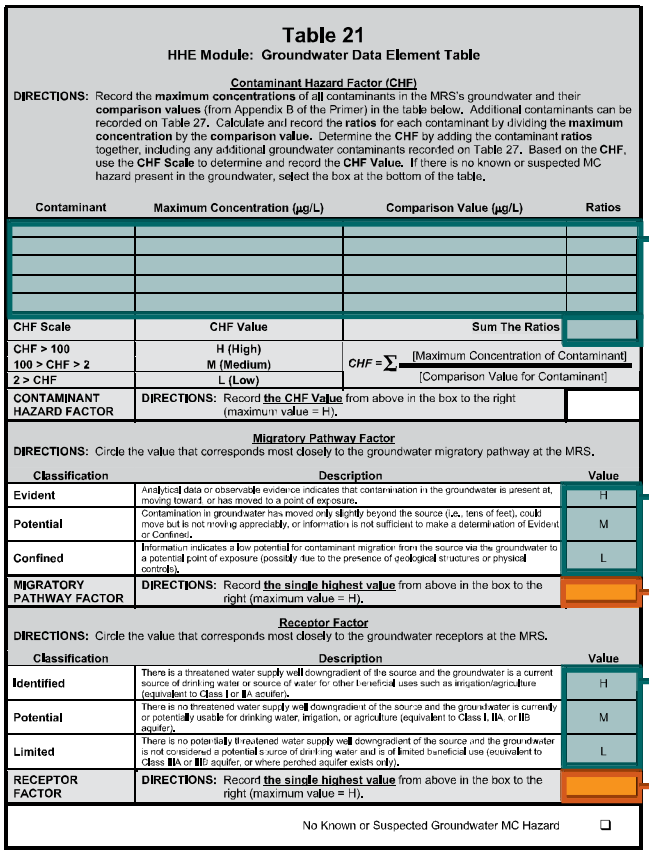


Table 21
HHE Module: Groundwater Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's groundwater and their **comparison values** (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value.** Determine the **CHF** by adding the contaminant **ratios** together, including any additional groundwater contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value.** If there is no known or suspected MC hazard present in the groundwater, select the box at the bottom of the table.

Contaminant	Maximum Concentration (µg/L)	Comparison Value (µg/L)	Ratios

CHF Scale	CHF Value	Sum The Ratios	
CHF > 100 100 > CHF > 2 2 > CHF	H (High) M (Medium) L (Low)	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).		

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the groundwater migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the groundwater is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in groundwater has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the groundwater to a potential point of exposure (possibly due to the presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the groundwater receptors at the MRS.

Classification	Description	Value
Identified	There is a threatened water supply well downgradient of the source and the groundwater is a current source of drinking water or source of water for other beneficial uses such as irrigation/agriculture (equivalent to Class I or IIA aquifer).	H
Potential	There is no threatened water supply well downgradient of the source and the groundwater is currently or potentially usable for drinking water, irrigation, or agriculture (equivalent to Class I, IIA, or IIB aquifer).	M
Limited	There is no potentially threatened water supply well downgradient of the source and the groundwater is not considered a potential source of drinking water and is of limited beneficial use (equivalent to Class IIA or IIB aquifer, or where perched aquifer exists only).	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

No Known or Suspected Groundwater MC Hazard ❑

See Figure 4.15 for directions on how to determine the Contaminant Hazard Factor Value.

Circle the value for the Migration Pathway Factor.

Record the value.

Circle the value for the Receptor Factor.

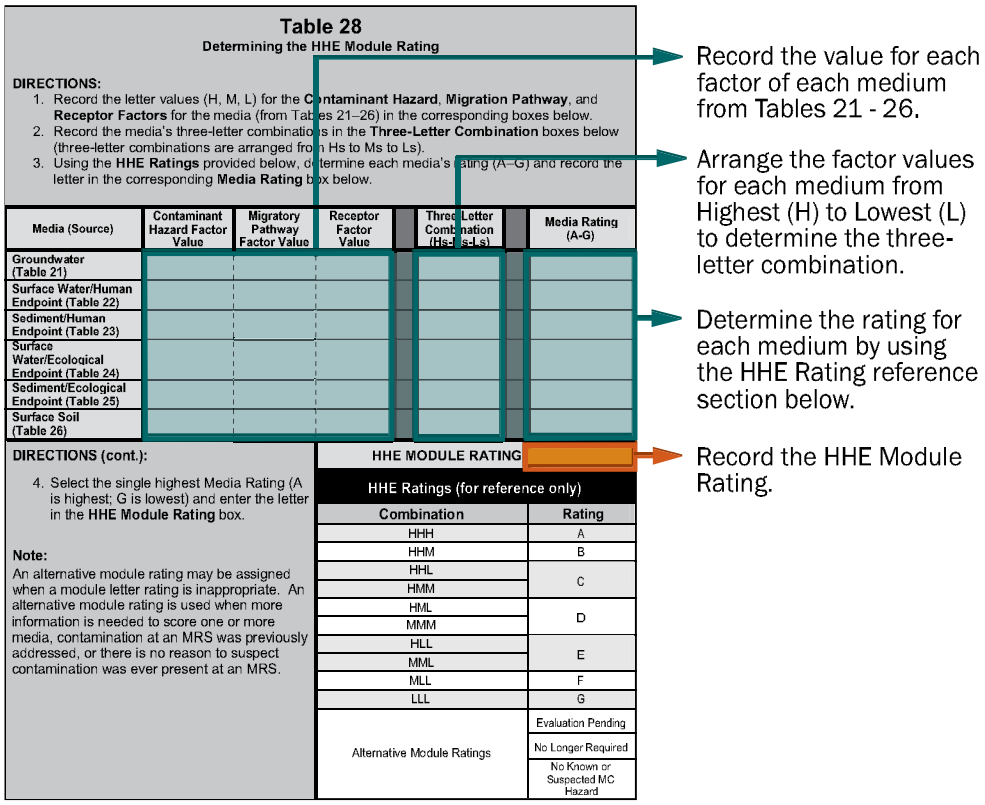
Record the value.

Table 28 should be used to determine the HHE Module Rating. As shown in Figure 4.19, letter values (H, M, and L) for the Contaminant Hazard, Migration Pathway, and Receptor Factors for each medium (from Tables 21-26) are recorded in their corresponding boxes. For each medium, the three-letter combination is then compiled such that the letter values are ranked from Highest (H) to Lowest (L). The appropriate media rating (A through G) is chosen using the HHE Module Rating reference section and recorded for each medium. The single highest letter rating (A is highest; G is lowest) is selected from the Media Rating column and recorded in the HHE Module Rating box. If a letter rating is inappropriate, the MRS Project Team can choose one of the three alternative module ratings (i.e., Evaluation Pending, No Longer Required, or **No Known or Suspected MC Hazard**).

Tips and Tricks

The three-letter combination (H, M, L) should be arranged in the order of the risk with H representing the highest risk and L representing the lowest risk.

Figure 4.19 Directions for Completing Table 28



USING THE TABLES TO DETERMINE THE MRS PRIORITY

The three module ratings obtained during an MRS's evaluation are used to determine an MRS Priority or Alternative MRS Rating. Information from Tables 10, 20, and 28 is used to complete Table 29, which is used to determine the MRS Priority or Alternative MRS Rating.

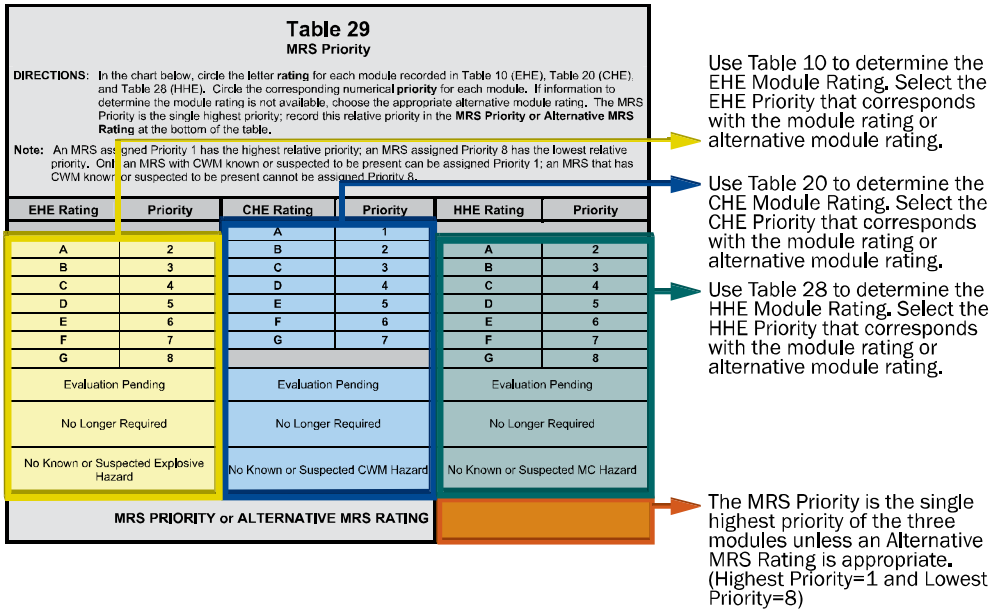
To obtain an MRS's relative priority, the MRS Project Team uses Table 29 to capture the EHE Module Rating from Table 10, the CHE Module Rating from Table 20, and the HHE Module Rating from Table 28, as shown in Figure 4.20. The

Definitions
(See Appendix C)

No Known or Suspected MC Hazard

module rating from each table and its corresponding priority is circled. The MRS Priority or Alternative MRS Rating is the highest of the three module priorities (1 is highest; 8 is lowest). The priority is recorded in the appropriate box on Table 29.

Figure 4.20 Directions for Completing Table 29



DoD's approach is to assign each MRS a relative priority based on the greatest potential hazard posed by UXO, DMM, or MC. The MRS Priority scale is such that the lowest numerical priority represents the highest potential hazard at an MRS. For example, a Priority 1 MRS contains the highest potential hazard, while a Priority 8 MRS contains the lowest potential hazard. Only an MRS with a CWM hazard can be assigned to Priority 1, while no MRS with CWM can be assigned to Priority 8. An MRS's relative priority is determined based on the modules completed.

In addition to letter ratings, modules may be assigned alternative module ratings. An MRS Priority is based on the greatest potential hazard rating from the three modules. So long as at least one module has a letter rating, the MRS numerical priority (i.e., 1 through 8) can be determined. When all three modules have alternative module ratings and a numerical priority is inappropriate, the following alternative MRS ratings will apply:

- *Evaluation Pending.* The alternative MRS rating used to indicate that an MRS requires further evaluation. This designation is only used when none of the three modules has a numerical priority (i.e., 1 through 8) and at least one module is rated Evaluation Pending.

- *No Longer Required.* The alternative MRS rating used to indicate that an MRS no longer requires prioritization. The MRS will receive this rating when none of the three modules has a numerical priority (i.e., 1 through 8) or an Evaluation Pending designation, and at least one of the modules is rated No Longer Required.

- *No Known or Suspected Hazard.* The alternative MRS rating used to indicate that an MRS has no known or suspected hazard. This designation is used only when the hazard evaluation modules are rated as No Known or Suspected Explosive Hazard, No Known or Suspected CWM Hazard, and No Known or Suspected MC Hazard.

The Protocol should be reapplied to an MRS when new data required to complete a module's evaluation becomes available. Depending upon the results of the reapplication, the MRS Priority or Alternative MRS Rating may change. Components will review each MRS Priority at least annually and update the priority, as necessary, to reflect new information that has become available.

SUMMARY

This chapter contains general instructions for evaluating an MRS using the Protocol. Step-by-step directions on how to complete the Primer Scoring Tables for each hazard module are provided. Results from the three hazard modules are compared to determine an MRS's relative priority or alternative MRS rating.

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Chapter 5: Explosive Hazard Evaluation Module

By applying the Protocol, DoD assigns each MRS a relative priority for response activities. As previously indicated, three modules evaluate the potential hazards associated with UXO, DMM, and MC known or suspected to be present at an MRS. This priority, which is based on the overall conditions at an MRS, considers the potential for explosive, chemical, and environmental hazards to be present at an MRS. Because of the inherent differences between each type of hazard, each module addresses only one hazard as shown in Figure 5.1.

Figure 5.1 Hazard Evaluation Modules

Module	Hazard
EHE Module	Explosive Hazards
CHE Module	Chemical Warfare Materiel Hazards
HHE Module	Health and Environmental Hazards

This chapter provides an overview of the **EHE Module**. It also describes the structure of the EHE Module, its factors, and their associated data elements and provides instructions for using MRS-specific data to determine the data element scores, factor values, and the EHE Module Rating.

OVERVIEW OF THE EHE MODULE

The EHE Module provides the approach for assigning a relative priority to an MRS where **MEC** (i.e., UXO, DMM, and MC in high enough concentrations to pose an explosive hazard) are known or suspected to be present. The EHE Module assesses the explosive hazard through the evaluation of three factors. Using MRS-specific data, these factors consider the presence of MEC, the likelihood of encountering MEC, and potential receptors. Figure 5.2 summarizes the areas to be evaluated and their associated factors.

Figure 5.2 EHE Factor Structure

Subject Evaluated	Factor Name
The presence of MEC	Explosive Hazard Factor
The likelihood of encountering MEC	Accessibility Factor
Receptors potentially affected by MEC hazards	Receptor Factor

Tips and Tricks

The MRS Project Team should include munitions experts to help complete the EHE Module.

Definitions
(See Appendix C)

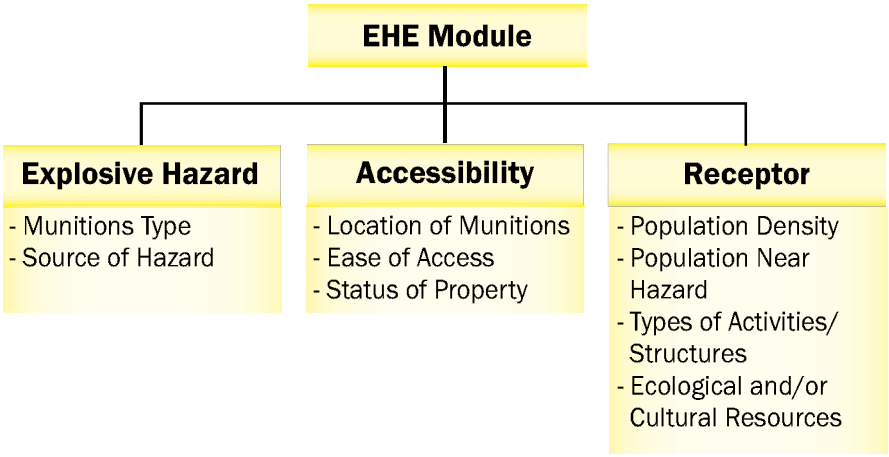
Explosive Hazard Evaluation (EHE) Module

Munitions and explosives of concern (MEC)

The **Explosive Hazard Factor**, **Accessibility Factor**, and **Receptor Factor** create a structure that limits the influence of any one factor on the module rating, but captures all factors that influence the potential risk associated with any hazard known or suspected to be present.

Within a hazard module, each factor is further broken into data elements that characterize the factor. Each factor is comprised of between two and four specific data elements which contain a range of classifications that, based on available MRS-specific data, characterize any hazards known or suspected to be present. For example, the Explosive Hazard Factor is broken into two data elements, the Munitions Type Data Element and the Source of Hazard Data Element. The Munitions Type Data Element is further divided into classifications that characterize the potential explosive hazard. The score assigned to each data element is based on its highest classification score and reflects the data element's contribution to the overall hazard. Figure 5.3 depicts the factors and data elements specific to the EHE Module.

Figure 5.3 EHE Module Structure

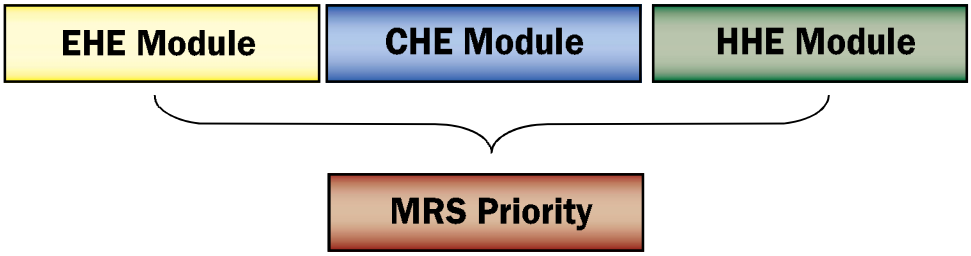


The data element classifications and associated scores were developed based on the knowledge of technical experts within DoD and comments received from stakeholders. The classifications were designed to characterize all potential MRS conditions. Based on MRS-specific information, the MRS Project Team is tasked with selecting data element classifications that best characterize the MRS. Once all data element classifications applicable to an MRS are selected, the single highest classification becomes the data element score. The data elements for each factor are summed to obtain the factor value. The three factor values are then summed to obtain the EHE Module Rating. Ratings from the three modules (EHE, CHE, and HHE) are then used to determine the MRS's relative priority as shown in Figure 5.4.

Definitions
(See Appendix C)

Explosive Hazard Factor
Accessibility Factor
Receptor Factor

Figure 5.4 General Protocol Structure



MUNITIONS AND EXPLOSIVES OF CONCERN

The EHE Module evaluates the explosive hazard potentially posed by MEC known or suspected to be present at an MRS. **MEC** refers to specific categories of military munitions that may pose unique explosive safety risks and includes:

- UXO, as defined in 10 USC 101(e)(5);
- DMM, as defined in 10 USC 2710(e)(2); and
- MC (e.g., TNT or RDX), as defined in 10 USC 2710(e)(3), that are present in high enough concentrations to pose an explosive hazard.

This term does not create new categories of material covered by the Protocol. DoD adopted this term for consistency throughout the MMRP and with related policies, procedures, and documents.

References

MEC: www.denix.osd.mil/denix/Public/Library/Cleanup/CleanupOfc/whats_new/FinalProtocolRule.pdf

GENERAL SCORING PROCEDURES

Each of the three factors contribute points towards the EHE Module Rating. The maximum possible point totals for each of the EHE Module Factors are listed in Figure 5.5.

Figure 5.5 EHE Module Factor Values

Explosive Hazard Factor	40 points
Accessibility Factor	40 points
Receptor Factor	20 points
Maximum Total	**100 points**

Definitions
(See Appendix C)

Munitions and explosives of concern (MEC)

References

All tables can be found in Appendix A.

DoD has developed a table to record MRS-specific conditions for each factor's data elements. All of the EHE Module tables (shown in Figure 5.6) include descriptions and scores for data element classifications that allow the explosive hazards potentially present at an MRS to be evaluated. All tables used in the Protocol can be found in Appendix A.

The maximum total for the EHE Module is 100 points. Based on the EHE Module Rating, an MRS is assigned one of seven letter ratings (A - G) that will later be evaluated with similar letter ratings from the CHE and HHE Modules. When a letter rating is not appropriate, an MRS may be assigned one of three alternative module ratings: **Evaluation Pending**, **No Longer Required**, or **No Known or Suspected Explosive Hazard**. The directions for the Primer Scoring Tables are discussed in detail in Chapter 4.

References

Scoring procedures are found in Chapter 4.

Figure 5.6 EHE Module Tables 1-9

Factor	Tables
Explosive Hazard Factor	Table 1: Munitions Type Table 2: Source of Hazard
Accessibility Factor	Table 3: Location of Munitions Table 4: Ease of Access Table 5: Status of Property
Receptor Factor	Table 6: Population Density Table 7: Population Near Hazard Table 8: Types of Activities/Structures Table 9: Ecological and/or Cultural Resources

The selection of the appropriate classifications within the data elements requires careful review of both MRS-specific data and the definitions for each classification. The following sections provide detailed information on each of the EHE Module's factors and data elements.

EHE MODULE STRUCTURE

Explosive Hazard Factor

Definitions
(See Appendix C)

Evaluation Pending

No Longer Required

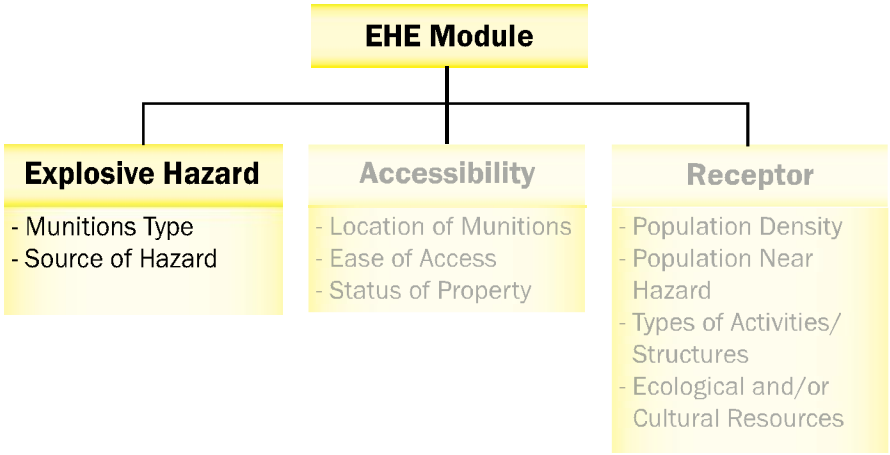
No Known or Suspected Explosive Hazard

Munitions Type

Source of Hazard

The Explosive Hazard Factor evaluates the munitions types known or suspected to be present at an MRS and the munitions-related activities that occurred at the MRS. This factor is composed of the **Munitions Type** and **Source of Hazard** Data Elements, as shown in Figure 5.7. The Explosive Hazard Factor constitutes a maximum of 40 points of the EHE Module Total.

Figure 5.7 EHE Module Structure, Highlighting the Explosive Hazard Factor



Munitions Type

Data Element:

The Munitions Type Data Element is designed to assess the potential explosive hazard posed by the types of munitions known or suspected to be present at an MRS. The design and configuration (e.g., **fuzed**), its armed state, and its condition (e.g., weathered, damaged) are used to determine the potential explosive hazards.

Data Element Classifications:

The Munitions Type Data Element categorizes military munitions into 1 of 11 classifications, as shown in Figure 5.8, according to their potential to detonate if encountered and disturbed. The number to the right is the score for each classification, the highest of which is used to determine the hazard factor value for each MRS.

Definitions
(See Appendix C)

Fuzed

Tips and Tricks

Only the *single highest* scoring Munitions Type Data Element classification is used to determine the Explosive Hazard Factor value. These scores are *NOT* added together.

Figure 5.8 Munitions Type Data Element Classifications

Table 1 EHE Module: Munitions Type Data Element Table	
Classification	**Score**
Sensitive	30
High explosive (used or damaged)	25
Pyrotechnic (used or damaged)	20
High explosive (unused)	15
Propellant	15
Bulk secondary high explosives, pyrotechnics, or propellant	10
Pyrotechnic (not used or damaged)	10
Practice	5
Riot control	3
Small arms	2
Evidence of no munitions	0

Classification Distinctions:

The Munitions Type Data Element classifies MEC according to its potential hazard, its condition, and the likelihood it will function (e.g., detonate) upon disturbance. It considers the explosive fill, whether the munition is fuzed, the type of fuze, the armed status of the fuze and/or the condition of the munition. For MC in concentrations high enough to pose an explosive hazard, it considers the ease of detonation initiation.

Explosive hazard means a condition where danger exists because explosives are present that may react (e.g., detonate, deflagrate) in a mishap with potential unacceptable effects (e.g., death, injury, damage) to people, property, operational capability, or the environment. Munitions that contain a high explosive fill (e.g., TNT, HMX, RDX) generally pose a greater risk than munitions with other fills (e.g., smoke) because the blast and fragmentation effects produced upon detonation are greater. One exception to this general rule may be munitions with a white phosphorus fill. The main categories of explosive fillers used in munitions include:

- **High explosives**;
- **Low explosives**;

Definitions
(See Appendix C)

Explosive hazard
High explosive
Low explosive

- **Pyrotechnics**;
- **Propellants**; and
- **Incendiaries**.

Because they are normally fuzed and have experienced their **arming sequence**, used munitions that failed to function as intended are considered to pose a greater explosive hazard than either damaged munitions or munitions that have never been used. DoD considers UXO to be the most dangerous category of military munitions. Based on their fuzing, some UXO are considered far more sensitive to disturbance than others.

- **Used munitions** found at an MRS are UXO. Because used munitions have normally been primed, fuzed, armed, or otherwise prepared for action and have been through their firing sequence, they are more likely both to be armed and to detonate if disturbed.

- **Unused munitions** found at an MRS are DMM. These munitions pose an explosive hazard as they have often experienced an unknown environment and may have been damaged by burning, incomplete detonation, or deterioration.

Finally, explosives are classified as primary or secondary based on their sensitivity to initiation. Explosives that have a higher sensitivity to initiation pose a greater potential explosive risk.

- **Primary explosives**, such as lead azide, are highly susceptible to initiation.

- **Secondary explosives** (e.g., TNT, RDX, HMX), which constitute the bulk of the explosives likely to be present at an MRS, are formulated to be far less susceptible to initiation.

Figure 5.8 shows the 11 data element classifications used to describe the munitions types that may be found at an MRS. These data elements are based on the explosive hazard of the munitions present and their condition. For example, the ***sensitive*** data element classification describes MEC that are likely to function with any disturbance. This classification also includes bulk primary explosives, or mixtures of bulk primary explosives with environmental media such that the mixture poses an explosive hazard. **Practice munitions** with a sensitive fuze are also classified *sensitive* because the fuze is likely to function with any disturbance.

The *high explosives (used or damaged)*, *pyrotechnics (used or damaged)*, or *propellant* classifications are designed to exclude primary explosives, which are highly susceptible to initiation.

The *small arms* classification should be selected if there is evidence that only **small arms ammunition** was used at the MRS. If there is evidence that munitions other than small arms were used, the munition with the highest hazard potential should be used for scoring purposes.

Tips and Tricks

To help distinguish between the 11 categories in the Munitions Type Data Element, the MRS Project Team should include a munitions expert.

Tips and Tricks

Note that all high explosives, including bulk explosives should be identified as either primary or secondary high explosive.

Definitions
(See Appendix C)

Pyrotechnics
Propellants
Incendiary
Arming sequence
Used or fired military munitions
Unused military munitions
Primary explosives
Secondary explosives
Sensitive
Practice munitions
Small arms ammunition

The ***evidence of no munitions*** classification can only be selected if an investigation was conducted and there is **physical** or **historical evidence** indicating no munitions are present. The MRS Project Team determines the appropriate level of physical or historical evidence necessary for a determination of *evidence of no munitions*.

Source of Hazard

Data Element:

The Source of Hazard Data Element assesses the potential explosive risk at an MRS based on the MRS's previous uses. It reflects the manner and extent to which munitions-related activities (e.g., range, treatment, and storage) were conducted at the MRS. These classifications reflect common locations where munitions activities occur. For example, there is a high likelihood that damaged DMM may be found in areas used for open detonation or that UXO may be found on the impact areas of formerly used ranges. There is a very low likelihood that UXO or DMM will be found in manufacturing, storage, or transfer areas.

Data Element Classifications:

The 11 classifications shown in Figure 5.9 are found within the Source of Hazard Data Element. **Former ranges** are ranges for which a formal decision has been made to close the range or that have been put to a use that is incompatible with continued use as a military range. Former ranges may be found on active installations, installations impacted by BRAC decisions, FUDS, and other property released from DoD control.

Figure 5.9 Source of Hazard Data Element Classifications

Table 2 EHE Module:
Source of Hazard Data Element Table

Classification	Score
Former range	10
Former munitions treatment (i.e., OB/OD) unit	8
Former practice munitions range	6
Former maneuver area	5
Former burial pit or other disposal area	5
Former industrial operating facilities	4
Former firing points	4
Former missile or air defense artillery emplacements	2
Former storage or transfer points	2
Former small arms range	1
Evidence of no munitions	0

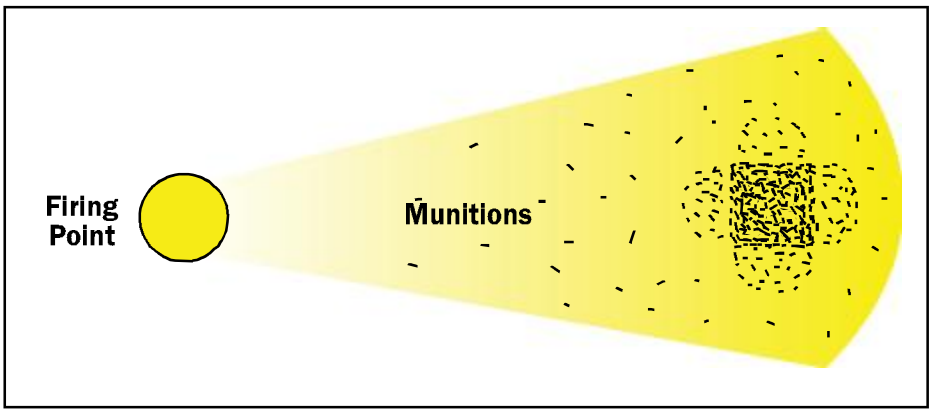
Definitions
(See Appendix C)

Evidence of no munitions
Physical evidence
Historical evidence
Former range

Classification Distinctions:

The *former range* classification has the highest score because it includes locations (e.g., impact or target areas, buffer zones) that supported live-fire training and testing. The *former range* classification should only be used when a more specific classification is not appropriate, or the MRS is an area (e.g., impact area, buffer zone) where UXO are most likely present. These locations are more likely to contain UXO, which are considered to pose the greatest potential explosive hazard. Although part of a former range, the *former* ***firing points*** classification receives a much lower score because they are not expected to contain UXO. See Figure 5.10.

Figure 5.10 Firing Point



The *former* ***munitions treatment (i.e., OB/OD) unit*** classification describes areas where excess, obsolete, or unserviceable munitions were burned or detonated. Treatment units that were used or permitted for disposal of military munitions are normally excluded from prioritization. Generally, the closure requirements for such treatment units are identified in the unit's permit. However, some open burn/open detonation (OB/OD) units are subject to prioritization under the Protocol if they meet the requirements for inclusion in DoD's MRS Inventory. Such units may contain DMM on the surface or in the subsurface in the form of military munitions that did not detonate and were ejected during an attempted demilitarization by detonation (also referred to as kick-outs).

The *evidence of no munitions* classification can only be used if an investigation was conducted and reported no physical or historical evidence indicating munitions are present.

Accessibility Factor

The Accessibility Factor focuses on the potential for receptors to encounter MEC that may be present at an MRS. To capture accessibility, this factor is composed of the **Location of Munitions**, **Ease of Access**, and **Status of Property** Data Elements, shown in Figure 5.11. The Accessibility Factor constitutes a maximum of 40 points of the EHE Module Total.

References

DoD's MRS Inventory:
http://deparc.egovservices.net/deparc/do/mmrp

Definitions
(See Appendix C)

Firing point

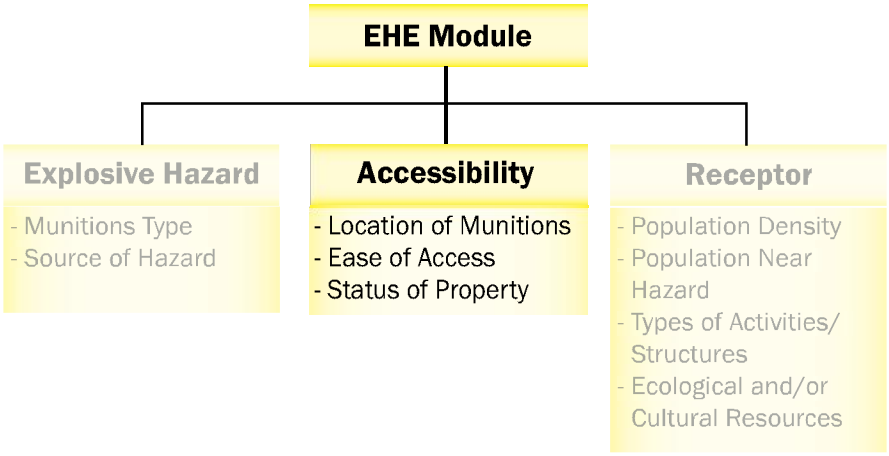
Munitions treatment open burn/open detonation (OB/OD) unit

Location of Munitions

Ease of Access

Status of Property

Figure 5.11 EHE Module Structure, Highlighting the Accessibility Factor



Location of Munitions

Data Element:

The Location of Munitions Data Element evaluates three conditions that together characterize the potential for encountering munitions. These conditions are:

- Whether the presence of munitions is confirmed or suspected;
- The proximity of MEC to the surface (i.e., whether MEC is on the **surface** or in the **subsurface**); and
- The potential for subsurface MEC to be brought to the surface.

Data Element Classifications:

The following eight classifications, shown in Figure 5.12, identify the locations and circumstances considered.

Definitions
(See Appendix C)

Surface
Subsurface

Figure 5.12 Location of Munitions Data Element Classifications

Table 3 EHE Module: Location of Munitions Data Element Table	
Classification	**Score**
Confirmed surface	25
Confirmed subsurface, active	20
Confirmed subsurface, stable	15
Suspected (physical evidence)	10
Suspected (historical evidence)	5
Subsurface, physical constraint	2
Small arms (regardless of location)	1
Evidence of no munitions	0

Classification Distinctions:

An MRS evaluated under the EHE Module is known or suspected to contain MEC. The presence of MEC can be verified by either physical or historical evidence. An MRS confirmed to have MEC is considered to pose a greater hazard than an MRS suspected to contain MEC.

- **Confirmed**: There is indisputable factual evidence that UXO or DMM are present in either the surface or subsurface.
    - The presence of MEC can be verified based on physical evidence that indicates that UXO or DMM are present on the surface of the MRS; or
    - Historical evidence (i.e., a confirmed report, such as an EOD, police, or fire department report that an incident or accident that involved UXO or DMM occurred) indicates there are UXO or DMM on the surface of the MRS.
- **Suspected**: The presence of MEC is likely, based on physical or historical evidence of munitions (e.g., munitions debris, anecdotal information).

MEC is more likely to be encountered when it is on the surface. When any portion of a munition is above the surface, the likelihood of an encounter and potential detonation is greater. Therefore, the explosive hazard is greater for MEC on the surface than for MEC in the subsurface.

Definitions
(See Appendix C)

Confirmed

Suspected

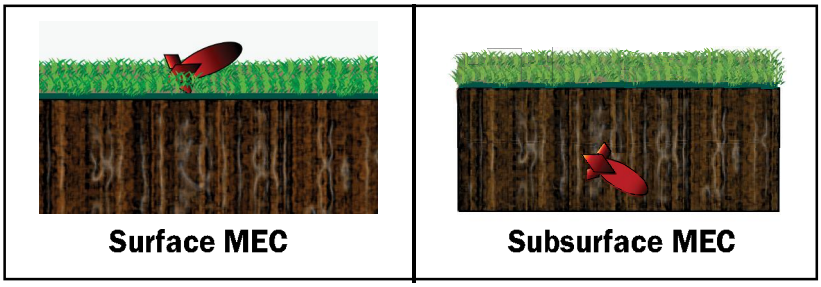
Tips and Tricks

MEC that is exposed at any time as a result of tidal activity is considered on the surface.

- **Surface**: MEC is considered on the surface when it is entirely or partially exposed above the ground surface or above the surface of a water body at any time.

- **Subsurface**: MEC is considered in the subsurface when it is entirely beneath the ground surface or is submerged below the surface of a water body at all times.

Figure 5.13 Surface and Subsurface MEC



While subsurface MEC is less likely to be encountered, the EHE Module considers the potential for dynamic conditions (e.g., erosion or dredging) to bring MEC to the surface. Conditions that could cause MEC to migrate to the surface and are characterized as either active or stable.

- **Active**: Conditions are "active" when:

  - The MRS's geological conditions are likely to cause UXO or DMM to be exposed in the future by naturally occurring phenomena (e.g., drought, flooding, erosion, frost heave, tidal action); or

  - Intrusive activities (e.g., plowing, construction, dredging) at the MRS are likely to expose UXO or DMM.

- **Stable**: Conditions are "stable" when:

  - The MRS's geological conditions are not likely to cause UXO or DMM to be exposed in the future by naturally occurring phenomena; or

  - Intrusive activities at the MRS are not likely to cause UXO or DMM to be exposed.

Finally, certain **physical constraints** may prevent MEC from being brought to the surface, even by naturally occurring phenomena. A physical constraint (e.g., pavement, water depth in excess of 120 feet) is something that significantly reduces or eliminates the potential for an encounter with MEC.

The *confirmed surface* classification is used when physical or historical evidence indicate MEC is present on the surface. A munition is considered confirmed on the surface when it is entirely or partially exposed above the ground surface or is partially exposed above the surface of a water body. UXO found in the tundra of Alaska is considered to be on the surface, as the tundra is above the soil layer.

Definitions
(See Appendix C)

Surface
Subsurface
Active condition
Stable condition
Physical constraint

If an investigation confirms that naturally occurring phenomena or intrusive activities that are likely to occur at the MRS increase the potential for subsurface munitions to migrate to the surface, the *confirmed subsurface, active* classification is appropriate.

Physical constraints can be anything that prevent subsurface MEC from migrating to the surface. MEC at a water depth of more than 120 feet is considered in the *subsurface, physical constraint* classification. DoD selected water depth in excess of 120 feet as a physical constraint because of the limited time (less than 15 minutes) normally allowed for recreational scuba divers at this depth, the considerable effort needed to dive to and below this depth, and the dangers associated with such deep dives.

Tips and Tricks

Future changes in physical constraints or land use at an MRS require reapplication of the Protocol.

The *small arms (regardless of location)* classification is appropriate when a range was determined to have been exclusively used for live-fire training or testing using only small arms ammunition. Small arms ammunition located either on the surface or in the subsurface are classified together and receive a low hazard score.

As with the previous two data elements in Explosive Hazard Factor, the *evidence of no munitions* classification is to be used only when the MRS has been investigated and there is physical or historical evidence that no munitions are present.

Ease of Access

Data Element:

The Ease of Access Data Element focuses on the means for a human receptor to encounter MEC based on the extent of controls preventing access to the MRS. Both natural obstacles such as dense vegetation, rugged terrain, deep water, and man-made controls such as fencing are considered.

Data Element Classifications:

The four classifications within this data element and their associated scores are listed in Figure 5.14. These classifications describe barriers that may be present to prevent or restrict access to an MRS.

Figure 5.14 Ease of Access Data Element Classifications

Table 4 EHE Module: Ease of Access Data Element Table

Classification	Score
No barrier	10
Barrier to MRS access is incomplete	8
Barrier to MRS access is complete but not monitored	5
Barrier to MRS access is complete and monitored	0

Classification Distinctions:

Ease of access to an MRS is determined by controls restricting access to an MRS. Access can be determined by the presence of one or more of the factors listed below.

- A **barrier** is a natural obstacle (e.g., difficult terrain, dense vegetation, deep or fast moving water), a man-made obstacle (e.g., fencing), or a combination of natural and man-made obstacles.
- **Monitoring** is used to systematically track access to an MRS and may be conducted by humans, electronic components, or a combination of both.

Tips and Tricks

For deep-water barriers, evaluate the effectiveness of the barrier in preventing access to all parts of the MRS to select the appropriate classification.

An MRS is classified as *no barrier* when all parts of the MRS are accessible. If some parts of an MRS are inaccessible, then incomplete barrier is the most appropriate classification. If a barrier prevents access to the entire MRS, but there is no formal monitoring system in place, then the *barrier to MRS access is complete but not monitored* classification should be chosen. The *barrier to MRS access is complete and monitored* classification should be chosen only if there is active, continual monitoring (surveillance) of the MRS and access to all parts of the MRS is prevented.

Both barriers and monitoring decrease the likelihood of an individual accessing an MRS and encountering MEC. Preventing or restricting access to an MRS known or suspected to contain MEC helps mitigate any explosive hazard. Conditions within this data element can be difficult to capture, especially for large MRSs that have not been characterized or MRSs that have varying MRS conditions (e.g., short grass and dense swamp). The MRS Project Team should use judgment when making a final determination as to which natural or man-made features at an MRS are barriers.

Status of Property

Data Element:

The last data element in the Accessibility Factor is the Status of Property Data Element. This data element differentiates between an MRS that is currently under DoD's control and an MRS that has been transferred out of **DoD control**. While all property subject to the Protocol must have once belonged to DoD, current ownership may have changed. DoD control implies the land and water on the MRS are currently owned, leased, or otherwise possessed or used by DoD. An MRS within DoD control is less likely to allow access to MEC so the explosive hazard to the public is reduced.

Definitions
(See Appendix C)

Barrier
Monitoring
DoD control

Data Element Classifications:

The three classifications in Figure 5.15 list all the possible scenarios for DoD's ownership role of an MRS.

Figure 5.15 Status of Property Data Element Classifications

Table 5 EHE Module: Status of Property Data Element Table	
Classification	**Score**
Non-DoD control	5
Scheduled for transfer from DoD control	3
DoD control	0

Classification Distinctions:

The *non-DoD control* classifications include privately owned land or water bodies; land or water bodies owned or controlled by state, tribal, or local governments; and land or water bodies managed by other federal agencies. If property is scheduled to be transferred from DoD control within *three years* it is included in the *scheduled for transfer from DoD control* classification. The *DoD control* classification is used when the MRS property is currently owned, leased, or otherwise possessed by DoD. Property leased to a non-DoD entity where the non-DoD entity provides security is considered *non-DoD control*. FUDS properties are not considered under DoD's control for purposes of this data element.

Tips and Tricks

To be considered under DoD control, DoD must control the property for 24 hours a day, every day of the calendar year.

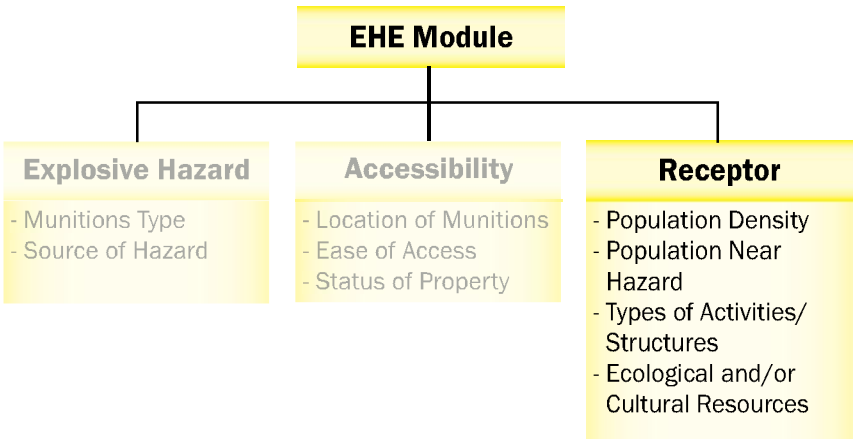
Receptor Factor

The Receptor Factor focuses on the human and ecological populations that may be impacted by the presence of MEC. It is composed of four data elements: **Population Density**, **Population Near Hazard**, **Types of Activities/Structures**, and **Ecological and/or Cultural Resources**. The Receptor Factor constitutes a maximum of 20 points of the EHE Module Total.

Tips and Tricks

The Receptor Factor Value is identical in the EHE and CHE Modules. If the MRS Project Team has already completed one module, the information recorded for the Receptor Factor can be used to complete the other module *unless* new information is available.

Figure 5.16 EHE Module Structure, Highlighting the Receptor Factor



Definitions (See Appendix C)

Population Density

Population Near Hazard

Types of Activities/ Structures

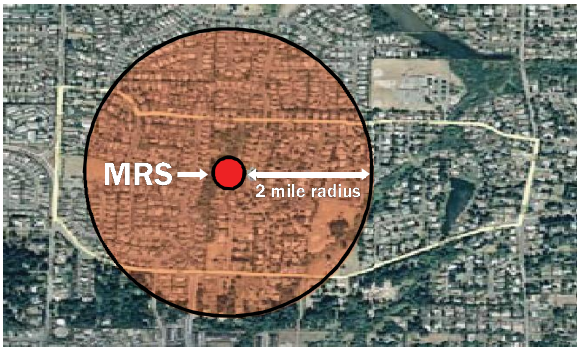
Ecological and/or Cultural Resources

Population Density

Data Element:

The Population Density Data Element assesses the number of people that could be exposed to any explosive hazard potentially posed by MEC. Because the blast and fragmentation effects of an incident (detonation) that involves MEC at an MRS may affect both on-site and off-site populations, both are included in this data element. The Receptor Factor considers these effects by including both the MRS and areas extending up to *two miles* from the perimeter of an MRS. The more people potentially exposed to the effects of an explosive incident, the higher the potential explosive hazard.

Figure 5.17 Two-Mile Boundary



Data Element Classifications:

This data element considers permanent resident populations both on the MRS and in the surrounding area based on the number of people per square mile in the county or nearby city using US Census Bureau statistics. There are three classifications under this data element, shown in Figure 5.18, based on the number of persons per square mile.

References

US Census Bureau Statistics:
www.census.gov

Figure 5.18 Population Density Data Element Classifications

Table 6 EHE Module:
Population Density Data Element Table

Classification	Score
> 500 persons per square mile	5
100 – 500 persons per square mile	3
< 100 persons per square mile	1

Tips and Tricks

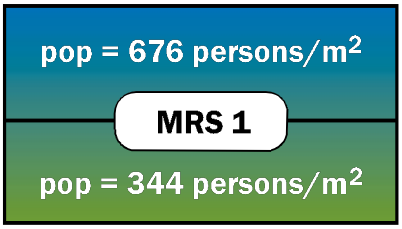
The MRS Project Team should rely on local knowledge to determine the most appropriate US Census tract data.

Classification Distinctions:

This data element evaluates the number of people who may be injured by an explosive incident (unintentional detonation) that occurs at an MRS. Either city or county population densities, based on the MRS's location, are considered. Where an MRS is located within or borders a city limit, use the city rather than

the county population density. If the MRS is not located within a city and does not border a city, use the county population density. If an MRS is located in more than one county, use the largest population value among the counties. For example, if an MRS is located on the border of two counties, one with a population density of 676 persons per square mile and another with a population density of 344 persons per square mile, the MRS Project Team would use the county with the higher population density. In this example, the *> 500 persons per square mile* classification would be appropriate. In developing the Protocol, DoD based the data element classifications and scores in the Population Density Data Element on risk appropriate distribution among the test sites.

Figure 5.19 Census Population Data Surrounding an MRS



Population Near Hazard

Data Element:

The Population Near Hazard Data Element addresses the number of **inhabited structures** on the MRS and within *two miles* of the MRS boundary. The term inhabited structure means permanent or temporary structures, other than military munitions-related structures, that are routinely occupied by one or more persons for any portion of a day. This data element focuses on the population (through the number of structures) within a two-mile range that could be impacted by an unintentional detonation.

This data element differs from the Population Density Data Element, which is used to assess the number of persons that could possibly access the MRS. By using US Census Bureau statistics, the Population Density Data Element accounts for permanent residential populations surrounding an MRS. In addition to permanent occupants, the Population Near Hazard Data Element also considers any routine occupants of structures, therefore, accounting for transient (such as seasonal) populations. Inhabited structures do not require permanent residents because this classification is intended to capture any permanent or temporary structures (other than DoD munitions-related structures) that are routinely occupied by one or more persons for any portion of a day.

Data Element Classifications:

This data element contains the six classifications shown in Figure 5.20. The classifications are based on the number of inhabited structures on or within a two-mile radius of an MRS.

Definitions
(See Appendix C)

Inhabited structures

Figure 5.20 Population Near Hazard Data Element Classifications

Table 7 EHE Module: Population Near Hazard Data Element Table	
Classification	**Score**
26 or more inhabited structures	5
16 to 25 inhabited structures	4
11 to 15 inhabited structures	3
6 to 10 inhabited structures	2
1 to 5 inhabited structures	1
0 inhabited structures	0

Classification Distinctions:

Each of these classifications describes the number of inhabited structures on or within two miles of the MRS. The more inhabited structures on or nearby an MRS, the higher the hazard score. For example, an MRS that contains five buildings and is surrounded by a densely populated area with over 100 inhabited structures would receive a *26 or more inhabited structures* classification. DoD based the distribution among the number of structures and their associated scores on the outcome of a series of stakeholder meetings and testing of the Protocol. Like the Population Density Data Element, the data element classifications and scores in the Population Near Hazard Data Element provided the most appropriate distribution among sites tested in Protocol development.

Types of Activities/Structures

Data Element:

The Types of Activities/Structures Data Element addresses the amount, type, and intrusiveness of activities, as well as the likelihood of people congregating on or within a *two-mile* radius of the MRS. This data element was not developed to give undue weight to high-population areas, but to assess certain activities increasing the likelihood of encountering MEC, or MEC's potentially harmful effects. The more intrusive the activities, the more frequently they occur, and the more receptors likely to be present on or surrounding an MRS, the higher the potential explosive hazard.

Data Element Classifications:

This data element contains five classifications, shown in Figure 5.21. Classifications are distinguished by the likelihood of receptors to encounter MEC.

Figure 5.21 Types of Activities/Structures Data Element Classifications

Table 8 EHE Module:
Types of Activities/Structures Data Element Table

Classification	Score
Residential, educational, commercial, or subsistence	5
Parks and recreational areas	4
Agricultural, forestry	3
Industrial or warehousing	2
No known or recurring activities	1

Classification Distinctions:

This data element accounts for the types of activities occurring on or within a two-mile radius of an MRS and the potential for those activities to allow a receptor to encounter MEC. The classifications are designed to reflect the nature of the activities that may result in an encounter with MEC or to the potential effects of an explosive incident. The ***residential***, ***educational***, ***commercial***, *or* ***subsistence*** classification and ***parks and recreational areas*** classification are weighted highest to reflect the types of activities (e.g., planting trees, gardening) and the population that may be in the vicinity of an MRS known or suspected to contain MEC.

While the Population Density Data Element considers permanent populations and the Population Near Hazard Data Element considers inhabited structures, the Types of Activities/Structures Data Element accounts for transient populations without structures. Transient populations are captured by including activities not requiring structures as well as structures that may only be occasionally occupied.

The *residential, educational, commercial, or subsistence* classification describes situations where activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary that are associated with residential areas; educational; child care; critical assets (e.g., hospitals, fire and rescue, police stations, dams); hotels; commercial; shopping centers; playgrounds; community gathering areas; religious sites; or sites used for subsistence hunting, fishing, and gathering. These high density activities are

Definitions
(See Appendix C)

Residential
Educational
Commercial
Subsistence
Parks and recreational areas

likely to expose the greatest number of receptors to the effects of an incident involving MEC.

All classifications balance activity intrusiveness with the potential population that could be exposed to a hazard. The ***agricultural***, ***forestry*** classification and the ***industrial*** *or* ***warehousing*** classification are weighted less than the other classifications in this data element because they typically involve fewer people. While agricultural or forestry activities penetrate the ground surface, the exposed population is typically smaller than commercial, residential, or recreational areas, resulting in a decreased explosive hazard.

Ecological and/or Cultural Resources

Data Element:

References

Threatened and Endangered Species List: www.fws.gov/endangered/wildlife.html

The Ecological and/or Cultural Resources Data Element captures the explosive hazard to **threatened and endangered species**, **critical habitats**, historical sites, cultural items, **American Indian and Alaska Native** sacred sites, and other similar resources on the MRS.

Data Element Classifications:

As shown in Figure 5.22, this data element contains four classifications with the greatest weight awarded to an MRS with both ecological and cultural resources.

Figure 5.22 Ecological and/or Cultural Resources Data Element Classifications

Table 9 EHE Module:
Ecological and/or Cultural Resources Data Element Table

Classification	Score
Ecological and cultural resources present	5
Ecological resources present	3
Cultural resources present	3
No ecological or cultural resources present	0

Definitions
(See Appendix C)

Agriculture
Forestry
Industrial
Warehousing
Threatened and endangered species
Critical habits
American Indian and Alaska Native Tribes

Classification Distinctions:

An **ecological resource** present at an MRS means that:

- A threatened or endangered species (designated under the *Endangered Species Act [ESA]*) is present on the MRS;
- The MRS is designated under the *ESA* as critical habitat for a threatened or endangered species; or
- There are identified sensitive ecosystems such as wetlands or breeding grounds present on the MRS.

A **cultural resource** present at an MRS means there are recognized cultural, traditional, spiritual, religious, or historical features (e.g., structures, artifacts, symbolism) on the MRS. Requirements for determining if a particular feature is a cultural resource are found in the *National Historic Preservation Act, Native American Graves Protection and Repatriation Act, Archeological Resources Protection Act, Executive Order 13007, and the American Indian Religious Freedom Act.* Examples of cultural resources include:

- American Indians or Alaska Natives deem an MRS to be of religious significance.
- American Indians or Alaska Natives use land on an MRS for subsistence activities (e.g., hunting, fishing).

An MRS where ecological resources, such as an endangered species, are present would be classified as *ecological resources present*. An MRS that contains both ecological and cultural resources would receive a higher score and be classified as *ecological and cultural resources present*.

References

Cultural resource information:
www.doi.gov

DETERMINING THE EHE MODULE RATING

As described in Chapter 4, the nine data element scores are used to derive the three factor values. The three factor values are summed together to determine the EHE Module Rating. This rating is comprised of either a letter rating (A - G) or an alternative module rating. The module rating reflects the potential explosive hazard at the MRS.

Definitions
(See Appendix C)

Ecological resources
Cultural resources

Figure 5.23 EHE Module Data Element Scoring

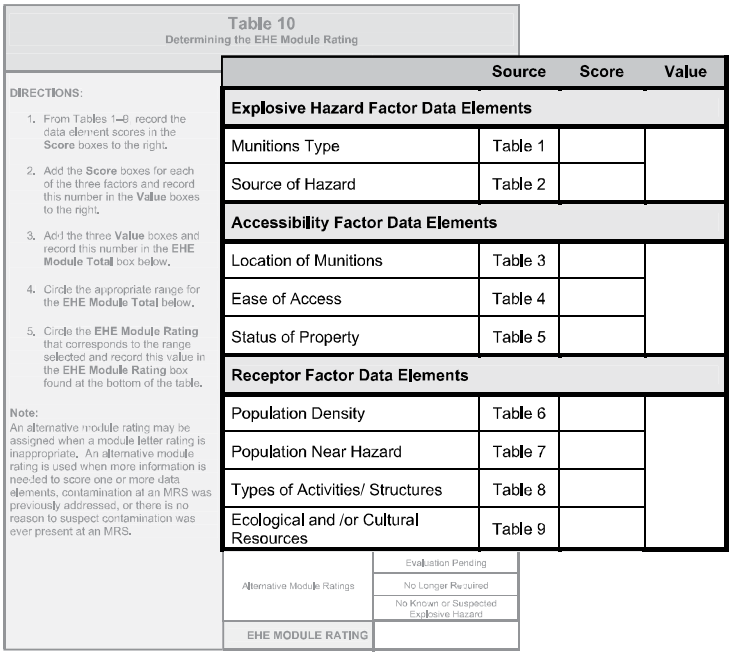


Table 10
Determining the EHE Module Rating

DIRECTIONS:

1. From Tables 1–9 record the data element scores in the **Score** boxes to the right.
2. Add the **Score** boxes for each of the three factors and record this number in the **Value** boxes to the right.
3. Add the three **Value** boxes and record this number in the **EHE Module Total** box below.
4. Circle the appropriate range for the **EHE Module Total** below.
5. Circle the **EHE Module Rating** that corresponds to the range selected and record this value in the **EHE Module Rating** box found at the bottom of the table.

Note:
An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more data elements, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

	Source	Score	Value
Explosive Hazard Factor Data Elements			
Munitions Type	Table 1		
Source of Hazard	Table 2		
Accessibility Factor Data Elements			
Location of Munitions	Table 3		
Ease of Access	Table 4		
Status of Property	Table 5		
Receptor Factor Data Elements			
Population Density	Table 6		
Population Near Hazard	Table 7		
Types of Activities/ Structures	Table 8		
Ecological and /or Cultural Resources	Table 9		

Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected Explosive Hazard
EHE MODULE RATING	

To determine the EHE Module Rating, the highest applicable data element score from each of the nine EHE Data Elements scores are recorded on Table 10, as shown in Figure 5.23. The nine data element scores are summed to determine an overall EHE Module Total of between 0 and 100 points. The EHE Module Rating is selected from a range of associated values that encompass the EHE Module Total. As shown in Figure 5.24, the EHE Module Rating will be evaluated with the two other hazard module (CHE and HHE) ratings and used to determine the MRS's relative priority.

Figure 5.24 MRS Prioritization Framework

	CHE Module Rating	
EHE Module Rating	Hazard Evaluation A (Highest) 1	**HHE Module Rating**
Hazard Evaluation A 2	Hazard Evaluation B 2	Hazard Evaluation A 2
Hazard Evaluation B 3	Hazard Evaluation C 3	Hazard Evaluation B 3
Hazard Evaluation C 4	Hazard Evaluation D 4	Hazard Evaluation C 4
Hazard Evaluation D 5	Hazard Evaluation E 5	Hazard Evaluation D 5
Hazard Evaluation E 6	Hazard Evaluation F 6	Hazard Evaluation E 6
Hazard Evaluation F 7	Hazard Evaluation G 7	Hazard Evaluation F 7
Hazard Evaluation G (Lowest) 8		Hazard Evaluation G (Lowest) 8

As mentioned previously, an alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when information needed to score one or more data elements is not readily available, no further munitions response action is required at an MRS, or there is not a reason to suspect any UXO, DMM, or MC was ever present at an MRS. The three alternative module ratings are:

- *Evaluation Pending*. This alternative module rating is used when MEC is known or suspected at the MRS but sufficient information is not available to determine the MRS's EHE Module Rating.

- *No Longer Required*. This alternative module rating is used when the MRS no longer requires an assigned priority because DoD has conducted a munitions response to MEC, all objectives set out in the decision document for the MRS have been achieved, and no further action except for long-term management or recurring reviews is required.

- *No Known or Suspected Explosive Hazard*. This alternative module rating is used for an MRS that does not require evaluation under the EHE Module because there is no known or suspected explosive hazard.

Tips and Tricks

The MRS Project Team needs to agree on the sufficiency of the data.

The Protocol is created as a tool to determine an MRS's relative priority. The priority assigned to an MRS does not directly impact the design of the required munitions response. All MRSs known or suspected to contain UXO, DMM, or MC will be thoroughly investigated and, if required by MRS-specific conditions, the hazards determined to be present will be addressed through an appropriate response.

SUMMARY

The EHE Module is used to evaluate the potential explosive hazards posed by MEC. The EHE Module determines the explosive hazard through evaluation of three general factors, each of which is comprised of between two and four specific data elements. These factors include information about the:

- Explosive Hazard Factor that has the data elements Munitions Type and Source of Hazard;

- Accessibility Factor that has the data elements Location of Munitions, Ease of Access, and Status of Property; and

- Receptor Factor that has the data elements Population Density, Population Near Hazard, Types of Activities/Structures, and Ecological and/or Cultural Resources.

Based on MRS-specific information, each data element is assigned a numerical score. The data element scores are summed to determine their respective factor values. In aggregate, these values characterize the explosive hazard conditions at an MRS.

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Chapter 6: Chemical Warfare Materiel Hazard Evaluation Module

Known or suspected hazards found at an MRS can be explosive hazards posed by munitions, chemical hazards posed by CWM, or health and environmental hazards posed by MC and incidental non munitions-related contaminants. Because of the inherent differences among each type of hazard, each module addresses only one hazard as depicted in Figure 6.1. This chapter addresses the chemical hazards posed by CWM. In addition to providing an overview of the **CHE Module**, this chapter describes the structure of the CHE Module, its factors, and their associated data elements, and provides instructions for using MRS-specific data to determine the data element scores, factor values, and CHE Module Rating.

Figure 6.1 Hazard Evaluation Modules

Module	Hazard
EHE Module	Explosive Hazards
CHE Module	Chemical Warfare Materiel Hazards
HHE Module	Health and Environmental Hazards

OVERVIEW OF THE CHE MODULE

The CHE Module provides a consistent approach for assigning a relative priority to an MRS where CWM hazards are known or suspected to be present. The CHE Module is used to evaluate the hazards associated with the physiological effects of CWM. The CHE Module is only applied where CWM are known or suspected to be present at an MRS. If historical or physical evidence indicates that CWM is not present, then the MRS Project Team will circle the ***evidence of no CWM*** classification on the appropriate data element tables.

As explained in Chapter 4, each module is composed of factors and data elements that are used to assess conditions at an MRS. The CHE Module is comprised of three factors, shown in Figure 6.2. Each characterizes a different aspect of CWM hazards that may be present at an MRS.

Figure 6.2 CHE Factor Structure

Subject Evaluated	Factor Name
The presence of CWM	CWM Hazard Factor
The likelihood of encountering CWM	Accessibility Factor
Receptors potentially affected by CWM hazards	Receptor Factor

Definitions
(See Appendix C)

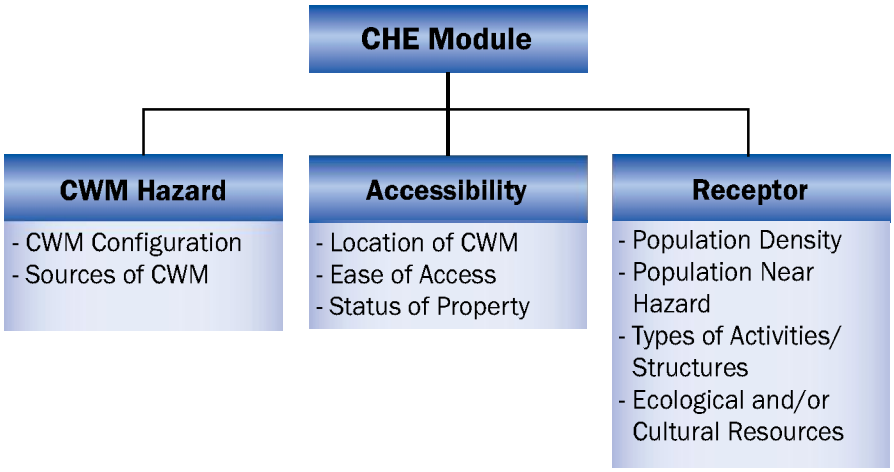
CWM Hazard Evaluation (CHE) Module

Evidence of no CWM

The CHE Module closely mirrors the EHE Module discussed in Chapter 5. The CHE Module characterizes the potential for receptors to encounter CWM on an MRS by evaluating the **CWM Hazard Factor**, **Accessibility Factor**, and **Receptor Factor**. This structure limits the influence of any one factor on the CHE Module Rating, but captures all factors that, in the aggregate, influence the potential for harm from a CWM hazard. These factors were designed to assess the conditions at an MRS, and similar to the EHE Module, the CHE Factor Values are based on MRS-specific information. As shown in Figure 6.3, each factor has two to four data elements. There are a total of nine data elements in the CHE Module. The MRS Project Team is tasked with selecting data element classifications that accurately characterize an MRS.

While the CWM Hazard Factor is unique to the CHE Module, the Accessibility Factor is similar and the Receptor Factor is identical in both the EHE and CHE Modules. The one difference in the Accessibility Factor between the EHE and CHE Modules is that the EHE Location of Munitions Data Element has an additional classification, *small arms (regardless of location)*, while small arms are not included in the CHE **Location of CWM** Data Element.

Figure 6.3 CHE Module Structure

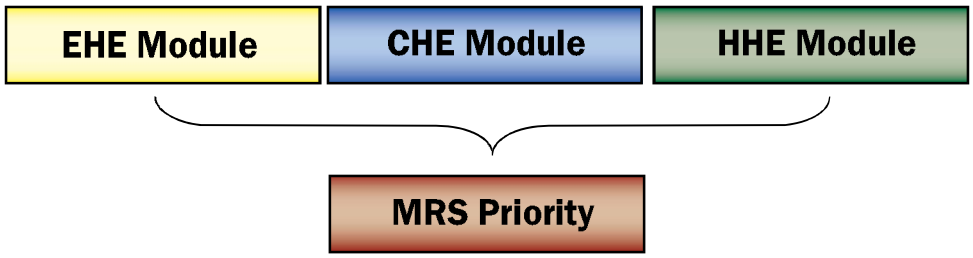


Tips and Tricks

Prioritization does not determine the actions taken during a munitions response.

The data elements for each factor are summed to obtain the factor value, and the three factors values are summed to obtain the CHE Module Rating. Ratings from the three modules (EHE, CHE, and HHE) are then evaluated to produce an overall MRS Priority, as shown in Figure 6.4.

Figure 6.4 General Protocol Structure



Definitions
(See Appendix C)

CWM Hazard Factor
Accessibility Factor
Receptor Factor
Location of CWM

CHEMICAL WARFARE MATERIEL

During the early part of the 20th century, CWM was produced for use in chemical warfare. **CWM** is generally configured as a munition containing a chemical compound that is intended for use in military operations to kill, seriously injure, or incapacitate a person through its physiological effects. The hazard posed by CWM is directly attributed to the presence of **CA**. CA is a chemical compound (to include experimental compounds) that, through its chemical properties, produces lethal or other damaging effects on human beings, is intended for use in military operations to kill, seriously injure, or incapacitate persons through its physiological effects. This definition is based on the definition of "chemical agent and munitions" found in 50 USC 1521(j)(1). See Figure 6.5 for examples of what are, and are not, considered CWM.

References

Chemical Agents and Munitions: www.access.gpo.gov/uscode/title50a/title50a.html

Figure 6.5 Items Considered CWM and Not CWM

CWM	Not CWM
• V- and G-series nerve agents regardless of configuration	• Research, development, testing, and evaluation (RDT&E) solutions
• H-series (mustard) regardless of configuration	• Riot control devices (e.g., tear gas)
• L-series (lewisite) regardless of configuration	• Chemical defoliants and herbicides (e.g., Agent Orange)
• Certain industrial chemicals (e.g., hydrogen cyanide, cyanogen chloride, or carbonyl dichloride) configured as a military munition	• Industrial chemicals (e.g., hydrogen cyanide, cyanogen chloride or carbonyl dichloride) not configured as a munition
• Chemical agent identification sets (CAIS)	• Smoke and other obscuration producing items
	• Flame and incendiary-producing items
	• Soil, water, debris, or other media contaminated with low concentrations of chemical agents where no CA hazards exist

Tips and Tricks

Hydrogen cyanide is otherwise known as AC, cyanogen chloride is otherwise known as CK, and carbonyl dichloride (called phosgene) is otherwise known as CG.

Because of past training and testing activities, CWM may remain on MRSs as UXO or DMM (explosively or non-explosively configured), containers of CA such as bulk containers or laboratory vials, or as **chemical agent identification sets (CAIS)**.

GENERAL SCORING PROCEDURES

A table has been developed for each factor's data elements to record an MRS's conditions. There is one table per data element or nine tables in total that are used during the data collection phase. Each table provides descriptions and scores for each data element classification. All tables can be found in Appendix A of this document. Figure 6.6 is an example table from the CHE Module.

Definitions
(See Appendix C)

Chemical warfare materiel (CWM)

Chemical agent (CA)

Chemical agent identification sets (CAIS)

Figure 6.6 Example Table from the CHE Module

Table 11

CHE Module: CWM Configuration Data Element Table

DIRECTIONS: Below are seven classifications of CWM configuration and their descriptions. Circle the scores that correspond with **all** the CWM configurations known or suspected to be present at the MRS.

Note: The terms *CWM/UXO, CWM/DMM, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score
CWM, that are either UXO, or explosively configured damaged DMM	The CWM known or suspected of being present at the MRS are: ◆ CWM that are UXO (i.e., CWM/UXO) ◆ Explosively configured CWM that are DMM (i.e., CWM/DMM) that have been damaged.	30
CWM mixed with UXO	◆ The CWM known or suspected of being present at the MRS are undamaged CWM/DMM or CWM not configured as a munition that are commingled with conventional munitions that are UXO.	25
CWM, explosive configuration that are undamaged DMM	◆ The CWM known or suspected of being present at the MRS are explosively configured CWM/DMM that have not been damaged.	20
CWM/DMM, not explosively configured or CWM, bulk container	The CWM known or suspected of being present at the MRS are: ◆ Nonexplosively configured CWM/DMM either damaged or undamaged ◆ Bulk CWM (e.g., ton container).	15
CAIS K941 and CAIS K942	◆ The CWM/DMM known or suspected of being present at the MRS are CAIS K941-toxic gas set M-1 or CAIS K942-toxic gas set M-2/E11.	12
CAIS (chemical agent identification sets)	◆ CAIS, other than CAIS K941 and K942, are known or suspected of being present at the MRS.	10
Evidence of no CWM	◆ Following investigation, the physical evidence indicates that CWM are not present at the MRS, or the historical evidence indicates that CWM are not present at the MRS.	0
CWM CONFIGURATION	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30).	

DIRECTIONS: Document any MRS-specific data used in selecting the ***CWM Configuration*** classifications in the space provided.

The data elements within the three factors contribute the following point totals to the CHE Module as found in Figure 6.7.

Figure 6.7 CHE Module Factor Values

CWM Hazard Factor	40 points
Accessibility Factor	40 points
Receptor Factor	20 points
Maximum Total	**100 points**

The maximum score that the CHE Module can receive is 100 points. Similar to the EHE Module, an MRS is assigned one of seven letter ratings (A through G) based on the sum of the factor values. When a letter rating is not appropriate, an MRS may be assigned one of three alternative module ratings: **Evaluation Pending**, **No Longer Required**, or **No Known or Suspected CWM Hazard**. The tables and scoring procedures are discussed in detail in Chapter 4.

The selection of relevant classifications within the data elements requires careful review of the MRS-specific data and the definitions of the classifications. The following sections provide detailed information on each factor and data element in the CHE Module.

References

Scoring procedures are found in Chapter 4 of this document.

CHE MODULE STRUCTURE

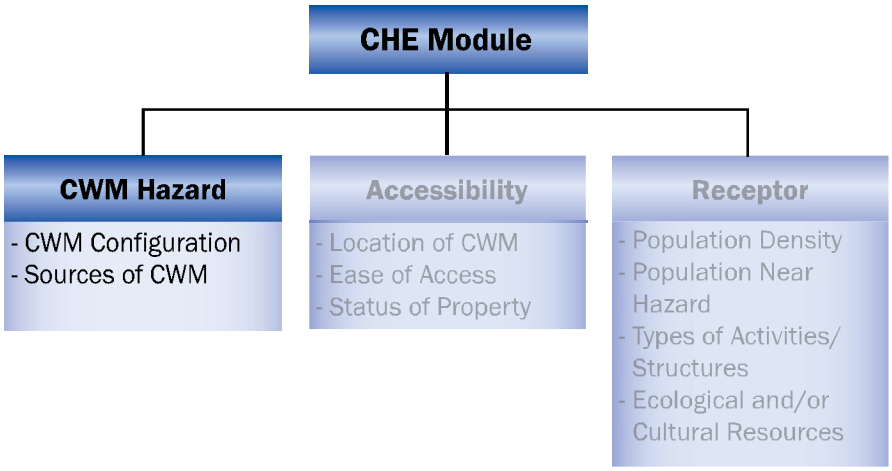
CWM Hazard Factor

The CWM Hazard Factor evaluates the CWM hazards potentially posed by CWM known or suspected to be present at an MRS. This factor considers the configuration of any CWM at the MRS as well as the CWM-related activities that occurred at the MRS. This factor is composed of the **CWM Configuration** and the **Sources of CWM** Data Elements as shown in Figure 6.8. The CWM Hazard Factor constitutes up to 40 points of the CHE Module numerical score.

Tips and Tricks

The MRS Project Team should include members knowledgeable in CWM to help complete the CHE Module.

Figure 6.8 CHE Module Structure, Highlighting the CWM Hazard Factor



Definitions
(See Appendix C)

Evaluation Pending

No Longer Required

No Known or Suspected CWM Hazard

CWM Configuration

Sources of CWM

CWM Configuration

Data Element:

The CWM Configuration Data Element classifies CWM according to the type of CWM known or suspected to be present at an MRS, its condition, and the potential hazard presented. This data element considers the likelihood for

detonation and for detonation to cause dispersal of CA. Because any release of CA is considered equally hazardous, this data element does not differentiate the types of CA or their potential physiological effects. The potential hazard posed by CWM that are explosively configured are further classified into one of four groups:

- CWM that are explosively configured and that are also UXO or damaged DMM pose the greatest hazard.
- CWM regardless of configuration that are mixed with conventional UXO are considered to pose slightly less of a hazard.
- Undamaged CWM that are explosively configured that are not mixed with conventional UXO are considered to pose a lesser hazard.
- Other configurations of CWM (e.g., CWM that are not explosively configured, bulk CWM, CAIS K941 and CAIS K942, other CAIS) are considered to pose lower hazards than explosively configured CWM or CWM mixed with conventional UXO hazard. This is because the absence of explosives limit the potential for CA dispersal.

Data Element Classifications:

The seven classifications of CWM configuration and associated scores are shown in Figure 6.9. The highest classification score for the MRS determines the hazard factor value.

Tips and Tricks

Only the *single highest* scoring CWM Configuration Data Element classification is used to determine the CWM Hazard Factor value. These scores are *NOT* added together.

Figure 6.9 CWM Configuration Data Element Classifications

Table 11 CHE Module: CWM Configuration Data Element Table

Classification	Score
CWM, that are either UXO, or explosively configured damaged DMM	30
CWM mixed with UXO	25
CWM, explosive configuration that are undamaged DMM	20
CWM/DMM not explosively configured or CWM, bulk container	15
CAIS K941 and CAIS K942	12
CAIS (chemical agent identification sets)	10
Evidence of no CWM	0

Classification Distinctions:

CWM is a general term that describes different types of chemical warfare-related materiel. For the purposes of the Protocol, DoD separated CWM into four specific materiel subcategories. The CWM Configuration Data Element assesses the hazards posed by CWM. CWM configured as a munition that are also explosively configured (i.e., contain explosive components, such as a fuze or **burster**) are considered to present the greatest hazard because of the higher potential for CA dispersal. The least hazard is posed by the type of CAIS vials that are most likely to be found at an MRS. The four CWM subcategories are:

- **CWM explosively configured:** All munitions that contain a CA fill and any explosive component. Examples are chemical munitions with burster charges.
- **CWM nonexplosively configured:** All munitions that contain a CA fill, but that do not contain any explosive components. An example is a mustard agent spray canister.
- **CWM, bulk container:** All nonmunitions-configured containers of CA (e.g., a ton container) and CAIS K941-toxic gas set M-1 and CAIS K942-toxic gas set M-2/E11.
- **CAIS:** Military training aids containing small quantities of various CA and other chemicals. All forms of CAIS are scored the same in this rule, except CAIS K941 and CAIS K942.

The Protocol does not consider the differences in the type of CA. However, the CWM Configuration Data Element does address the differences in the hazards posed by the CWM release mechanisms (e.g., CWM with an explosive burster scores higher than CWM without a burster).

The *CWM, that are either UXO, or explosively configured* ***damaged*** *DMM* classification poses the greatest potential CA hazard. Explosively configured CWM are designed to achieve optimal dispersion of their CA fill. The remaining classifications are assigned slightly lower scores based on their relative likelihood of dispersing any CA present.

Figure 6.10 CAIS Vial

CAIS were used to train personnel in the safe handling, identification, and decontamination of CA. These training sets consist of small or dilute quantities CA in 40-milliliter glass vials or 3.5 ounce bottles that were packed in metal shipping containers or wooden boxes. CAIS identified as either K941 or K942 contain larger quantities (approximately 3.5 ounces per bottle) of pure or neat CA. These CAIS are scored slightly lower than other CWM, and slightly higher than all other CAIS.

Similar to the Munitions Type Data Element in the EHE module, there is an *evidence of no CWM* classification, which can only be used after an investigation

Tips and Tricks

Industrial chemicals in bulk containers are not considered CA and are treated as any other hazardous or toxic waste.

Definitions
(See Appendix C)

Burster

CWM explosively configured

CWM nonexplosively configured

CWM, bulk container

Chemical agent identification sets (CAIS)

Damaged

Tips and Tricks

The MRS Project Team determines the appropriate level of physical or historical evidence necessary for a determination of evidence of no CWM.

is conducted and there is **physical** or **historical evidence** indicating there are no CWM present. Any MRS where UXO, DMM, and MC are suspected to be present must be evaluated under the Protocol. If the MRS does not contain CWM, it would receive an *evidence of no CWM* classification for the CWM Configuration Data Element.

Sources of CWM

Data Element:

The Sources of CWM Data Element assesses potential CWM hazards at an MRS based on the chemical warfare-related activities that occurred at the MRS. An MRS formerly used as a range that supported live-fire testing or training with munitions that contained a CA fill is considered to pose a greater potential risk than an MRS where CWM was only stored or transferred.

Data Element Classifications:

The following 11 classifications, as shown in Figure 6.11, are found within the Sources of CWM Data Element. **Former ranges** are ranges for which a formal decision has been made to close the range or that have been put to a use that is incompatible with continued use as a military range. Former ranges may be found on active installations, installations impacted by BRAC decisions, FUDS, and other property released from DoD control.

Figure 6.11 Sources of CWM Data Element Classifications

Table 12 CHE Module: Sources of CWM Data Element Table

Classification	Score
Live-fire involving CWM	10
Damaged CWM/DMM surface or subsurface	10
Undamaged CWM/DMM surface	10
CAIS/DMM surface	10
Undamaged CWM/DMM subsurface	5
CAIS/DMM subsurface	5
Former CA or CWM Production Facilities	3
Former Research, Development, Testing, and Evaluation (RDT&E) facility using CWM	3
Former Training Facility using CWM or CAIS	2
Former Storage or Transfer points of CWM	1
Evidence of no CWM	0

Tips and Tricks

CAIS/DMM means CAIS, other than CAIS K941 and K942.

Definitions
(See Appendix C)

Physical evidence

Historical evidence

Former range

Classification Distinctions:

The *live-fire involving CWM*, *damaged* ***CWM/DMM surface*** *or* ***subsurface***, *undamaged CWM/DMM surface*, and ***CAIS/DMM*** *surface* classifications all receive the highest score.

The *live-fire involving CWM* classification receives a higher hazard score because it includes ranges that supported live-fire training or testing of explosively configured CWM and may have **CWM/UXO** on the surface or in the subsurface. These ranges also include ranges that supported live-fire training or testing with conventional munitions and that may have CWM/DMM commingled with conventional munitions that are UXO.

The *damaged CWM/DMM surface or subsurface* classification also receives a high hazard score because it characterizes damaged CWM. CWM/DMM indicates that the actual condition of the CWM/DMM is not known, and the potential for an unintentional detonation resulting in dispersal of CA or an unintentional release of CA to the environment is more likely to occur.

The *undamaged CWM/DMM surface* and the *CAIS/DMM surface* classifications receive high hazard scores because they characterize CWM that is easily accessible. CWM/DMM or CAIS/DMM that is entirely or partially exposed above the ground surface or a water body is more likely to be encountered; therefore, they pose a greater potential hazard to receptors.

If an investigation at the MRS reveals that there is physical or historical evidence to indicate that no CWM is present, a classification of *evidence of no CWM* is assigned.

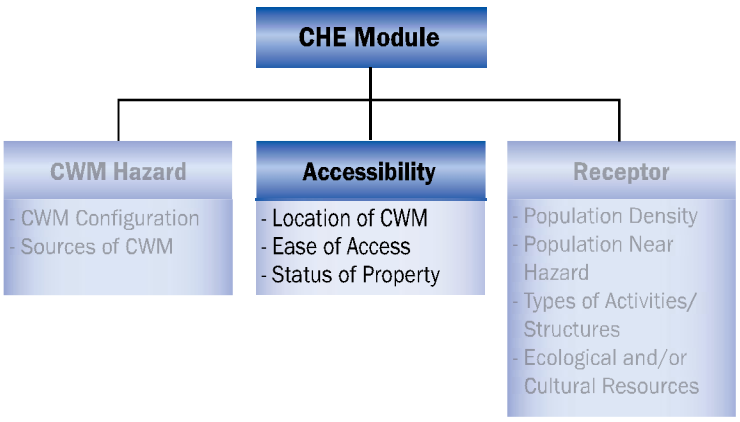
Tips and Tricks

Use of tear gas or other riot control agents at former training facilities are not evaluated by the CWM Module.

Accessibility Factor

The Accessibility Factor focuses on the potential for receptors to encounter CWM that may be present at an MRS. To capture accessibility, this factor is comprised of the **Location of CWM**, **Ease of Access**, and **Status of Property** Data Elements as shown in Figure 6.12. The Accessibility Factor for the CHE Module is similar to the Accessibility Factor used in the EHE Module and constitutes up to 40 points of the total CHE Module score.

Figure 6.12 CHE Module Structure, Highlighting the Accessibility Factor



Definitions
(See Appendix C)

CWM/DMM
Surface
Subsurface
CAIS/DMM
CWM/UXO
Location of CWM
Ease of Access
Status of Property

Location of CWM

Data Element:

The Location of CWM Data Element evaluates three conditions that characterize the potential for encountering CWM. The three conditions are:

- Whether the presence of CWM is confirmed or suspected;
- The proximity of CWM to the surface; and
- The potential for CWM to be brought to the surface.

Data Element Classifications:

The following seven classifications, shown in Figure 6.13, characterize the scenarios in which CWM are likely to be found.

Figure 6.13 Location of CWM Data Element Classifications

Table 13 CHE Module: Location of CWM Data Element Table

Classification	Score
Confirmed surface	25
Confirmed subsurface, active	20
Confirmed subsurface, stable	15
Suspected (physical evidence)	10
Suspected (historical evidence)	5
Subsurface, physical constraint	2
Evidence of no CWM	0

Classification Distinctions:

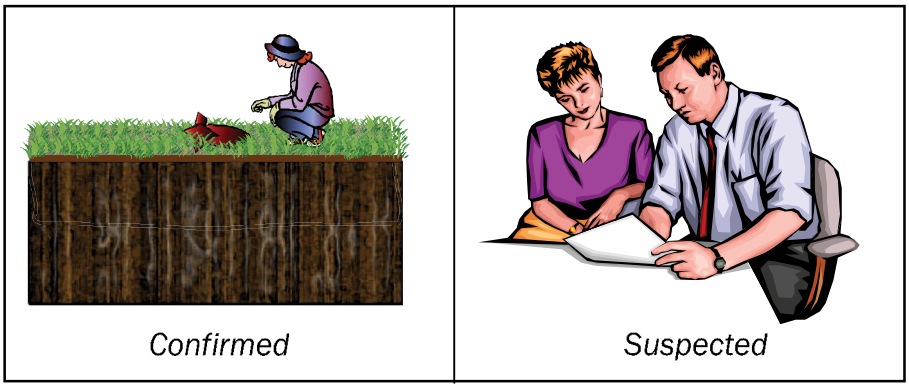
An MRS evaluated under the CHE Module is known or suspected to contain CWM. The presence of CWM can be confirmed by physical or historical evidence and poses a greater potential hazard than an MRS where CWM is only suspected.

- **Confirmed**: The presence of CWM can be established based on physical or historical evidence of CWM (e.g., physical presence of CWM, historical firing records).
- **Suspected**: The presence of CWM is likely based on physical or historical evidence of CWM (e.g., CWM debris, anecdotal information).

Definitions
(See Appendix C)

Confirmed
Suspected

Figure 6.14 Confirmed and Suspected CWM



Encountering CWM is often based on its proximity to the surface. CWM directly exposed at the surface pose the greatest potential CA hazard because no barrier obstructs contact with potential receptors. The CWM hazard is greater for CWM on the surface than in the subsurface.

- Surface: CWM is considered on the surface when it is entirely or partially exposed above the ground surface or above the surface of a water body at any time.

- Subsurface: CWM is considered in the subsurface when it is entirely beneath the ground surface or is submerged below the surface of a water body at all times.

Tips and Tricks

CWM, regardless of configuration, that is exposed at any time as a result of tidal activity is considered on the surface.

While subsurface CWM may pose less of a CA hazard, the potential for subsurface CWM to be brought to the surface by dynamic conditions increases the potential hazard at an MRS. Dynamic conditions are characterized as either active or stable, with active conditions being more likely to bring subsurface CWM to the surface.

- **Active**: Conditions are "active" when the MRS's geological conditions are likely to cause CWM to be exposed in the future by naturally occurring phenomena (e.g., drought, flooding, frost heave and tidal action); or intrusive activities (e.g., plowing, construction, dredging).

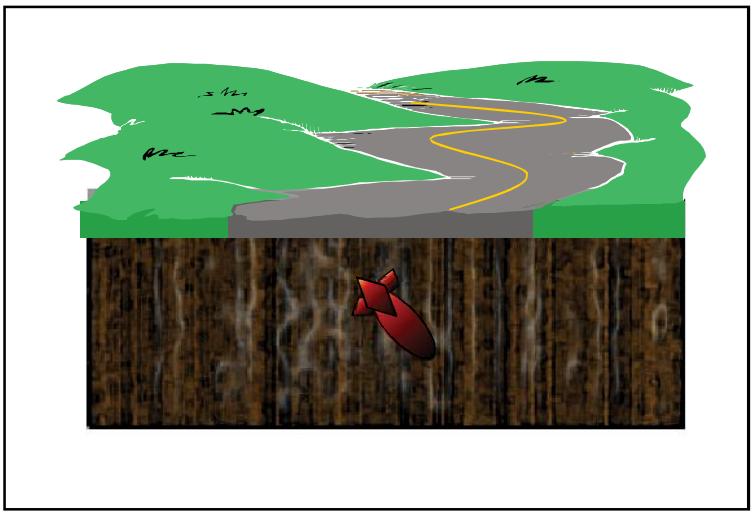
- **Stable**: Conditions are "stable" when the MRS's geological conditions are not likely to cause CWM to be exposed in the future by naturally occurring phenomena or intrusive activities.

Other conditions at an MRS may prevent even dynamic conditions from bringing subsurface CWM to the surface. As shown in Figure 6.15, a **physical constraint** (e.g., pavement or water depth in excess of 120 feet) prevents encounters with any CWM present.

Definitions
(See Appendix C)

Active condition
Stable condition
Physical constraint

Figure 6.15 Example of a Physical Constraint



The *confirmed surface* classification characterizes CWM above the ground surface and is appropriate when it is entirely or partially exposed above the ground surface or above the surface of a water body. Assignment of this classification requires physical or historical evidence. If CWM were found on the surface during an investigation, the MRS would be classified as *confirmed surface*.

If an investigation confirms that there are subsurface CWM and no dynamic activity, such as flooding or dredging, that may expose the CWM, the *confirmed subsurface*, *stable* classification is appropriate.

Tips and Tricks

Future changes in physical constraints or land use at an MRS require reapplication of the Protocol.

Physical constraints can be anything that prevents subsurface CWM from becoming exposed to the surface. For example, CWM at a water depth of 120 feet is classified as *subsurface*, *physical constraint*. DoD selected water in excess of 120 feet as a physical constraint because of the limited time (less than 15 minutes) normally allowed to scuba divers at this depth, the considerable effort needed to dive to and below this depth, and the dangers associated with such deep dives for novice scuba divers.

Similar to the data elements in the CWM Hazard Factor, the *evidence of no CWM* classification should only be used when an MRS initially suspected or known to contain CWM has subsequently been investigated, and physical or historical evidence indicates that CWM is not present.

Ease of Access

Data Element:

The Ease of Access Data Element focuses on the means for a human receptor to encounter CWM based on the extent of controls preventing access to the MRS. Both natural obstacles such as dense vegetation, rugged terrain, or deep water; and man-made controls, such as fencing, are considered.

Data Element Classifications:

The four classifications within this data element are listed in Figure 6.16. These classifications describe all possible controls that may be present to prevent access to an MRS.

Figure 6.16 Ease of Access Data Element Classifications

Table 14 CHE Module: Ease of Access Data Element Table	
Classification	**Score**
No barrier	10
Barrier to MRS access is incomplete	8
Barrier to MRS access is complete but not monitored	5
Barrier to MRS access is complete and monitored	0

Classification Distinctions:

Ease of access to an MRS is determined by controls restricting access to an MRS. Access can be determined by the presence of one or more of the factors listed below.

- A **barrier** is a natural obstacle (e.g., difficult terrain, dense vegetation, deep or fast moving water), a man-made obstacle (e.g., fencing), or a combination of natural and man-made obstacles.

- **Monitoring** is used to systematically track access to an MRS and may be conducted by humans, electronic components, or a combination of both.

An MRS is classified as *no barrier* when all parts of the MRS are accessible. If some parts of an MRS are not accessible, then the *barrier to MRS access is incomplete* classification is the most appropriate. If a barrier prevents access to the entire MRS, but there is no formal monitoring system in place, then the *barrier to MRS access is complete but not monitored* classification should be chosen. The *barrier to MRS access is complete and monitored* classification should be chosen only if there is active, continual surveillance of the site and access to all parts of the MRS is prevented.

Both barriers and monitoring decrease the likelihood of encountering CWM and therefore, decrease the CWM hazard. Conditions within this data element can be difficult to capture especially for a large MRS and areas that have not been characterized with varying MRS conditions (e.g., short grass and dense swamp). The MRS Project Team should use judgement when making a final determination as to which natural or man-made features at an MRS are barriers.

Tips and Tricks

For deep-water barriers, evaluate the effectiveness of the barrier in preventing access to all parts of the MRS to select the appropriate classification.

Definitions
(See Appendix C)

Barrier

Monitoring

Status of Property

Data Element:

The last data element in the Accessibility Factor is the Status of Property Data Element. This data element differentiates between an MRS that is currently under DoD's control and an MRS that has been transferred out of DoD control. ***DoD control*** means the land and water on the MRS are currently owned, leased, or otherwise possessed or used by DoD. While all property subject to the Protocol must have been owned by, leased to, or otherwise possessed or used by DoD, current ownership may have changed. When an MRS is under DoD control access to CWM is less likely; therefore, the CA hazard to the public is reduced.

Data Element Classifications:

The three classifications in Figure 6.17 list all possible scenarios for DoD's ownership role of an MRS.

Figure 6.17 Status of Property Data Element Classifications

Table 15 CHE Module: Status of Property Data Element Table

Classification	Score
Non-DoD control	5
Scheduled for transfer from DoD Control	3
DoD control	0

Tips and Tricks

To be considered under DoD control, DoD must control the property for 24 hours a day, every day of the calendar year.

Classification Distinctions:

The *non-DoD control* classification includes privately owned land or water bodies; land or water bodies owned or controlled by state, tribal, or local governments; and land or water bodies managed by other federal agencies. If property is scheduled to be transferred from DoD control within three years from when the Protocol is applied, it is included in the *scheduled for transfer from DoD control* classification. The *DoD control* classification is used when the MRS is currently owned, leased, or otherwise possessed by DoD. FUDS properties are not considered under DoD control for purposes of this data element.

Definitions
(See Appendix C)

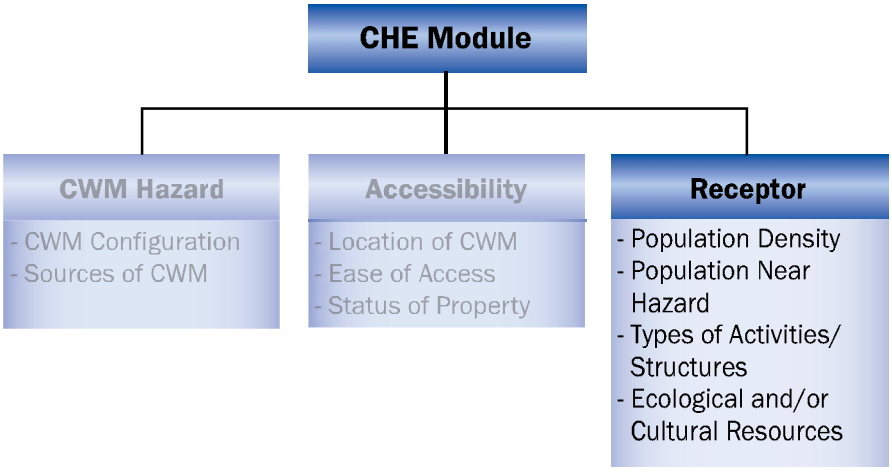
DoD control
Population Density
Population Near Hazard

Receptor Factor

Similar to the EHE Module, the Receptor Factor focuses on the human and ecological populations that may be impacted by the presence of CWM. It is composed of four data elements: **Population Density**, **Population Near Hazard**,

Types of Activities/Structures, and **Ecological and/or Cultural Resources**, as shown in Figure 6.18. The Receptor Factor constitutes 20 points of the CHE Module Total.

Figure 6.18 CHE Module Structure, Highlighting the Receptor Factor



Tips and Tricks

The Receptor Factor Value is identical in the EHE and CHE Modules. If the MRS Project Team has already completed one module, the information recorded for the Receptor Factor can be used to complete the other module *unless* new information is available.

Population Density

Data Element:

The Population Density Data Element assesses the number of people that could be exposed to CWM. This data element accounts for both on-site and off-site populations. While access is a prerequisite for an on-site population, the effects of an event (e.g., an explosion or CA release) at an MRS may affect populations that are not on-site; therefore, the more people who surround an MRS, the higher the overall CWM hazard. This is one of the reasons that several of the data elements in the Receptor Factor include a radius extending two miles from the perimeter of the MRS.

Data Element Classifications:

This data element assesses permanent resident populations both on the MRS and in the surrounding area, based on the number of people per square mile in the county or nearby city, using US Census Bureau statistics. There are three classifications under this data element, showing the number of persons per square mile as shown in Figure 6.19.

Reference

US Census Bureau:
www.census.gov

Definitions
(See Appendix C)

Types of Activities/ Structures

Ecological and/or Cultural Resources

Figure 6.19 Population Density Data Element Classifications

Table 16 CHE Module: Population Density Data Element Table	
Classification	**Score**
> 500 persons per square mile	5
100 to 500 persons per square mile	3
< 100 persons per square mile	1

Classification Distinctions:

This data element captures the number of people who may be injured by a CA hazard. To determine the population that may be in harms way, this data element captures the number of people per square mile from US Census Bureau statistics. This data element is designed to capture the maximum number of people who have the potential to be injured by CWM so it is designed to use the largest US Census Bureau statistic available. Therefore, if the MRS is located in more than one county, the largest population value from the counties should be used. County population is often used for this data element because it is more consistently available for all MRSs, especially those in rural or remote locations. Where an MRS is located within or borders the city limit, use the larger population density, either city or county. DoD based these data element classifications and scores on risk appropriate distribution among the test sites.

Tips and Tricks

The MRS Project Team should rely on local knowledge to determine the most appropriate US Census tract data.

Population Near Hazard

Data Element:

The Population Near Hazard Data Element addresses the number of **inhabited structures** on the MRS and within a *two-mile* radius of the MRS boundary. Inhabited structures do not require permanent residents since this classification includes both permanent and temporary structures (other than DoD munitions-related structures) that are routinely occupied by one or more persons for any portion of a day. This data element focuses on the population (through number of structures) within a two-mile range that could be impacted by a release of CA or an unintentional explosion. Because the Population Near Hazard Data Element classifications consider routine occupation of structures, not just residential populations, they consider transient (such as seasonal) as well as permanent populations. For example, campgrounds or parks do not have any permanent populations, but the likelihood of receptors being present at these sites is captured in this data element.

Definitions
(See Appendix C)

Inhabited structures

Data Element Classifications:

This data element contains six classifications shown in Figure 6.20. The classifications are based on the number of inhabited structures on or within a two-mile radius of the MRS.

Figure 6.20 Population Near Hazard Data Element Classifications

Table 17 CHE Module: Population Near Hazard Data Element Table	
Classification	**Score**
26 or more inhabited structures	5
16 to 25 inhabited structures	4
11 to 15 inhabited structures	3
6 to 10 inhabited structures	2
1 to 5 inhabited structures	1
0 inhabited structures	0

Classification Distinctions:

Each of these classifications describes the number of inhabited structures on or within two miles of the MRS. Larger numbers of inhabited structures on or nearby an MRS present the greater potential for risk to human health from CWM and as a result have a higher hazard score. The distribution among the number of structures and their associated scores is based on the outcome of a series of stakeholder meetings and testing of the Protocol model. Like the Population Density Data Element, the data element classifications and scores in the Population Near Hazard Data Element provided the most appropriate distribution among sites tested in Protocol development.

Types of Activities/Structures

Data Element:

The Types of Activities/Structures Data Element addresses the amount, type, and intrusiveness of activities, as well as the likelihood of people congregating on the MRS and within a *two-mile* radius of the MRS. This data element was not developed to give undue weight to high-population areas, but to assess certain activities increasing the likelihood of encountering CWM. The more intensive the types of activities or structures on or surrounding an MRS, the higher the CWM hazard risk.

Data Element Classifications:

This data element contains five classifications, as shown in Figure 6.21. Classifications are distinguished by the likelihood of receptors to encounter CWM.

Figure 6.21 Types of Activities/Structures Data Element Classifications

Table 18 CHE Module:
Types of Activities/Structures Data Element Table

Classification	Score
Residential, educational, commercial, or subsistence	5
Parks and recreational areas	4
Agricultural, forestry	3
Industrial or warehousing	2
No known or recurring activities	1

Classification Distinctions:

This data element accounts for the types of activities occurring on or within two miles of an MRS and the potential for those activities to allow a receptor to encounter CWM. The ***residential***, ***educational***, ***commercial***, *or* ***subsistence*** classification and ***parks and recreational areas*** classification carry the most weight to reflect the types of activities and population that may be in their vicinity. The *residential, educational, commercial, or subsistence* classification applies to situations where activities are conducted, or inhabited structures are located within or up to *two miles* from the MRS's boundary, and are associated with any of the following purposes: residential; educational; childcare; critical assets (e.g., hospitals, fire and rescue, police stations, dams); hotels; commercial; shopping centers; playgrounds; community gathering areas; religious sites; or sites used for subsistence hunting, fishing, and gathering. These high density activities are likely to allow the greatest number of receptors to encounter any CWM present on the MRS.

Definitions
(See Appendix C)

- Residential
- Educational
- Commercial
- Subsistence
- Parks and recreational areas
- Agriculture
- Forestry
- Industrial
- Warehousing

The greatest weight is given to activities and structures involving the most people. Therefore, the ***agricultural***, ***forestry*** classification and the ***industrial*** *or* ***warehousing*** classification carry less weight on the overall score. While agricultural or forestry activities penetrate the ground surface, the exposed population is typically smaller than commercial, residential, or recreational areas, resulting in a decreased CWM hazard. The scores given to all classifications reflect a balance between activity intrusiveness and the potential population that could be exposed to a hazard.

While the Population Density Data Element only considers permanent populations, the Types of Activities/Structures Data Element accounts for

transient populations. By considering both activities not requiring structures and structures that may only be occasionally occupied, transient populations are captured.

Ecological and/or Cultural Resources

Data Element:

The Ecological and/or Cultural Resources Data Element accounts for risks to **threatened and endangered species**, **critical habitats**, historical sites, cultural items, and **American Indian and Alaska Native** sacred sites on the MRS.

References

Threatened and Endangered Species List: www.fws.gov/endangered/wildlife.html

Data Element Classifications:

As shown in Figure 6.22, this data element contains four classifications and the greatest weight is awarded to MRSs with both cultural and natural resources.

Figure 6.22 Ecological and/or Cultural Resources Data Element Classifications

Table 19 CHE Module: Ecological and/or Cultural Resources Data Element Table

Classification	Score
Ecological and cultural resources present	5
Ecological resources present	3
Cultural resources present	3
No ecological and cultural resources present	0

Classification Distinctions:

The Ecological and/or Cultural Resources Data Element considers threatened and endangered species, critical habitats, historical sites, cultural items, American Indian and Alaska Native sacred sites, and other similar resources on the MRS.

- **Ecological resource**: means that (1) a threatened or endangered species as designated under the *ESA* is present on the MRS (this does not include state-listed species); or (2) the MRS is designated under the *ESA* as critical habitat for a threatened or endangered species; or (3) there are identified sensitive ecosystems such as wetlands or breeding grounds present on the MRS.

Definitions (See Appendix C)

Threatened and endangered species

Critical habitats

American Indian and Alaska Native Tribes

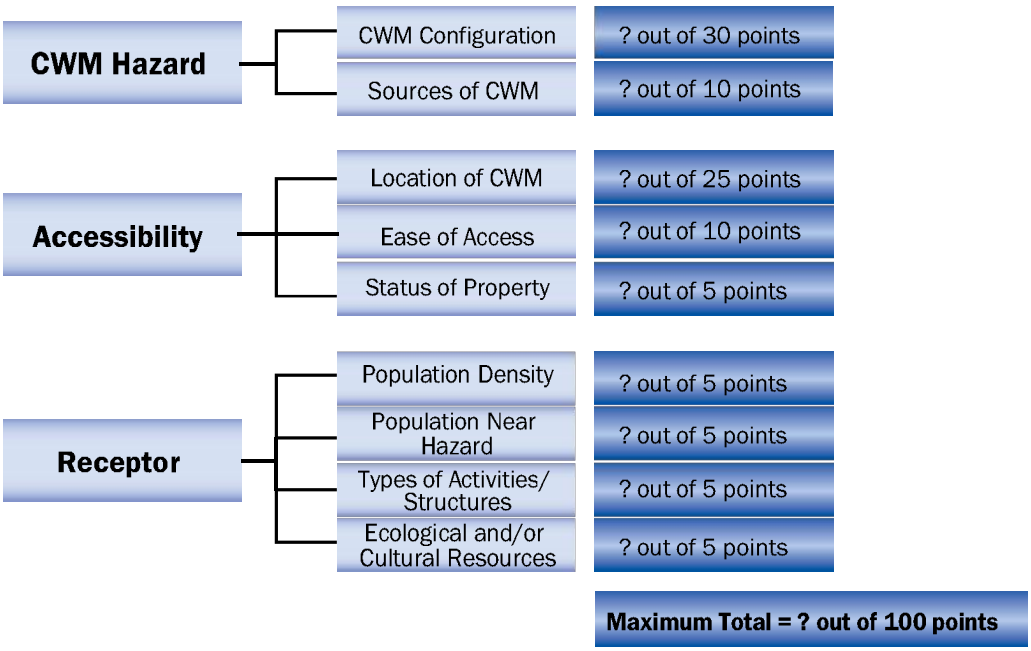
Ecological resources

- **Cultural resource:** means there are recognized cultural, traditional, spiritual, religious, or historical features (e.g., structures, artifacts, symbolism) on the MRS. Requirements for determining whether a particular feature is a cultural resource are found in the *National Historic Preservation Act*, *Native American Graves Protection and Repatriation Act*, *Archeological Resources Protection Act*, *Executive Order 13007*, and the *American Indian Religious Freedom Act*. For example, American Indians or Alaska Natives deem an MRS to be of religious significance or to be used for subsistence activities, such as hunting or fishing.

DETERMINING THE CHE MODULE RATING

As described in Chapter 4, the nine data element scores are used to derive the three factor values. The highest data element score from each of the nine CHE data elements are recorded on Table 20 and summed to determine their associated CHE Factor values as shown in Figure 6.23. The factor values are then summed. The factor sum is the overall CHE Module Total (between 0 and 100 points). The MRS Project Team then uses the CHE Module Total to choose the appropriate CHE Module Rating.

Figure 6.23 CHE Module Data Element Scoring



The letter rating (A though G) reflects the CA hazard potential from CWM at the MRS. The rating is comprised of either a letter rating or an alternative module rating. As shown in Figure 6.24, the CHE Module Rating will be evaluated with the other hazard module ratings and used to determine a relative priority.

Definitions
(See Appendix C)
Cultural resources

As mentioned above, an alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when information needed to score one or more data elements is not readily available, contamination at an MRS was previously addressed, or there is no reason to suspect CWM was ever present at the MRS. The three alternative module ratings are:

- *Evaluation Pending*. This alternative module rating is used when CWM is known or suspected at an MRS, but sufficient information is not available to determine the MRS's CHE Module Rating.

- *No Longer Required*. This alternative module rating is used when an MRS no longer requires an assigned priority because DoD has conducted a response, all objectives set out in the decision document for the MRS have been achieved, and no further action, except for long-term management and recurring reviews, is required.

- *No Known or Suspected CWM Hazard*. This alternative module rating is used for an MRS that does not require evaluation under the CHE Module because there is no known or suspected CWM hazard.

The Protocol is created as a tool to determine an MRS's relative priority. The priority assigned to an MRS does not directly impact the design of the required munitions response. All MRSs known or suspected to contain UXO, DMM, or MC will be thoroughly investigated and, if required by MRS-specific conditions, the hazards determined to be present will be addressed through an appropriate response.

Tips and Tricks

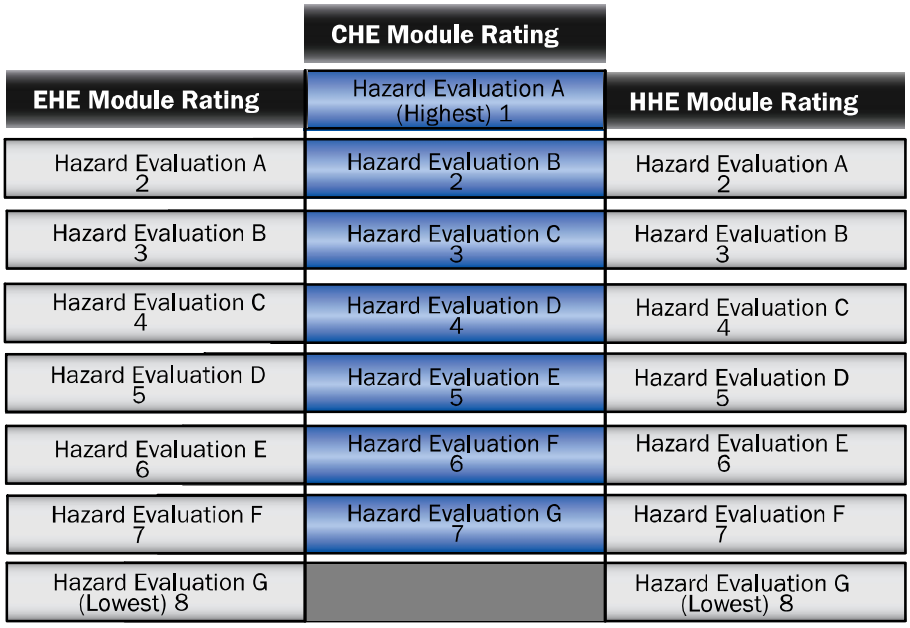
The MRS Project Team needs to agree the sufficiency of the data.

SUMMARY

The CHE Module is used to evaluate the potential CA hazards posed by CWM. The CHE Module determines the CWM hazard through evaluation of three general factors, each of which is comprised of between two and four specific data elements.

Based on MRS-specific information, each data element is assigned a numerical score. In aggregate, these scores characterize the CA hazard at an MRS. CA can cause physiological effects and MRSs containing CWM pose a unique hazard. To address this hazard, only MRSs with CWM can be assigned Priority 1 and no MRS with CWM can be assigned Priority 8, as shown in Figure 6.24.

Figure 6.24 MRS Prioritization Framework



Chapter 7: Health Hazard Evaluation Module

The Protocol considers the potential for explosive, CWM, and environmental hazards (i.e., **MC** and any incidental nonmunitions-related contaminants) to be present at an MRS. Because of the inherent differences among each type of hazard, each module addresses one hazard area as depicted in Figure 7.1. This chapter provides an overview of the **HHE Module**. The HHE Module is used to evaluate the potential human health (both acute and chronic) and environmental hazards posed by MC and any incidental nonmunitions-related contaminants. The HHE Module structure and scoring method differ from the EHE and CHE Modules. This chapter describes the structure of the HHE Module, the four environmental media evaluated in this module, and their associated factors, and provides instructions for using MRS-specific data to determine the factor values, media ratings, and HHE Module Rating.

Tips and Tricks

The HHE Module is not a CERCLA risk assessment nor is it to be used to select remedies or plan munitions response actions.

Figure 7.1 Hazard Evaluation Modules

Module	Hazard
EHE Module	Explosive Hazards
CHE Module	Chemical Warfare Materiel Hazards
HHE Module	Health and Environmental Hazards

OVERVIEW OF THE HHE MODULE

References

Relative Risk Site Evaluation Primer: www.denix.osd.mil/denix/Public/Library/Cleanup/CleanupOfc/Documents/Cleanup/relrisk_relrisk.html

The HHE Module provides a consistent DoD-wide approach for evaluating the relative risk to human health and the environment potentially posed by MC and any incidental nonmunitions-related contaminants. The HHE Module builds on the **RRSE** framework used in the IRP, but it has been modified for consistency with the EHE and CHE Modules and to address MC-related concerns potentially present at an MRS. DoD chose to apply the RRSE framework to evaluate the potential chronic health and environmental effects of MC at an MRS because of its successful implementation at IRP sites. Using the same framework to evaluate IRP sites and MRSs ensures consistency in the approach taken to evaluate potential chronic health and environmental effects of contaminants released into the environment. Because the HHE Module builds on the RRSE, text from the *Relative Risk Site Evaluation Primer* (Revised Edition, Summer 1997) is used throughout this chapter to provide directions on evaluating environmental media and their factors.

Definitions
(See Appendix C)

Munitions constituents (MC)

Health Hazard Evaluation (HHE) Module

Relative Risk Site Evaluation (RRSE)

Contaminant Hazard Factor

Migration Pathway Factor

Receptor Factor

Similar to the EHE and CHE Modules, the HHE Module has a three-factor structure that limits the influence of any one factor on the HHE Module Rating. However, the three factors—the **Contaminant Hazard Factor**, **Migration Pathway Factor**, and **Receptor Factor**—differ from the EHE and CHE factors. The Contaminant Hazard Factor assesses the potential hazards to receptors

from MC and any incidental nonmunitions-related contaminants. The Migration Pathway Factor evaluates the potential for contaminant migration from the MRS to other areas, while the Receptor Factor assesses the presence of receptors to potentially become exposed to or come in contact with MRS-related contamination from MC and any incidental nonmunitions-related contaminants. Figure 7.2 summarizes the three factors evaluated under the HHE Module.

Figure 7.2 HHE Factor Structure

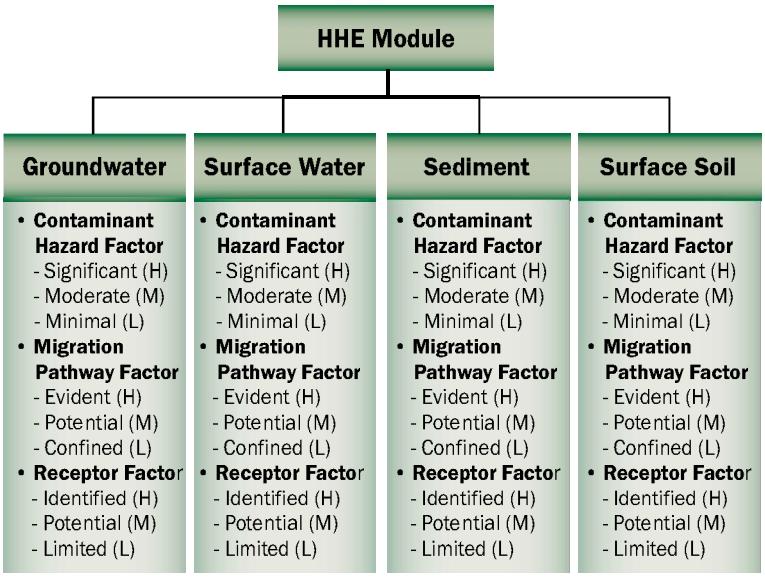
Subject Evaluated	Factor Name
The potential hazards to receptors from MC and any incidental nonmunitions-related contaminants	Contaminant Hazard Factor
The potential for contaminant migration from the MRS	Migration Pathway Factor
The presence of receptors to potentially come in contact with MRS-related contamination	Receptor Factor

In the HHE Module, the evaluation of MRS information uses three factors and four environmental media, along with their exposure endpoints (human and ecological). The three factors are used to evaluate four distinct environmental media: **groundwater**, **surface water**, **sediment**, and **surface soil**. The HHE Module evaluates:

- Human receptors for groundwater and surface soils.
- Human and ecological receptors for surface water and sediments.

Figure 7.3 depicts the media, factors, and classifications specific to the HHE Module.

Figure 7.3 HHE Module Structure



Definitions
(See Appendix C)

Groundwater
Surface water
Sediment
Surface soil

Environmental Media

Definitions for the four distinct environmental media (groundwater, surface water, sediment, and surface soil) and their associated receptors are found in Figure 7.4.

Air is not evaluated as an inhalation pathway in either the HHE Module or the RRSE framework because the risk through this pathway from MRSs without soil contamination is generally minimal, and the **Preliminary Remediation Goals (PRGs)** for contaminated soils consider inhalation of volatiles and contaminated particles.

References

Preliminary Remediation Goals: www.epa.gov/region09/waste/sfund/prg/

Figure 7.4 Environmental Media and Receptors Defined

	Definition	Human Receptors	Ecological Receptors
Groundwater	Groundwater is precipitation or water from surface water bodies (e.g., lakes or streams) that soaks into the soil/bedrock and is stored underground	Individuals that may be exposed to contamination via on-site and downgradient water supply wells	Not evaluated
Surface Water	Surface water is precipitation that collects in surface water bodies (e.g., lakes or streams) or groundwater that discharges to the surface from springs	Individuals that may be exposed to contamination via on-site and downgradient water supplies and recreational areas	Critical habitats and other habitats found in Figure 7.14 of this chapter
Sediment	Sediment is formed from the deposition of solid material that includes the clays and silts on the bottom of a water body (e.g., ocean, lake, or stream)		
Surface Soil	Surface soil is the layer of soil on the surface (with a depth of 0 to 6 inches)	Residents, people in schools and daycare, and workers who have direct access to contamination frequently	Not evaluated

Groundwater

Groundwater is precipitation or water from surface water bodies that soaks into the soil/bedrock and is stored underground. Human receptors of groundwater include those individuals that may be exposed to groundwater contamination via on-site and downgradient water supply wells used for human consumption or in food production. Ecological receptors are not evaluated for this media.

Definitions (See Appendix C)

Preliminary Remediation Goals (PRGs)

Surface Water and Sediment

For the purposes of evaluation under the HHE Module, surface water and sediment may be evaluated together because the contaminants potentially share the same migration pathway. Surface water is precipitation that collects in surface water bodies or groundwater that discharges to the surface water from springs, while sediments are formed from the deposition of solid material that include the clays and silts on the bottom of a water body. Surface water and sediment are evaluated for both their human and ecological receptors. Human receptors for surface water and sediment share the same migration pathway; therefore, those individuals that may be exposed to surface water or sediment contamination through on-site and downgradient water supplies and recreational areas are included. Receptors include downgradient water supplies used for drinking water, irrigation of food crops, watering of livestock, aquaculture, and recreational activities such as fishing.

Surface Soil

Surface soil is the layer of soil on the surface with a depth up to six inches. Human receptors for surface soil include residents, people in schools and daycare, and workers who have direct access to contamination on a frequent basis. Ecological receptors are not considered for evaluation of the surface soil since ecological standards are generally not available. Ecological receptors may be incorporated into the soil evaluation if ecological standards become available.

References

Ecological Risk Assessment Guidance for Superfund: www.epa.gov/superfund/programs/nrd/era.htm

MUNITIONS CONSTITUENTS

References

Munitions Constituents: www.gpo.gov/uscode/title10/title10.html

The HHE Module is intended to evaluate potential health and environmental hazards associated with MC at an MRS. **MC** means any materials originating from UXO, DMM, or other military munitions, including explosive and nonexplosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions. This definition is based on the definition of "munitions constituents" in 10 USC 2710(e)(3).

The HHE Module also evaluates potential health and environmental hazards associated with any incidental nonmunitions-related contaminants present at an MRS. Although the RRSE typically addresses environmental contaminants, the DoD workgroup that developed the Protocol believed it beneficial to allow such incidental contaminants to be evaluated under the HHE Module. The intent was to ensure, when possible, that the munitions response implemented at an MRS provided land that was suitable for its current, determined, or reasonably anticipated end use.

There are also programmatic benefits realized by addressing any incidental nonmunitions-related contaminants present at an MRS during a munitions response. These include, but are not limited to, the cost avoidances provided by a single munitions response and development of good will with the community or property owner.

Definitions
(See Appendix C)

Munitions constituents (MC)

GENERAL SCORING PROCEDURES

The HHE Module's scoring method is different from that of the EHE and CHE Modules. A table has been developed for each environmental medium to evaluate the conditions at an MRS. Figure 7.5 is an example table from the HHE Module. Human and ecological receptors are evaluated on separate tables for surface water and sediment. All tables can be found in Appendix A.

References

All tables can be found in Appendix A.

Figure 7.5 Example Table from the HHE Module

Table 21
HHE Module: Groundwater Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's groundwater and their **comparison values** (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the contaminant **ratios** together, including any additional groundwater contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard present in the groundwater, select the box at the bottom of the table.

Contaminant	Maximum Concentration (µg/L)	Comparison Value (µg/L)	Ratios

CHF Scale	CHF Value	Sum The Ratios	
CHF > 100	H (High)	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	M (Medium)		
2 > CHF	L (Low)		
CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).		

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the groundwater migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the groundwater is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in groundwater has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the groundwater to a potential point of exposure (possibly due to the presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the groundwater receptors at the MRS.

Classification	Description	Value
Identified	There is a threatened water supply well downgradient of the source and the groundwater is a current source of drinking water or source of water for other beneficial uses such as irrigation/agriculture (equivalent to Class I or IIA aquifer).	H
Potential	There is no threatened water supply well downgradient of the source and the groundwater is currently or potentially usable for drinking water, irrigation, or agriculture (equivalent to Class I, IIA, or IIB aquifer).	M
Limited	There is no potentially threatened water supply well downgradient of the source and the groundwater is not considered a potential source of drinking water and is of limited beneficial use (equivalent to Class IIIA or IIIB aquifer, or where perched aquifer exists only).	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

No Known or Suspected Groundwater MC Hazard ☐

For each medium, three factors (Contaminant Hazard Factor, Migration Pathway Factor, and Receptor Factor) are used to evaluate the potential risks posed by specific concentrations of MC or incidental nonmunitions-related contaminants

at an MRS, the likelihood of migration through a medium, and the receptors that potentially encounter the hazards at the MRS.

The factors in the HHE Module do not receive a numerical score. Instead, each factor has three classifications (e.g., *Evident*, *Potential*, or *Confined* for the Migration Pathway Factor) with corresponding values (i.e., High [H], Medium [M], or Low [L]) that are based on MRS-specific data for a given medium. Figure 7.6 shows the classifications and values for the three factors. The MRS Project Team determines the best classification for the factor and assigns a value (H, M, or L) for that factor based on the provided descriptions.

Figure 7.6 HHE Factor Classifications and Values

Contaminant Hazard Factor		Migration Pathway Factor		Receptor Factor	
Significant	High (H)	*Evident*	High (H)	*Identified*	High (H)
Moderate	Medium (M)	*Potential*	Medium (M)	*Potential*	Medium (M)
Minimal	Low (L)	*Confined*	Low (L)	*Limited*	Low (L)

For each medium (groundwater, surface water, sediment, and surface soil) and its specific receptor endpoint (e.g., human/ecological receptors), the MRS Project Team will group the three factor values into a three-letter combination, such that the combination is ranked from highest to the lowest. Examples of three-letter combinations include HLL, HHM, and MLL. The environmental media are assigned a single letter media rating (i.e., A - G) based on their associated three-letter combinations. The highest media rating (A is highest; G is lowest) becomes the HHE Module Rating. When an MRS cannot be characterized by a letter rating, the MRS may be assigned one of three alternative module ratings: **Evaluation Pending**, **No Longer Required**, or **No Known or Suspected MC Hazard**. The HHE Module's tables and scoring procedures are discussed in detail in Chapter 4. Figure 7.7 depicts the process for scoring the HHE Module.

Tips and Tricks

Scoring procedures are found in Chapter 4 of this document.

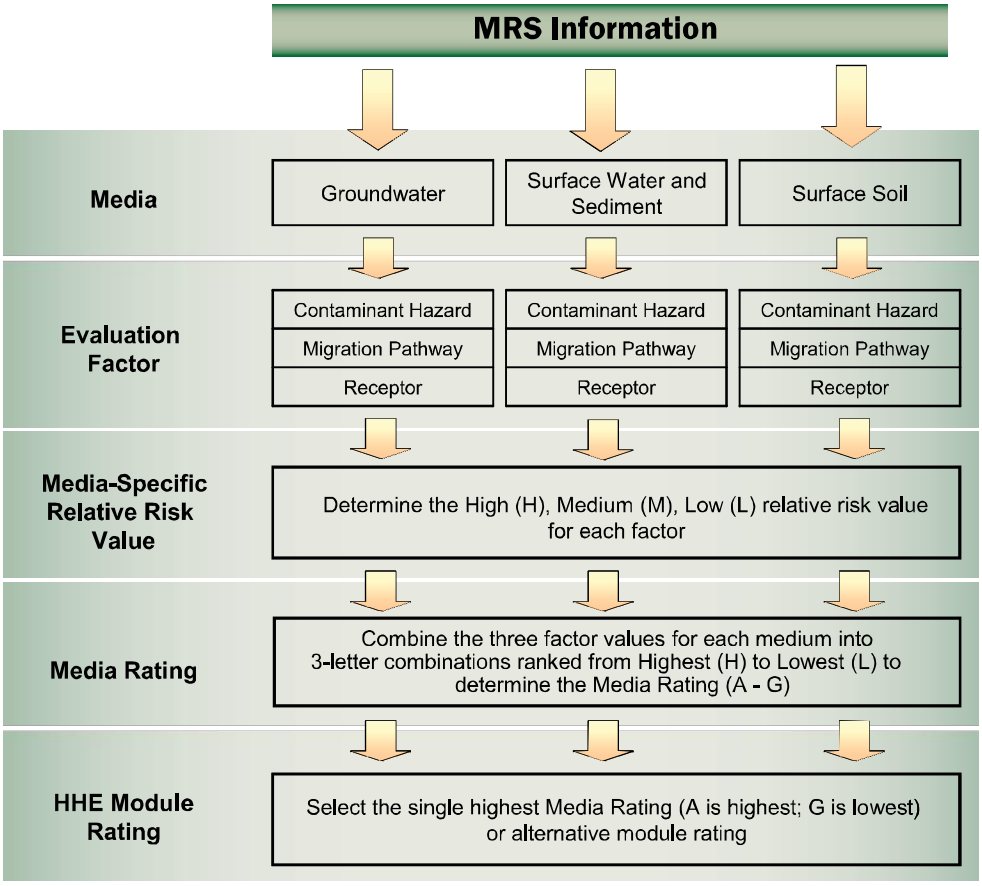
Definitions
(See Appendix C)

Evaluation Pending

No Longer Required

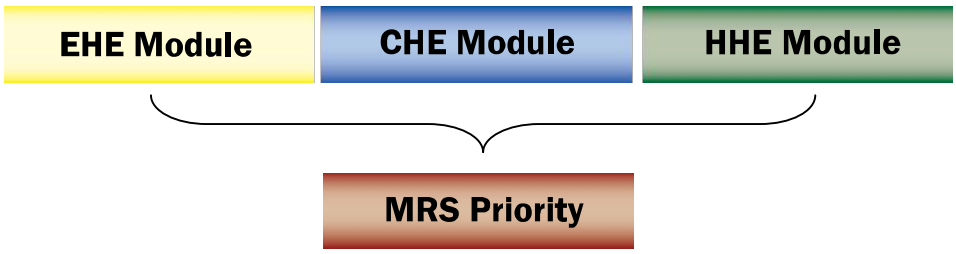
No Known or Suspected MC Hazard

Figure 7.7 HHE Scoring Process



An MRS's ratings from the Protocol's three hazard evaluation modules (EHE, CHE, and HHE) are then evaluated to determine the MRS Priority, as shown in Figure 7.8.

Figure 7.8 General Protocol Structure



Scoring the Contaminant Hazard Factor

The Contaminant Hazard Factor is evaluated differently than any other factor in the Protocol. The Contaminant Hazard Factor evaluates the potential hazards to receptors from MC and any incidental nonmunitions-related contaminants in the four distinct environmental media. Specific instructions on how to calculate the Contaminant Hazard Factor are found below. Information on how to complete the tables with MRS-specific information is found in Chapter 4.

The Contaminant Hazard Factor is based on the ratio of the maximum concentration of a contaminant detected in an environmental medium to a risk-based comparison value for that contaminant in that medium. Detected contamination must be attributed to the MRS. First, the MRS Project Team should list the contaminants and their maximum concentrations for each medium on its corresponding media table. If there are more than five contaminants, the additional contaminants and concentrations should be listed on the supplemental Table 27, shown in Figure 7.9.

Tips and Tricks

Naturally occurring compounds that are detected within established background concentration ranges are not included.

Figure 7.9 Supplemental Contaminant Hazard Factor Table

Table 27

HHE Module: Supplemental Contaminant Hazard Factor Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: **Only use this table if there are more than five contaminants in any given medium present at the MRS.** This is a supplemental table designed to hold information about contaminants that do not fit in the previous tables. Indicate the **media** in which these contaminants are present. Then record **all contaminants**, their **maximum concentrations** and their **comparison values** (from Appendix B of the Primer) in the table below. Calculate and record the **ratio** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** for each medium on the appropriate media-specific tables.

Note: Do not add ratios from different media.

Media	Contaminant	Maximum Concentration	Comparison Value	Ratio

After the MRS Project Team has identified the contaminants of concern, the Team locates the comparison value for each contaminant of concern. The comparison values for the contaminants are found in three tables in Appendix B. Appendices B-1, B-2, and B-3, derived from the *Relative Risk Site Evaluation Primer* (Revised Edition, Summer 1997), have been updated to include and reflect the most current comparison values.

- Appendix B-1 contains comparison values derived from PRGs used by EPA's Region IX and from benchmarks for radionuclides and military-unique compounds used by other organizations. Comparison values in Appendix B-1 are used to evaluate all four media (groundwater, surface water, sediment, and surface soil) for human receptors.

- Appendix B-2 contains ambient water quality criteria developed under Section 304(a) of the Clean Water Act. Comparison values in Appendix B-2 are used to evaluate surface water for ecological receptors.

- Appendix B-3 contains sediment screening values developed in part by EPA's Equilibrium Partitionary Sediment Benchmarks. Comparison values in Appendix B-3 are used to evaluate sediments for ecological receptors.

References

Clean Water Act Section 304(a): www.epa.gov/region5/water/pdf/ecwa_t3.pdf

For the purpose of the Protocol, only contaminants and their associated comparison values listed in Appendix B can be used to calculate the Contaminant Hazard Factor. Naturally occurring compounds that are detected within established background concentration ranges are not included.

The MRS Project Team calculates and records the ratios for each evaluated contaminant by dividing the maximum concentration by the comparison value. The Team determines the Contaminant Hazard Factor by adding the ratios for each medium together, including additional contaminants recorded on Table 27. Based on the sum of the ratios, use the Contaminant Hazard Factor Scale to determine and record the value. The Contaminant Hazard Factor is assigned a classification (and factor value) of ***Significant*** (H), if the sum of the ratios is greater than 100; ***Moderate*** (M), if the sum of the ratios is between 2 and 100; or ***Minimal*** (L), if the sum of the ratios is less than 2. The sum of ratios and their corresponding factor classifications and values are depicted in Figure 7.10.

Figure 7.10 Contaminant Hazard Factor Scale and Values

Contaminant Hazard Factor	
Scale	**Value**
Sum of Ratios > 100	*Significant* (H)
Sum of Ratios 2 - 100	*Moderate* (M)
Sum of Ratios < 2	*Minimal* (L)

Definitions
(See Appendix C)

Significant
Moderate
Minimal

HHE MODULE STRUCTURE

Instructions on how to evaluate each medium's factors are explained in this section. This section is organized by media, with any nuances for the data collection and analysis for the specific medium explained.

Groundwater

Groundwater is precipitation or water from surface water bodies that soaks into the soil/bedrock and is stored underground. Human receptors of groundwater include those individuals that may be exposed to groundwater contamination by an MRS and downgradient water supply wells used for human consumption or in food production. Groundwater contaminant data used in MRS evaluations must be based on groundwater samples affected by the MRS. The sampling location need not be on an MRS, but contamination must be attributable to the MRS. The groundwater sample location (e.g., a well) may be a source of drinking or irrigation water, or it may be a monitoring well. A well that is confirmed to be upgradient from an MRS does not provide suitable data for evaluation. If a well is thought to be influenced by more than one MRS, exercise additional care in selecting any data to be used. Select only contaminants that can reasonably be linked to past practices at the MRS. The classifications for each factor to be evaluated for groundwater are summarized in Figure 7.11. More specific detail on how to score each factor for groundwater is explained below.

Figure 7.11 Groundwater Factor Classifications

Classification and Description for Groundwater			
	High	**Medium**	**Low**
Contaminant Hazard Factor	*Significant* Contaminant Levels – Sum of Ratios > 100	*Moderate* Contaminant Levels – Sum of Ratios 2 – 100	*Minimal* Contaminant Levels – Sum of Ratios < 2
Migration Pathway Factor	*Evident* Migration – Analytical data or observable evidence indicates that contaminatio in the groundwater is present at, moving toward, or has moved to a point of exposure	*Potential* Migration – Contamination in the groundwater has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of *Evident* or *Confined*	*Confined* Migration – Information indicates a low potential for contaminant migration from the source via the groundwater to a potential point of exposure (possibly due to geological structures or physical controls)
Receptor Factor	*Identified* Receptor – There is a threatened water supply well downgradient of the source and the groundwater is a current source of drinking water or source of water for other beneficial uses such as irrigation/ agriculture (equivalent to Class I or IIA aquifer)	*Potential* Receptor – There is no threatened water supply well downgradient of the source and the groundwater is currently or potentially usable for drinking water, irrigation, or agriculture (equivalent to Class I, IIA, or IIB aquifer)	*Limited* Receptor – There is no potentially threatened water supply well downgradient of the source and the groundwa- ter is not considered a potential source of drinking water and is of limited beneficial use (equivalent to Class IIIA or IIIB aquifer, or where perched aquifer exists only)

Contaminant Hazard Factor

The Contaminant Hazard Factor evaluates the potential risk posed by the presence of MC and any incidental nonmunitions-related contaminants that may be in groundwater. To analyze a potential risk, review the most recent, yet representative, analytical data to determine what contaminants have been detected in groundwater at or near the MRS, and which of these contaminants can be reasonably attributed to the MRS. For each contaminant listed on the table, record a maximum detected concentration in µg/L. Adjacent to this value, record the comparison value for the contaminant using the values in Appendix B-1. For groundwater, use the comparison values listed in Appendix B-1 under "water," which are reported in units of µg/L. The contaminant levels present at the MRS in groundwater are evaluated quantitatively:

- A *Significant* Contaminant Hazard Factor is greater than 100.
- A *Moderate* Contaminant Hazard Factor is from 2 to 100.
- A *Minimal* Contaminant Hazard Factor is less than 2.

Instructions on how to score the Contaminant Hazard Factor are provided in a summary, *Scoring the Contaminant Hazard Factor* in this chapter. Information to complete the tables is found in Chapter 4.

Migration Pathway Factor

The Migration Pathway Factor assesses the potential for MC or any incidental nonmunitions-related contaminants to migrate from an MRS. The migration of a contaminant from an MRS into and through groundwater is dependent upon a complex interaction of the physical and chemical properties of the contaminant, the hydrologic environment surrounding the MRS, and the presence or absence of physical factors that could impede migration. The likelihood that contaminants will migrate by groundwater is evaluated qualitatively as ***Evident*** (H), ***Potential*** (M), or ***Confined*** (L). This qualitative evaluation is based on available MRS-specific data and professional judgment.

The Migration Pathway Factor is evaluated as *Evident* only if analytical data or direct observation indicate that contamination in the groundwater is present at, moving toward, or has moved to a point of exposure. This evaluation's data may be from a water supply well or a monitoring well.

The Migration Pathway Factor is *Potential* under the following conditions:

- Contamination in the groundwater is largely restricted to the area directly under the source or only slightly (i.e., tens of feet) beyond the source's edge.
- There is no evidence of appreciable contaminant migration in groundwater, but subsurface soil contamination has been identified, the contaminants have physical properties that suggest they are mobile, and there are no known barriers to migration.

Definitions
(See Appendix C)

Evident
Potential
Confined

- Information is not available to support an Migration Pathway Factor of *Evident* or *Confined*.

The Migration Pathway Factor is *Confined* at an MRS when any contaminants in the source have very little potential to migrate to groundwater, or where contaminated groundwater has little potential to migrate downgradient. Confined conditions may be due to physical barriers to migration, such as a hydraulic barrier created by an installed and properly operating removal or remedial action, or a confining clay layer between the source and groundwater. There may be limited net precipitation (e.g., 0 to 5 inches per year) to drive soil contamination towards groundwater, and/or groundwater may be located several hundred feet below the ground surface with very long travel times for contamination to reach groundwater.

Receptor Factor

The Receptor Factor evaluates the presence of receptors that may potentially be exposed to or come in contact with MC or any incidental nonmunitions-related contaminants at an MRS. Possible Receptor Factors are ***Identified*** (H), ***Potential*** (M), and ***Limited*** (L). Only human receptors are considered for groundwater exposure, and no distinction is made for the type of receptor (e.g., worker or resident) or the number of receptors. To evaluate the receptor factor, groundwater must be classified using EPA's *Guidelines for Groundwater Classification Under the EPA Groundwater Protection Strategy,* Office of Groundwater Protection, 1986. This classification scheme is presented in Figure 7.12.

References

Guidelines for Groundwater Classification:
www.epa.gov/epaoswer/hazwaste/ca/resource/guidance/gw/gwclass.htm

Definitions
(See Appendix C)

Identified

Potential

Limited

Figure 7.12 EPA Groundwater Classification Guidelines

Class I Groundwater	Special groundwater is highly vulnerable to contamination because of the hydrological characteristics of the areas in which it occurs and irreplaceable; no reasonable alternative source of drinking water is available to substantial populations.	If water supply wells in Class I groundwater are threatened, the receptor factor is *Identified.* If water supply wells in Class I groundwater are not threatened the receptor factor is *Potential.*
Class II Groundwater	Current and potential source of drinking water and water having other beneficial uses includes all other groundwater that is currently used (IIA) or is potentially available (IIB) for drinking water, agriculture, or other beneficial use.	If water supply wells in Class IIA groundwater are threatened, the receptor factor is *Identified.* If water supply wells in Class IIA groundwater are not threatened, the receptor factor is *Potential.* If groundwater is Class IIB, the receptor factor is *Potential.*
Class III Groundwater	Groundwater that is not considered a potential source of drinking water and of limited beneficial use (Class IIIA and Class IIIB), is saline [i.e., it has a total dissolved solids level over 10,000 milligrams per liter (mg/l)], or is otherwise contaminated by naturally occurring constituents or human activity that is not associated with a particular waste disposal activity or another site beyond levels that allow remediation using methods reasonably employed in public water treatment systems. Class III also includes groundwater that is not available in sufficient quantity at any depth to meet the needs of an average household. Class IIIA includes groundwater that is interconnected to surface water or adjacent groundwater that potentially could be used for drinking water. Class IIIB includes groundwater that has no interconnection to surface water or adjacent aquifers.	If groundwater is Class III, the receptor factor is *Limited.*

The Receptor Factor is classified:

- As *Identified* if a currently used water supply well downgradient from a source is threatened. A threatened water supply well is one that is either impacted by contamination or will likely be impacted by contamination within a reasonable timeframe. The water supply must be equivalent to either EPA Class I or Class IIA groundwater, as outlined in Figure 7.12.

- As *Potential* if there are no threatened water supply wells downgradient from the source, but the groundwater is currently or potentially usable for drinking water, irrigation, or agriculture. The water supply should be equivalent to EPA Class I, Class IIA, or Class IIB groundwater.

- As *Limited* when there is no potentially threatened groundwater supply well downgradient from the source and the groundwater from the MRS is not considered to be a potential source of drinking water and is of limited beneficial use. This is a water supply equivalent to Class III groundwater, such as saline water or an aquifer with insufficient production to meet the needs of an average household, for example, a perched aquifer.

Properly abandoned wells should not be included in the Receptor Factor evaluation.

Surface Water and Sediment

Surface water and sediment may be evaluated together because the contaminants potentially share the same migration pathway. Surface water and sediment are evaluated for both their human and ecological receptors. Human receptors for surface water and sediment share the same migration pathway; therefore, those individuals that may be exposed to surface water or sediment contamination through on-site and downgradient water supplies and recreational areas are included. Receptors include downgradient water supplies used for drinking water, irrigation of food crops, watering of livestock, aquaculture, and recreational activities, such as fishing. The classifications for each factor to be evaluated for surface water and sediment are summarized in Figure 7.13.

Figure 7.13 Surface Water and Sediment Factor Classifications

Classifications and Descriptions for Surface Water and Sediment			
	High	**Medium**	**Low**
Contaminant Hazard Factor	*Significant* Contaminant Levels – Sum of Ratios > 100	*Moderate* Contaminant Levels – Sum of Ratios 2 – 100	*Minimal* Contaminant Levels – Sum of Ratios < 2
Migration Pathway Factor	*Evident* Migration – Analytical data or observable evidence indicates that contamination in the surface water or sediment is present at, moving toward, or has moved to a point of exposure	*Potential* Migration – Contamination in surface water or sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of *Evident* or *Confined*	*Confined* Migration – Information indicates a low potential for contaminant migration from the source via the surface water or sediment to a potential point of exposure (possibly due to presence of geological structures or physical controls)
Receptor Factor	*Identified* Receptor – Identified receptors have access to surface water or sediment to which contamination has moved or can move	*Potential* Receptor – Potential for receptors to have access to surface water or sediment to which contamination has moved or can move	*Limited* Receptor – Little or no potential for receptors to have access to surface water or sediment to which contamination has moved or can move

Contaminant Hazard Factor

The Contaminant Hazard Factor evaluates potential risk posed by the presence of MC and any incidental nonmunitions-related contaminants that may be present in surface water and sediment. To assess the potential risk, review the most representative, analytical data to determine what contaminants have been detected in surface water and sediment at or near an MRS and which of these contaminants can be reasonably attributed to the MRS.

To evaluate surface water, samples collected from surface streams, drainage ditches, rivers, lakes, wetlands, and embayments are all appropriate. Samples do not have to be collected adjacent to the MRS, but greater distances often make attribution to the MRS more difficult, and dilution from downstream tributaries

often reduces observed contaminant concentrations. For contaminants in surface water with a potential for human exposure, use comparison values in Appendix B-1 under "water," which are reported in units of µg/L. For contaminants in surface water with a potential for ecological exposure, use comparison values in Appendix B-2, which are reported in units of µg/L.

Sediment is the result of deposition of solid material from the water. Obtain sediment samples from surface water bodies receiving runoff from an MRS or from areas such as swales and ditches that are known to have migrated water from the MRS. For contaminants in sediment with a potential for human exposure, use values in Appendix B-1 under the "soil" column, which are reported in units of mg/kg. For contaminants in sediments with a potential for ecological exposure, use comparison values in Appendix B-3, which are reported in units of mg/kg.

For each contaminant listed on the table, record the maximum detected concentration. Use units of µg/L for water samples and mg/kg for sediment samples. Adjacent to this value record the comparison value for the contaminant using the appropriate table from Appendix B. Only contaminants with comparison values in the appropriate tables are to be included in the factor calculation. The contaminant levels present at the MRS in surface water and sediment are evaluated quantitatively:

- A *Significant* Contaminant Hazard Factor is greater than 100.
- A *Moderate* Contaminant Hazard Factor is from 2 to 100.
- A *Minimal* Contaminant Hazard Factor is less than 2.

Instructions on how to score the Contaminant Hazard Factor are provided in a summary, *Scoring the Contaminant Hazard Factor* in this chapter. Information to complete the tables is found in Chapter 4.

Migration Pathway Factor

The Migration Pathway Factor assesses the potential for MC or any incidental nonmunitions-related contaminants to migrate from an MRS. The migration potential by surface water or sediment is evaluated qualitatively as *Evident*, *Potential*, or *Confined*. The Migration Pathway Factor evaluations are based on available information and professional judgment.

The Migration Pathway Factor is considered *Evident* if analytical data or direct observation indicate that MC or any incidental nonmunitions-related contaminants are present at an MRS, are moving toward, or have moved to a point of exposure. Water or sediment samples can provide the analytical data. Showing the actual movement of contaminated runoff from a source toward a point of exposure is needed for direct observation.

The *Potential* Migration Pathway Factor is used in any instance where there is information to suggest contamination could move away from the source toward a

point of exposure for a surface water receptor, or has moved slightly (i.e., tens of feet) beyond the source area. Where there is insufficient information to support a Migration Pathway Factor of *Evident* or *Confined*, the factor defaults to *Potential*.

Application of the *Confined* Migration Pathway Factor to an MRS requires information that migration of MC or any incidental nonmunitions-related contaminants from the source by surface water to a potential point of exposure to a surface water receptor is restricted. The rationale for a *Confined* Migration Pathway Factor must be based upon hydrologic factors; water must be prevented from coming into contact with a contaminated source or moving to a potential point of exposure for a surface water receptor. Reasons to believe such a condition could exist at an MRS include:

- The MRS has engineered runon/runoff controls that can effectively interrupt migration of contaminants to surface water.
- Removal or remedial actions have been implemented that restrict the movement of contaminants away from the source.
- Contamination at the source is below the ground surface and is not subject to erosion or interaction with surface water.
- Topographic conditions at an MRS prevent surface water from leaving the immediate area of the MRS. If there is effectively no runoff from the MRS to surface water, there will be no migration of contaminants to points of exposure. This may also occur in areas with very low rainfall, perhaps with only nearby ephemeral streams. In some areas surface water may be completely lost to groundwater recharge.

The chemical or physical characteristics of the contaminants, although important in determining the migration mechanisms, will not in themselves prevent migration. The chemical and physical properties of MC or any incidental nonmunitions-related contaminants may determine whether these contaminants will be transported primarily in a dissolved form or adsorbed on particulate matter, but if the contaminant is in contact with surface water and subject to erosive forces, it will tend to move. Further, the existence of man-made structures, such as dams, or the presence of lakes and reservoirs in the surface water pathway does not necessarily imply a *Confined* condition. Although the travel time for the contaminants will undoubtedly be affected by such structures, the migration pathway may still be uninterrupted.

Receptor Factor

The Receptor Factor evaluates the presence of receptors that may potentially be exposed to or come in contact with MC or any incidental nonmunitions-related contaminants at an MRS. Receptors could be subject to a number of potential exposure scenarios associated with surface water and sediment. Surface water can be a source of drinking water and is often used for recreational activities (e.g., boating, swimming, and fishing). Human exposure could occur through the use of surface water for drinking water, the incidental ingestion of surface water during recreational activity, dermal contact with surface water or sediments,

consumption of aquatic species caught in the water body, or the use of surface water for watering livestock or irrigation of human food crops. Aquatic species, considered part of the human food chain, could potentially include, but may not be limited to, freshwater and marine species (e.g., finfish, shellfish, shrimp, squid, snails, crayfish, and seaweed). Ecological receptors to be considered are restricted to those areas specifically identified in Figure 7.14.

The Receptor Factor can be *Identified*, *Potential*, or *Limited*. Rate the factor as:

- *Identified* when receptors have been specifically identified as having access to surface water or sediment to which the contaminants have moved or can move. This could potentially include the presence of ecological areas downstream from the MRS and within the surface water migration pathway as well as the use of water:
  - As drinking water.
  - For irrigating human food crops.
  - For watering livestock.
  - For supporting recreational activity.
  - For subsistence fishing.
- *Potential* if there are no known uses of surface water as outlined above, but the potential for such use is thought to exist because of nearby populations or predicted future development.
- *Limited* when it is unlikely that human population will come into contact with the water or sediment and when there are no ecological receptors apparent. These conditions, as they apply to humans, may be met in remote areas or areas in which access is highly restricted.

Figure 7.14 List of Ecological Receptors

Critical habitat for federally designated endangered or threatened species
Marine Sanctuary
National Park
Designated Federal Wilderness Area
Areas identified under Coastal Zone Management Act
Sensitive areas identified under National Estuary Program or Near Coastal Waters Program
Critical areas identified under the Clean Lakes Program
National Seashore Recreational Area
National Lakeshore Recreational Area
Habitat known to be used by federally designated or proposed endangered or threatened species
National Preserve
National or State Wildlife Refuge
Unit of Coastal Barrier Resources System
Coastal Barrier (undeveloped)
Federal land designated for protection of natural ecosystems
Administratively Proposed Federal Wilderness Area
Spawning areas critical for the maintenance of fish or shellfish species within river, lake, or coastal tidal waters
Migratory pathways and feeding areas critical for maintenance of anadromous fish species within river reaches or areas in lakes or coastal tidal waters in which the fish spend extended periods of time
Terrestrial areas utilized for breeding by large or dense aggregations of animals
National river reach designated as Recreational

Surface Soil

Surface soil is the layer of soil on the surface with a depth up to six inches. Only human receptors are evaluated for surface soils. Soil receptors include only those human receptors with the potential to come into contact with contaminated surface soils. Human receptors include people who are residents, in schools or daycare, or who have direct access to contamination on a frequent basis because of their work.

If samples are not available from a depth of 0 to 6 inches, samples from depths up to 24 inches can be used. Preference is given to shallower samples when there is a choice. In no instance should samples deeper than 24 inches be used. For the purpose of this evaluation, the hazard posed by subsurface soil contaminants (e.g., a buried leaking storage tank deeper than 24 inches) is assumed to be assessed by the evaluation of groundwater (based on actual groundwater sampling data), which would be the most probable pathway of deep soil contaminant migration to humans. The classifications for each factor to be evaluated for surface soil are summarized in Figure 7.15.

Figure 7.15 Surface Soil Factor Classifications

Classification and Description for Surface Soil			
	High	**Medium**	**Low**
Contaminant Hazard Factor	*Significant* Contaminant Levels – Sum of Ratios > 100	*Moderate* Contaminant Levels – Sum of Ratios 2 – 100	*Minimal* Contaminant Levels – Sum of Ratios 2 < 100
Migration Pathway Factor	*Evident* Migration – Analytical data or observable evidence indicates that contamination in the surface soil is present at, moving toward, or has moved to a point of exposure	*Potential* Migration – Contamination in surface soil has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of *Evident or Confined*	*Confined* Migration – Information indicates a low potential for contaminant migration from the source via the surface soil to a potential point of exposure (possibly due to the presence of geological structures or physical controls)
Receptor Factor	*Identified* Receptor – Identified receptors have access to surface soil to which contamination has moved or can move	*Potential* Receptor – Potential for receptors to have access to surface soil to which contamination has moved or can move	*Limited* Receptor – Little or no potential for receptors to have access to surface soil to which contamination has moved or can move

Contaminant Hazard Factor

The Contaminant Hazard Factor evaluates the risk posed by the presence of MC and any incidental nonmunitions-related contaminants that may be in surface soil. To evaluate the risk, review the most recent, yet representative, analytical data to determine what contaminants have been detected in surface soils at the MRS.

For MC and any incidental nonmunitions-related contaminants in surface soil with a potential for human exposure, use comparison values in Appendix B-1 under "soil," which are reported in units of mg/kg. For each contaminant listed on the table, note a maximum detected concentration in mg/kg. Adjacent to this value, record the comparison value for the contaminant, using the values in Appendix B-1. Contaminants in soils with a potential for ecological exposure are not evaluated. The contaminant levels present at the MRS in surface soil are evaluated quantitatively:

- A *Significant* Contaminant Hazard Factor is greater than 100.
- A *Moderate* Contaminant Hazard Factor is from 2 to 100.
- A *Minimal* Contaminant Hazard Factor is less than 2.

Instructions on how to score the Contaminant Hazard Factor are provided in a summary, *Scoring the Contaminant Hazard Factor* in this chapter. Information to complete the tables is found in Chapter 4.

Migration Pathway Factor

The Migration Pathway Factor assesses the potential for MC or any incidental nonmunitions-related contaminants to migrate from an MRS. The migration potential through soil is evaluated qualitatively as *Evident, Potential,* or *Confined*. The Migration Pathway Factor evaluations are based on available information and professional judgment. The Migration Pathway Factor is assigned:

- *Evident* if analytical data or direct observation indicate that MC or any incidental nonmunitions-related contaminants in the surface soil are present at an MRS, are moving toward, or have moved to a point of exposure. This may be determined through analysis of runoff or observation of secondary sources as a result of the slumping of soil or wind erosion.

- *Potential* if contamination has moved only slightly (i.e., tens of feet) beyond the source or if it could move, but is not moving appreciably. Where there is insufficient information to support an Migration Pathway Factor of *Evident* or *Confined*, the factor defaults to *Potential*. This value would be appropriate when there is no evidence of movement from an unconfined source on an MRS or when berms surrounding such sources are old, eroding, or otherwise not maintained.

- *Confined* if migration of contaminated surface soil from the MRS to a point of exposure is restricted. Reasons to believe such confinement exists include the presence of MRS barriers such as buildings, maintained berms, and pavement or caps that prevent contact with the contaminated soil or prevent the contaminated soil from moving to a point of exposure. When conducting relative risk site evaluations for soils, take into account remedies implemented to contain or confine soil contamination.

Receptor Factor

The Receptor Factor evaluates the presence of receptors that may potentially be exposed to or come in contact with MC or any incidental nonmunitions-related contaminants at an MRS. Soil receptors include only those humans receptors with the potential to come into contact with contaminated surface soils. Human receptors include people who are residents, in schools or daycare, or who have direct access to contamination on a frequent basis because of their work.

The Receptor Factor can be *Identified*, *Potential*, or *Limited*. The Receptor Factor is:

- *Identified* if analytical data or direct observation indicates that people reside or frequently work, recreate, hunt (subsistence), or attend school or daycare in the area of contamination.

- *Potential* if there are no workplaces, residences, schools, or daycare centers in the area of contamination, but access to the MRS is not restricted.

- *Limited* when it is unlikely that humans will come into contact with the contaminated soil at an MRS. This would be appropriate when the Migration Pathway Factor is *Confined*.

DETERMINING THE HHE MODULE RATING

As discussed earlier in this chapter, for each contaminant and its specific receptor endpoint (e.g., human/ecological receptor), the MRS Project Team will group each factor's values into a three-letter combination, such that the combination is ranked from Highest (H) to the Lowest (L). The three-letter combinations are distributed across seven categories. The least and most hazardous combinations are placed in the lowest and highest categories, respectively. Figure 7.16 illustrates the 27 possible three-letter combinations that are generated for each medium. Only MRSs that have a *Significant* Contaminant Hazard, an *Evident* Migration Pathway, and an *Identified* Receptor receive an HHH three-letter combination. Conversely, an LLL three-letter combination is only assigned to MRSs that have a *Minimal* Contaminant Hazard, *Confined* Migration Pathway, and *Limited* Receptor.

Figure 7.16 HHE Three-Letter Combinations

Contaminant Hazard Factor	Migration Pathway			Receptor Factor
	Evident	***Potential***	***Confined***	
Significant	HHH	HHM	HHL	***Identified***
	HHM	HMM	HML	***Potential***
	HHL	HML	HLL	***Limited***
Moderate	HHM	HMM	HML	***Identified***
	HMM	MMM	MML	***Potential***
	HML	MML	MLL	***Limited***
Minimal	HHL	HML	HLL	***Identified***
	HML	MML	MLL	***Potential***
	HLL	MLL	LLL	***Limited***

The HHE Module distributes the three-letter combinations across seven categories, while RRSE has only three categories. During development of the Protocol, the workgroup considered using RRSE with its three categories as the basis for the HHE Module. During public comment, a state regulator expressed concern with the use of the RRSE framework, believing its use could inappropriately skew an MRS Priority by giving more weight to the HHE Module, compared to the EHE and CHE Modules. To balance the modules, the workgroup analyzed the construct of the HHE Module and revised it so that it more closely mirrored the EHE and CHE Modules by containing seven possible outcomes. Revising the HHE Module negated the concern, and increased the ability to differentiate MRSs with MC and any incidental nonmunitions-related

contaminants and to determine an MRS Priority when the HHE Module and one or both of the other hazard modules applied. Only an MRS with *Significant* health hazards, an *Identified* receptor, and *Evident* migration pathway are assigned the highest HHE Module Rating. Accordingly, DoD believes that the revised module better reflects the relative evaluation of explosive, CWM, and MC hazards potentially present at an MRS.

To determine the HHE Module Rating, the environmental media are assigned single letter media ratings (i.e., A through G) based on their associated three-letter combinations, as shown in Figure 7.17. The HHE Module Rating is the single highest media rating (A is the highest; G is the lowest). The HHE Module Rating will be compared with the other hazard module ratings and used to determine the MRS's relative priority.

Figure 7.17 HHE Module Ratings

HHE Module Ratings	
Combination	**Rating**
HHH	A
HHM	B
HHL HMM	C
HML MMM	D
HLL MML	E
MLL	F
LLL	G

An alternative module rating may be assigned when a module letter rating is inappropriate. The three alternative module ratings are:

Tips and Tricks

The MRS Project Team needs to agree on the sufficiency of the data.

- *Evaluation Pending*. This alternative module rating is used when MC and any incidental nonmunitions-related contaminants are known or suspected at an MRS, but sufficient information is not available to determine the MRS's HHE Module Rating.

- *No Longer Required*. This alternative module rating is used when an MRS no longer requires an assigned priority because DoD has conducted a response, all objectives set out in the decision document for the MRS have

been achieved, and no further action except for long-term management or recurring reviews is required.

- *No Known or Suspected MC Hazard.* This alternative module rating is used for an MRS that does not require evaluation under the HHE Module because there is no known or suspected MC hazard.

The Protocol is created as a tool to determine an MRS's relative priority. The priority assigned to an MRS does not directly impact the design of the required munitions response. All MRSs known or suspected to contain UXO, DMM, or MC will be thoroughly investigated and, if required by MRS-specific conditions, the hazards determined to be present will be addressed through an appropriate response.

SUMMARY

The HHE Module is used to evaluate the potential health and environmental hazards posed by MC and any incidental nonmunitions-related contaminants. Application of the Protocol's HHE Module evaluates the potential health and environmental hazards by considering the potential impact of MC and any incidental nonmunitions-related contaminants in four distinct environmental media, each of which is comprised of three factors.

Based on MRS-specific information, each medium is assigned a letter rating (i.e., A through G). The letter rating (A is highest; G is lowest) from the media ratings characterizes the potential human health and environmental hazard conditions at an MRS.

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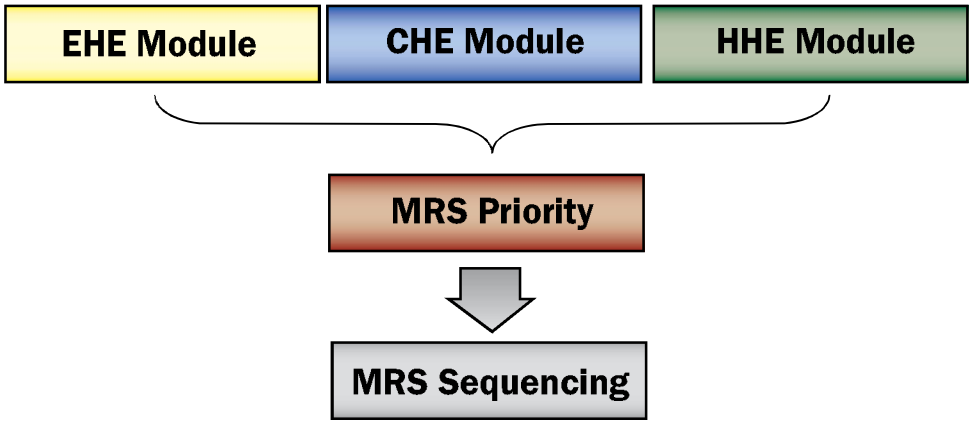
Chapter 8: Determining MRS Priority

The Protocol is designed to ensure that the relative priority assigned to an MRS reflects actual MRS conditions and potential hazards. An MRS's relative priority is determined by reviewing the hazard ratings from the EHE, CHE, and HHE Modules and selecting the highest rating. This chapter outlines the process for using the ratings of the three hazard evaluation modules to determine an MRS's relative priority as shown in Figure 8.1.

Figure 8.1 General Protocol Structure



HAZARD MODULE RATINGS

An MRS's relative priority is determined by comparing the ratings of the hazard evaluation modules (EHE, CHE, and HHE) applied to an MRS. The priority assigned to an MRS may be one of eight numerical priorities or one of three alternative MRS ratings. At least one hazard evaluation module must be completed to assign a relative priority to an MRS. When only two modules have been completed, the module with the highest rating will provide the MRS's relative priority.

While an MRS Priority can be determined from only one module, eventually, each module rating must be completed. The steps for completing the EHE and CHE Module Ratings are identical; detailed directions to determine the module ratings are found in Chapter 5 for the EHE Module and Chapter 6 for the CHE Module. As shown in Figure 8.2, the EHE Module Rating is obtained from Table 10, while the CHE Module Rating is found on Table 20.

Directions for determining the HHE Module Rating differ somewhat from those for the EHE and CHE Module Ratings; detailed instructions for determining the HHE Module Rating are described in Chapter 7. The HHE Module Rating can be obtained from Table 28, as shown in Figure 8.2.

References

Chapter 5 provides directions to determine the EHE Module Rating.

Chapter 6 has directions to determine the CHE Module Rating.

Chapter 7 has directions to determine the HHE Module Rating.

All tables can be found in Appendix A.

Figure 8.2 Using Tables 10, 20, and 28 to Complete Table 29

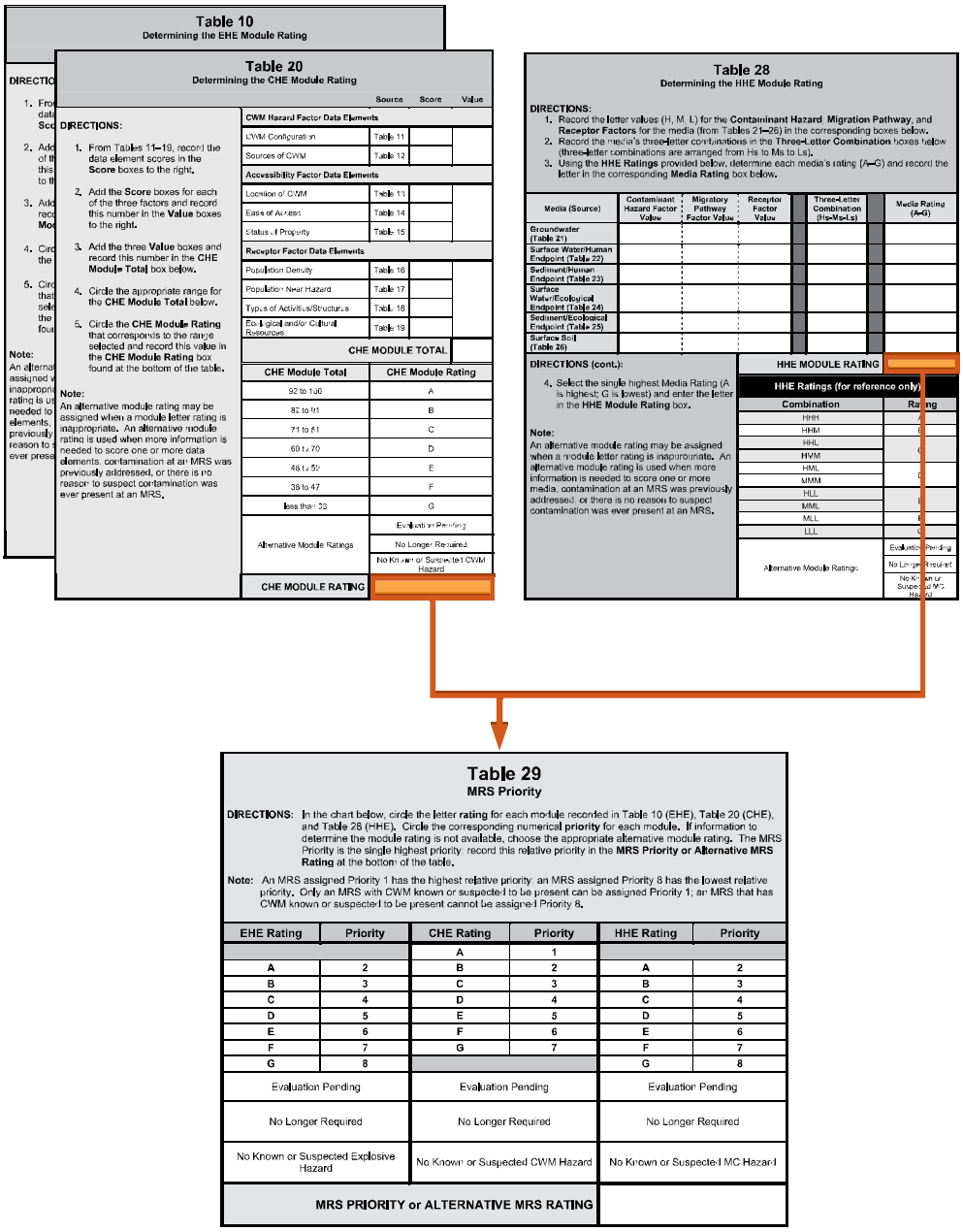


Table 29
MRS Priority

DIRECTIONS: In the chart below, circle the letter rating for each module recorded in Table 10 (EHE), Table 20 (CHE), and Table 28 (HHE). Circle the corresponding numerical priority for each module. If information to determine the module rating is not available, choose the appropriate alternative module rating. The MRS Priority is the single highest priority; record this relative priority in the **MRS Priority or Alternative MRS Rating** at the bottom of the table.

Note: An MRS assigned Priority 1 has the highest relative priority; an MRS assigned Priority 8 has the lowest relative priority. Only an MRS with CWM known or suspected to be present can be assigned Priority 1; an MRS that has CWM known or suspected to be present cannot be assigned Priority 8.

EHE Rating	Priority	CHE Rating	Priority	HHE Rating	Priority
		A	1		
A	2	B	2	A	2
B	3	C	3	B	3
C	4	D	4	C	4
D	5	E	5	D	5
E	6	F	6	E	6
F	7	G	7	F	7
G	8			G	8
Evaluation Pending		Evaluation Pending		Evaluation Pending	
No Longer Required		No Longer Required		No Longer Required	
No Known or Suspected Explosive Hazard		No Known or Suspected CWM Hazard		No Known or Suspected MC Hazard	
MRS PRIORITY or ALTERNATIVE MRS RATING					

DETERMINING MRS PRIORITY

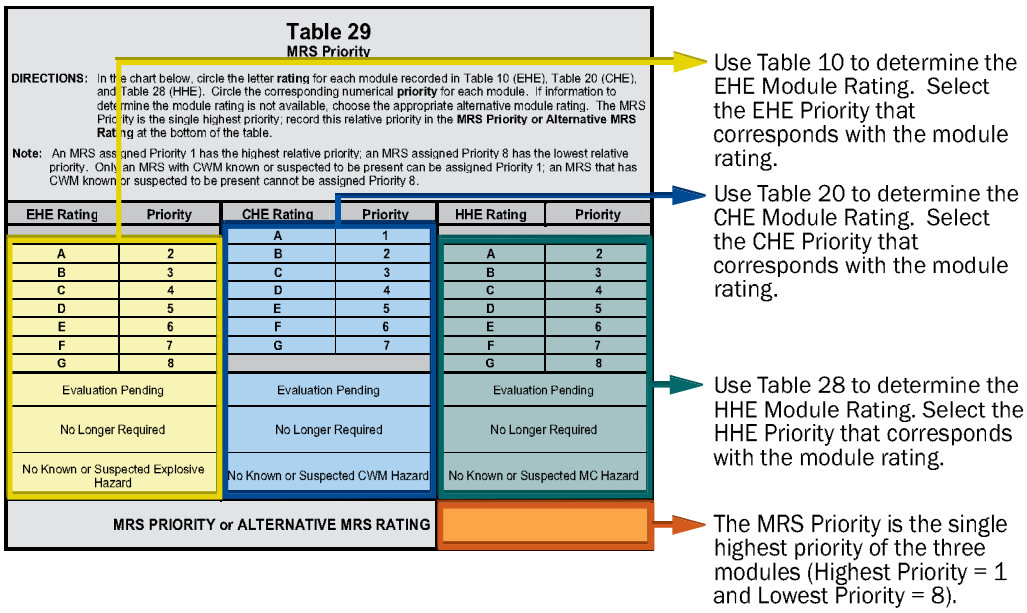
As described in the previous section, an MRS's relative priority is determined by comparing the module ratings from Tables 10, 20, and 28, on Table 29, as shown in Figure 8.3. The MRS Project Team will circle both the module rating for each module and its corresponding numerical priority. For example, if the EHE, CHE, and HHE Ratings for an MRS are C, C, and F, respectively, then the corresponding numerical priorities would be four, three, and seven. The MRS Priority scale is such that the lowest numerical priority represents the highest potential hazard at an MRS. Therefore, the MRS Priority would be three, the lowest numerical priority. The MRS numerical priority should be recorded in the "MRS Priority or Alternative MRS Rating" box at the bottom of Table 29.

As long as one of the three modules can be applied to an MRS, an MRS can be assigned a priority. Until all the modules have been evaluated, the MRS's relative priority shall be based on the results of the evaluated modules. The Components will reapply the Protocol once sufficient data are available to complete the remaining modules. Detailed information on completing Table 29 can be found in Chapter 4.

References

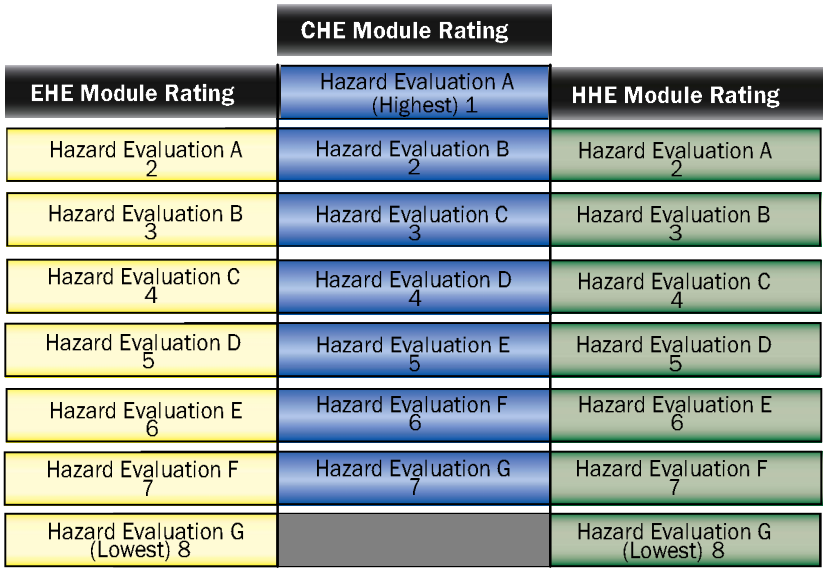
Chapter 4 details the procedures for scoring all three modules and provides instructions for determining the MRS Priority.

Figure 8.3 Directions for Completing Table 29



DoD's approach is to assign each MRS a relative priority based on the greatest potential hazards posed by UXO, DMM, or MC. A Priority 1 MRS contains the highest potential hazard, while a Priority 8 MRS contains the lowest potential hazard. Thus, an MRS's relative priority is the highest potential hazard, represented by the lowest numerical priority, of the modules evaluated. As seen in Figure 8.4, only an MRS that poses a potential CWM hazard can be assigned Priority 1 and no MRS with a potential CWM hazard can be assigned Priority 8.

Figure 8.4 MRS Prioritization Framework



The universe of MRS priorities is presented as tiers, rather than discrete scores. DoD's intent was to assign each MRS a relative priority when compared against all MRSs, not to develop a one-to-N priority listing of MRSs. DoD applied the draft Protocol to MRSs using available MRS-specific data to ensure the Protocol's application resulted in priorities that accurately represented MRS conditions and were reasonably distributed. Relative priorities are a primary factor in sequencing MRSs for response action, but sequencing decisions are further defined based on additional factors.

References

Chapter 9 details sequencing MRSs for response action.

ALTERNATIVE MRS RATING

In addition to being assigned one of eight numerical priorities, an MRS can be assigned one of three alternative MRS ratings if a numerical priority is inappropriate. These alternative MRS ratings are Evaluation Pending, No Longer Required, and No Known or Suspected Hazard.

Evaluation Pending

The Protocol should be applied to an MRS when sufficient information is available to complete any of the three hazard evaluation modules. When sufficient information is not available to complete any of the three modules, an MRS should be assigned an alternative MRS rating of Evaluation Pending. Evaluation Pending is used to indicate that the MRS requires further evaluation. This designation is only used when at least one module is rated Evaluation Pending and none of the three modules has a numerical rating (i.e., 1 through 8). MRSs designated with this alternative MRS rating shall be programmed for additional study. DoD plans to develop program metrics focused on reducing the number of MRSs with a status of Evaluation Pending for any of the three modules.

No Longer Required

An alternative MRS rating of No Longer Required is used to indicate that an MRS no longer requires prioritization because all necessary munitions responses have been completed. This alternative MRS rating is only assigned when DoD has conducted a final response; all objectives set out in the decision document have been achieved; and no further action, except for long-term management and recurring reviews, is required. An MRS will be assigned this alternative MRS rating when none of the three modules has a numerical rating (i.e., 1 through 8) or an Evaluation Pending rating, and at least one of the modules is rated No Longer Required.

No Known or Suspected Hazard

A No Known or Suspected Hazard alternative MRS rating is selected to indicate that an MRS has no known or suspected hazards associated with UXO, DMM, or MC. This designation is used only when the three hazard evaluation modules are rated as No Known or Suspected Explosive Hazard, No Known or Suspected CWM Hazard, and No Known or Suspected MC Hazard. Physical or historical evidence must affirmatively support this classification. For example, results of a site inspection that find no evidence of UXO, DMM, or MC can be considered physical evidence in support of a No Known or Suspected Hazard alternative MRS rating.

ADDITIONAL REQUIREMENTS

Reapplication of the Protocol

The Protocol will be reapplied to an MRS when data to complete any module not evaluated become available. A completed response action, further MRS characterization, or changes in nearby land use might also necessitate the Protocol's reapplication. The MRS Priority or Alternative MRS Rating may change based on the results of the Protocol's reapplication. Components will review each MRS's priority at least annually and update assigned priorities, as necessary, to reflect any new information that has become available. Although the MRS's relative priority should be reviewed annually, the Protocol only needs to be reapplied when significant new data are available. Criteria for reapplication of the Protocol are discussed in detail in Chapter 9.

References

A complete list of circumstances that require reapplication of the Protocol can be found in Chapter 9.

MRS Sequencing

The sequencing of an MRS for action will be based primarily on its relative priority. As a matter of DoD policy, MRSs with higher relative priorities will be addressed before MRSs with lower relative priorities. However, both DoD and Congress recognized that other factors such as community interests and value

of land for development could also influence sequencing decisions. As such, the Protocol allows other factors to be considered. Once the MRS Priority is determined, the Component may consider other factors including but not limited to environmental justice, economic development, and programmatic concerns when determining the MRS's sequence for response actions. These factors do not change the MRS's relative priority, but may influence sequencing decisions. Chapter 9 provides additional detail on MRS sequencing decisions and the use of risk-plus factors in sequencing decisions.

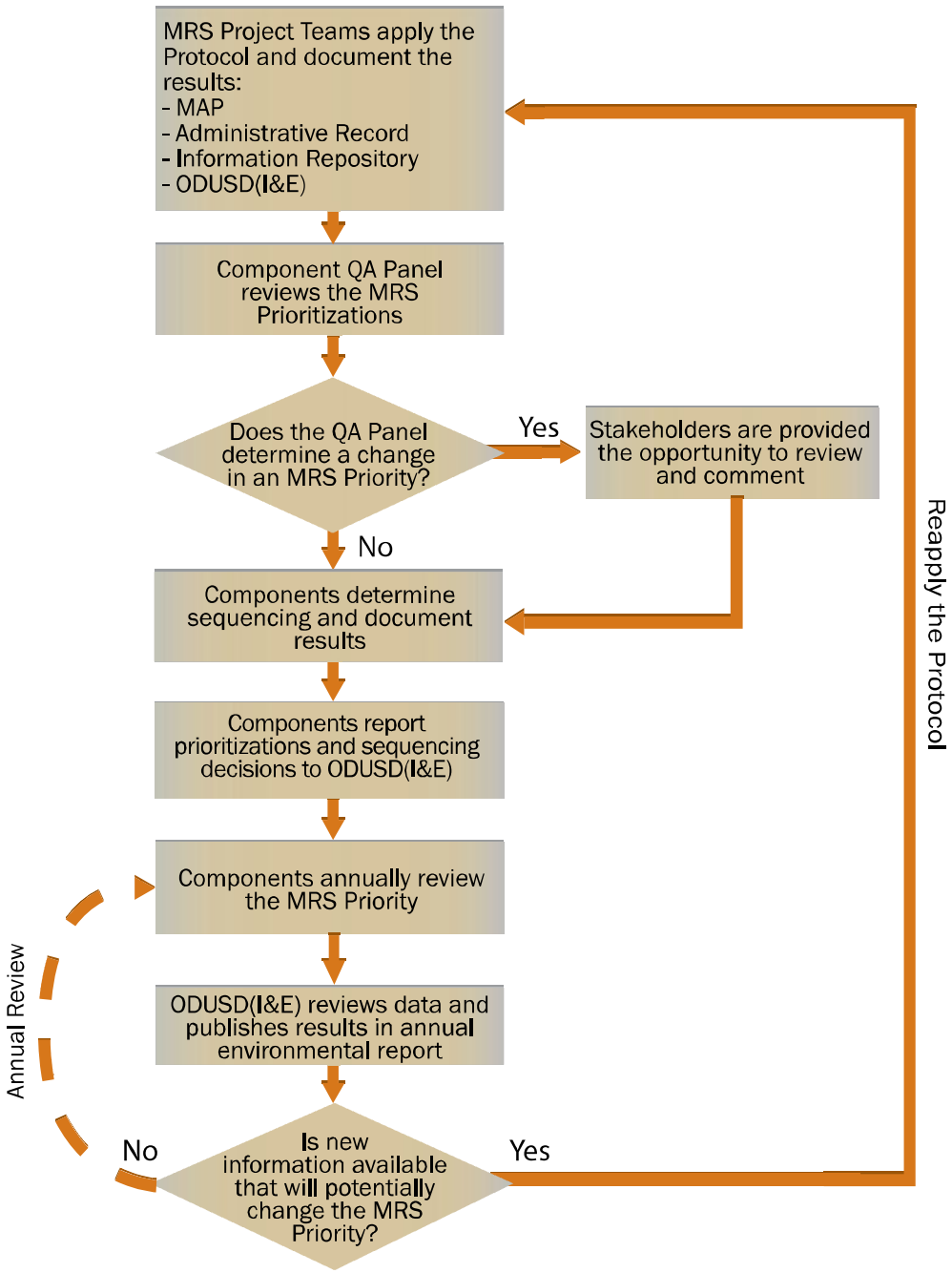
References

A complete list of risk-plus factors can be found in Chapter 9.

Chapter 9: Administrative Requirements

This chapter addresses the Components' responsibilities for performing quality assurance (QA), sequencing MRSs, documenting the prioritization process, reporting the MRS relative priorities, and reviewing and reapplying the Protocol. Requirements for conducting stakeholder involvement are discussed in Chapter 10. This section expands upon the description of administrative and procedural requirements provided in Chapter 3. Figure 9.1 depicts the sequence of administrative requirements.

Figure 9.1 Administrative Process



QUALITY ASSURANCE OF THE PROTOCOL

ODUSD(I&E) and the Components have crucial roles and responsibilities for the quality control of the Protocol's implementation. DoD will establish QA guidelines to ensure that the Protocol is applied appropriately and consistently across all MRSs. The purpose of QA of the Protocol is to:

- Ensure the Components are applying the Protocol in a consistent manner;
- Ensure the Protocol's application leads to decisions that are representative of MRS conditions;
- Serve as an internal management and oversight function; and
- Establish and preserve the accountability and credibility of the Protocol's application.

Component Requirements

Each Component shall develop Component-level guidance that will outline QA requirements to ensure the Protocol is applied appropriately and consistently across all MRSs. The Component's QA of the Protocol will include provisions for complying with the Protocol by establishing an independent QA Panel that reviews each MRS's relative priority.

Figure 9.2 QA Panel

Quality Assurance Panel

Each Component will form a QA Panel to provide oversight for the application of the Protocol. The QA Panel shall review MRS-specific data to evaluate the adequacy and consistency of Protocol evaluations for all MRSs in its inventory. The QA Panel shall review MRS prioritization decisions prior to MRS sequencing. The QA Panel is not responsible for reviewing sequencing decisions. Each Component has the flexibility to determine the appropriate size and composition of its QA Panel.

How the Panel Works

The QA Panel shall consist of Component personnel trained in the application of the Protocol and who were not involved in the initial evaluation of specific MRSs under review. Initially, the QA Panel shall review all MRS prioritization decisions. If the QA Panel concludes that the Protocol has not been applied to an MRS correctly or consistently, the Panel may recommend a change that results in a different priority. The QA Panel's decision, when adopted, will supersede the original priority assigned.

Finalizing the Prioritization Decision

The Component shall ensure that stakeholders are provided an opportunity to comment on the QA Panel's rationale for any changes to the relative priority originally assigned to an MRS. If the QA Panel recommended a change in the relative priority, stakeholders and Component organizations involved in the original prioritization must be contacted and requested to review and comment on the proposed changes. The QA Panel shall review all comments and finalize the prioritization packages. If the Panel's decision changes the priority originally assigned to the MRS, the Component shall report the rationale for the change to ODUSD(I&E) and stakeholders.

ODUSD(I&E) Requirements

ODUSD(I&E) is responsible for providing internal management and oversight of the Protocol's application to all MRSs included in the DoD MRS Inventory. ODUSD(I&E) will collect and maintain all data required by the Protocol and any additional data deemed necessary to provide sufficient management oversight and quality control of the overall process. In addition, ODUSD(I&E) will review and compare the Components' application for compliance with the Protocol's requirements and consistency in implementation across the Components. ODUSD(I&E) will organize a DoD Protocol workgroup to exchange information relating to the Protocol's application and discuss lessons learned. Any inconsistencies found from ODUSD(I&E)'s review will be examined by the workgroup.

Once ODUSD(I&E) determines that the Components are applying the Protocol in a consistent manner and the Protocol application leads to decisions that are representative of MRS conditions, the Department may establish a sampling-based approach for such reviews.

MRS SEQUENCING

The sequencing of an MRS for action will be based primarily on the MRS's relative priority. As a matter of DoD policy, an MRS with higher relative risks will be addressed before an MRS with lower relative risks. However, DoD recognizes that other factors, such as environmental justice, economic development, and programmatic concerns could influence sequencing decisions; therefore, the Protocol allows for such factors to be considered.

Once an MRS's relative priority is determined, the Component may consider other factors when determining an MRS's sequence for response actions. These risk-plus factors do not change the MRS's relative priority, but may influence sequencing decisions. Examples of the kinds of risk-plus factors that DoD may consider are shown in Figure 9.3.

Figure 9.3 Examples of Risk-Plus Factors

Concerns expressed by regulators or stakeholders
Cultural and social factors
Economic factors, including economic considerations pertaining to environmental justice issues, economies of scale, evaluation of total life cycle costs, and estimated valuations of long-term liabilities
Findings of health, safety, ecological risk assessments or evaluations based on MRS-specific data
Reasonably anticipated future land use, especially when planning response actions, conducting evaluations of response alternatives, or establishing specific response action objectives
A community's reuse plan at BRAC installations
Specialized considerations of tribal trust lands (held in trust by the United States for the benefit of any tribe or individual). The United States holds the legal title to the land and the tribe holds the beneficial interest
The availability of technology to detect, discriminate, recover, and destroy
Implementation and execution considerations (e.g., funding availability; the availability of the necessary equipment and people to implement a particular action; examination of alternative responses that entail significant capital investments, a lenghty period of operation, or costly maintenance; alternatives to removal or treatment of contamination when existing technology cannot achieve established standards [e.g., maximum contaminant levels])
Mission-driven requirements
Implementing standing commitments, including those in formal agreements with regulatory agencies, requirements for continuation of remedial action operations until response objectives are met, other long-term management activities, and program administration
Established program goals and initiatives
Short-term and long-term ecological effects and environmental impacts in general, including injuries to natural resources

DoD ensures that EPA, other federal agencies (as appropriate or required), state regulatory agencies, tribal governments, Restoration Advisory Boards (RABs) or Technical Review Committees (TRCs), community stakeholders, and the current property owner (if the MRS is outside DoD's control) are offered opportunities to participate throughout the Protocol's application and sequencing recommendations. Chapter 10 details opportunities for stakeholder participation in the application of the Protocol and sequencing decisions. The Components must document and report sequencing decisions to ODUSD(I&E). Procedures and documentation requirements for sequencing decisions are summarized below.

DOCUMENTATION OF RESULTS

Management Action Plan

Definitions
(See Appendix C)

Management Action Plan (MAP)

The Components shall ensure each installation, or USACE District that is responsible for a FUDS property, documents all sequencing decisions in the **MAP** or its equivalent. Each installation or FUDS property is required to develop and maintain a MAP or its equivalent. The MAP is used to identify and monitor environmental restoration requirements, schedules, and estimates of cost. The MAP also serves as the basis for an installation's or USACE District's (for FUDS) input to overall program planning, budget development, and execution

decisions. The *DERP Management Guidance* requires that a MAP be updated at least annually. Any changes to a MRS's relative priority or sequencing shall be included in the subsequent MAP update. Guidance on preparing and updating the MAP is provided in the *DERP Management Guidance*.

Administrative Record and Information Repository

Components are responsible for updating and maintaining an MRS's **Administrative Record** and **Information Repository**. The following information must be included:

- Information provided by stakeholders that influenced the relative priority assigned to an MRS or sequencing decision concerning an MRS.
- Records of:
  - Notification to EPA, other federal agencies, state regulatory agencies, tribal governments, and local government organizations, as appropriate, seeking their involvement in the Protocol's application and MRS sequencing.
  - Announcements in local community publications requesting information pertinent to prioritization or sequencing.
  - Any information provided to stakeholders that may influence the relative priority assigned to an MRS or sequencing decision concerning an MRS.

Reporting Requirements

The Components shall provide ODUSD(I&E) with the results of the Protocol's application and any other inventory data that 10 USC 2710(c) requires be made publicly available. ODUSD(I&E) shall include this information in its report on environmental restoration activities for that fiscal year. The Components must provide ODUSD(I&E) with:

- A rating for each of the three hazard modules;
- An MRS Priority or Alternative MRS Rating for each MRS in the Component's MRS Inventory;
- The rationale for any change in a priority because of the QA Panel's review; and
- The rationale for sequencing an MRS of a lower relative priority before an MRS with a higher relative priority.

The schedule for submitting data are outlined in the *DERP Management Guidance*. Data are required for incorporation into the ODUSD(I&E) data management system.

Definitions
(See Appendix C)

Administrative Record

Information Repository

In addition to reporting to ODUSD(I&E), the Components shall ensure documents that influenced the prioritization or sequencing of an MRS are maintained as part of the project file or Administrative Record if one has been established for the MRS. The documentation maintained for each MRS shall be sufficient to provide auditibility and accountability of the Protocol application to the MRS.

Figure 9.4 Documentation Locations of Protocol Results

ANNUAL REVIEW OF PRIORITIZATION DECISIONS

The Components will review each MRS Priority at least annually and update the relative priority, as necessary, to reflect new information. The Protocol will be reapplied to an MRS under any of the following circumstances:

- Upon completion of a response action that changes an MRS's conditions in a manner that could affect the evaluation under this Protocol;
- When new information is available to update or validate a previous evaluation of an MRS;
- When the relative priority assigned to an MRS can be updated or validated, where that priority has been previously assigned based on evaluation of only one or two of the three hazard evaluation modules;
- Upon further delineation and characterization of an MRA into more than a single MRS; or
- When new information is available to categorize any MRS previously assigned an alternative MRS rating of Evaluation Pending.

The Protocol is only required to be reapplied once sufficient new data are available. If no new data are available at the time of annual review, the Protocol need not be reapplied. If the new information justifies updating an MRS's relative priority, the Component shall:

- Provide stakeholders the opportunity to review and comment on any changes to the priority originally assigned;
- Include all required information in the Administrative Record and Information Repository; and
- Include changes in subsequent updates to the MAP or its equivalent.

The Components will provide ODUSD(I&E) an updated prioritized list of MRSs annually. ODUSD(I&E) will publish all relevant information on updated priorities and sequencing in the report on environmental restoration activities for that fiscal year.

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Chapter 10: Stakeholder Involvement

During the development of the Protocol, DoD proactively engaged stakeholders throughout the process. The DoD workgroup that developed the Protocol made a concerted effort to consult representatives of the states and tribes, as required by the FY 2002 NDAA. DoD notified all federally recognized tribes of the opportunity to participate in the Protocol development effort and consulted with those tribes with interests in lands that are known or suspected of containing UXO, DMM, or MC. The workgroup made a similar effort to consult with other federal agencies, including USDA, DOI, and EPA, and provided opportunities for interested members of the public to express their input. DoD believes stakeholder involvement was an important part of the Protocol's development and considers it key to the Protocol's application and overall success.

This chapter defines stakeholders for the purposes of the Protocol and outlines requirements for stakeholder involvement. Through stakeholder involvement, DoD hopes to provide interested stakeholders with the information and tools necessary to understand the MMRP, the Protocol and its application, and how the Components will conduct munitions responses.

CONDUCTING STAKEHOLDER OUTREACH

The Protocol requires the Components to notify stakeholders of opportunities to participate in the Protocol's application at various phases. Because DoD recognizes the benefit and importance of stakeholder involvement, it established these requirements to ensure stakeholders are provided opportunities to provide input, as early as possible, and throughout the Protocol's application.

DoD recognizes that stakeholder involvement is an effective way to identify and address stakeholder concerns about environmental and safety issues related to MRSs. If stakeholders are engaged early and often throughout the process, they will gain a better understanding of the Protocol and its application.

For stakeholder involvement to be successful, effective two-way communication is necessary between interested stakeholders and the Components during the application of the Protocol and the sequencing of an MRS. Stakeholders may have information vital to both the Protocol's application and sequencing decisions. For example, stakeholders from a community near an MRS can provide the MRS Project Team information on local history, citizen involvement, and MRS conditions that may facilitate the Protocol's application and be important factors in sequencing decisions. DoD believes that a proactive stakeholder involvement program will facilitate the munitions response process and help ensure the protection of human health and the environment.

DEFINING STAKEHOLDERS

For the purposes of the Protocol, stakeholders include, but may not be limited to, groups or individuals who regulate or are interested in, concerned about, affected by, or are involved in the application of the Protocol. Figure 10.1 illustrates stakeholders that may participate in the Protocol's application and MRS sequencing.

Figure 10.1 Example Stakeholders

PROTOCOL REQUIREMENTS

The Components will ensure that stakeholders have the opportunity to provide input in the Protocol's application by:

- Notifying heads (or their designated points of contact) of stakeholder organizations of the opportunity to participate in the Protocol's application and seeking their involvement;
- Publishing an announcement in local community publications about stakeholder participation in the initial application of the Protocol and requesting information pertinent to prioritization or sequencing;
- Including a copy of public notices and announcements in an MRS Administrative Record, Information Repository, or project file;

- Considering stakeholders' input in prioritization and sequencing decisions and documenting such decisions in the MAP or its equivalent;

- Including information provided by stakeholders that influenced an MRS's prioritization or sequencing in the Administrative Record, Information Repository, or project file; and

- Providing stakeholders with information on prioritization and sequencing changes and requesting their comments.

During the annual reapplication of the Protocol, if the MRS Priority or Alternative MRS Rating does not change, stakeholder outreach does not have to be conducted. Stakeholders only need to be involved if the Protocol is reapplied.

TOOLS FOR APPLYING THE PROTOCOL

Components are encouraged to work with **RABs** and **TRCs** during the prioritization process. RABs and TRCs are comprised of installation representatives and various stakeholders who are interested in or are concerned about environmental restoration decisions that have a potential to affect their community. RABs and TRCs offer an established stakeholder group that can act as an information conduit between installations or districts and the community. They possess useful knowledge, networks, and resources for installation and community personnel to leverage because of their involvement and understanding of DoD installations, FUDS, and the environmental restoration process.

Community Relations Plans

To facilitate communication with stakeholders, each installation or district is required to have a community relations plan. DoD uses community relations plans to build trust and ensure transparency within a community. By building this foundation of trust, DoD is able to make better cleanup decisions and more efficiently plan and implement required munitions responses. The MRS Project Team should use the community relations plan as the basis for fulfilling Protocol stakeholder requirements.

The community relations plan:

- May provide the MRS Project Team insight on whether the community would be interested in the Protocol and its activities.

- Provides an analysis of past impacts of environmental restoration activities on the community and evaluates the degree and nature of community interest in these activities.

- Contains strategies for providing opportunities for community participation and reflects input gained through interviews with a sufficient number of persons to represent the diversity of the community.

References

Community relations plans: www.denix.osd.mil/denix/Public/Library/Cleanup/CleanupOfc/stakeholder/crp.html

Definitions
(See Appendix C)

Restoration Advisory Board (RAB)

Technical Review Committee (TRC)

- Identifies appropriate mechanisms for disseminating information to the public (e.g., media publications, public meetings, Web sites).

Tools to Promote Involvement

Proactive outreach and open communication can help establish trust, reduce misinformation, and garner information pertinent to an MRS. Although the MRS Project Teams should involve stakeholders throughout the Protocol process, it is very important to involve them as early as possible. Early involvement helps educate stakeholders on the Protocol and its application.

There are many mechanisms an MRS Project Team can use to educate stakeholders about the Protocol and its application. Examples of outreach mechanisms are captured in Figure 10.2. The MRS Project Team should consult their community relations plan for mechanisms that have been used effectively in the past. The MRS Project Team can also contact the installation's Public Affairs Officer, or equivalent, to identify other appropriate mechanisms and approaches for publicizing the Protocol.

Figure 10.2 Example Outreach Mechanisms

Example Outreach Mechanisms
- Hotlines - Web sites - Newsletters - E-mail list servers - Distribution lists - *Federal Register* Notices - Exhibits - Documents - Electronic bulletin boards - Fact sheets - Brochures - Briefings - Formal public meetings - News releases - Radio or television public service announcements - News conferences and press kits - Open houses - Information meetings

Sequencing the MRS

DoD ensures that stakeholders, including current property owners (if an MRS is outside DoD's control), are offered opportunities to participate throughout the Protocol's application and provide sequencing recommendations. Once an MRS's relative priority is determined, the MRS Project Team should provide stakeholders with the opportunity to review and comment on how an MRS is sequenced for munitions responses. This is especially important because other factors such as community development or environmental justice concerns can influence sequencing decisions. Stakeholder input may provide vital information that the MRS Project Team or installation would not be aware of otherwise. Areas that stakeholders may be able to provide insight include:

- Cultural and social factors;
- Economic factors;

- Reasonably anticipated future land use;
- A community's reuse requirements at BRAC installations;
- Specialized considerations of tribal trust lands;
- The availability of appropriate technology; and
- Short-term and long-term ecological effects and environmental impacts in general, including injuries to natural resources.

SUMMARY

DoD recognizes that stakeholder involvement is the most effective way to identify and address stakeholder concerns during the environmental restoration process. By engaging with the community and other stakeholders early and often throughout the process, stakeholders gain a better understanding of the Protocol, the steps needed for a munitions response, and in turn, improve the efficiency of the Protocol's application.

The Protocol requires Components to offer stakeholders and regulators opportunities to comment and participate in the application of the Protocol and sequencing recommendations. DoD understands that stakeholders should be provided the opportunity, as early as possible, to obtain information about, and provide input for, Protocol and sequencing decisions that may affect them.

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Appendix A: Primer Scoring Tables

Table 1
EHE Module: Munitions Type Data Element Table

DIRECTIONS: Below are 11 classifications of munitions and their descriptions. Circle the scores that correspond with **all** the munitions types known or suspected to be present at the MRS.

Note: The terms *practice munitions, small arms ammunition, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score
Sensitive	◆ UXO that are considered most likely to function upon any interaction with exposed persons (e.g., submunitions, 40mm high-explosive [HE] grenades, white phosphorus [WP] munitions, high-explosive antitank [HEAT] munitions, and practice munitions with sensitive fuzes, but excluding all other practice munitions). ◆ Hand grenades containing energetic filler. ◆ Bulk primary explosives, or mixtures of these with environmental media, such that the mixture poses an explosive hazard.	30
High explosive (used or damaged)	◆ UXO containing a high-explosive filler (e.g., RDX, Composition B), that are not considered "sensitive." ◆ DMM containing a high-explosive filler that have: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	25
Pyrotechnic (used or damaged)	◆ UXO containing a pyrotechnic filler other than white phosphorus (e.g., flares, signals, simulators, smoke grenades). ◆ DMM containing a pyrotechnic filler other than white phosphorus (e.g., flares, signals, simulators, smoke grenades) that have: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	20
High explosive (unused)	◆ DMM containing a high-explosive filler that: ▪ Have not been damaged by burning or detonation ▪ Are not deteriorated to the point of instability.	15
Propellant	◆ UXO containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). ◆ DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor) that are: ▪ Damaged by burning or detonation ▪ Deteriorated to the point of instability.	15
Bulk secondary high explosives, pyrotechnics, or propellant	◆ DMM containing mostly single-, double-, or triple-based propellant, or composite propellants (e.g., a rocket motor). ◆ DMM that are bulk secondary high explosives, pyrotechnic compositions, or propellant (not contained in a munition), or mixtures of these with environmental media such that the mixture poses an explosive hazard.	10
Pyrotechnic (not used or damaged)	◆ DMM containing a pyrotechnic filler (i.e., red phosphorus), other than white phosphorus filler, that: ▪ Have not been damaged by burning or detonation ▪ Are not deteriorated to the point of instability.	10
Practice	◆ UXO that are practice munitions that are not associated with a sensitive fuze. ◆ DMM that are practice munitions that are not associated with a sensitive fuze and that have not: ▪ Been damaged by burning or detonation ▪ Deteriorated to the point of instability.	5
Riot control	◆ UXO or DMM containing a riot control agent filler (e.g., tear gas).	3
Small arms	◆ Used munitions or DMM that are categorized as small arms ammunition. (Physical evidence or historical evidence that no other types of munitions [e.g., grenades, subcaliber training rockets, demolition charges] were used or are present on the MRS is required for selection of this category.)	2
Evidence of no munitions	◆ Following investigation of the MRS, there is physical evidence that there are no UXO or DMM present, or there is historical evidence indicating that no UXO or DMM are present.	0
MUNITIONS TYPE	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30).	

DIRECTIONS: Document any MRS-specific data used in selecting the ***Munitions Type*** classifications in the space provided.

Table 2

EHE Module: Source of Hazard Data Element Table

DIRECTIONS: Below are 11 classifications describing sources of explosive hazards. Circle the scores that correspond with **all** the sources of explosive hazards known or suspected to be present at the MRS.

Note: The terms *former range, practice munitions, small arms range, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score
Former range	◆ The MRS is a former military range where munitions (including practice munitions with sensitive fuzes) have been used. Such areas include impact or target areas and associated buffer and safety zones.	10
Former munitions treatment (i.e., OB/OD) unit	◆ The MRS is a location where UXO or DMM (e.g., munitions, bulk explosives, bulk pyrotechnic, or bulk propellants) were burned or detonated for the purpose of treatment prior to disposal.	8
Former practice munitions range	◆ The MRS is a former military range on which only practice munitions without sensitive fuzes were used.	6
Former maneuver area	◆ The MRS is a former maneuver area where no munitions other than flares, simulators, smokes, and blanks were used. There must be evidence that no other munitions were used at the location to place an MRS into this category.	5
Former burial pit or other disposal area	◆ The MRS is a location where DMM were buried or disposed of (e.g., disposed of into a water body) without prior thermal treatment.	5
Former industrial operating facilities	◆ The MRS is a location that is a former munitions maintenance, manufacturing, or demilitarization facility.	4
Former firing points	◆ The MRS is a firing point, where the firing point is delineated as an MRS separate from the rest of a former military range.	4
Former missile or air defense artillery emplacements	◆ The MRS is a former missile defense or air defense artillery (ADA) emplacement not associated with a military range.	2
Former storage or transfer points	◆ The MRS is a location where munitions were stored or handled for transfer between different modes of transportation (e.g., rail to truck, truck to weapon system).	2
Former small arms range	◆ The MRS is a former military range where only small arms ammunition was used. (There must be evidence that no other types of munitions [e.g., grenades] were used or are present to place an MRS into this category.)	1
Evidence of no munitions	◆ Following investigation of the MRS, there is physical evidence that no UXO or DMM are present, or there is historical evidence indicating that no UXO or DMM are present.	0
SOURCE OF HAZARD	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 10).	

DIRECTIONS: Document any MRS-specific data used in selecting the ***Source of Hazard*** classifications in the space provided.

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Table 3

EHE Module: Location of Munitions Data Element Table

DIRECTIONS: Below are eight classifications of munitions locations and their descriptions. Circle the scores that correspond with **all** the locations where munitions are known or suspected to be present at the MRS.

Note: The terms *confirmed, surface, subsurface, small arms ammunition, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score
Confirmed surface	◆ Physical evidence indicates that there are UXO or DMM on the surface of the MRS. ◆ Historical evidence (i.e., a confirmed report such as an explosive ordnance disposal [EOD], police, or fire department report that an incident or accident that involved UXO or DMM occurred) indicates there are UXO or DMM on the surface of the MRS.	25
Confirmed subsurface, active	◆ Physical evidence indicates the presence of UXO or DMM in the subsurface of the MRS, and the geological conditions at the MRS are likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena (e.g., drought, flooding, erosion, frost heave, tidal action), or intrusive activities (e.g., plowing, construction, dredging) at the MRS are likely to expose UXO or DMM. ◆ Historical evidence indicates that UXO or DMM are located in the subsurface of the MRS and the geological conditions at the MRS are likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena (e.g., drought, flooding, erosion, frost heave, tidal action), or intrusive activities (e.g., plowing, construction, dredging) at the MRS are likely to expose UXO or DMM.	20
Confirmed subsurface, stable	◆ Physical evidence indicates the presence of UXO or DMM in the subsurface of the MRS and the geological conditions at the MRS are not likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena, or intrusive activities at the MRS are not likely to cause UXO or DMM to be exposed. ◆ Historical evidence indicates that UXO or DMM are located in the subsurface of the MRS and the geological conditions at the MRS are not likely to cause UXO or DMM to be exposed, in the future, by naturally occurring phenomena, or intrusive activities at the MRS are not likely to cause UXO or DMM to be exposed.	15
Suspected (physical evidence)	◆ There is physical evidence (e.g., munitions debris such as fragments, penetrators, projectiles, shell casings, links, fins), other than the documented presence of UXO or DMM, indicating that UXO or DMM may be present at the MRS.	10
Suspected (historical evidence)	◆ There is historical evidence indicating that UXO or DMM may be present at the MRS.	5
Subsurface, physical constraint	◆ There is physical or historical evidence indicating that UXO or DMM may be present in the subsurface, but there is a physical constraint (e.g., pavement, water depth over 120 feet) preventing direct access to the UXO or DMM.	2
Small arms (regardless of location)	◆ The presence of small arms ammunition is confirmed or suspected, regardless of other factors such as geological stability. (There must be evidence that no other types of munitions [e.g., grenades] were used or are present at the MRS to place an MRS into this category.)	1
Evidence of no munitions	◆ Following investigation of the MRS, there is physical evidence that there are no UXO or DMM present, or there is historical evidence indicating that no UXO or DMM are present.	0
LOCATION OF MUNITIONS	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 25).	

DIRECTIONS: Document any MRS-specific data used in selecting the ***Location of Munitions*** classifications in the space provided.

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Table 4

EHE Module: Ease of Access Data Element Table

DIRECTIONS: Below are four classifications of barrier types that can surround an MRS and their descriptions. The barrier type is directly related to the ease of public access to the MRS. Circle the score that corresponds with the ease of access to the MRS.

Note: The term *barrier* is defined in Appendix C of the Primer.

Classification	Description	Score
No barrier	◆ There is no barrier preventing access to any part of the MRS (i.e., all parts of the MRS are accessible).	10
Barrier to MRS access is incomplete	◆ There is a barrier preventing access to parts of the MRS, but not the entire MRS.	8
Barrier to MRS access is complete but not monitored	◆ There is a barrier preventing access to all parts of the MRS, but there is no surveillance (e.g., by a guard) to ensure that the barrier is effectively preventing access to all parts of the MRS.	5
Barrier to MRS access is complete and monitored	◆ There is a barrier preventing access to all parts of the MRS, and there is active, continual surveillance (e.g., by a guard, video monitoring) to ensure that the barrier is effectively preventing access to all parts of the MRS.	0
EASE OF ACCESS	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 10).	

DIRECTIONS: Document any MRS-specific data used in selecting the ***Ease of Access*** classification in the space provided.

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Table 5

EHE Module: Status of Property Data Element Table

DIRECTIONS: Below are three classifications of the status of a property within the Department of Defense (DoD) and their descriptions. Circle the score that corresponds with the status of property at the MRS.

Classification	Description	Score
Non-DoD control	◆ The MRS is at a location that is no longer owned by, leased to, or otherwise possessed or used by DoD. Examples are privately owned land or water bodies; land or water bodies owned or controlled by state, tribal, or local governments; and land or water bodies managed by other federal agencies. ◆ The MRS is at a location that is owned by DoD, but that DoD has leased to another entity and for which DoD does not control access 24 hours per day.	5
Scheduled for transfer from DoD control	◆ The MRS is on land or is a water body that is owned, leased, or otherwise possessed by DoD, and DoD plans to transfer that land or water body to the control of another entity (e.g., a state, tribal, or local government; a private party; another federal agency) within 3 years from the date the Protocol is applied.	3
DoD control	◆ The MRS is on land or is a water body that is owned, leased, or otherwise possessed by DoD. With respect to property that is leased or otherwise possessed, DoD must control access to the MRS 24 hours per day, every day of the calendar year.	0
STATUS OF PROPERTY	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	

DIRECTIONS: Document any MRS-specific data used in selecting the ***Status of Property*** classification in the space provided.

Table 6

EHE Module: Population Density Data Element Table

DIRECTIONS: Below are three classifications for population density and their descriptions. Determine the population density per square mile that most closely corresponds with the population of the MRS, including the area within a two-mile radius of the MRS's perimeter. Circle the most appropriate score.

Note: Use the U.S. Census Bureau tract data available to capture the **highest** population density within a two-mile radius of the perimeter of the MRS.

Classification	Description	Score
> 500 persons per square mile	◆ There are more than 500 persons per square mile in the U.S. Census Bureau tract in which the MRS is located.	5
100–500 persons per square mile	◆ There are 100 to 500 persons per square mile in the U.S. Census Bureau tract in which the MRS is located.	3
< 100 persons per square mile	◆ There are fewer than 100 persons per square mile in the U.S. Census Bureau tract in which the MRS is located.	1
POPULATION DENSITY	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	

DIRECTIONS: Document any MRS-specific data used in selecting the ***Population Density*** classification in the space provided.

Table 7

EHE Module: Population Near Hazard Data Element Table

DIRECTIONS: Below are six classifications describing the number of inhabited structures near the MRS. The number of inhabited buildings relates to the potential population near the MRS. Determine the number of inhabited structures within two miles of the MRS boundary and circle the score that corresponds with the number of inhabited structures.

Note: The term *inhabited structures* is defined in Appendix C of the Primer.

Classification	Description	Score
26 or more inhabited structures	◆ There are 26 or more inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	5
16 to 25 inhabited structures	◆ There are 16 to 25 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	4
11 to 15 inhabited structures	◆ There are 11 to 15 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	3
6 to 10 inhabited structures	◆ There are 6 to 10 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	2
1 to 5 inhabited structures	◆ There are 1 to 5 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	1
0 inhabited structures	◆ There are no inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	0
POPULATION NEAR HAZARD	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	

DIRECTIONS: Document any MRS-specific data used in selecting the ***Population Near Hazard*** classification in the space provided.

Table 8

EHE Module: Types of Activities/Structures Data Element Table

DIRECTIONS: Below are five classifications of activities and/or inhabited structures and their descriptions. Review the types of activities that occur and/or structures that are present within two miles of the MRS and circle the scores that correspond with **all** the activities/structure classifications at the MRS.

Note: The term *inhabited structure* is defined in Appendix C of the Primer.

Classification	Description	Score
Residential, educational, commercial, or subsistence	◆ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with any of the following purposes: residential, educational, child care, critical assets (e.g., hospitals, fire and rescue, police stations, dams), hotels, commercial, shopping centers, playgrounds, community gathering areas, religious sites, or sites used for subsistence hunting, fishing, and gathering.	5
Parks and recreational areas	◆ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with parks, nature preserves, or other recreational uses.	4
Agricultural, forestry	◆ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with agriculture or forestry.	3
Industrial or warehousing	◆ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with industrial activities or warehousing.	2
No known or recurring activities	◆ There are no known or recurring activities occurring up to two miles from the MRS's boundary or within the MRS's boundary.	1
TYPES OF ACTIVITIES/STRUCTURES	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	

DIRECTIONS: Document any MRS-specific data used in selecting the ***Types of Activities/Structures*** classifications in the space provided.

Table 9

EHE Module: Ecological and/or Cultural Resources Data Element Table

DIRECTIONS: Below are four classifications of ecological and/or cultural resources and their descriptions. Review the types of resources present and circle the score that corresponds with the ecological and/or cultural resources present on the MRS.

Note: The terms *ecological resources* and *cultural resources* are defined in Appendix C of the Primer.

Classification	Description	Score
Ecological and cultural resources present	◆ There are both ecological and cultural resources present on the MRS.	5
Ecological resources present	◆ There are ecological resources present on the MRS.	3
Cultural resources present	◆ There are cultural resources present on the MRS.	3
No ecological or cultural resources present	◆ There are no ecological resources or cultural resources present on the MRS.	0
ECOLOGICAL AND/OR CULTURAL RESOURCES	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	

DIRECTIONS: Document any MRS-specific data used in selecting the ***Ecological and/or Cultural Resources*** classification in the space provided.

Table 10
Determining the EHE Module Rating

DIRECTIONS:

1. From Tables 1–9, record the data element scores in the **Score** boxes to the right.
2. Add the **Score** boxes for each of the three factors and record this number in the **Value** boxes to the right.
3. Add the three **Value** boxes and record this number in the **EHE Module Total** box below.
4. Circle the appropriate range for the **EHE Module Total** below.
5. Circle the **EHE Module Rating** that corresponds to the range selected and record this value in the **EHE Module Rating** box found at the bottom of the table.

Note:
An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more data elements, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

	Source	Score	Value
Explosive Hazard Factor Data Elements			
Munitions Type	Table 1		
Source of Hazard	Table 2		
Accessibility Factor Data Elements			
Location of Munitions	Table 3		
Ease of Access	Table 4		
Status of Property	Table 5		
Receptor Factor Data Elements			
Population Density	Table 6		
Population Near Hazard	Table 7		
Types of Activities/Structures	Table 8		
Ecological and/or Cultural Resources	Table 9		
EHE MODULE TOTAL			

EHE Module Total	EHE Module Rating
92 to 100	A
82 to 91	B
71 to 81	C
60 to 70	D
48 to 59	E
38 to 47	F
less than 38	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected Explosive Hazard
EHE MODULE RATING	

Table 11

CHE Module: CWM Configuration Data Element Table

DIRECTIONS: Below are seven classifications of CWM configuration and their descriptions. Circle the scores that correspond with **all** the CWM configurations known or suspected to be present at the MRS.

Note: The terms *CWM/UXO, CWM/DMM, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score
CWM, that are either UXO, or explosively configured damaged DMM	The CWM known or suspected of being present at the MRS are: ◆ CWM that are UXO (i.e., CWM/UXO) ◆ Explosively configured CWM that are DMM (i.e., CWM/DMM) that have been damaged.	30
CWM mixed with UXO	◆ The CWM known or suspected of being present at the MRS are undamaged CWM/DMM or CWM not configured as a munition that are commingled with conventional munitions that are UXO.	25
CWM, explosive configuration that are undamaged DMM	◆ The CWM known or suspected of being present at the MRS are explosively configured CWM/DMM that have not been damaged.	20
CWM/DMM, not explosively configured or CWM, bulk container	The CWM known or suspected of being present at the MRS are: ◆ Nonexplosively configured CWM/DMM either damaged or undamaged ◆ Bulk CWM (e.g., ton container).	15
CAIS K941 and CAIS K942	◆ The CWM/DMM known or suspected of being present at the MRS are CAIS K941-toxic gas set M-1 or CAIS K942-toxic gas set M-2/E11.	12
CAIS (chemical agent identification sets)	◆ CAIS, other than CAIS K941 and K942, are known or suspected of being present at the MRS.	10
Evidence of no CWM	◆ Following investigation, the physical evidence indicates that CWM are not present at the MRS, or the historical evidence indicates that CWM are not present at the MRS.	0
CWM CONFIGURATION	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 30).	

DIRECTIONS: Document any MRS-specific data used in selecting the ***CWM Configuration*** classifications in the space provided.

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Table 12

CHE Module: Sources of CWM Data Element Table

DIRECTIONS: Below are 11 sources of CWM hazards and their descriptions. Review these classifications and circle the scores that correspond with **all** the sources of CWM hazards known or suspected to be present at the MRS.

Note: The terms *CWM/UXO, CWM/DMM, CAIS/DMM, surface, subsurface, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score
Live-fire involving CWM	◆ The MRS is a former military range that supported live-fire of explosively configured CWM and the CWM/UXO are known or suspected of being present on the surface or in the subsurface. ◆ The MRS is a former military range that supported live-fire with conventional munitions, and CWM/DMM are on the surface or in the subsurface commingled with conventional munitions that are UXO.	10
Damaged CWM/DMM surface or subsurface	◆ There are damaged CWM/DMM on the surface or in the subsurface at the MRS.	10
Undamaged CWM/DMM surface	◆ There are undamaged CWM/DMM on the surface at the MRS.	10
CAIS/DMM surface	◆ There are CAIS/DMM on the surface.	10
Undamaged CWM/DMM, subsurface	◆ There are undamaged CWM/DMM in the subsurface at the MRS.	5
CAIS/DMM subsurface	◆ There are CAIS/DMM in the subsurface at the MRS.	5
Former CA or CWM Production Facilities	◆ The MRS is a facility that formerly engaged in production of CA or CWM, and CWM/DMM is suspected of being present on the surface or in the subsurface.	3
Former Research, Development, Testing, and Evaluation (RDT&E) facility using CWM	◆ The MRS is at a facility that formerly was involved in non-live-fire RDT&E activities (including static testing) involving CWM, and there are CWM/DMM suspected of being present on the surface or in the subsurface.	3
Former Training Facility using CWM or CAIS	◆ The MRS is a location that formerly was involved in training activities involving CWM and/or CAIS (e.g., training in recognition of CWM, decontamination training) and CWM/DMM or CAIS/DMM are suspected of being present on the surface or in the subsurface.	2
Former Storage or Transfer points of CWM	◆ The MRS is a former storage facility or transfer point (e.g., intermodal transfer) for CWM.	1
Evidence of no CWM	◆ Following investigation, the physical evidence indicates that CWM are not present at the MRS, or the historical evidence indicates that CWM are not present at the MRS.	0
SOURCES OF CWM	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 10).	

DIRECTIONS: Document any MRS-specific data used in selecting the ***Sources of CWM*** classifications in the space provided.

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Table 13

CHE Module: Location of CWM Data Element Table

DIRECTIONS: Below are seven classifications of CWM locations and their descriptions. Review these locations and circle the scores that correspond with **all** the locations where CWM are known or suspected of being found at the MRS.

Note: The terms *confirmed, surface, subsurface, physical evidence,* and *historical evidence* are defined in Appendix C of the Primer.

Classification	Description	Score
Confirmed surface	◆ Physical evidence indicates that there are CWM on the surface of the MRS. ◆ Historical evidence (i.e., a confirmed report such as an explosive ordnance disposal [EOD], police, or fire department report, that an incident or accident that involved CWM, regardless of configuration, occurred) indicates there are CWM on the surface of the MRS.	25
Confirmed subsurface, active	◆ Physical evidence indicates the presence of CWM in the subsurface of the MRS and the geological conditions at the MRS are likely to cause CWM to be exposed, in the future, by naturally occurring phenomena (e.g., drought, flooding, erosion, frost heave, tidal action), or intrusive activities (e.g., plowing, construction, dredging) at the MRS are likely to expose CWM. ◆ Historical evidence indicates that CWM are located in the subsurface of the MRS and the geological conditions at the MRS are likely to cause CWM to be exposed, in the future, by naturally occurring phenomena (e.g., drought, flooding, erosion, frost heave, tidal action), or intrusive activities (e.g., plowing, construction, dredging) at the MRS are likely to expose CWM.	20
Confirmed subsurface, stable	◆ Physical evidence indicates the presence of CWM in the subsurface of the MRS and the geological conditions at the MRS are not likely to cause CWM to be exposed, in the future, by naturally occurring phenomena, or intrusive activities at the MRS are not likely to cause CWM to be exposed. ◆ Historical evidence indicates that CWM are located in the subsurface of the MRS and the geological conditions at the MRS are not likely to cause CWM to be exposed, in the future, by naturally occurring phenomena, or intrusive activities at the MRS are not likely to cause CWM to be exposed.	15
Suspected (physical evidence)	◆ There is physical evidence, other than the documented presence of CWM, indicating that CWM may be present at the MRS.	10
Suspected (historical evidence)	◆ There is historical evidence indicating that CWM may be present at the MRS.	5
Subsurface, physical constraint	◆ There is physical or historical evidence indicating that CWM may be present in the subsurface, but there is a physical constraint (e.g., pavement, water depth over 120 feet) preventing direct access to the CWM.	2
Evidence of no CWM	◆ Following investigation of the MRS, there is physical evidence that there is no CWM present or there is historical evidence indicating that no CWM are present.	0
LOCATION OF CWM	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 25).	

DIRECTIONS: Document any MRS-specific data used in selecting the ***Location of CWM*** classifications in the space provided.

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Table 14
CHE Module: Ease of Access Data Element Table

DIRECTIONS: Below are four classifications of barrier types that can surround an MRS and their descriptions. The barrier type is directly related to the ease of public access to the MRS. Circle the score that corresponds with the ease of access to the MRS.
Note: The term *barrier* is defined in Appendix C of the Primer.

Classification	Description	Score
No barrier	◆ There is no barrier preventing access to any part of the MRS (i.e., all parts of the MRS are accessible).	10
Barrier to MRS access is incomplete	◆ There is a barrier preventing access to parts of the MRS, but not the entire MRS.	8
Barrier to MRS access is complete but not monitored	◆ There is a barrier preventing access to all parts of the MRS, but there is no surveillance (e.g., by a guard) to ensure that the barrier is effectively preventing access to all parts of the MRS.	5
Barrier to MRS access is complete and monitored	◆ There is a barrier preventing access to all parts of the MRS, and there is active continual surveillance (e.g., by a guard, video monitoring) to ensure that the barrier is effectively preventing access to all parts of the MRS.	0
EASE OF ACCESS	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 10).	

DIRECTIONS: Document any MRS-specific data used in selecting the ***Ease of Access*** classification in the space provided.

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Table 15

CHE Module: Status of Property Data Element Table

DIRECTIONS: Below are three classifications of the status of a property within the Department of Defense (DoD) and their descriptions. Circle the score that corresponds with the status of property at the MRS.

Classification	Description	Score
Non-DoD control	◆ The MRS is at a location that is no longer owned by, leased to, or otherwise possessed or used by DoD. Examples are privately owned land or water bodies; land or water bodies owned or controlled by state, tribal or local governments; and land or water bodies managed by other federal agencies. ◆ The MRS is at a location that is owned by DoD, but that DoD has leased to another entity and for which DoD does not control access 24 hours per day.	5
Scheduled for transfer from DoD control	◆ The MRS is on land or is a water body that is owned, leased, or otherwise possessed by DoD, and DoD plans to transfer that land or water body to control of another entity (e.g., a state, tribal, or local government; a private party; another federal agency) within 3 years from the date the Protocol is applied.	3
DoD control	◆ The MRS is on land or is a water body that is owned, leased, or otherwise possessed by DoD. With respect to property that is leased or otherwise possessed, DoD controls access to the MRS 24 hours per day, every day of the calendar year.	0
STATUS OF PROPERTY	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	

DIRECTIONS: Document any MRS-specific data used in selecting the ***Status of Property*** classification in the space provided.

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Table 16

CHE Module: Population Density Data Element Table

DIRECTIONS: Below are three classifications for population density and their descriptions. Determine the population density per square mile that most closely corresponds with the population of the MRS, including the area within a two-mile radius of the MRS's perimeter. Circle the most appropriate score.

Note: Use the U.S. Census Bureau tract data available to capture the **highest** population density within a two-mile radius of the perimeter of the MRS.

Classification	Description	Score
> 500 persons per square mile	◆ There are more than 500 persons per square mile in the U.S. Census Bureau tract in which the MRS is located.	5
100–500 persons per square mile	◆ There are 100 to 500 persons per square mile in the U.S. Census Bureau tract in which the MRS is located.	3
< 100 persons per square mile	◆ There are fewer than 100 persons per square mile in the U.S. Census Bureau tract in which the MRS is located.	1
POPULATION DENSITY	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	

DIRECTIONS: Document any MRS-specific data used in selecting the ***Population Density*** classification in the space provided.

Table 17

CHE Module: Population Near Hazard Data Element Table

DIRECTIONS: Below are six classifications describing the number of inhabited structures near the MRS. The number of inhabited buildings relates to the potential population near the MRS. Determine the number of inhabited structures within two miles of the MRS boundary and circle the score that corresponds with the number of inhabited structures.

Note: The term *inhabited structures* is defined in Appendix C of the Primer.

Classification	Description	Score
26 or more inhabited structures	◆ There are 26 or more inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	5
16 to 25 inhabited structures	◆ There are 16 to 25 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	4
11 to 15 inhabited structures	◆ There are 11 to 15 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	3
6 to 10 inhabited structures	◆ There are 6 to 10 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	2
1 to 5 inhabited structures	◆ There are 1 to 5 inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	1
0 inhabited structures	◆ There are no inhabited structures located up to 2 miles from the boundary of the MRS, within the boundary of the MRS, or both.	0
POPULATION NEAR HAZARD	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	

DIRECTIONS: Document any MRS-specific data used in selecting the ***Population Near Hazard*** classification in the space provided.

Table 18

CHE Module: Types of Activities/Structures Data Element Table

DIRECTIONS: Below are five classifications of activities and/or inhabited structures and their descriptions. Review the types of activities that occur and/or structures that are present within two miles of the MRS and circle the scores that correspond with **all** the activities/structures classifications at the MRS.

Note: The term *inhabited structures* is defined in Appendix C of the Primer.

Classification	Description	Score
Residential, educational, commercial, or subsistence	◆ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with any of the following purposes: residential, educational, child care, critical assets (e.g., hospitals, fire and rescue, police stations, dams), hotels, commercial, shopping centers, playgrounds, community gathering areas, religious sites, or sites used for subsistence hunting, fishing, and gathering.	5
Parks and recreational areas	◆ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with parks, nature preserves, or other recreational uses.	4
Agricultural, forestry	◆ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with agriculture or forestry.	3
Industrial or warehousing	◆ Activities are conducted, or inhabited structures are located up to two miles from the MRS's boundary or within the MRS's boundary, that are associated with industrial activities or warehousing.	2
No known or recurring activities	◆ There are no known of recurring activities occurring up to two miles from the MRS's boundary or within the MRS's boundary.	1
TYPES OF ACTIVITIES/STRUCTURES	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	

DIRECTIONS: Document any MRS-specific data used in selecting the ***Types of Activities/Structures*** classifications in the space provided.

Table 19

CHE Module: Ecological and/or Cultural Resources Data Element Table

DIRECTIONS: Below are four classifications of ecological and/or cultural resources and their descriptions. Review the types of resources present and circle the score that corresponds with the ecological and/or cultural resources present on the MRS.

Note: The terms *ecological resources* and *cultural resources* are defined in Appendix C of the Primer.

Classification	Description	Score
Ecological and cultural resources present	◆ There are both ecological and cultural resources present on the MRS.	5
Ecological resources present	◆ There are ecological resources present on the MRS.	3
Cultural resources present	◆ There are cultural resources present on the MRS.	3
No ecological or cultural resources present	◆ There are no ecological resources or cultural resources present on the MRS.	0
ECOLOGICAL AND/OR CULTURAL RESOURCES	**DIRECTIONS:** Record **the single highest score** from above in the box to the right (maximum score = 5).	

DIRECTIONS: Document any MRS-specific data used in selecting the ***Ecological and/or Cultural Resources*** classification in the space provided.

Table 20
Determining the CHE Module Rating

DIRECTIONS:

1. From Tables 11–19, record the data element scores in the **Score** boxes to the right.
2. Add the **Score** boxes for each of the three factors and record this number in the **Value** boxes to the right.
3. Add the three **Value** boxes and record this number in the **CHE Module Total** box below.
4. Circle the appropriate range for the **CHE Module Total** below.
5. Circle the **CHE Module Rating** that corresponds to the range selected and record this value in the **CHE Module Rating** box found at the bottom of the table.

Note:
An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more data elements, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

	Source	Score	Value
CWM Hazard Factor Data Elements			
CWM Configuration	Table 11		
Sources of CWM	Table 12		
Accessibility Factor Data Elements			
Location of CWM	Table 13		
Ease of Access	Table 14		
Status of Property	Table 15		
Receptor Factor Data Elements			
Population Density	Table 16		
Population Near Hazard	Table 17		
Types of Activities/Structures	Table 18		
Ecological and/or Cultural Resources	Table 19		
CHE MODULE TOTAL			

CHE Module Total	CHE Module Rating
92 to 100	A
82 to 91	B
71 to 81	C
60 to 70	D
48 to 59	E
38 to 47	F
less than 38	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected CWM Hazard
CHE MODULE RATING	

Table 21

HHE Module: Groundwater Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's groundwater and their **comparison values** (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the contaminant **ratios** together, including any additional groundwater contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard present in the groundwater, select the box at the bottom of the table.

Contaminant	Maximum Concentration (µg/L)	Comparison Value (µg/L)	Ratios

CHF Scale	CHF Value	Sum The Ratios
CHF > 100	H (High)	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$
100 > CHF > 2	M (Medium)	
2 > CHF	L (Low)	

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the groundwater migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the groundwater is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in groundwater has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the groundwater to a potential point of exposure (possibly due to the presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the groundwater receptors at the MRS.

Classification	Description	Value
Identified	There is a threatened water supply well downgradient of the source and the groundwater is a current source of drinking water or source of water for other beneficial uses such as irrigation/agriculture (equivalent to Class I or IIA aquifer).	H
Potential	There is no threatened water supply well downgradient of the source and the groundwater is currently or potentially usable for drinking water, irrigation, or agriculture (equivalent to Class I, IIA, or IIB aquifer).	M
Limited	There is no potentially threatened water supply well downgradient of the source and the groundwater is not considered a potential source of drinking water and is of limited beneficial use (equivalent to Class IIIA or IIIB aquifer, or where perched aquifer exists only).	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

No Known or Suspected Groundwater MC Hazard ❑

Table 22

HHE Module: Surface Water – Human Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's surface water and their **comparison values** (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the contaminant **ratios** together, including any additional surface water contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard with human endpoints present in the surface water, select the box at the bottom of the table.

Contaminant	Maximum Concentration (µg/L)	Comparison Value (µg/L)	Ratios

CHF Scale	CHF Value	Sum The Ratios	
CHF > 100	H (High)	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	M (Medium)		
2 > CHF	L (Low)		

CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).	

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface water is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface water has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface water to a potential point of exposure (possibly due to the presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface water to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface water to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface water to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

No Known or Suspected Surface Water (Human Endpoint) MC Hazard ❑

Table 23

HHE Module: Sediment – Human Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's sediment and their **comparison values** (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the contaminant **ratios** together, including any additional sediment contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard with human endpoints present in the sediment, select the box at the bottom of the table.

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios
CHF Scale	**CHF Value**	**Sum The Ratios**	
CHF > 100	**H (High)**	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		
CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right maximum value = H).		

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the sediment is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the sediment to a potential point of exposure (possibly due to the presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to sediment to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to sediment to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to sediment to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

No Known or Suspected Sediment (Human Endpoint) MC Hazard ❑

Table 24

HHE Module: Surface Water – Ecological Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's surface water and their **comparison values** (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the contaminant **ratios** together, including any additional surface water contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard with ecological endpoints present in the surface water, select the box at the bottom of the table.

Contaminant	Maximum Concentration (µg/L)	Comparison Value (µg/L)	Ratios

CHF Scale	CHF Value	Sum the Ratios	
CHF > 100	H (High)	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	M (Medium)		
2 > CHF	L (Low)		
CONTAMINANT HAZARD FACTOR	DIRECTIONS: Record **the CHF Value** from above in the box to the right (maximum value = H).		

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface water is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface water has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface water to a potential point of exposure (possibly due to the presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	DIRECTIONS: Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface water receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface water to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface water to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface water to which contamination has moved or can move.	L
RECEPTOR FACTOR	DIRECTIONS: Record **the single highest value** from above in the box to the right (maximum value = H).	

No Known or Suspected Surface Water (Ecological Endpoint) MC Hazard ❑

Table 25

HHE Module: Sediment – Ecological Endpoint Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's sediment and their **comparison values** (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the contaminant **ratios** together, including any additional sediment contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard with ecological endpoints present in the sediment, select the box at the bottom of the table.

.

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratios

CHF Scale	CHF Value	Sum the Ratios	
CHF > 100	H (High)	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	M (Medium)		
2 > CHF	L (Low)		
CONTAMINANT HAZARD FACTOR	DIRECTIONS: Record **the CHF Value** from above in the box to the right (maximum value = H).		

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the sediment is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in sediment has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the sediment to a potential point of exposure (possibly due to the presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	DIRECTIONS: Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the sediment receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to sediment to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to sediment to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to sediment to which contamination has moved or can move.	L
RECEPTOR FACTOR	DIRECTIONS: Record **the single highest value** from above in the box to the right (maximum value = H).	

No Known or Suspected Sediment (Ecological Endpoint) MC Hazard ❑

Table 26

HHE Module: Surface Soil Data Element Table

Contaminant Hazard Factor (CHF)

DIRECTIONS: Record the **maximum concentrations** of all contaminants in the MRS's surface soil and their **comparison values** (from Appendix B of the Primer) in the table below. Additional contaminants can be recorded on Table 27. Calculate and record the **ratios** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** by adding the contaminant **ratios** together, including any additional surface soil contaminants recorded on Table 27. Based on the **CHF**, use the **CHF Scale** to determine and record the **CHF Value**. If there is no known or suspected MC hazard present in the surface soil, select the box at the bottom of the table.

.

Contaminant	Maximum Concentration (mg/kg)	Comparison Value (mg/kg)	Ratio
CHF Scale	**CHF Value**	**Sum the Ratios**	
CHF > 100	**H (High)**	$CHF = \sum \frac{\text{[Maximum Concentration of Contaminant]}}{\text{[Comparison Value for Contaminant]}}$	
100 > CHF > 2	**M (Medium)**		
2 > CHF	**L (Low)**		
CONTAMINANT HAZARD FACTOR	**DIRECTIONS:** Record **the CHF Value** from above in the box to the right (maximum value = H).		

Migratory Pathway Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface soil migratory pathway at the MRS.

Classification	Description	Value
Evident	Analytical data or observable evidence indicates that contamination in the surface soil is present at, moving toward, or has moved to a point of exposure.	H
Potential	Contamination in surface soil has moved only slightly beyond the source (i.e., tens of feet), could move but is not moving appreciably, or information is not sufficient to make a determination of Evident or Confined.	M
Confined	Information indicates a low potential for contaminant migration from the source via the surface soil to a potential point of exposure (possibly due to the presence of geological structures or physical controls).	L
MIGRATORY PATHWAY FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

Receptor Factor

DIRECTIONS: Circle the value that corresponds most closely to the surface soil receptors at the MRS.

Classification	Description	Value
Identified	Identified receptors have access to surface soil to which contamination has moved or can move.	H
Potential	Potential for receptors to have access to surface soil to which contamination has moved or can move.	M
Limited	Little or no potential for receptors to have access to surface soil to which contamination has moved or can move.	L
RECEPTOR FACTOR	**DIRECTIONS:** Record **the single highest value** from above in the box to the right (maximum value = H).	

No Known or Suspected Surface Soil MC Hazard ❑

Table 27

HHE Module: Supplemental Contaminant Hazard Factor Table

<u>Contaminant Hazard Factor (CHF)</u>

DIRECTIONS: **Only use this table if there are more than five contaminants in any given medium present at the MRS.** This is a supplemental table designed to hold information about contaminants that do not fit in the previous tables. Indicate the **media** in which these contaminants are present. Then record all **contaminants**, their **maximum concentrations** and their **comparison values** (from Appendix B of the Primer) in the table below. Calculate and record the **ratio** for each contaminant by dividing the **maximum concentration** by the **comparison value**. Determine the **CHF** for each medium on the appropriate media-specific tables.

Note: Do not add ratios from different media.

Media	Contaminant	Maximum Concentration	Comparison Value	Ratio

Table 28
Determining the HHE Module Rating

DIRECTIONS:

1. Record the letter values (H, M, L) for the **Contaminant Hazard**, **Migration Pathway**, and **Receptor Factors** for the media (from Tables 21–26) in the corresponding boxes below.
2. Record the media's three-letter combinations in the **Three-Letter Combination** boxes below (three-letter combinations are arranged from Hs to Ms to Ls).
3. Using the **HHE Ratings** provided below, determine each media's rating (A–G) and record the letter in the corresponding **Media Rating** box below.

Media (Source)	Contaminant Hazard Factor Value	Migratory Pathway Factor Value	Receptor Factor Value	Three-Letter Combination (Hs-Ms-Ls)	Media Rating (A-G)
Groundwater (Table 21)					
Surface Water/Human Endpoint (Table 22)					
Sediment/Human Endpoint (Table 23)					
Surface Water/Ecological Endpoint (Table 24)					
Sediment/Ecological Endpoint (Table 25)					
Surface Soil (Table 26)					

DIRECTIONS (cont.):

4. Select the single highest Media Rating (A is highest; G is lowest) and enter the letter in the **HHE Module Rating** box.

Note:

An alternative module rating may be assigned when a module letter rating is inappropriate. An alternative module rating is used when more information is needed to score one or more media, contamination at an MRS was previously addressed, or there is no reason to suspect contamination was ever present at an MRS.

HHE MODULE RATING	

HHE Ratings (for reference only)

Combination	Rating
HHH	A
HHM	B
HHL	C
HMM	C
HML	D
MMM	D
HLL	E
MML	E
MLL	F
LLL	G
Alternative Module Ratings	Evaluation Pending
	No Longer Required
	No Known or Suspected MC Hazard

Table 29
MRS Priority

DIRECTIONS: In the chart below, circle the letter **rating** for each module recorded in Table 10 (EHE), Table 20 (CHE), and Table 28 (HHE). Circle the corresponding numerical **priority** for each module. If information to determine the module rating is not available, choose the appropriate alternative module rating. The MRS Priority is the single highest priority; record this relative priority in the **MRS Priority or Alternative MRS Rating** at the bottom of the table.

Note: An MRS assigned Priority 1 has the highest relative priority; an MRS assigned Priority 8 has the lowest relative priority. Only an MRS with CWM known or suspected to be present can be assigned Priority 1; an MRS that has CWM known or suspected to be present cannot be assigned Priority 8.

EHE Rating	Priority	CHE Rating	Priority	HHE Rating	Priority
		A	1		
A	2	B	2	A	2
B	3	C	3	B	3
C	4	D	4	C	4
D	5	E	5	D	5
E	6	F	6	E	6
F	7	G	7	F	7
G	8			G	8
Evaluation Pending		Evaluation Pending		Evaluation Pending	
No Longer Required		No Longer Required		No Longer Required	
No Known or Suspected Explosive Hazard		No Known or Suspected CWM Hazard		No Known or Suspected MC Hazard	
MRS PRIORITY or ALTERNATIVE MRS RATING					

Table A
MRS Background Information

DIRECTIONS: Record the background information below for the MRS to be evaluated. Much of this information is available from Service and DoD databases. If the MRS is located on a FUDS property, the suitable FUDS property information should be substituted. In the **MRS Summary**, briefly describe the UXO, DMM, or MC that are known or suspected to be present, the exposure setting (the MRS's physical environment), any other incidental nonmunitions-related contaminants (e.g., benzene, trichloroethylene) found at the MRS, and any potentially exposed human and ecological receptors. If possible, include a map of the MRS.

Munitions Response Site Name: _____

Component: _____

Installation/Property Name: _____

Location (City, County, State): _____

Site Name/Project Name (Project No.): _____

Date Information Entered/Updated: _____

Point of Contact (Name/Phone): _____

Project Phase (check only one):

❑ PA	❑ SI	❑ RI	❑ FS	❑ RD
❑ RA-C	❑ RIP	❑ RA-O	❑ RC	❑ LTM

Media Evaluated (check all that apply):

❑ Groundwater	❑ Sediment (human receptor)
❑ Surface soil	❑ Surface Water (ecological receptor)
❑ Sediment (ecological receptor)	❑ Surface Water (human receptor)

MRS Summary:

MRS Description: Describe the munitions-related activities that occurred at the installation, the dates of operation, and the UXO, DMM, or MC known or suspected to be present. When possible, identify munitions, CWM, and MC by type:

_____

_____

Description of Pathways for Human and Ecological Receptors: _____

_____

_____

Description of Receptors (Human and Ecological): _____

_____

_____

APPENDIX B-1: Human Health Comparison Values

The Human Health Comparison Values (CVs) presented in this appendix replace those contained in the *Relative Risk Site Evaluation Primer* (Summer 1997). These CVs are to be used in conjunction with the Munitions Response Site Prioritization Protocol (32 CFR Part 179, October 5, 2005) to evaluate known or suspected hazards to human receptors at or near munitions response sites. CVs to evaluate ecological receptors using surface water or sediment sampling data are found in Appendices B-2 and B-3, respectively. These CVs should not be equated with a more comprehensive baseline risk assessment, nor should they be considered final cleanup goals or action levels. Furthermore, the Human Health CVs are not to be used to reevaluate existing sites under the Installation Restoration Program.

The CVs listed in this appendix were derived primarily using a methodology developed by the U.S. Environmental Protection Agency (EPA), Region 9 to calculate their Preliminary Remediation Goals (PRGs). This methodology is outlined in EPA Region 9's *Users' Guide and Background Technical Document for the Preliminary Remediation Goals* (*PRGs Users' Guide*). The Human Health CVs in this appendix were calculated by combining current toxicity data with standard exposure factors using generally accepted models to estimate contaminant concentrations in media (e.g., soil and water) that are considered to be protective of human exposures (including sensitive receptor subpopulations) over a lifetime. Deviations from this approach are noted for specific CVs.

The toxicity values used to develop the CVs in this appendix were selected using EPA's hierarchy of toxicological sources for CERCLA sites outlined in OSWER Directive 9285.7-53 "Human Health Toxicity Values in Superfund Risk Assessments." The following hierarchy of toxicological sources were used to derive these CVs:

1) EPA's Integrated Risk Information System (IRIS).

2) EPA's Provisional Peer Reviewed Toxicity Values (PPRTVs).

3) Other toxicity value sources, such as the California EPA toxicity values, the Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Levels, EPA's Health Effects Assessment Summary Tables (HEAST), and the Department of the Army's Center for Health Promotion and Preventative Medicine (CHPPM) databases. These data were primarily obtained from EPA Region 9 PRGs, EPA Region 6 *Medium-Specific Human Health Screening Levels* (*MSSL*), EPA Region 3 *Risk-Based Concentrations* (*RBC*) table, the Oak Ridge National Laboratory (ORNL) *Risk Assessment Information System* (*RAIS*), and the CHPPM *Chronic Toxicity Criteria for Human Health Risk Assessment*, Version 3.

Conservative exposure factors developed by EPA for a default residential scenario were used to calculate CVs for each medium. These exposure factors are listed in Exhibit 4-1 of EPA Region 9's *PRGs Users' Guide*, with three notable

exceptions. Soil inhalation exposures were evaluated using chemical-specific values for volatilization factors (VFs) and particulate emission factors (PEFs), where available. Chemical-specific VFs, and PEFs were obtained from the same sources as cited above for toxicity data. When not available, the following approaches were used to determine default values for these variables:

- VFs for most volatile compounds were available via the sources listed above. No default methodology was available in current guidance for volatile compounds lacking published VFs; consequently, the inhalation exposure evaluation for these constituents was limited to the particulate fraction.

- A default PEF of 1.316×10^9 was used to estimate particulate inhalation exposures to organics and inorganics per the recommendation of EPA Region 9's *PRGs Users' Guide*.

Soil dermal exposures were evaluated using an approach consistent with EPA Region 9's *PRGs Users' Guide* and EPA's *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual* (*Part E, Supplemental Guidance for Dermal Risk Assessment*), July 2004. Accordingly, chemical-specific skin absorption factors or ABS_d were used, when available. A default ABS_d of 0.10 was used for semi-volatile organics, and the ABS_d for inorganics and volatiles was zero. A gastro-intestinal absorption factor (ABS_{GI}) of 1.00 was assumed for published oral toxicity values (i.e., RfD_0 and SF_0) for all constituents.

CVs are based on either a carcinogenic (ca) or noncarcinogenic (nc) exposure endpoints depending on which computed value is more conservative. Noncarcinogenic values are calculated by combining default exposure parameters, a target hazard index of 1.0, and noncarcinogenic reference doses (RfDs). Values based on carcinogenic exposure endpoints are calculated by combining default exposure parameters, a target risk level, and cancer slope factors (SFs). The EPA has determined that a computed carcinogenic risk range of 10^{-4} to 10^{-6} (i.e., one-in-ten thousand to one-in-one-million) is acceptable, depending on other prevailing circumstances. The Preamble to the National Oil and Hazardous Substances Pollution Contingency Plan (55 *FR* 8716, March 8, 1990) defines the remedial action threshold for carcinogens as 10^{-4}. As a result, for the purposes of computing the relative risk CVs, the DoD Workgroup has deemed 10^{-4} to be the appropriate target risk level.

Because a target cancer risk level of 10^{-4} was used when calculating CVs, for certain contaminants, the resulting noncarcinogenic CV is less (i.e., more conservative) than the CV based on a carcinogenic effect. As a result, the noncarcinogenic screening level is the risk driver and is the reported in this appendix. However, it should be noted that, if the CVs were recalculated to account for a target cancer risk level of 10^{-6}, the carcinogenic CV would be less (i.e., more conservative) than the noncarcinogenic CV reported in this appendix. The CVs that are currently based on a noncarcinogenic endpoint, which would not be the calculated CV (i.e., most conservative endpoint) if a target cancer risk level of 10^{-6} were used, are noted in this appendix with an asterisk.

CVs representing military-unique materials (e.g., explosives, propellants, chemical agent materials, and by-products) have been incorporated into the overall, alphabetical listing of materials. CVs for these munitions constituents were identified from the U.S. Army Corps of Engineers, *Military Munitions Center of Expertise*, *Munitions Constituent Sampling* (March 2005).

The screening criteria for radionuclides are provided at the end of this appendix. They were derived from the U.S. Department of Energy, Oak Ridge National Laboratories' *RAIS PRG*s. All radiological levels presented are based on carcinogenic exposure endpoints and have been adjusted to reflect a 1×10^{-4} excess lifetime cancer risk, as described above.

Analytes in this appendix are listed by their most common names. Therefore, there is no more than one record for each Chemical Abstract System (CAS) number included in this appendix.

Figure B.1.1 Human Health Comparison Values for General Organic and Inorganic Analytes

Analyte	Note	CAS Number	Soil (mg/kg)	Qualifier	Water (µg/L)	Qualifier
Acenaphthene		83-32-9	3.7E+03	nc	3.7E+02	nc
Acephate		30560-19-1	2.4E+02	nc**	1.5E+02	nc*
Acetaldehyde		75-07-0	5.0E+01	nc**	1.7E+02	ca
Acetochlor		34256-82-1	1.2E+03	nc	7.3E+02	nc
Acetone		67-64-1	1.4E+04	nc	5.5E+03	nc
Acetone cyanohydrin		75-86-5	4.9E+01	nc	2.9E+01	nc
Acetonitrile		75-05-8	4.2E+02	nc	1.0E+02	nc
Acetophenone		98-86-2	7.8E+03	nc	3.7E+03	nc
Acifluorfen	a	50594-66-6	8.5E+02	nc	4.7E+02	nc
Acrolein		107-02-8	1.0E-01	nc	4.2E-02	nc
Acrylamide		79-06-1	1.1E+01	ca	1.5E+00	ca
Acrylic acid		79-10-7	2.9E+04	nc	1.8E+04	nc
Acrylonitrile		107-13-1	7.3E+00	nc**	3.7E+00	nc*
Adamsite	a, g	578-94-9	3.6E+03	ca	NA	NA
Alachlor		15972-60-8	6.0E+02	ca	8.4E+01	ca
Alar		1596-84-5	9.2E+03	nc	5.5E+03	nc
Aldicarb		116-06-3	6.1E+01	nc	3.6E+01	nc
Aldicarb sulfone		1646-88-4	6.1E+01	nc	3.6E+01	nc
Aldrin		309-00-2	1.8E+00	nc**	4.0E-01	ca
Ally		74223-64-6	1.5E+04	nc	9.1E+03	nc
Allyl alcohol		107-18-6	3.1E+02	nc	1.8E+02	nc
Allyl chloride		107-05-1	3.0E+03	nc	1.8E+03	nc
Aluminum	h	7429-90-5	7.6E+04	nc	3.6E+04	nc
Aluminum phosphide		20859-73-8	3.1E+01	nc	1.5E+01	nc
Amdro		67485-29-4	1.8E+01	nc	1.1E+01	nc
Ametryn		834-12-8	5.5E+02	nc	3.3E+02	nc
Aminodinitrotoluene		1321-12-6	1.2E+02	nc	7.3E+01	nc
m-Aminophenol		591-27-5	4.3E+03	nc	2.6E+03	nc
4-Aminopyridine		504-24-5	1.2E+00	nc	7.3E-01	nc
Amitraz		33089-61-1	1.5E+02	nc	9.1E+01	nc
Ammonia		7664-41-7	NA	NA	2.1E+02	nc
Ammonium perchlorate	e	7790-98-9	5.5E+01	nc	2.5E+01	nc
Ammonium sulfamate		7773-06-0	1.2E+04	nc	7.3E+03	nc
Aniline		62-53-3	4.3E+02	nc**	2.6E+02	nc*
Anthracene		120-12-7	2.2E+04	nc	1.8E+03	nc
Antimony and compounds	h	7440-36-0	3.1E+01	nc	1.5E+01	nc
Antimony pentoxide		1314-60-9	3.9E+01	nc	1.8E+01	nc
Antimony Potassium Tartrate		28300-74-5	7.0E+01	nc	3.3E+01	nc
Antimony Tetroxide		1332-81-6	3.1E+01	nc	1.5E+01	nc
Antimony Trioxide		1309-64-4	3.1E+01	nc	1.5E+01	nc
Apollo		74115-24-5	7.9E+02	nc	4.7E+02	nc
Aramite		140-57-8	1.9E+03	ca	2.7E+02	ca
Aroclor-1016		12674-11-2	3.9E+00	nc	2.6E+00	nc
Aroclor-1221		11104-28-2	2.2E+01	ca	3.3E+00	ca
Aroclor-1232		11141-16-5	2.2E+01	ca	3.3E+00	ca
Aroclor-1242		53469-21-9	2.2E+01	ca	3.3E+00	ca
Aroclor-1248		12672-29-6	2.2E+01	ca	3.3E+00	ca
Aroclor-1254		11097-69-1	1.1E+00	nc**	7.3E-01	nc*

Analyte	Note	CAS Number	Soil (mg/kg)	Qualifier	Water (µg/L)	Qualifier
Aroclor-1260		11096-82-5	2.2E+01	ca	3.3E+00	ca
Arsenic	h	7440-38-2	2.2E+01	nc*	4.5E+00	ca
Arsine	a	7784-42-1	3.6E+03	ca	NA	NA
Assure		76578-14-8	5.5E+02	nc	3.3E+02	nc
Asulam		3337-71-1	3.1E+03	nc	1.8E+03	nc
Atrazine		1912-24-9	2.2E+02	ca	3.0E+01	ca
Avermectin B1		71751-41-2	2.4E+01	nc	1.5E+01	nc
Azobenzene		103-33-3	4.4E+02	ca	6.1E+01	ca
Barium and compounds		7440-39-3	1.6E+04	nc	7.3E+03	nc
Barium Cyanide		542-62-1	7.8E+03	nc	3.7E+03	nc
Baygon		114-26-1	2.4E+02	nc	1.5E+02	nc
Bayleton		43121-43-3	1.8E+03	nc	1.1E+03	nc
Baythroid		68359-37-5	1.5E+03	nc	9.1E+02	nc
Benefin		1861-40-1	1.8E+04	nc	1.1E+04	nc
Benomyl		17804-35-2	3.1E+03	nc	1.8E+03	nc
Bentazon		25057-89-0	1.8E+03	nc	1.1E+03	nc
Benz[a]anthracene		56-55-3	6.2E+01	ca	9.2E+00	ca
Benzaldehyde		100-52-7	6.1E+03	nc	3.6E+03	nc
Benzene		71-43-2	3.3E+01	nc*	3.5E+01	ca
Benzenethiol		108-98-5	7.8E-01	nc	3.7E-01	nc
Benzidine		92-87-5	2.1E-01	ca	2.9E-02	ca
Benzo[a]pyrene		50-32-8	6.2E+00	ca	9.1E-01	ca
Benzo[b]fluoranthene		205-99-2	6.2E+01	ca	9.2E+00	ca
Benzo(j)Fluoranthene		205-82-3	3.8E+01	ca	5.5E+00	ca
Benzo[k]fluoranthene		207-08-9	6.2E+02	ca	9.2E+01	ca
Benzoic acid		65-85-0	1.0E+05	max	1.5E+05	nc
Benzotrichloride		98-07-7	3.7E+00	ca	5.2E-01	ca
Benzyl alcohol		100-51-6	3.1E+04	nc	1.8E+04	nc
Benzyl chloride		100-44-7	8.4E+01	nc*	6.6E+00	ca
Beryllium and compounds	h	7440-41-7	1.5E+02	nc	7.3E+01	nc
Bidrin		141-66-2	6.1E+00	nc	3.6E+00	nc
Biphenthrin (Talstar)		82657-04-3	9.2E+02	nc	5.5E+02	nc
1,1-Biphenyl		92-52-4	3.0E+03	nc	3.0E+02	nc
Bis(2-chloroethyl)ether		111-44-4	2.2E+01	ca	1.0E+00	ca
Bis(2-chloroisopropyl)ether		108-60-1	2.9E+02	ca	2.7E+01	ca
Bis(chloromethyl)ether		542-88-1	1.9E-02	ca	5.2E-03	ca
Bis(2-ethylhexyl)phthalate (DEHP)		117-81-7	1.2E+03	nc*	4.8E+02	ca
Bisphenol A		80-05-7	3.1E+03	nc	1.8E+03	nc
Boron		7440-42-8	1.6E+04	nc	7.3E+03	nc
Boron trifluoride		7637-072	1.0E+05	max	NA	NA
Bromate		15541-45-4	6.9E+01	ca	9.6E+00	ca
Bromobenzene		108-86-1	3.2E+01	nc	2.3E+01	nc
Bromodichloromethane		75-27-4	8.2E+01	ca	1.8E+01	ca
Bromoform (tribromomethane)		75-25-2	1.2E+03	nc*	7.3E+02	nc*
Bromomethane (Methyl bromide)		74-83-9	3.9E+00	nc	8.7E+00	nc
4-Bromophenyl Phenyl Ether	a	101-55-3	4.5E+03	nc	2.1E+03	nc
Bromophos		2104-96-3	3.1E+02	nc	1.8E+02	nc
Bromoxynil		1689-84-5	1.2E+03	nc	7.3E+02	nc

Analyte	Note	CAS Number	Soil (mg/kg)	Qualifier	Water (µg/L)	Qualifier
Bromoxynil octanoate		1689-99-2	1.2E+03	nc	7.3E+02	nc
1,3-Butadiene		106-99-0	8.4E-01	nc*	3.5E+00	nc*
1-Butanol		71-36-3	6.1E+03	nc	3.7E+03	nc
Butyl benzyl phthalate		85-68-7	1.2E+04	nc	7.3E+03	nc
Butylate		2008-41-5	3.1E+03	nc	1.8E+03	nc
n-Butylbenzene		104-51-8	1.4E+02	nc	6.1E+01	nc
sec-Butylbenzene		135-98-8	1.1E+02	nc	6.1E+01	nc
tert-Butylbenzene		98-06-6	1.3E+02	nc	6.1E+01	nc
Butylphthalyl butylglycolate		85-70-1	6.1E+04	nc	3.6E+04	nc
Cacodylic Acid		75-60-5	1.8E+01	nc	1.1E+01	nc
Cadmium and compounds		7440-43-9	3.9E+01	nc	1.8E+01	nc
Calcium Cyanide		592-01-8	3.1E+03	nc	1.5E+03	nc
Caprolactam		105-60-2	3.1E+04	nc	1.8E+04	nc
Captafol		2425-061	1.2E+02	nc**	7.3E+01	nc**
Captan		133-06-2	7.9E+03	nc*	1.9E+03	ca
Carbaryl		63-25-2	6.1E+03	nc	3.6E+03	nc
Carbazole		86-74-8	2.4E+03	ca	3.4E+02	ca
Carbofuran		1563-66-2	3.1E+02	nc	1.8E+02	nc
Carbon disulfide		75-15-0	3.6E+02	nc	1.0E+03	nc
Carbon tetrachloride		56-23-5	2.4E+01	ca	1.7E+01	ca
Carbosulfan		55285-14-8	6.1E+02	nc	3.6E+02	nc
Carboxin		5234-68-4	6.1E+03	nc	3.6E+03	nc
Chloral Hydrate		302-17-0	7.8E+03	nc	3.7E+03	nc
Chloramben		133-90-4	9.2E+02	nc	5.5E+02	nc
Chloranil		118-75-2	1.2E+02	ca	1.7E+01	ca
Chlordane		12789-03-6	3.5E+01	nc*	1.8E+01	nc*
Chlorimuron-ethyl		90982-32-4	1.2E+03	nc	7.3E+02	nc
Chlorine		7782-50-5	7.8E+03	nc	3.7E+03	nc
Chloroacetaldehyde	a	107-20-0	5.4E+02	nc	2.5E+02	nc
Chlorine dioxide		10049-04-4	1.8E+03	nc	1.1E+03	nc
Chloroacetic acid		79-11-8	1.2E+02	nc	7.3E+01	nc
2-Chloroacetophenone		532-27-4	3.3E-02	nc	5.2E-02	nc
4-Chloroaniline		106-47-8	2.4E+02	nc	1.5E+02	nc
Chlorobenzene		108-90-7	1.3E+02	nc	9.1E+01	nc
Chlorobenzilate		510-15-6	1.8E+02	ca	2.5E+01	ca
p-Chlorobenzoic acid		74-11-3	1.2E+04	nc	7.3E+03	nc
4-Chlorobenzotrifluoride		98-56-6	1.2E+03	nc	7.3E+02	nc
2-Chloro-1,3-butadiene		126-99-8	3.6E+00	nc	1.4E+01	nc
1-Chlorobutane		109-69-3	4.8E+02	sat	2.4E+03	nc
1-Chloro-1,1-difluoroethane (HCFC-142b)		75-68-3	3.4E+02	sat	8.7E+04	nc
Chlorodifluoromethane		75-45-6	3.4E+02	sat	8.5E+04	nc
Chloroethane		75-00-3	3.0E+02	ca	4.6E+02	ca
tris(2-Chloroethyl)amine (HN3)	g, k	555-77-1	4.3E-01	nc	2.6E-01	nc
bis(2-Chloroethyl)ethylamine (HN1)	g, k	538-07-8	4.3E-01	nc	2.6E-01	nc
2-Chloroethyl Vinyl Ether	a	110-75-8	2.0E+03	nc	1.5E+02	nc
Chloroform		67-66-3	2.2E+01	ca	1.7E+01	ca
Chloromethane (methyl chloride)		74-87-3	4.7E+01	nc	1.6E+02	nc

Analyte	Note	CAS Number	Soil (mg/kg)	Qualifier	Water (µg/L)	Qualifier
4-Chloro-2-methylaniline		95-69-2	8.4E+01	ca	1.2E+01	ca
4-Chloro-2-methylaniline hydrochloride		3165-93-3	1.1E+02	ca	1.5E+01	ca
beta-Chloronaphthalene		91-58-7	4.9E+03	nc	4.9E+02	nc
o-Chloronitrobenzene		88-73-3	1.4E+00	nc	1.5E-01	nc
p-Chloronitrobenzene		100-00-5	1.0E+01	nc	1.2E+00	nc
2-Chlorophenol		95-57-8	6.3E+01	nc	3.0E+01	nc
Chloropicrin	a, f	76-06-2	1.6E+02	nc	NA	NA
2-Chloropropane		75-29-6	1.7E+02	nc	1.7E+02	nc
Chlorothalonil		1897-45-6	9.2E+02	nc*	5.5E+02	nc**
o-Chlorotoluene		95-49-8	1.6E+02	nc	1.2E+02	nc
p-Chlorotoluene		106-43-4	5.5E+03	nc	2.6E+03	nc
2-Chlorovinyl Arsenous Acid	b, g	85090-33-2	6.1E+00	nc	3.7E+00	nc
Chlorpropham		101-21-3	1.2E+04	nc	7.3E+03	nc
Chlorpyrifos		2921-88-2	1.8E+02	nc	1.1E+02	nc
Chlorpyrifos-methyl		5598-13-0	6.1E+02	nc	3.6E+02	nc
Chlorsulfuron		64902-72-3	3.1E+03	nc	1.8E+03	nc
Chlorthiophos		60238-56-4	4.9E+01	nc	2.9E+01	nc
Total Chromium (1:6 ratio Cr VI:Cr III)	l	MRSPP-01	1.6E+03	nc	NA	NA
Chromium III		16065-83-1	1.0E+05	max	5.5E+04	nc
Chromium VI		18540-29-9	2.3E+02	nc**	1.1E+02	nc
Chrysene		218-01-9	6.2E+03	ca	9.2E+02	ca
Cobalt	h	7440-48-4	1.4E+03	nc*	7.3E+02	nc
Coke Oven Emissions		8007-45-2	4.0E+05	ca	NA	NA
Copper and compounds	h	7440-50-8	3.1E+03	nc	1.5E+03	nc
Copper Cyanide		544-92-3	3.9E+02	nc	1.8E+02	nc
Crotonaldehyde		123-73-9	5.3E-01	ca	5.9E-01	ca
Cumene (isopropylbenzene)		98-82-8	5.7E+02	nc	6.6E+02	nc
Cyanazine		21725-46-2	5.8E+01	ca	8.0E+00	ca
Cyanide (free)		57-12-5	1.2E+03	nc	7.3E+02	nc
Potassium Cyanide		151-50-8	3.9E+03	nc	1.8E+03	nc
Sodium Cyanide		143-33-9	3.1E+03	nc	1.5E+03	nc
Cyanogen		460-19-5	1.3E+02	nc	2.4E+02	nc
Cyanogen bromide		506-68-3	2.9E+02	nc	5.5E+02	nc
Cyanogen chloride	b	506-77-4	2.3E+03	nc	1.1E+03	nc
Cyclohexane		110-82-7	1.4E+02	sat	1.0E+04	nc
Cyclohexanone		108-94-1	1.0E+05	max	1.8E+05	nc
Cyclohexylamine		108-91-8	1.2E+04	nc	7.3E+03	nc
Cyhalothrin/Karate		68085-85-8	3.1E+02	nc	1.8E+02	nc
Cypermethrin		52315-07-8	6.1E+02	nc	3.6E+02	nc
Cyromazine		66215-27-8	4.6E+02	nc	2.7E+02	nc
Dacthal		1861-32-1	6.1E+02	nc	3.6E+02	nc
Dalapon		75-99-0	1.8E+03	nc	1.1E+03	nc
Danitol		39515-41-8	1.5E+03	nc	9.1E+02	nc
DDD		72-54-8	2.4E+02	ca	2.8E+01	ca
DDE		72-55-9	1.7E+02	ca	2.0E+01	ca
DDT		50-29-3	3.6E+01	nc*	1.8E+01	nc**
Decabromodiphenyl ether		1163-19-5	6.1E+02	nc	3.6E+02	nc
Demeton		8065-48-3	2.4E+00	nc	1.5E+00	nc

Analyte	Note	CAS Number	Soil (mg/kg)	Qualifier	Water (µg/L)	Qualifier
Diallate		2303-16-4	8.0E+02	ca	1.1E+02	ca
Diazinon		333-41-5	5.5E+01	nc	3.3E+01	nc
Dibenz[ah]anthracene		53-70-3	6.2E+00	ca	9.2E-01	ca
Dibenz(a,h)Acridine		226-36-8	3.8E+01	ca	5.5E+00	ca
Dibenz(a,j)Acridine		224-42-0	3.8E+01	ca	5.5E+00	ca
7H-Dibenzo(c,g)Carbazole		194-59-2	3.8E+00	ca	5.5E-01	ca
Dibenzofuran		132-64-9	1.5E+02	nc	1.2E+01	nc
Dibenzo(a,e)Pyrene		192-65-4	3.8E+00	ca	5.5E-01	ca
Dibenzo(a,h)Pyrene		189-64-0	3.8E-01	ca	5.5E-02	ca
Dibenzo(a,i)Pyrene		189-55-9	3.8E-01	ca	5.5E-02	ca
Dibenzo(a,l)Pyrene		191-30-0	3.8E-01	ca	5.5E-02	ca
1,4-Dibromobenzene		106-37-6	6.1E+02	nc	3.6E+02	nc
Dibromochloromethane		124-48-1	1.1E+02	ca	1.3E+01	ca
1,2-Dibromo-3-chloropropane (DBCP)		96-12-8	1.4E+00	ca	6.3E-02	ca
1,2-Dibromoethane (EDB)		106-93-4	3.2E+00	ca	5.6E-01	ca
Dibutyl phthalate		84-74-2	6.1E+03	nc	3.6E+03	nc
Dicamba		1918-00-9	1.8E+03	nc	1.1E+03	nc
1,2-Dichlorobenzene		95-50-1	6.0E+02	sat	3.7E+02	nc
1,3-Dichlorobenzene		541-73-1	5.3E+02	nc	1.8E+02	nc
1,4-Dichlorobenzene		106-46-7	3.4E+02	ca	5.0E+01	ca
3,3-Dichlorobenzidine		91-94-1	1.1E+02	ca	1.5E+01	ca
4,4’-Dichlorobenzophenone		90-98-2	1.8E+03	nc	1.1E+03	nc
1,4-Dichloro-2-butene		764-41-0	7.9E-01	ca	1.2E-01	ca
Dichlorodifluoromethane		75-71-8	9.4E+01	nc	3.9E+02	nc
2,2’-Dichlorodiisopropyl ether (bis(2-chloroisopropyl) ether)		39638-32-9	2.9E+02	ca	2.7E+01	ca
1,1-Dichloroethane		75-34-3	6.2E+02	nc	9.1E+02	nc
1,2-Dichloroethane (EDC)		107-06-2	1.1E+01	nc	1.0E+01	nc
1,2-Dichloroethylene (cis)		156-59-2	4.3E+01	nc	6.1E+01	nc
1,2-Dichloroethene (total)		540-59-0	7.0E+02	nc	3.3E+02	nc
1,2-Dichloroethylene (trans)		156-60-5	6.9E+01	nc	1.2E+02	nc
1,1-Dichloroethylene		75-35-4	1.2E+02	nc	3.4E+02	nc
2,4-Dichlorophenol		120-83-2	1.8E+02	nc	1.1E+02	nc
4-(2,4-Dichlorophenoxy) butyric Acid (2,4-DB)		94-82-6	4.9E+02	nc	2.9E+02	nc
2,4-Dichlorophenoxyacetic Acid (2,4-D)		94-75-7	6.9E+02	nc	3.6E+02	nc
1,2-Dichloropropane		78-87-5	6.0E+00	nc*	6.9E+00	nc**
2,3-Dichloropropanol		616-23-9	1.8E+02	nc	1.1E+02	nc
1,3-Dichloropropane		142-28-9	1.0E+02	nc	1.2E+02	nc
1,3-Dichloropropene		542-75-6	7.8E+01	ca	4.0E+01	ca
Dichlorvos		62-73-7	3.1E+01	nc*	1.8E+01	nc**
Dicofol		115-32-2	1.1E+02	ca	1.5E+01	ca
Dicyclopentadiene		77-73-6	1.9E+01	nc	1.4E+01	nc
Dieldrin		60-57-1	3.0E+00	ca	4.2E-01	ca
Diethyl phthalate		84-66-2	4.9E+04	nc	2.9E+04	nc
Diethylene glycol, monobutyl ether		112-34-5	6.1E+02	nc	3.6E+02	nc

Analyte	Note	CAS Number	Soil (mg/kg)	Qualifier	Water (µg/L)	Qualifier
Diethylene glycol, monoethyl ether		111-90-0	3.7E+03	nc	2.2E+03	nc
Diethylformamide		617-84-5	2.4E+01	nc	1.5E+01	nc
Di(2-ethylhexyl)adipate		103-23-1	4.1E+04	ca	5.6E+03	ca
Diethylstilbestrol		56-53-1	1.0E-02	ca	1.4E-03	ca
Difenzoquat (Avenge)		43222-48-6	4.9E+03	nc	2.9E+03	nc
Diflubenzuron		35367-38-5	1.2E+03	nc	7.3E+02	nc
1,1-Difluoroethane		75-37-6	NA	NA	6.9E+04	nc
Diisononyl phthalate		28553-12-0	1.2E+03	nc	7.3E+02	nc
Diisopropyl methylphosphonate	g	1445-75-6	4.9E+03	nc	2.9E+03	nc
S-(2-diisopropylaminoethyl)-methylphosphonothioic acid	b	73207-98-4	4.7E-02	nc	2.2E-02	nc
Dimethipin		55290-64-7	1.2E+03	nc	7.3E+02	nc
Dimethoate		60-51-5	1.2E+01	nc	7.3E+00	nc
3,3'-Dimethoxybenzidine		119-90-4	3.5E+03	ca	4.8E+02	ca
Dimethylamine		124-40-3	6.7E-02	nc	3.5E-02	nc
2,4-Dimethylaniline		95-68-1	6.5E+01	ca	9.0E+00	ca
2,4-Dimethylaniline hydrochloride		21436-96-4	8.4E+01	ca	1.2E+01	ca
N-N-Dimethylaniline		121-69-7	1.2E+02	nc	7.3E+01	nc
7,12-Dimethylbenzanthracene	a	57-97-6	6.1E+01	ca	NA	NA
3,3'-Dimethylbenzidine		119-93-7	2.1E+01	ca	2.9E+00	ca
N,N-Dimethylformamide		68-12-2	6.1E+03	nc	3.6E+03	nc
Dimethylphenethylamine		122-09-8	6.1E+01	nc	3.6E+01	nc
1,2-Dimethylhydrazine		540-73-8	1.3E+00	ca	1.8E-01	ca
2,4-Dimethylphenol		105-67-9	1.2E+03	nc	7.3E+02	nc
2,6-Dimethylphenol		576-26-1	3.7E+01	nc	2.2E+01	nc
3,4-Dimethylphenol		95-65-8	6.1E+01	nc	3.6E+01	nc
Dimethyl phthalate		131-11-3	1.0E+05	max	3.6E+05	nc
Dimethyl terephthalate		120-61-6	6.1E+03	nc	3.6E+03	nc
4,6-Dinitro-o-cresol		534-52-1	6.1E+00	nc	3.6E+00	nc
4,6-Dinitro-o-cyclohexyl phenol		131-89-5	1.2E+02	nc	7.3E+01	nc
1,2-Dinitrobenzene		528-29-0	6.1E+00	nc	3.6E+00	nc
1,3-Dinitrobenzene		99-65-0	6.1E+00	nc	3.6E+00	nc
1,4-Dinitrobenzene		100-25-4	6.1E+00	nc	3.6E+00	nc
2,4-Dinitrophenol		51-28-5	1.2E+02	nc	7.3E+01	nc
1,6-Dinitropyrene		42397-64-8	3.8E-01	ca	5.5E-02	ca
1,8-Dinitropyrene	a	42397-65-9	6.1E+01	ca	NA	NA
Dinitrotoluene mixture		25321-14-6	7.2E+01	ca	9.9E+00	ca
2,4-Dinitrotoluene	f	121-14-2	1.2E+02	nc	7.3E+01	nc
2,6-Dinitrotoluene	f	606-20-2	6.1E+01	nc	3.6E+01	nc
Dinoseb		88-85-7	6.1E+01	nc	3.6E+01	nc
di-n-Octyl phthalate		117-84-0	2.4E+03	nc	1.5E+03	nc
1,4-Dioxane		123-91-1	4.4E+03	ca	6.1E+02	ca
Diphenamid		957-51-7	1.8E+03	nc	1.1E+03	nc
Diphenylamine		122-39-4	1.5E+03	nc	9.1E+02	nc
N,N-Diphenyl-1,4 benzenediamine (DPPD)		74-31-7	1.8E+01	nc	1.1E+01	nc
1,2-Diphenylhydrazine		122-66-7	6.1E+01	ca	8.4E+00	ca
Diphenyl sulfone		127-63-9	1.8E+02	nc	1.1E+02	nc

Analyte	Note	CAS Number	Soil (mg/kg)	Qualifier	Water (µg/L)	Qualifier
Diquat		85-00-7	1.3E+02	nc	8.0E+01	nc
Direct black 38		1937-37-7	5.7E+00	ca	7.8E-01	ca
Direct blue 6		2602-46-2	6.0E+00	ca	8.3E-01	ca
Direct brown 95		16071-86-6	5.2E+00	ca	7.2E-01	ca
Disulfoton		298-04-4	2.4E+00	nc	1.5E+00	nc
1,4-Dithiane	j	505-29-3	6.1E+02	nc	3.6E+02	nc
Diuron		330-54-1	1.2E+02	nc	7.3E+01	nc
Dodine		2439-103	2.4E+02	nc	1.5E+02	nc
Dysprosium		7429-91-6	7.8E+03	nc	3.6E+03	nc
Endosulfan		115-29-7	3.7E+02	nc	2.2E+02	nc
Endothall		145-73-3	1.2E+03	nc	7.3E+02	nc
Endrin		72-20-8	1.8E+01	nc	1.1E+01	nc
Epichlorohydrin		106-89-8	7.8E+00	nc	2.1E+00	nc
1,2-Epoxybutane		106-88-7	3.5E+02	nc	2.1E+02	nc
EPTC (S-Ethyl dipropylthiocarbamate)		759-94-4	1.5E+03	nc	9.1E+02	nc
Ethephon (2-chloroethyl phosphonic acid)		16672-87-0	3.1E+02	nc	1.8E+02	nc
Ethion		563-12-2	3.1E+01	nc	1.8E+01	nc
2-Ethoxyethanol		110-80-5	2.4E+04	nc	1.5E+04	nc
2-Ethoxyethanol acetate		111-15-9	1.8E+04	nc	1.1E+04	nc
Ethyl acetate		141-78-6	1.9E+04	nc	5.5E+03	nc
Ethyl acrylate		140-88-5	2.1E+01	ca	2.3E+01	ca
Ethyl ether		60-29-7	1.8E+03	sat	1.2E+03	nc
Ethyl methacrylate		97-63-2	1.4E+02	sat	5.5E+02	nc
Ethyl methylphosphonic acid (EMPA)	b	1832-53-7	1.5E+03	nc	9.1E+02	nc
Ethyl p-nitrophenyl phenylphosphorothioate		2104-64-5	6.1E-01	nc	3.6E-01	nc
o-Ethyl S-(2diisopropylaminoethyl) Methylphosphonothiolate (VX)	b	50782-69-9	3.7E-02	nc	2.2E-02	nc
Ethylbenzene		100-41-4	4.0E+02	sat	1.3E+03	nc
Ethylene cyanohydrin		109-78-4	1.8E+04	nc	1.1E+04	nc
Ethylene glycol		107-21-1	1.0E+05	max	7.3E+04	nc
Ethylene glycol, monobutyl ether		111-76-2	3.1E+04	nc	1.8E+04	nc
Ethylene oxide		75-21-8	1.4E+01	ca	2.4E+00	ca
Ethylene thiourea (ETU)		96-45-7	4.9E+00	nc**	2.9E+00	nc**
Ethylene diamine		107-15-3	5.5E+03	nc	3.3E+03	nc
Ethylphthalyl ethyl glycolate		84-72-0	1.0E+05	max	1.1E+05	nc
Express		101200-48-0	4.9E+02	nc	2.9E+02	nc
Fenamiphos		22224-92-6	1.5E+01	nc	9.1E+00	nc
Fluometuron		2164-17-2	7.9E+02	nc	4.7E+02	nc
Fluoranthene		206-44-0	2.3E+03	nc	1.5E+03	nc
Fluorene		86-73-7	2.7E+03	nc	2.4E+02	nc
Fluorine		7782-41-4	3.7E+03	nc	2.2E+03	nc
Fluorine (soluble fluoride)		16984-48-8	3.7E+03	nc	2.2E+03	nc
Fluoridone		59756-60-4	4.9E+03	nc	2.9E+03	nc

Analyte	Note	CAS Number	Soil (mg/kg)	Qualifier	Water (µg/L)	Qualifier
Flurprimidol		56425-91-3	1.2E+03	nc	7.3E+02	nc
Flutolanil		66332-96-5	3.7E+03	nc	2.2E+03	nc
Fluvalinate		69409-94-5	6.1E+02	nc	3.6E+02	nc
Folpet		133-07-3	6.1E+03	nc*	1.9E+03	ca
Fomesafen		72178-02-0	2.6E+02	ca	3.5E+01	ca
Fonofos		944-22-9	1.2E+02	nc	7.3E+01	nc
Formaldehyde		50-00-0	9.2E+03	nc	5.5E+03	nc
Formic Acid		64-18-6	1.0E+05	max	7.3E+04	nc
Fosetyl-al		39148-24-8	1.0E+05	max	1.1E+05	nc
Furan		110-00-9	2.5E+00	nc	6.1E+00	nc
Furazolidone		67-45-8	1.3E+01	ca	1.8E+00	ca
Furfural		98-01-1	1.8E+02	nc	1.1E+02	nc
Furium		531-82-8	9.7E-01	ca	1.3E-01	ca
Furmecyclox		60568-05-0	1.6E+03	ca	2.2E+02	ca
Glufosinate-ammonium		77182-82-2	2.4E+01	nc	1.5E+01	nc
Glycidaldehyde		765-34-4	2.4E+01	nc	1.5E+01	nc
Glyphosate		1071-83-6	6.1E+03	nc	3.6E+03	nc
Haloxyfop-methyl		69806-40-2	3.1E+00	nc	1.8E+00	nc
Harmony		79277-27-3	7.9E+02	nc	4.7E+02	nc
HCH (alpha)		319-84-6	9.0E+00	ca	1.1E+00	ca
HCH (beta)		319-85-7	3.2E+01	ca	3.7E+00	ca
Heptachlor		76-44-8	1.1E+01	ca	1.5E+00	ca
Heptachlor epoxide		1024-57-3	7.9E-01	nc*	4.7E-01	nc*
Hexabromobenzene		87-82-1	1.2E+02	nc	7.3E+01	nc
Hexachlorobenzene		118-74-1	3.0E+01	ca	4.2E+00	ca
Hexachlorobutadiene		87-68-3	1.2E+01	nc	7.3E+00	nc
Hexachlorocyclohexane (HCH)		608-73-1	3.2E+01	ca	3.7E+00	ca
Hexachlorocyclopentadiene		77-47-4	3.7E+02	nc	2.2E+02	nc
Hexachlorodibenzodioxin Mix		19408-74-3	7.8E-03	ca	1.1E-03	ca
Hexachloroethane		67-72-1	6.1E+01	nc**	3.6E+01	nc**
Hexachlorophene		70-30-4	1.8E+01	nc	1.1E+01	nc
Hexahydro-1,3,5-trinitroso-1,3,5-triazine (TNX)	f	13980-04-6	1.8E+02	nc*	6.1E+01	ca
1,6-Hexamethylene diisocyanate		822-06-0	1.7E-01	nc	1.0E-01	nc
n-Hexane		110-54-3	1.1E+02	sat	1.5E+03	nc
Hexazinone		51235-04-2	2.0E+03	nc	1.2E+03	nc
HMX	f	2691-41-0	3.1E+03	nc	1.8E+03	nc
Hydrazine, hydrazine sulfate		302-01-2	1.6E+01	ca	2.2E+00	ca
Hydrazine, monomethyl		60-34-4	1.6E+01	ca	2.2E+00	ca
Hydrazine, dimethyl		57-14-7	1.6E+01	ca	2.2E+00	ca
Hydrogen cyanide		74-90-8	1.1E+01	nc	6.2E+00	nc
Hydrogen sulfide		7783-064	1.8E+02	nc	1.1E+02	nc
p-Hydroquinone		123-31-9	8.7E+02	ca	1.2E+02	ca
Imazalil		35554-44-0	7.9E+02	nc	4.7E+02	nc
Imazaquin		81335-37-7	1.5E+04	nc	9.1E+03	nc
Iprodione		36734-19-7	2.4E+03	nc	1.5E+03	nc
Iron	i	7439-89-6	2.3E+04	nc	1.1E+04	nc
Isobutanol		78-83-1	1.3E+04	nc	1.8E+03	nc
Isophorone		78-59-1	1.2E+04	nc*	7.1E+03	ca

Analyte	Note	CAS Number	Soil (mg/kg)	Qualifier	Water (µg/L)	Qualifier
Isopropalin		33820-53-0	9.2E+02	nc	5.5E+02	nc
Isopropyl methyl phosphonic acid	g	1832-54-8	6.1E+03	nc	3.6E+03	nc
Isoxaben		82558-50-7	3.1E+03	nc	1.8E+03	nc
Kepone		143-50-0	6.1E+00	ca	8.3E-01	ca
Lactofen		77501-63-4	1.2E+02	nc	7.3E+01	nc
Lead	h, l	7439-92-1	4.0E+02	NA	1.5E+01	NA
Lead (tetraethyl)		78-00-2	6.1E-03	nc	3.6E-03	nc
Lewisite	b	541-25-3	6.1E+00	nc	3.7E+00	nc
HCH (gamma) Lindane		58-89-9	2.1E+01	nc*	5.2E+00	ca
Linuron		330-55-2	1.2E+02	nc	7.3E+01	nc
Lithium		7439-93-2	1.6E+03	nc	7.3E+02	nc
Londax		83055-99-6	1.2E+04	nc	7.3E+03	nc
Malathion		121-75-5	1.2E+03	nc	7.3E+02	nc
Maleic anhydride		108-31-6	6.1E+03	nc	3.6E+03	nc
Maleic hydrazide		123-33-1	1.7E+03	nc	3.0E+03	nc
Malononitrile		109-77-3	6.1E+00	nc	3.6E+00	nc
Mancozeb		8018-017	1.8E+03	nc	1.1E+03	nc
Maneb		12427-38-2	3.1E+02	nc*	1.1E+02	ca
Manganese and compounds		7439-96-5	3.3E+03	nc	1.7E+03	nc
Mephosfolan		950-10-7	5.5E+00	nc	3.3E+00	nc
Mepiquat chloride		24307-26-4	1.8E+03	nc	1.1E+03	nc
2-Mercaptobenzothiazole		149-30-4	1.7E+03	ca	2.3E+02	ca
Mercury and compounds		7487-94-7	2.3E+01	nc	1.1E+01	nc
Mercury (methyl)		22967-92-6	6.1E+00	nc	3.6E+00	nc
Merphos		150-50-5	1.8E+00	nc	1.1E+00	nc
Merphos oxide		78-48-8	1.8E+00	nc	1.1E+00	nc
Metalaxyl		57837-19-1	3.7E+03	nc	2.2E+03	nc
Methacrylonitrile		126-98-7	2.1E+00	nc	1.0E+00	nc
Methamidophos		10265-92-6	3.1E+00	nc	1.8E+00	nc
Methanol		67-56-1	3.1E+04	nc	1.8E+04	nc
Methidathion		950-37-8	6.1E+01	nc	3.6E+01	nc
Methomyl		16752-77-5	4.4E+01	nc	1.5E+02	nc
Methoxychlor		72-43-5	3.1E+02	nc	1.8E+02	nc
2-Methoxyethanol		109-86-4	6.1E+01	nc	3.6E+01	nc
2-Methoxyethanol acetate		110-49-6	1.2E+02	nc	7.3E+01	nc
2-Methoxy-5-nitroaniline		99-59-2	1.1E+03	ca	1.5E+02	ca
Methyl acetate		79-20-9	2.2E+04	nc	6.1E+03	nc
Methyl acrylate		96-33-3	7.0E+01	nc	1.8E+02	nc
Methylene bromide		74-95-3	6.7E+01	nc	6.1E+01	nc
Methylene chloride		75-09-2	9.0E+02	ca	4.2E+02	ca
Methyl Chlorocarbonate	a	79-22-1	6.5E+04	nc	3.7E+04	nc
Methyl ethyl ketone (2-Butanone)		78-93-3	2.2E+04	nc	7.0E+03	nc
Methyl isobutyl ketone		108-10-1	5.3E+03	nc	2.0E+03	nc
Methyl methacrylate		80-62-6	2.2E+03	nc	1.4E+03	nc
2-Methylnaphthalene		91-57-6	3.1E+02	nc	1.5E+02	nc
Methyl parathion		298-00-0	1.5E+01	nc	9.1E+00	nc
Methyl styrene (mixture)		25013-15-4	1.3E+02	nc	6.0E+01	nc
Methyl styrene (alpha)		98-83-9	6.8E+02	sat	4.3E+02	nc

Analyte	Note	CAS Number	Soil (mg/kg)	Qualifier	Water (µg/L)	Qualifier
Methyl tertbutyl ether (MTBE)		1634-04-4	3.1E+03	ca	1.0E+03	ca
2-Methylphenol		95-48-7	3.1E+03	nc	1.8E+03	nc
3-Methylphenol		108-39-4	3.1E+03	nc	1.8E+03	nc
4-Methylphenol		106-44-5	3.1E+02	nc	1.8E+02	nc
2-Methylaniline (o-toluidine)		95-53-4	2.0E+02	ca	2.8E+01	ca
2-Methylaniline hydrochloride		636-21-5	2.7E+02	ca	3.7E+01	ca
2-Methyl-4-chlorophenoxyacetic acid		94-74-6	3.1E+01	nc	1.8E+01	nc
4-(2-Methyl-4-chlorophenoxy) butyric acid		94-81-5	6.1E+02	nc	3.6E+02	nc
2-(2-Methyl-4-chlorophenoxy) propionic acid		93-65-2	6.1E+01	nc	3.6E+01	nc
2-(2-Methyl-1,4chlorophenoxy) propionic acid		16484-77-8	6.1E+01	nc	3.6E+01	nc
5-Methylchrysene		3697-24-3	3.8E+00	ca	5.5E-01	ca
Methylcyclohexane		108-87-2	2.6E+03	nc	5.2E+03	nc
4,4'-Methylenebisbenzeneamine		101-77-9	1.9E+02	ca	2.7E+01	ca
4,4'-Methylene bis (2-chloroaniline)		101-14-4	1.2E+02	ca	6.6E+01	ca
4,4'-Methylene bis (N,N'-dimethyl)aniline		101-61-1	1.1E+03	ca	1.5E+02	ca
4,4'-Methylene diphenyl diisocyanate		101-68-8	1.0E+01	nc	6.2E+00	nc
Methyl Mercaptan		74-93-1	3.5E+01	nc	2.1E+01	nc
2-Methyl-5-nitroaniline		99-55-8	1.5E+03	ca	2.0E+02	ca
Methyl phosphonic acid	g	993-13-5	1.2E+02	nc	7.3E+01	nc
Metolaclor (Dual)		51218-45-2	9.2E+03	nc	5.5E+03	nc
Metribuzin		21087-64-9	1.5E+03	nc	9.1E+02	nc
Mirex		2385-85-5	1.2E+01	nc*	3.7E+00	ca
Molinate		2212-67-1	1.2E+02	nc	7.3E+01	nc
Molybdenum		7439-98-7	3.9E+02	nc	1.8E+02	nc
Monochloramine		10599-90-3	6.1E+03	nc	3.6E+03	nc
Naled		300-76-5	1.2E+02	nc	7.3E+01	nc
Naphthalene		91-20-3	5.6E+01	nc	6.2E+00	nc
2-Naphthylamine		91-59-8	2.5E+01	ca	3.7E+00	ca
Napropamide		15299-99-7	6.1E+03	nc	3.6E+03	nc
Nickel (soluble salts)	h, i	7440-02-0	1.6E+03	nc	7.3E+02	nc
Nickel refinery dust		MRSPP-02	1.0E+06	ca	NA	NA
Nickel subsulfide	m	12035-72-2	1.1E+06	ca	NA	NA
Nitrapyrin	a	1929-82-4	9.2E+01	nc	5.5E+01	nc
Nitrate	l	14797-55-8	1.3E+05	nc	5.8E+04	nc
Nitric Oxide	a	10102-43-9	6.1E+03	nc	3.7E+03	nc
Nitrite	l	14797-65-0	7.8E+03	nc	3.7E+03	nc
5-Nitroacenaphthene		602-87-9	3.5E+02	ca	5.1E+01	ca
2-Nitroaniline		88-74-4	1.8E+02	nc	1.1E+02	nc
3-Nitroaniline		99-09-2	1.8E+01	nc	1.1E+01	nc*
4-Nitroaniline		100-01-6	1.8E+02	nc**	1.1E+02	nc*
6-Nitrochrysene		7496-028	3.8E-01	ca	5.5E-02	ca

Analyte	Note	CAS Number	Soil (mg/kg)	Qualifier	Water (µg/L)	Qualifier
2-Nitrofluorene		607-57-8	3.8E+02	ca	5.5E+01	ca
Nitrobenzene	f	98-95-3	2.0E+01	nc	3.4E+00	nc
Nitrofurantoin		67-20-9	4.3E+03	nc	2.6E+03	nc
Nitrofurazone		59-87-0	3.2E+01	ca	4.4E+00	ca
Nitrogen dioxide		10102-44-0	6.1E+04	nc	3.7E+04	nc
Nitroglycerin	f	55-63-0	1.0E+03	nc	4.7E+02	ca
Nitroguanidine		556-88-7	6.1E+03	nc	3.7E+03	nc
4-Nitrophenol		100-02-7	4.9E+02	nc	2.9E+02	nc
2-Nitropropane		79-46-9	5.2E+00	ca	1.2E-01	ca
1-Nitropyrene		5522-43-0	4.1E+01	ca	5.5E+00	ca
4-Nitropyrene		57835-92-4	4.1E+01	ca	5.5E+00	ca
N-Nitrosodibutylamine		924-16-3	2.4E+00	ca	2.0E-01	ca
N-Nitrosodiethanolamine		1116-54-7	1.7E+01	ca	2.4E+00	ca
N-Nitrosodiethylamine		55-18-5	3.2E-01	ca	4.5E-02	ca
N-Nitrosodimethylamine		62-75-9	4.9E-01	nc	1.3E-01	ca
N-Nitrosodiphenylamine		86-30-6	1.2E+03	nc*	7.3E+02	nc*
N-Nitrosodipropylamine		621-64-7	6.9E+00	ca	9.6E-01	ca
N-Nitroso-N-ethylurea		759-73-9	1.8E+00	nc	2.5E-01	ca
N-Nitroso-N-methylethylamine		10595-95-6	2.2E+00	ca	3.1E-01	ca
N-Nitrosopyrrolidine		930-55-2	2.3E+01	ca	3.2E+00	ca
m-Nitrotoluene	f	99-08-1	7.3E+02	nc	1.2E+02	nc
o-Nitrotoluene	f	88-72-2	8.8E+01	ca	4.9E+00	ca
p-Nitrotoluene	f	99-99-0	3.7E+02	nc*	6.1E+01	nc*
Norflurazon		27314-13-2	2.4E+03	nc	1.5E+03	nc
NuStar		85509-19-9	4.3E+01	nc	2.6E+01	nc
Octabromodiphenyl ether		32536-52-0	1.8E+02	nc	1.1E+02	nc
Octamethylpyrophosphoramide		152-16-9	1.2E+02	nc	7.3E+01	nc
Oryzalin		19044-88-3	3.1E+03	nc	1.8E+03	nc
Oxadiazon		19666-30-9	3.1E+02	nc	1.8E+02	nc
Oxamyl		23135-22-0	1.5E+03	nc	9.1E+02	nc
Oxyfluorfen		42874-03-3	1.8E+02	nc	1.1E+02	nc
Paclobutrazol		76738-62-0	7.9E+02	nc	4.7E+02	nc
Paraquat		4685-14-7	2.7E+02	nc	1.6E+02	nc
Paraquat dichloride		1910-42-5	2.7E+02	nc	1.6E+02	nc
Parathion		56-38-2	3.7E+02	nc	2.2E+02	nc
Pebulate		1114-71-2	3.1E+03	nc	1.8E+03	nc
Pendimethalin		40487-42-1	2.4E+03	nc	1.5E+03	nc
Pentabromo-6-chloro cyclohexane		87-84-3	2.1E+03	ca	2.9E+02	ca
Pentabromodiphenyl ether		32534-81-9	1.2E+02	nc	7.3E+01	nc
Pentachlorobenzene		608-93-5	4.9E+01	nc	2.9E+01	nc
Pentachloronitrobenzene		82-68-8	1.8E+02	nc*	2.6E+01	ca
Pentachlorophenol		87-86-5	3.0E+02	ca	5.6E+01	ca
Perchlorate	e	7601-90-3	5.5E+01	nc	2.5E+01	nc
Permethrin		52645-53-1	3.1E+03	nc	1.8E+03	nc
Phenmedipham		13684-63-4	1.5E+04	nc	9.1E+03	nc
Phenol		108-95-2	1.8E+04	nc	1.1E+04	nc
Phenothiazine		92-84-2	1.2E+02	nc	7.3E+01	nc
m-Phenylenediamine		108-45-2	3.7E+02	nc	2.2E+02	nc
o-Phenylenediamine		95-54-5	1.0E+03	ca	1.4E+02	ca

Analyte	Note	CAS Number	Soil (mg/kg)	Qualifier	Water (µg/L)	Qualifier
p-Phenylenediamine		106-50-3	1.2E+04	nc	6.9E+03	nc
Phenylmercuric acetate		62-38-4	4.9E+00	nc	2.9E+00	nc
2-Phenylphenol		90-43-7	2.5E+04	ca	3.5E+03	ca
Phorate		298-02-2	1.2E+01	nc	7.3E+00	nc
Phosmet		732-11-6	1.2E+03	nc	7.3E+02	nc
Phosphine		7803-51-2	1.8E+01	nc	1.1E+01	nc
Phosphorus (white)		7723-14-0	1.6E+00	nc	7.3E-01	nc
p-Phthalic acid		100-21-0	6.1E+04	nc	3.6E+04	nc
Phthalic anhydride		85-44-9	1.0E+05	max	7.3E+04	nc
Picloram		1918-021	4.3E+03	nc	2.6E+03	nc
Pirimiphos-methyl		29232-93-7	6.1E+02	nc	3.6E+02	nc
Polybrominated biphenyls		59536-65-1	4.3E-01	nc**	2.6E-01	nc*
Polychlorinated biphenyls (PCBs)		1336-36-3	2.2E+01	ca	3.3E+00	ca
Polychlorinated terphenyls		61788-33-8	1.1E+01	ca	1.5E+00	ca
Potassium perchlorate	e	7778-74-7	5.5E+01	nc	2.5E+01	nc
Potassium Silver Cyanide		506-61-6	1.6E+04	nc	7.3E+03	nc
Prochloraz		67747-09-5	3.2E+02	ca	4.5E+01	ca
Profluralin		26399-36-0	3.7E+02	nc	2.2E+02	nc
Prometon		1610-18-0	9.2E+02	nc	5.5E+02	nc
Prometryn		7287-19-6	2.4E+02	nc	1.5E+02	nc
Pronamide		23950-58-5	4.6E+03	nc	2.7E+03	nc
Propachlor		1918-16-7	7.9E+02	nc	4.7E+02	nc
Propanil		709-98-8	3.1E+02	nc	1.8E+02	nc
Propargite		2312-35-8	1.2E+03	nc	7.3E+02	nc
Propargyl alcohol		107-19-7	1.2E+02	nc	7.3E+01	nc
Propazine		139-40-2	1.2E+03	nc	7.3E+02	nc
Propham		122-42-9	1.2E+03	nc	7.3E+02	nc
Propiconazole		60207-90-1	7.9E+02	nc	4.7E+02	nc
n-Propylbenzene		103-65-1	1.4E+02	nc	6.1E+01	nc
Propylene glycol		57-55-6	3.0E+04	nc	1.8E+04	nc
Propylene glycol, monoethyl ether		52125-53-8	4.3E+04	nc	2.6E+04	nc
Propylene glycol, monomethyl ether		107-98-2	4.3E+04	nc	2.6E+04	nc
Propylene oxide		75-56-9	1.4E+02	nc*	2.2E+01	ca
Pursuit		81335-77-5	1.5E+04	nc	9.1E+03	nc
Pydrin		51630-58-1	1.5E+03	nc	9.1E+02	nc
Pyrene		129-00-0	2.3E+03	nc	1.8E+02	nc
Indeno[1,2,3-cd]pyrene		193-39-5	6.2E+01	ca	9.2E+00	ca
Pyridine		110-86-1	6.1E+01	nc	3.6E+01	nc
Quinalphos		13593-03-8	3.1E+01	nc	1.8E+01	nc
Quinoline		91-22-5	1.6E+01	ca	2.2E+00	ca
RDX (Cyclonite)	f	121-82-4	1.8E+02	nc*	6.1E+01	ca
Resmethrin		10453-86-8	1.8E+03	nc	1.1E+03	nc
Ronnel		299-84-3	3.1E+03	nc	1.8E+03	nc
Rotenone		83-79-4	2.4E+02	nc	1.5E+02	nc
Sarin (GB)	b, g	107-44-8	1.2E+00	nc	7.3E-01	nc
Savey		78587-05-0	1.5E+03	nc	9.1E+02	nc
Selenious Acid		7783-00-8	3.1E+02	nc	1.8E+02	nc

Analyte	Note	CAS Number	Soil (mg/kg)	Qualifier	Water (µg/L)	Qualifier
Selenium	h	7782-49-2	3.9E+02	nc	1.8E+02	nc
Selenourea		630-10-4	3.1E+02	nc	1.8E+02	nc
Sethoxydim		74051-80-2	5.5E+03	nc	3.3E+03	nc
Silver and compounds	h	7440-22-4	3.9E+02	nc	1.8E+02	nc
Silver Cyanide		506-64-9	7.8E+03	nc	3.7E+03	nc
Simazine		122-34-9	3.1E+02	nc*	5.6E+01	ca
Sodium azide		26628-22-8	2.4E+02	nc	1.5E+02	nc
Sodium diethyldithiocarbamate		148-18-5	1.8E+02	ca	2.5E+01	ca
Sodium fluoroacetate		62-74-8	1.2E+00	nc	7.3E-01	nc
Sodium metavanadate		13718-26-8	6.1E+01	nc	3.6E+01	nc
Soman (GD)	b	96-64-0	2.4E-01	nc	1.5E-01	nc
Strontium, stable	h	7440-24-6	4.7E+04	nc	2.2E+04	nc
Strychnine		57-24-9	1.8E+01	nc	1.1E+01	nc
Styrene		100-42-5	1.7E+03	sat	1.6E+03	nc
1,1'-Sulfonylbis (4-chlorobenzene)		80-07-9	3.9E+02	nc	1.8E+02	nc
Sulfur Mustard (H, HD)	b	505-60-2	4.3E-01	nc	2.6E-01	nc
Systhane		88671-89-0	1.5E+03	nc	9.1E+02	nc
Tabun (GA)	b	77-81-6	2.4E+00	nc	1.5E+00	nc
2,3,7,8-TCDD (dioxin)		1746-01-6	3.9E-04	ca	4.5E-05	ca
Tebuthiuron		34014-18-1	4.3E+03	nc	2.6E+03	nc
Temephos		3383-96-8	1.2E+03	nc	7.3E+02	nc
Terbacil		5902-51-2	7.9E+02	nc	4.7E+02	nc
Terbufos		13071-79-9	1.5E+00	nc	9.1E-01	nc
Terbutryn		886-50-0	6.1E+01	nc	3.6E+01	nc
1,2,4,5-Tetrachlorobenzene		95-94-3	1.8E+01	nc	1.1E+01	nc
1,1,1,2-Tetrachloroethane		630-20-6	3.2E+02	ca	4.3E+01	ca
1,1,2,2-Tetrachloroethane		79-34-5	3.8E+01	ca	5.5E+00	ca
Tetrachloroethylene (PCE)		127-18-4	5.5E+01	ca	1.0E+01	ca
2,3,4,6-Tetrachlorophenol		58-90-2	1.8E+03	nc	1.1E+03	nc
p,a,a,a-Tetrachlorotoluene		5216-25-1	2.4E+00	ca	3.4E-01	ca
Tetrachlorovinphos		961-11-5	1.8E+03	nc*	2.8E+02	ca
Tetraethyldithiopyrophosphate		3689-24-5	3.1E+01	nc	1.8E+01	nc
1,1,1,2-Tetrafluoroethane		811-97-2	NA	NA	1.7E+05	nc
Tetrahydrofuran		109-99-9	9.4E+02	ca	1.6E+02	ca
Tetryl		479-45-8	2.4E+02	nc	1.5E+02	nc
Thallic oxide		1314-32-5	6.3E+00	nc	2.9E+00	nc
Thallium and compounds	h, l	7440-28-0	NA	NA	NA	NA
Thallium acetate		563-68-8	7.0E+00	nc	3.3E+00	nc
Thallium carbonate		6533-73-9	6.3E+00	nc	2.9E+00	nc
Thallium chloride		7791-12-0	6.3E+00	nc	2.9E+00	nc
Thallium nitrate		10102-45-1	7.0E+00	nc	3.3E+00	nc
Thallium selenite		12039-52-0	7.0E+00	nc	3.3E+00	nc
Thallium Sulfate		7446-18-6	6.3E+00	nc	2.9E+00	nc
Thiobencarb		28249-77-6	6.1E+02	nc	3.6E+02	nc
Thiocyanate		463-56-9	1.2E+01	nc	7.3E+00	nc
Thiodiglycol	b	111-48-8	2.4E+04	nc	1.5E+04	nc
Thiofanox		39196-18-4	1.8E+01	nc	1.1E+01	nc
Thiophanate-methyl		23564-05-8	4.9E+03	nc	2.9E+03	nc
1,4-Thioxane	a	15980-15-1	1.0E+05	sat	2.6E+07	nc

Analyte	Note	CAS Number	Soil (mg/kg)	Qualifier	Water (µg/L)	Qualifier
Thiram		137-26-8	3.1E+02	nc	1.8E+02	nc
Tin (inorganic, also see tributyltin oxide)		7440-31-5	4.7E+04	nc	2.2E+04	nc
Titanium	h	7440-32-6	1.0E+05	max	1.5E+05	nc
Toluene		108-88-3	5.2E+02	sat	2.3E+03	nc
Toluene-2,4-diamine		95-80-7	1.5E+01	ca	2.1E+00	ca
Toluene-2,5-diamine		95-70-5	3.7E+04	nc	2.2E+04	nc
Toluene-2,6-diamine		823-40-5	1.8E+03	nc	1.1E+03	nc
p-Toluidine		106-49-0	2.6E+02	ca	3.5E+01	ca
Toxaphene		8001-35-2	4.4E+01	ca	6.1E+00	ca
Tralomethrin		66841-25-6	4.6E+02	nc	2.7E+02	nc
Triallate		2303-17-5	7.9E+02	nc	4.7E+02	nc
Triasulfuron		82097-50-5	6.1E+02	nc	3.6E+02	nc
1,2,4-Tribromobenzene		615-54-3	3.1E+02	nc	1.8E+02	nc
Tributyl phosphate		126-73-8	5.3E+03	ca	7.3E+02	ca
Tributyltin oxide (TBTO)		56-35-9	1.8E+01	nc	1.1E+01	nc
1,1,2-Trichloro-1,2,2-Trifluoroethane		76-13-1	5.6E+03	sat	5.9E+04	nc
2,4,6-Trichloroaniline		634-93-5	1.4E+03	ca	2.0E+02	ca
2,4,6-Trichloroaniline hydrochloride		33663-50-2	1.7E+03	ca	2.3E+02	ca
1,2,4-Trichlorobenzene		120-82-1	6.6E+01	nc	7.9E+00	nc
1,1,1-Trichloroethane		71-55-6	1.2E+03	sat	3.2E+03	nc
1,1,2-Trichloroethane		79-00-5	3.6E+01	nc*	2.0E+01	ca
Trichloroethylene (TCE)	j	79-01-6	2.9E+02	ca	1.4E+02	ca
Trichlorofluoromethane		75-69-4	3.9E+02	nc	1.3E+03	nc
2,4,5-Trichlorophenol		95-95-4	6.1E+03	nc	3.6E+03	nc
2,4,6-Trichlorophenol		88-06-2	6.1E+00	nc	3.6E+00	nc
2,4,5-Trichlorophenoxyacetic Acid		93-76-5	6.1E+02	nc	3.6E+02	nc
2-(2,4,5-Trichlorophenoxy) propionic acid		93-72-1	4.9E+02	nc	2.9E+02	nc
1,1,2-Trichloropropane		598-77-6	7.1E+01	nc	3.0E+01	nc
1,2,3-Trichloropropane		96-18-4	3.4E+00	ca	5.6E-01	ca
1,2,3-Trichloropropene		96-19-5	5.2E+00	nc	2.2E+00	nc
Tridiphane		58138-08-2	1.8E+02	nc	1.1E+02	nc
Triethylamine		121-44-8	2.3E+01	nc	1.2E+01	nc
Trifluralin		1582-09-8	4.6E+02	nc**	2.7E+02	nc**
Trimellitic Anhydride (TMAN)		552-30-7	8.6E+00	nc	5.1E+00	NA
1,2,4-Trimethylbenzene		95-63-6	5.2E+01	nc	1.2E+01	nc
1,3,5-Trimethylbenzene		108-67-8	2.1E+01	nc	1.2E+01	nc
Trimethyl phosphate		512-56-1	1.3E+03	ca	1.8E+02	ca
1,3,5-Trinitrobenzene	f	99-35-4	1.8E+03	nc	1.1E+03	nc
2,4,6-Trinitrotoluene (TNT)		118-96-7	3.1E+01	nc**	1.8E+01	nc**
Triphenylphosphine oxide		791-28-6	1.2E+03	nc	7.3E+02	nc
Tris(2-chloroethyl) phosphate		115-96-8	3.5E+03	ca	4.8E+02	ca
Tris(2-ethylhexyl) phosphate		78-42-2	6.1E+03	nc*	2.1E+03	ca
Uranium (chemical toxicity only)		7440-61-1	1.6E+01	nc	7.3E+00	nc

Analyte	Note	CAS Number	Soil (mg/kg)	Qualifier	Water (µg/L)	Qualifier
Vanadium and compounds	h	7440-62-2	7.8E+01	nc	3.6E+01	nc
Vanadium Pentoxide		1314-62-1	7.0E+02	nc	3.3E+02	nc
Vanadium Sulfate		13701-70-7	1.6E+03	nc	7.3E+02	nc
Vanadyl Sulfate		27774-13-6	1.2E+03	nc	7.3E+02	nc
Vernam		1929-77-7	6.1E+01	nc	3.6E+01	nc
Vinclozolin		50471-44-8	1.5E+03	nc	9.1E+02	nc
Vinyl acetate		108-05-4	4.3E+02	nc	4.1E+02	nc
Vinyl bromide (bromoethene)		593-60-2	4.1E+00	nc*	1.0E+01	nc**
Vinyl chloride (child/adult)	l	75-01-4	4.3E+00	ca	1.5E+00	ca
Warfarin		81-81-2	1.8E+01	nc	1.1E+01	nc
m-Xylene		108-38-3	2.0E+02	nc	2.1E+02	nc
o-Xylene		95-47-6	2.8E+02	sat	1.4E+03	nc
p-Xylene		106-42-3	2.3E+00	nc	2.1E+00	nc
Xylenes		1330-20-7	2.7E+02	nc	2.1E+02	nc
Zinc	i	7440-66-6	2.3E+04	nc	1.1E+04	nc
Zinc cyanide		557-21-1	3.9E+03	nc	1.8E+03	nc
Zinc phosphide		1314-84-7	2.3E+01	nc	1.1E+01	nc
Zineb		12122-67-7	3.1E+03	nc	1.8E+03	nc

All values presented in scientific notation (e.g., 2.5E+02 = 2.5 x 10^2= 250).

mg/kg milligrams per kilogram (equivalent to parts per million).
µg/L micrograms per Liter (equivalent to parts per billion).
nc value based on a non-cancer exposure endpoint.
ca value based on a carcinogenic exposure endpoint.
nc* ca comparison value would be less than nc comparison value if a target cancer risk level of 1 x 10^{-6} is used.
nc** ca comparison value would be less than nc comparison value if a target cancer risk level of 1 x 10^{-5} is used.
sat substance achieves point of saturation at this value.
max set at 100,000 mg/kg for soils (nonvolatiles).
NA no screening value available.

Notes:

[a] CVs could not be calculated because toxicity values and/or chemical-physical parameters are no longer available for this chemical. Therefore, the original CV from the DoD *Relative Risk Site Evaluation Primer*, Summer 1997, is provided.

[b] CVs were calculated using toxicity values from the CHPPM report *Chronic Toxicity Criteria for Human Health Risk Assessment, Version 3*, November 6, 2006.

[c] CVs are based on California EPA toxicity values as per Department of the Air Force Memorandum "Toxicity Values for Use in Risk Assessment and Establishing Risk-Based Clean-up Levels", July 14, 2006.

[d] Perchlorate is the anion of perchloric acid. Two salts of primary concern are the munitions constituents ammonium perchlorate and potassium perchlorate. As a result, the toxicity value for perchlorate was used as a surrogate for ammonium perchlorate and potassium perchlorate.

[e] Water CVs for perchlorate, ammonium perchlorate, and potassium perchlorate were established following the DoD Memorandum "Policy on DoD Required Actions Related to Perchlorate", January 26, 2006.

[f] Nitrogen-based explosive, co-contaminants, and/or breakdown product.

[g] Chemical warfare agents and agent breakdown products.

[h] Metals commonly found in military munitions.

[i] Essential nutrient.

[j] Trichloroethylene CV was established based on the approach outlined in the Department of the Air Force Memorandum "Toxicity Values for Use in Risk Assessments and Establishing Risk-Based Cleanup Levels", July 14, 2006, which indicated that the California EPA inhalation slope factor for TCE should be used when developing risk-based screening levels.

[k] Mustard gas was used as a surrogate for toxicity values for this chemical.

[l] The screening value was calculated following an alternative approach outlined in the U.S. Environmental Protection Agency, Region 9, *Users' Guide and Background Technical Document for the Preliminary Remediation Goals,* updated December 2004.

[m] The screening value for nickel subsulfide is based on an industrial exposure scenario as outlined in the U.S. Environmental Protection Agency, Region 9, *Users' Guide and Background Technical Document for the Preliminary Remediation Goals,* updated December 2004.

Figure B.1.2 Human Health Comparison Values for Radionuclides

Analyte	CAS Number	Soil (pCi/kg)	Water (pCi/L)
Plutonium 236	15411-92-4	3.30E+06	6.40E+01
Plutonium 238	13981-16-3	3.26E+05	3.60E+01
Plutonium 239	15117-48-3	2.85E+05	3.50E+01
Plutonium 240	14119-33-6	2.85E+05	3.50E+01
Plutonium 241	14119-32-5	4.50E+07	2.70E+03
Plutonium 242	13982-10-0	3.00E+05	3.70E+01
Plutonium 243	15706-37-3	7.42E+09	1.00E+04
Plutonium 244	14119-34-7	2.69E+05	3.50E+01
Radium 226	13982-63-3	1.07E+00	1.20E+01
Radon 222	14859-67-7	1.27E+10	5.00E+00*
Thorium 227	15623-47-9	1.14E+07	1.00E+02
Thorium 228	14274-82-9	2.59E+06	4.50E+01
Thorium 229	15594-54-4	3.78E+04	2.10E+01
Thorium 230	14269-63-7	3.80E+05	5.20E+01
Thorium 231	14932-40-2	3.14E+09	2.20E+03
Thorium 232	7440-29-1	3.38E+05	4.70E+01
Thorium 234	15065-10-8	1.37E+08	2.10E+02
Tritium	10028-17-8	7.44E+08	8.30E+04
Uranium 233	13968-55-3	4.74E+05	6.60E+01
Uranium 234	13966-29-5	4.95E+05	6.70E+01
Uranium 235	15117-96-1	2.07E+04	6.80E+01
Uranium 238	7440-61-1	5.52E+05	7.40E+01

* Value represents EPA's proposed Maximum Contaminant Level from the *Federal Register* (64 *FR* 59246, November 2, 1999).

APPENDIX B-2: Ambient Water Quality Comparison Values

The Ambient Water Quality Comparison Values (CVs) presented in this appendix replace those contained in the *Relative Risk Site Evaluation Primer* (Summer 1997). These CVs are to be used in conjunction with the Munitions Response Site Prioritization Protocol (32 CFR Part 179, October 5, 2005) to evaluate known or suspected hazards to ecological receptors at or near munitions response sites using surface water sampling data. CVs to evaluate human receptors are found in Appendix B-1, and CVs to evaluate ecological receptors using sediment sampling data are found in Appendix B-3. These CVs should not be equated with a more comprehensive baseline risk assessment, nor should they be considered final cleanup goals or action levels. Furthermore, the Ambient Water Quality CVs are not to be used to reevaluate existing sites under the Installation Restoration Program.

A variety of ecological screening value sources were used to assemble a comprehensive set of widely accepted screening values for the protection of freshwater and marine ecosystems. These sources include U.S. Environmental Protection Agency (EPA) national and regional guidance, and other secondary sources such as state ecological risk guidance documents.

National Ambient Water Quality Criteria (NAWQC) for the protection of aquatic life were used as the primary source for both freshwater and marine Ambient Water Quality Criteria CVs. NAWQC for priority toxic pollutants have been developed under Section 304(a) of the Clean Water Act as guidelines from which states develop water quality standards. The second source used to compile the CVs was the recently developed EPA Region 3 BTAG Screening Benchmarks. In the development of these benchmarks, EPA Region 3 drew upon a number of commonly used ecological screening value sources, including several of the references listed at the end of this appendix. The EPA Region 3 values used are often Tier II screening values, which are values that are developed when the more stringent data requirements of NAWQC cannot be met. The NAWQC and EPA Region 3 benchmarks comprise the majority of the CVs, but additional sources used are listed at the end of this appendix. In most cases, screening values used in this appendix are for freshwater and marine chronic exposures; however, acute exposure values have been used (and identified) where no chronic levels exist.

The CVs for freshwater ambient water quality listed in this appendix were derived from the following hierarchy of sources:

1) Freshwater Criterion Continuous Concentration (CCC) values from EPA, *National Recommended Water Quality Criteria*, 2006 Update.

2) EPA Region 3 Biological Technical Assessment Group (BTAG), *Freshwater Screening Benchmarks*, July 2006.

3) EPA Region 5, *Ecological Screening Levels*, August 22, 2003.

4) Other references that include screening values for freshwater, as listed at the end of this appendix, were consulted for chemicals lacking screening values in the above sources.

The CVs for marine ambient water quality listed in this appendix were derived from the following hierarchy of sources:

1) Saltwater CCC values from EPA, *National Recommended Water Quality Criteria*, 2006 Update.

2) EPA Region 3 BTAG, *Marine Screening Benchmarks*, July 2006.

3) Saltwater Surface Water Screening Values for Hazardous Waste Sites from EPA, *Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment*, updated November 30, 2001.

4) Other references that include screening values for marine ambient water quality, as listed at the end of this appendix, were consulted for chemicals lacking screening values in the above sources.

The analyte list in this appendix includes several chemical groups (e.g., chlorinated benzenes and phthalate esters). For these groups of compounds, screening values for analytes within each chemical group were reviewed, and the lowest available value (i.e., most conservative) was adopted for the entire group.

CVs representing military-unique materials (e.g., explosives, propellants, chemical agent materials, and by-products) have been incorporated into the overall, alphabetical listing of materials. CVs for these munitions constituents were identified from the U.S. Army Corps of Engineers, *Military Munitions Center of Expertise, Munitions Constituent Sampling* (March 2005).

Analytes in this appendix are listed by their most common names. Therefore, there is no more than one record for each Chemical Abstract System (CAS) number included in this appendix.

Figure B.2.1 Ambient Water Quality Comparison Values

Analyte	CAS Number	Freshwater (µg/L)	Note	Marine (µg/L)	Note
Acenaphthene	83-32-9	5.8E+00	e, f, P	6.6E+00	i
Acrolein	107-02-8	1.9E-01	h	5.5E-01	i
Acrylonitrile	107-13-1	6.6E+01	h	5.81E+02	i
Aldrin	309-00-2	3.0E+00	a, k	1.3E-01	i
Aluminum	7429-90-5	8.7E+01	a, e, j	2.71E+00	O
4-Amino-2,6-dinitrotoluene	19406-51-0	NA		NA	
2-Amino-4,6-dinitrotoluene	35572-78-2	1.48E+03	f	NA	
Ammonium perchlorate	7790-98-9	NA		NA	
Ammonium picrate (AP)	131-74-8	NA		NA	
Anthracene	120-12-7	1.2E-02	e, f, P	1.8E-01	i
Antimony	7440-36-0	3.0E+01	f	5E+02	i
Aroclor 1248	12672-29-6	7.4E-05	f, m	3E-02	q
Aroclor 1254	11097-69-1	7.4E-05	f, m	3E-02	q
Aroclor 1260	11096-82-5	7.4E-05	f, m	3E-02	q
Aroclor 1016	12674-11-2	7.4E-05	f, m	3E-02	q
Arsenic	7440-38-2	1.5E+02	a, b, y	3.6E+01	a, b, y
Arsenic (III)	22569-72-8	1.5E+02	a, b, y	3.6E+01	a, b, y
Barium	7440-39-3	4E+00	f	5E+03	O
Benzene	71-43-2	3.7E+02	e, f, P	1.1E+02	e, i
Benzidine	92-87-5	3.9E+00	f	NA	
Benzo(a)anthracene	56-55-3	1.8E-02	e, f, P	5E-01	O
Benzo(a)pyrene	50-32-8	1.5E-02	e, f, P	5E-01	O
Benzo(g,h,i)perylene	198-55-0	7.64E+00	h, p	NA	
Benzo(k)fluoranthene	207-08-9	2.7E-02	O	5E-01	O
Beryllium	7440-41-7	6.6E-01	f	6.6E-01	O
alpha-BHC	319-84-6	2.2E+00	f, o	2.5E+01	i
beta-BHC	319-85-7	2.2E+00	f, o	NA	
Cadmium	7440-43-9	2.5E-01	a, b, c	8.8E+00	a, b
Calcium	7440-70-2	1.16E+05	f	NA	
Carbazole	86-74-8	NA		NA	
Carbon Tetrachloride	56-23-5	1.33E+01	e, f, P	1.5E+03	i
Chlordane	57-74-9	4.3E-03	a	4E-03	a
Chlorinated naphthalenes	MRSPP-03	3.96E-01	h, p, s	NA	
Chlorinated benzenes	MRSPP-04	7E-01	e, f, t, P	5.4E+00	i, e, u
Chlorine	7782-50-5	1.1E+01	a	7.5E+00	a
tris(2-Chloroethyl)amine	555-77-1	NA		NA	
bis(2-Chloroethyl)ethylamine	538-07-8	NA		NA	
2-Chlorovinyl arsenous acid	85090-33-2	NA		NA	
2-Chlorovinyl arsenous oxide	3088-37-8	NA		NA	
Chloroform	67-66-3	1.8E+00	e, f, P	8.15E+02	i
4-Chlorophenol	106-48-9	NA		NA	
Chlorpyrifos	2921-88-2	4.1E-02	a	5.6E-03	a
Chromium (III)	1308-14-1	7.4E+01	a, b, c	1.03E+02	q
Chromium (VI)	7440-47-3	1.1E+01	a, b	5.0E+01	a, b
Chrysene	218-01-9	7E+00	r	NA	
Cobalt	7440-48-4	2.3E+01	f	NA	
Copper	7440-50-8	9.0E+00	a, b, c	3.1E+00	a, b

Analyte	CAS Number	Freshwater (µg/L)	Note	Marine (µg/L)	Note
Cyanide	57-12-5	5.2E+00	a	1E+00	a
Dibenz[a,h]anthracene	53-70-3	5E+00	r	5E-01	O
Dichlorodiphenyldichloroethane (DDD)	72-54-8	1.1E-02	f	2.5E-02	i
p,p'-DDE	72-55-9	4.51E-09	h, p	1.4E-01	i
DDT	50-29-3	1E-03	a	1E-03	a
Demeton	8065-48-3	1E-01	a	1E-01	a
Dichlorobenzenes (total)	25321-22-6	5E+00	f, g	1.99E+01	i, v
1,2-Dichloroethane (EDC)	107-06-2	1E+02	e, f, P	1.13E+03	i
Dichloroethylenes (total)	25323-30-3	2.5E+01	f, w	6.8E+02	i, x
2,4-Dichlorophenol	120-83-2	1.1E+01	f	NA	
Dichloropropane	26638-19-7	3.6E+02	h, z	2.4E+03	q, z
Dichloropropene	26952-23-8	5.5E-02	f, l	7.9E+00	i, l
Dieldrin	60-57-1	5.6E-02	a	1.9E-03	a
S-(2-diisopropylaminoethyl)-methylphosphonothioic acid	73207-98-4	NA		NA	
Dimethyl methylphosphonate	756-76-9	NA		NA	
2,4-Dimethylphenol	105-67-9	1E+02	h, p	NA	
1,3-Dinitrobenzene	99-65-0	2.2E+01	h	6.68E+01	O
Dinitrotoluene (total)	25321-14-6	4.4E+01	f, A	3.7E+02	A, O
2,4-Dinitrotoluene	121-14-2	4.4E+01	f	3.7E+02	O
2,6-Dinitrotoluene	606-20-2	8.1E+01	f	3.7E+02	O
1,2-Diphenylhydrazine	122-66-7	1.2+01	r	NA	
Di-sec-octyl phthalate ([bis (2-ethylhexyl) phthalate)]	117-81-7	1.6E+01	e, f	1.7E+00	O
1,4-Dithiane	505-29-3	NA		NA	
alpha-Endosulfan	959-98-8	5.6E-02	a	8.7E-03	a
beta-Endosulfan	33213-65-9	5.6E-02	a	8.7E-03	a
Endrin	72-20-8	3.6E-02	a	2.3E-03	a
Ethyl benzene	100-41-4	9.0E+01	e, f	2.5E+01	e, i
Ethyl methylphosphonic acid	1832-53-7	NA		NA	
o-Ethyl S-(2-diisopropylaminoethyl) methylphosphonothiolate (VX)	50782-69-9	NA		NA	
Ethyldiethanolamine	139-87-7	NA		NA	
Fluoranthene	206-44-0	4E-02	e, f, P	1.6E+00	i
Fluorene	86-73-7	3E+00	e, f, P	2.5E+00	i
Guthion	86-50-0	1E-02	a	1E-02	a
Haloethers (total)	MRSPP-05	1.5E+00	f, B	NA	
Halomethanes (total)	MRSPP-06	1.8E+00	e, f, C	1.2E+02	i, D
Heptachlor	76-44-8	3.8E-03	a	3.6E-03	a
Heptachlor epoxide	1024-57-3	3.8E-03	a	3.6E-03	a
Hexachlorobenzene	118-74-1	3E-04	f	1.0E+01	O
Hexachlorobutadiene	87-68-3	1.3E+00	e, f, P	3E-01	i
Hexachlorocyclohexane (HCH)	608-73-1	1E-02	e, f, P	NA	
Hexachlorocyclopentadiene	77-47-4	7.7E+01	h	7.0E-02	q
Hexachloroethane	67-72-1	1.2E+01	f	9.4E+00	i
Hexahydro-1,3-dinitroso-5-nitro-1,3,5-triazine (DNX)	MRSPP-07	NA		NA	

Analyte	CAS Number	Freshwater (µg/L)	Note	Marine (µg/L)	Note
Hexahydro-1-nitroso-3,5-dinitro-1,3,5-triazine (MNX)	MRSPP-08	NA		NA	
Hexahydro-1,3,5-trinitroso-1,3,5-triazine (TNX)	13980-04-6	NA		NA	
HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	2691-41-0	1.5E+02	f	NA	
Hydrogen sulfide	7783-06-4	2.0E+00	a	2.0E+00	a
Indeno(1,2,3-cd)pyrene	193-39-5	4.31E+00	h, p	5E-01	O
Iron	7439-89-6	1E+03	a	NA	
Isophorone	78-59-1	9.2E+02	h	1.29E+02	i
Isopropyl methyl phosphonic acid	1832-54-8	NA		NA	
Lead	7439-92-1	2.5E+00	a, b, c	8.1E+00	a, b
Lewisite (Dichoro(2-chlorovinyl)arsine)	541-25-3	NA		NA	
Lindane	58-89-9	1E-02	e, f, P	1.6E-02	i
Malathion	121-75-5	1E-01	a	1E-01	a
Magnesium	7439-95-4	8.2E+04	f	NA	
Manganese	7439-96-5	1.2E+02	f	NA	
Mercury	7439-97-6	7.7E-01	a, b	9.4E-01	a, b
Methoxychlor	72-43-5	3E-02	a	3E-02	a
2-Methylnaphthalene	91-57-6	4.7E+00	f	4.2E+00	i
4-Chloro-3-methylphenol	59-50-7	3.48E+01	h	NA	
Methylphosphonic acid	993-13-5	NA		NA	
Mirex	2385-85-5	1E-03	a	1E-03	a
Naphthalene	91-20-3	1.1E+00	e, f, P	1.4E+00	e, i
Nickel	7440-02-0	5.2E+01	a, b, c	8.2E+00	a, b
Nitrobenzene	98-95-3	2.2E+02	h	6.68E+01	i
Nitrocellulose (NC)	9004-70-0	NA		NA	
Nitroglycerine	55-63-0	1.38E+02	f	NA	
Nitroguanidine	556-88-7	NA		NA	
Nitrophenols (total)	MRSPP-09	6.0E+01	f, E	7.17E+01	i, E
Nitrosamines	35576-91-1	1.17E+02	f, F	1.2E+02	i, G
2-Nitrotoluene (o-Nitrotoluene)	88-72-2	4.4E+02	r	NA	
3-Nitrotoluene (m-Nitrotoluene)	99-08-1	7.5E+02	f	NA	
4-Nitrotoluene (p-Nitrotoluene)	99-99-0	1.9E+03	f	NA	
Parathion	56-38-2	1.3E-02	a	1.78E-01	i
Pentachloroethane	76-01-7	5.64E+01	f	NA	
Pentachlorophenol	87-86-5	1.5E+01	a, d	7.9E+00	a
Pentaerythritol tetranitrate (PETN)	78-11-5	8.5E+04	f	8.5E+04	i
Perchlorate	7601-90-3	NA		NA	
Phenanthrene	85-01-8	4E-01	e, f, P	1.5E+00	i
Phenol	108-95-2	4E+00	e, f, P	5.8E+01	i
Phosphorus	7723-14-0	NA		1E-01	i
Phthalate esters	MRSPP-10	1.6E+01	e, f, H, P	3.4E+00	i, J
Picric acid	88-89-1	NA		NA	
Pinacolyl methylphosphonic acid	616-52-48	NA		NA	

Analyte	CAS Number	Freshwater (µg/L)	Note	Marine (µg/L)	Note
Polychlorinated biphenyls (PCBs)	1336-36-3	1.4E-02	a	3E-02	a
Polynuclear aromatic hydrocarbons (PAHs)	MRSPP-11	1.2E-02	e, f, K, P	1.8E-01	i, K
Potassium	7440-09-7	5.3E+04	f	NA	
Potassium perchlorate	7778-74-7	NA		NA	
Pyrene	129-00-0	2.5E-02	e, f, P	2.4E-01	i
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	121-82-4	3.6E+02	f	NA	
Sarin (Isopropyl methylphosphonofluoridate)	107-44-8	NA		NA	
Selenium	7782-49-2	5.0E+00	a, e	7.1E+01	a, b
Silver	7440-22-4	3.2E+00	a, c, k	2.3E-01	i
Sodium	7440-23-5	6.8E+05	f		
Soman (Pinacolyl methylphosphonofluoridate)	96-64-0	NA		NA	
Strontium	7440-24-6	1.5E+03	f		
Sulfur Mustard (bis(2-chloroethyl)sulfide)	505-60-2	NA		NA	
Tabun (Ethyl n, n-dimethylphosphoramido-cyanidate)	77-81-6	NA		NA	
2,3,7,8-Tetrachlorodibenzo-*p*-dioxin	1746-01-6	3.1E-09	f, m	NA	
1,1,2,2-Tetrachloroethane	79-34-5	6.1E+02	f	9.02E+01	i
Tetrachloroethanes	25322-20-7	6.1E+02	f, L	9.02E+01	i, L
Tetrachloroethylene (PCE)	127-18-4	1.11E+02	e, f, P	4.5E+01	i
2,3,5,6-Tetrachlorophenol	935-95-5	1E+00	e, f, n, P	NA	
Tetryl (Methyl-2,4,6-trinitrophenylnitramine)	479-45-8	NA		NA	
Thallium	7440-28-0	8E-01	e, f, P	2.13E+01	i
Thiosulfan [Endosulfan, mixed isomers]	115-29-7	2E-02	e, f, P	1E-03	i
1,4-Thioxane	15980-15-1	NA		NA	
Titanium	7440-32-6	NA		NA	
TNT (2,4,6-Trinitrotoluene)	118-96-7	1E+02	f	1E+02	i
Toluene	108-88-3	2E+00	e, f, P	2.15E+02	e, i
Toxaphene	8001-35-2	2E-04	a	2E-04	a
Trichlorinated ethanes	25323-89-1	1.1E+01	f, M	3.12E+02	i, M
1,1,1-Trichloroethane	71-55-6	1.1E+01	f	3.12E+02	i
1,1,2-Trichloroethane	79-00-5	1.2E+03	f	5.5E+02	i
Trichloroethylene (TCE)	79-01-6	2.1E+01	e, f, P	1.94E+03	i
2,4,5-Trichlorophenol	95-95-4	6.4E+01	r	1.2E+01	i
2,4,6-Trichlorophenol	88-06-2	4.9E+00	f	6.1E+01	i
Triethanolamine	102-71-6	NA		NA	
1,3,5-Trinitrobenzene	99-35-4	1E+01	N	NA	
Vanadium	7440-62-2	2E+01	f	NA	
Zinc	7440-66-6	1.2E+02	a, b, c	8.1E+01	a, b
Zirconium	7440-67-7	1.7E+01	f	NA	

All values presented with the same number of significant figures reported in the source document. Analytes with no screening value available are identified with NA.

Notes:

[a] U.S. EPA National Recommended Water Quality Criteria, 2006 Update. Except where otherwise noted, freshwater Criterion Continuous Concentration (CCC) values were used for freshwater CVs, and saltwater CCC values were used for marine CVs.

[b] Freshwater and saltwater criteria for metals are expressed in terms of the dissolved metal in the water column, unless otherwise noted.

[c] Hardness dependent criteria; 100 mg/L CaCO3 was used.

[d] pH dependent criterion; pH = 7.8 was used.

[e] Value is expressed as a total concentration.

[f] U.S. EPA Region 3 BTAG Freshwater Screening Benchmarks, July 2006. Unless otherwise noted, values are expressed in terms of dissolved analyte in the water column.

[g] Applies to the sum of 1,2-, 1,3- and 1,4-dichlorobenzene.

[h] U.S. EPA Region 5 Ecological Screening Levels for Water, August 22, 2003.

[i] U.S. EPA Region 3 BTAG Marine Screening Benchmarks, July 2006. Unless otherwise noted, values are expressed in terms of dissolved analyte in the water column.

[j] Value is applicable at pH 6.5 – 9.0.

[k] Acute value (criterion maximum concentration or CMC) has been used because no chronic value is available.

[l] Value for 1,3-dichloropropylene.

[m] Value based on food chain effects to wildlife, not direct toxicity to aquatic life.

[n] Value for tetrachlorophenols, total.

[o] Value for BHC (non Lindane).

[p] Screening value is based on exposure to mink (Mustela vison) or belted kingfisher (Ceryle alcyon).

[q] Chronic values from U.S. EPA (2001), EPA Region 4 Waste Management Division Saltwater Surface Screening Values for Hazardous Waste, updated November 30, 2001.

[r] Ecological Benchmarks for Water from TCEQ (2006).

[s] Value for 2-chloronaphthalene.

[t] Value for 1,2-dichlorobenzene.

[u] Value for 1,2,4-trichlorobenzene.

[v] Value for 1,4-dichlorobenzene.

[w] Value for 1,1-dichloroethylene.

[x] Value for 1,2-dichloroethylene.

[y] Water quality criteria for arsenic were derived from data for arsenic (III).

[z] Value for 1,2-dichloropropane.

[A] Value for 2,4-dinitrotoluene.

[B] Value for 4-bromophenyl phenyl ether.

[C] Value for chloroform.

[D] Value for bromomethane.

[E] Value for 4-nitrophenol.

[F] Value for N-nitrosodimethylamine.

[G] Value for N-nitrosodi-n-propylamine.

[H] Value for bis(2-ethylhexyl)phthalate.

[J] Value for di-n-butylphthalate.

[K] Value for anthracene.

[L] Value for 1,1,2,2-tetrachloroethane.

[M] Value for 1,1,1-trichloroethane.

[N] Value from Talmage et al. (1999).

[O] Value from U.S. EPA (1999).

[P] The Canadian Water Quality Guidelines values refer to the total concentration in an unfiltered sample.

Additional References Consulted for Ambient Water Quality CVs

Canadian Council of Ministers of the Environment (CCME). 2002. Canadian Environmental Quality Guidelines. Summary Table. Update 2002.

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APPENDIX B-3: Freshwater and Marine Sediment Comparison Values

The Comparison Values (CVs) for Freshwater and Marine Sediments presented in this appendix replace those contained in the *Relative Risk Site Evaluation Primer* (Summer 1997). These CVs are to be used in conjunction with the Munitions Response Site Prioritization Protocol (32 CFR Part 179, October 5, 2005) to evaluate known or suspected hazards to ecological receptors at or near munitions response sites using sediment sampling data. CVs to evaluate human receptors are found in Appendix B-1, and CVs to evaluate ecological receptors using surface water sampling data are found in Appendix B-2. These CVs should not be equated with a more comprehensive baseline risk assessment, nor should they be considered final cleanup goals or action levels. Furthermore, the Freshwater and Marine Sediment CVs are not to be used to reevaluate existing sites under the Installation Restoration Program.

For the purposes of ecological risk screening, a variety of screening value sources have been drawn upon to assemble a comprehensive set of widely used and accepted screening values for the protection of freshwater and marine ecosystems. These sources primarily include U.S. Environmental Protection Agency (EPA) national and regional guidance, and other secondary sources such as state ecological risk guidance documents.

The CVs for freshwater sediments listed in this appendix were derived from the following hierarchy of sources:

1) EPA Equilibrium Partitioning Sediment Benchmarks:

   Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Dieldrin. EPA 600-R-02-010. August 2003.

   Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Endrin. EPA 600-R-02-009. August 2003.

   Note that ESBs for polynuclear aromatic hydrocarbons (PAHs) and metal mixtures are also available from EPA. These ESBs were not used in this appendix because the data requirements for their use (e.g., analysis of 34 PAHs; analysis of simultaneously extracted metals and acid volatile sulfides) may not always be met. However, if the ESB data requirements can be met, then the ESB for PAHs and metals mixtures could be used in preference to the values provided below.

2) EPA Region 3 Biological Technical Assessment Group (BTAG), *Freshwater Sediment Screening Benchmarks*, August 2006.

3) EPA Region 5, *Ecological Screening Levels*, August 22, 2003.

4) Other references that include screening values for freshwater sediments, as listed at the end of the appendix, were consulted for chemicals lacking screening values in the above sources.

The CVs for marine sediments listed in this appenidx are also applicable to estuarine sediments, and were derived from the following hierarchy of sources:

1) EPA Equilibrium Partitioning Sediment Benchmarks (as cited above).

2) EPA Region 3 BTAG, *Marine Sediment Screening Benchmark*s, July 2006.

3) Effects Range – Low (ERL) values from National Oceanic Atmospheric Administration (NOAA), *Sediment Quality Guidelines developed for the National Status and Trends Program*, June 12, 1999.

4) Buchman, M.F., *Screening Quick Reference Tables* (SQ*uiRT*s), NOAA HAZMAT Report 99-1, Seattle, WA, Coastal Protection and Restoration Division, 1999.

5) Other references that include screening values for marine ambient water quality, as listed at the end of this appendix, were consulted for chemicals lacking screening values in the above sources.

The analyte list in this appendix includes several chemical groups (e.g., chlorinated benzenes and phthalate esters). For these groups of compounds, screening values for analytes within each chemical group were reviewed, and the lowest available value (i.e., most conservative) was adopted for the entire group.

The CVs representing military-unique materials (e.g., explosives, propellants, chemical agent materials, and by-products) have been incorporated into the overall, alphabetical listing of materials. This includes munitions constituents identified in *Military Munitions Center of Expertise, Munitions Constituent Sampling (*March 2005*).*

Analytes in this appendix are listed by their most common names. Therefore, there is no more than one record for each Chemical Abstract System (CAS) number included in this appendix.

Figure B.3.1 Freshwater and Marine Sediment Comparison Values

Analyte	CAS Number	Freshwater (mg/kg)	Note	Marine (mg/kg)	Note
Acenaphthene	83-32-9	6.7E-03	b	6.71E-03	m
Acrolein	107-02-8	1.52E-06	c	NA	
Acrylonitrile	107-13-1	1.2E-03	c	2.22E-03	h, C
Aldrin	309-00-2	2E-03	b	9.5E-03	f
Aluminum	7429-90-5	1.4E+04	h	1.8E+04	f
4-Amino-2,6-dinitrotoluene	19406-51-0	NA		NA	
2-Amino-4,6-dinitrotoluene	35572-78-2	NA		NA	
Ammonium perchlorate	7790-98-9	NA		NA	
Ammonium picrate (AP)	131-74-8	NA		NA	
Anthracene	120-12-7	5.72E-02	b	4.69E-02	m
Antimony	7440-36-0	2E+00	b	9.3E+00	f
Aroclor 1248	12672-29-6	3E-02	k	2.27E-02	d, g
Aroclor 1254	11097-69-1	6E-02	k	6.33E-02	m
Aroclor 1260	11096-82-5	5E-03	k	2.27E-02	d, g
Aroclor 1016	12674-11-2	7E-03	k	2.27E-02	d, g
Arsenic	7440-38-2	9.8E+00	b	7.24E+00	m
Arsenic (III)	22569-72-8	NA		NA	
Barium	7440-39-3	2.0E+01	h	4.8E+01	f
Benzene	71-43-2	1.42E-01	c	1.37E-01	m
Benzidine	92-87-5	NA		NA	
Benzo(a)anthracene	56-55-3	1.08E-01	b	7.48E-02	m
Benzo(a)pyrene	50-32-8	1.5E-01	b	8.88E-02	m
Benzo(g,h,i)perylene	198-55-0	1.7E-01	b	6.7E-01	f
Benzo(k)fluoranthene	207-08-9	2.4E-01	b	1.8E+00	f
Beryllium	7440-41-7	NA		NA	
alpha-BHC	319-84-6	6E-03	b	1.36E+00	m
beta-BHC	319-85-7	5E-03	b	NA	
Cadmium	7440-43-9	9.9E-01	b	6.8E-01	m
Calcium	7440-70-2	NA		NA	
Carbazole	86-74-8	NA		NA	
Carbon tetrachloride	56-23-5	6.42E-02	b	7.24E+00	m
Chlordane	57-74-9	3.24E-03	b	2.26E-03	m
Chlorinated benzenes	MRSPP-12	8.42E-03	b, e	1.62E-01	e, m
Chlorinated naphthalenes	MRSPP-13	4.17E-01	c, z	NA	
Chlorine	7782-50-5	NA		NA	
tris(2-Chloroethyl)amine	555-77-1	NA		NA	
bis(2-Chloroethyl)ethylamine	538-07-8	NA		NA	
Chloroform	67-66-3	1.21E-01	c	9.54E-02	h, C
4-Chlorophenol	106-48-9	NA		NA	
2-Chlorovinyl arsenous acid	85090-33-2	NA		NA	
2-Chlorovinyl arsenous oxide	3088-37-8	NA		NA	
Chlorpyrifos	2921-88-2	5.19E-03	b	8.3E-03	m
Chromium	7440-47-3	4.34E+01	b	5.23E+01	m
Chromium (III)	1308-14-1	NA		NA	
Chrysene	218-01-9	1.66E-01	b	1.08E-01	m
Cobalt	7440-48-4	5E+01	b	1.0E+01	f
Copper	7440-50-8	3.16E+01	b	1.87E+01	m
Cyanide (free)	57-12-5	1E-01	b	NA	
DDD	72-54-8	4.88E-03	b	1.22E-03	m
DDE	72-55-9	3.16E-03	b	2.07E-03	m
DDT	50-29-3	4.16E-03	b	1.19E-03	m

Analyte	CAS Number	Freshwater (mg/kg)	Note	Marine (mg/kg)	Note
Demeton	8065-48-3	NA		NA	
Dibenz[a,h]anthracene	53-70-3	3.3E-02	b	6.22E-03	m
Dichlorobenzenes (total)	25321-22-6	1.65E-02	b, j	4.6E-01	m, w
1,2-Dichloroethane (EDC)	107-06-2	2.60E-01	c	4.3E+00	B
Dichloroethylenes (total)	25323-30-3	3.1E-02	b, n	2.78E+00	m, n
2,4-Dichlorophenol	120-83-2	1.17E-01	b	5E-03	f
Dichloropropane	26638-19-7	3.33E-01	c, A	2.82E+00	A, B
Dichloropropene	26952-23-8	5.09E-05	b	7.31E-03	m
Dieldrin	60-57-1	1.2E-01	a, i	2.8E-01	a, i
S-(2-diisopropylaminoethyl)-methylphosphonothioic acid	73207-98-4	NA		NA	
Dimethyl methylphosphonate	756-76-9	NA		NA	
2,4-Dimethylphenol	105-67-9	2.9E-02	b	1.8E-02	f
1,3-Dinitrobenzene	99-65-0	8.61E-03	c	1.38E-02	h, C
Dinitrotoluene (total)	25321-14-6	4.16E-02	b, o	NA	
2,4-Dinitrotoluene	121-14-2	4.16E-02	b	1.887E-01	h, C
2,6-Dinitrotoluene	606-20-2	3.98E-02	c	1.550E-01	h, C
1,2-Diphenylhydrazine	122-66-7	NA		NA	
Di-sec-octylphthalate [bis(2-ethylhexyl)phthalate]	117-81-7	1.8E-01	b	1.82E-01	m
1,4-Dithiane	505-29-3	NA		NA	
alpha-Endosulfan	959-98-8	2.9E-03	b	NA	
beta-Endosulfan	33213-65-9	1.4E-02	b	NA	
Endrin	72-20-8	5.4E-02	a, i	9.9E-03	a, i
Ethylbenzene	100-41-4	1.1E+00	b	3.05E-01	m
Ethyl methylphosphonic acid	1832-53-7	NA		NA	
o-Ethyl S-(2-diisopropylaminoethyl) Methylphosphonothiolate (VX)	50782-69-9	NA		NA	
Ethyldiethanolamine	139-87-7	NA		NA	
Fluoranthene	206-44-0	4.23E-01	b	1.13E-01	m
Fluorene	86-73-7	7.74E-02	b	2.12E-02	m
Guthion	86-50-0	5.05E-05	b	5.05E-05	m
Haloethers (total)	MRSPP-14	1.23E+00	b, p	NA	
Halomethanes (total)	MRSPP-15	6.42E-02	b, q	1.31E+00	m, x
Heptachlor	76-44-8	6.8E-02	b	3E-04	f
Heptachlor epoxide	1024-57-3	2.47E-03	b	6.0E-04	m
Hexachlorobenzene	118-74-1	2E-02	b	6E-03	f
Hexachlorobutadiene	87-68-3	2.65E-02	c	1.3E-03	f
Hexachlorocyclopentadiene	77-47-4	9.01E-01	c	1.39E-01	m
Hexachlorocyclohexane (HCH)	608-73-1	3E-03	b	NA	
Hexachloroethane	67-72-1	1.027E+00	b	8.04E-01	m
Hexahydro-1,3-dinitroso-5-nitro-1,3,5-triazine (DNX)	MRSPP-16	NA		NA	
Hexahydro-1-nitroso-3,5-dinitro-1,3,5-triazine (MNX)	MRSPP-17	NA		NA	
Hexahydro-1,3,5-trinitroso-1,3,5-triazine (TNX)	13980-04-6	NA		NA	
HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	2691-41-0	4.7E-03	l, i	NA	

Analyte	CAS Number	Freshwater (mg/kg)	Note	Marine (mg/kg)	Note
Hydrogen sulfide	7783-06-4	NA		NA	
Indeno(1,2,3-cd)pyrene	193-39-5	1.7E-02	b	6.0E-01	f
Iron	7439-89-6	2E+04	b	2.2E+05	f
Isophorone	78-59-1	4.32E-01	c	NA	
Isopropyl methyl phosphonic acid	1832-54-8	NA		NA	
Lead	7439-92-1	3.58E+01	b	3.02E+01	m
Lewisite (Dichoro(2-chlorovinyl)arsine)	541-25-3	NA		NA	
Lindane	58-89-9	2.37E-03	b	3.2E-04	m
Malathion	121-75-5	2.03E-04	b	2.1E-04	m
Magnesium	7439-95-4	NA		NA	
Manganese	7439-96-5	4.6E+02	b	2.6E+02	f
Mercury	7439-97-6	1.8E-01	b	1.3E-01	m
Methoxychlor	72-43-5	1.87E-02	b	2.96E-02	m
2-Methylnaphthalene	91-57-6	2.02E-02	b	2.02E-02	m
4-Chloro-3-methylphenol	59-50-7	3.88E-01	c	NA	
Methylphosphonic acid	993-13-5	NA		NA	
Mirex	2385-85-5	7E-03	b	NA	
Naphthalene	91-20-3	1.76E-01	b	3.46E-02	m
Nickel	7440-02-0	2.27E+01	b	1.59E+01	m
Nitrobenzene	98-95-3	1.45E-01	c	2.1E-02	f
Nitrocellulose (NC)	9004-70-0	NA		NA	
Nitroglycerine	55-63-0	NA		NA	
Nitroguanidine	556-88-7	NA		NA	
Nitrophenols (total)	MRSPP-18	1.33E-02	c, u	NA	
Nitrosamines	35576-91-1	2.68E+00	b, r	4.22E+02	m, r
2-Nitrotoluene (o-Nitrotoluene)	88-72-2	NA		NA	
3-Nitrotoluene (m-Nitrotoluene)	99-08-1	NA		NA	
4-Nitrotoluene (p-Nitrotoluene)	99-99-0	4.06E+00	b	NA	
PAHs (total)	MRSPP-19	1.61E+00	b	2.9E+00	m
Parathion	56-38-2	7.57E-04	b	1.04E-02	m
Pentachloroethane	76-01-7	8.26E-01	b	NA	
Pentachlorophenol	87-86-5	5.04E-01	b	7.97E+00	m
Pentaerythritol tetranitrate (PETN)	78-11-5	NA		NA	
Perchlorate	7601-90-3	NA		NA	
Phenanthrene	85-01-8	2.04E-01	b	8.67E-02	m
Phenol	108-95-2	4.2E-01	b	1.3E-01	f
Phosphorus	7723-14-0	NA		NA	
Phthalate esters	MRSPP-20	1.8E-01	b, s	1.82E-01	m, s
Picric acid	88-89-1	NA		NA	
Pinacolyl methylphosphonic acid	616-52-48	NA		NA	
Polychlorinated biphenyls (PCBs, total)	1336-36-3	5.98E-02	b	4.0E-02	m
Potassium	7440-09-7	NA		NA	
Potassium perchlorate	7778-74-7	NA		NA	

Analyte	CAS Number	Freshwater (mg/kg)	Note	Marine (mg/kg)	Note
Pyrene	129-00-0	1.95E-01	b	1.53E-01	m
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	121-82-4	1.3E-02	b	NA	
Sarin (Isopropyl methylphosphonofluoridate)	107-44-8	NA		NA	
Selenium	7782-49-2	2E+00	b	1.0E+00	f
Silver	7440-22-4	1E+00	b	7.3E-01	m
Sodium	7440-23-5	NA		NA	
Soman (Pinacolyl methylphosphonofluoridate)	96-64-0	NA		NA	
Strontium	7440-24-6	NA		NA	
Sulfur Mustard (bis(2-chloroethyl)sulfide)	505-60-2	NA		NA	
Tabun (Ethyl n, n-dimethylphosphoramido-cyanidate)	77-81-6	NA		NA	
2,3,7,8-Tetrachlorodibenzo-*p*-dioxin	1746-01-6	8.5E-07	b	3.6E-06	f
1,1,2,2-Tetrachloroethane	79-34-5	1.36E+00	b	2.02E-01	m
Tetrachloroethanes	25322-20-7	1.36E+00	b, t	2.02E-01	m, t
Tetrachloroethylene (PCE)	127-18-4	4.68E-01	b	1.9E-01	m
2,3,5,6-Tetrachlorophenol	935-95-5	NA		NA	
Tetryl (Methyl-2,4,6-trinitrophenylnitramine)	479-45-8	NA		NA	
Thallium	7440-28-0	NA		NA	
Thiosulfan [Endosulfan, mixed isomers]	115-29-7	2.14E-03	b	1.07E-04	m
1,4-Thioxane	15980-15-1	NA		NA	
Titanium	7440-32-6	NA		NA	
TNT (2,4,6-Trinitrotoluene)	118-96-7	9.2E-02	b	NA	
Toluene	108-88-3	1.22E+00	c	1.09E+00	m
Total Kjeldahl Nitrogen	MRSPP-21	5.5E+02	k	NA	
Total Organic Carbon (%)	MRSPP-22	NA		NA	
Total Phosphorus	MRSPP-23	6.0E+02	k	NA	
Toxaphene	8001-35-2	1E-04	b	5.36E-01	m
Trichlorinated ethanes	25323-89-1	3.02E-02	b, v	5.7E-01	m, y
1,1,1-Trichloroethane	71-55-6	3.02E-02	b	8.56E-01	m
1,1,2-Trichloroethane	79-00-5	1.24E+00	b	5.7E-01	m
Trichloroethylene (TCE)	79-01-6	9.69E-02	b	8.95E+00	m
2,4,5-Trichlorophenol	95-95-4	NA		8.19E-01	m
2,4,6-Trichlorophenol	88-06-2	2.13E-01	b	2.65E+00	m
Triethanolamine	102-71-6	NA		NA	
1,3,5-Trinitrobenzene	99-35-4	2.4E-03	l, i	NA	
Vanadium	7440-62-2	NA		5.7E+01	f
Zinc	7440-66-6	1.21E+02	b	1.24E+02	m
Zirconium	7440-67-7	NA		NA	

All values presented with the same number of significant figures reported in the source document. Analytes with no screening value available are identified with NA.

Notes:

[a] U.S. EPA Equilibrium Partitioning Sediment Benchmarks. August 2003.
[b] U.S. EPA Region 3 BTAG Freshwater Sediment Screening Benchmarks, August 2006.
[c] U.S. EPA Region 5 Ecological Screening Levels for Sediment, August 22, 2003.
[d] Effects Range – Low (ERL) values from NOAA's Sediment Quality Guidelines developed for the National Status and Trends Program, June 22, 1999. These values were originally reported in Long et al. (1995).
[e] Value for chlorobenzene.
[f] Apparent Effects Threshold (AET) value from Buchman, M.F. (1999).
[g] Value for total PCBs.
[h] Value from U.S. EPA (1999).
[i] Value based on 1% organic carbon content in sediment.
[j] Value for 1,2-dichlorobenzene.
[k] Value is a Lowest Effect Level (LEL) from Persaud et al. (1993).
[l] Value from Talmage et al. (1999).
[m] U.S. EPA Region 3 BTAG Marine Sediment Screening Benchmarks, July 2006.
[n] Value for 1,1-dichloroethylene.
[o] Value for 2,4-dinitrotoluene.
[p] Value for 4-bromophenyl phenyl ether.
[q] Value for tetrachloromethane.
[r] Value for N-nitrosodiphenylamine.
[s] Value for bis(2-ethylhexyl)phthalate.
[t] Value for 1,1,2,2-tetrachloroethane.
[u] Value for p-nitrophenol.
[v] Value for 1,1,1-trichloroethane.
[w] Value for 1,4-dichlorobenzene.
[x] Value for tribromomethane.
[y] Value for 1,1,2-trichloroethane.
[z] Value for 2-chloronaphthalene.
[A] Value for 1,2-dichloropropane.
[B] Value from TCEQ (2006).
[C] Values for organic compounds presented in U.S. EPA (1999) are based on an assumed 4% organic carbon content. Values presented here have been adjusted to 1% organic carbon content for consistency with other sources of screening values.

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Appendix C: Glossary

Accessibility Factor. Characterizes the potential for the receptor to encounter the hazard. The EHE Module Accessibility Factor has the data elements Location of Munitions, Ease of Access, and Status of Property and constitutes 40 percent of the EHE Module score. The CHE Module Accessibility Factor consists of three data elements, Location of CWM, Ease of Access, and Status of Property, and constitutes 40 percent of the CHE Module score. (Definition based on 32 CFR 179.6)

Active Condition. Naturally occurring phenomena (e.g., drought, flooding, frost heave) or intrusive activities (e.g., plowing, construction, dredging) are likely to expose subsurface UXO or DMM. (Definition based on 32 CFR Part 179, Appendix A, Tables 3 and 13)

Administrative Record. A lead agency shall establish an Administrative Record, located at an office of the lead agency or other central location, that contains the documents that form the basis for the selection of a response action. The record shall include documents containing factual information, data and analysis of the factual information, and data that may form a basis for the selection of a response action. Such documents may include verified sampling data, quality control and quality assurance documents, chain of custody forms, site inspection reports, preliminary assessment and site evaluation reports, ATSDR health assessments, documents supporting the lead agency's determination of imminent and substantial endangerment, public health evaluations, and technical and engineering evaluations. The record file shall also be made available for public review. (Definition based on 40 CFR 300.800, et. seq.)

Agriculture. The science, art, or practice of cultivating the soil, producing crops, and raising livestock and in varying degrees the preparation and marketing of the resulting products. (Merriam-Webster Online Dictionary)

American Indian and Alaska Native Tribes. Federally recognized American Indian and Alaska Native tribal entity as defined by the most current Department of Interior/Bureau of Indian Affairs list of tribal entities published in the *Federal Register* pursuant to Section 104 of the *Federally Recognized Tribe Act*.

Armed. A munition is considered armed when it is ready to function (e.g., safety devices have been removed or otherwise disabled, thus allowing all arming mechanisms to become fully functional). (Definition based on "arming" in the *DoD Dictionary of Military and Associated Terms*)

Arming Sequence. As applied to explosives, weapons, and ammunition; the process for changing from a safe condition to a state of readiness for initiation. (Definition based on "arming" in the *DoD Dictionary of Military and Associated Terms*)

Barrier. A natural obstacle or obstacles (e.g., difficult terrain, dense vegetation, deep or fast-moving water), a man-made obstacle or obstacles (e.g., fencing), and combinations of natural and man-made obstacles. (32 CFR 179.3)

Base Realignment and Closure (BRAC). The process that DoD uses to reorganize its installation infrastructure to more efficiently and effectively support its forces, increase operational readiness, and facilitate new ways of doing business. A variety of actions culminated in binding recommendations issued in 1988, 1991, 1993, 1995, and 2005 to close or realign military installations in the United States. These actions include the processes of selecting bases for closure or realignment and carrying out the associated closure or realignment activities such as relocating military units and disposing of excess property. The *National Defense Authorization Act for FY 1989*, Public Law 100-526, governed the 1988 BRAC process. The *Defense Base Closure and Realignment Act of 1990*, Public Law 101-510, as amended, governed the 1991, 1993, 1995, and 2005 BRAC processes.

Burial Pit or Other Disposal Area. A location where DMM were buried or disposed of (e.g., disposed of into a water body) without prior thermal treatment. (Definition based on 32 CFR Part 179, Appendix A, Table 2)

Burster. An auxiliary explosive component used in certain munitions to rupture the munition and disperse the munitions contents. (Definition based on "burster charge" in TM 9-1300-200)

CA or CWM Production Facilities. A facility that engaged in production of CA or CWM and where CWM/DMM would be suspected of being present on the surface or in the subsurface. (Definition based on 32 CFR Part 179, Appendix A, Table 12)

Note: All terms in this Glossary are only defined for use with the Munitions Response Site Prioritization Protocol.

CAIS/DMM. CAIS other than CAIS K941 and CAIS K942. (Definition based on 32 CFR Part 179, Appendix A, Tables 11 and 12)

CAIS K941 and CAIS K942. CAIS K941, toxic gas set M-1; and CAIS K942, toxic gas set M-2/E11 are considered forms of CWM, bulk container, due to the relatively large quantities of agent contained in those types of sets. (32 CFR 179.3)

Cancer Risk. The incremental probability of an individual developing cancer over a lifetime as a result of exposure to a carcinogen. (*Relative Risk Site Evaluation Primer* [Revised Edition, Summer 1997])

Carcinogen Reference Value (CRV). For carcinogens, the comparison value for human health is the concentration that presents a 1-in-10,000 risk of increased cancer incidence, which is the remedial action threshold for carcinogens defined in the Preamble to the *National Oil and Hazardous Substance Pollution Contingency Plan* (55 *Federal Register* 8716, March 8, 1990) and by Directive 9355.0-30 of the Office of Solid Waste and Emergency Response, US EPA (April 22, 1991). This value assigns a relative priority for action and does not assign a value for cleanup. (*Relative Risk Site Evaluation Primer* [Revised Edition, Summer 1997])

Chemical Agent (CA). A chemical compound (to include experimental compounds) that, through its chemical properties produces lethal or other damaging effects on human beings, is intended for use in military operations to kill, seriously injure, or incapacitate persons through its physiological effects. Excluded are research, development, testing, and evaluation (RDT&E) solutions; riot control agents; chemical defoliants and herbicides; smoke and other obscuration materials; flame and incendiary materials; and industrial chemicals. (32 CFR 179.3)

Chemical Agent Hazard. A condition where danger exists because CA is present in a concentration high enough to present potential unacceptable effects (e.g., death, injury, damage) to people, operational capability, or the environment. (32 CFR 179.3)

Chemical Agent Identification Sets (CAIS). Military training aids containing small quantities of various CA and other chemicals. All forms of CAIS are scored the same for the Protocol except CAIS K941, toxic gas set M–1; and CAIS K942, toxic gas set M–2/E11, which are considered forms of CWM, bulk container, due to the relatively large quantities of agent contained in those types of sets. (32 CFR 179.3)

Chemical Warfare Materiel (CWM). Items generally configured as a munition containing a chemical compound that is intended to kill, seriously injure, or incapacitate a person through its physiological effects. CWM includes V- and G-series nerve agents or H-series (mustard) and L-series (lewisite) blister agents in other than munition configurations; and certain industrial chemicals (e.g., hydrogen cyanide [AC], cyanogen chloride [CK], or carbonyl dichloride [called phosgene or CG]) configured as a military munition. Due to their hazards, prevalence, and military-unique application, CAIS are also considered CWM. CWM does not include riot control devices; chemical defoliants and herbicides; industrial chemicals (e.g., AC, CK, or CG) not configured as a munition; smoke and other obscuration-producing items; flame and incendiary-producing items; or soil, water, debris, or other media contaminated with low concentrations of chemical agents where no CA hazards exist. For the purposes of this Protocol, CWM encompasses four subcategories of specific materials: (1) CWM, explosively configured; (2) CWM, nonexplosively configured; (3) CWM, bulk container; and (4) CAIS. (32 CFR 179.3)

Commercial. Of, relating to, or being goods, often unrefined, produced and distributed in large quantities for use by industry. (Merriam-Webster Online Dictionary)

Community Relations Plan. The plan for community relations activities that an installation will use to meet its mission objectives. (ODUSD(I&E)/Environmental Management Office Glossary of Terms)

Complete Barrier. There is a barrier preventing access to all parts of the MRS and there is active, continual surveillance (e.g., by a guard, video monitoring) of the MRS. (Definition based on 32 CFR Part 179, Appendix A, Tables 4 and 14)

Components. The Office of the Secretary of Defense, the Military Departments, the Defense Agencies, the Department Field Activities, and any other Department organizational entity or instrumentality established to perform a government function. (32 CFR 179.3)

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Confined. Classification within the Migration Pathway Factor assigned when there is a low possibility for contamination to be present at or migrate to a point of exposure. (Definition based on the *Relative Risk Site Evaluation Primer* [Revised Edition, Summer 1997] and 32 CFR Part 179, Appendix A, Tables 21-26)

Confirmed. The presence of a munition hazard can be established based on physical or historical evidence. (Definition based on 32 CFR Part 179)

Contaminant Hazard Factor (CHF). Assesses the hazards to receptors from MC and any nonmunitions-related incidental contaminants present in the four environmental media. The CHF contributes a value of High (H), Medium (M), or Low (L) based on Significant, Moderate, or Minimal contaminants present, respectively. (Definition based on the *Relative Risk Site Evaluation Primer* [Revised Edition, Summer 1997] and 32 CFR 179.6)

Critical Habitat. A specific geographic area(s) that contains features essential for the conservation of a threatened or endangered species and that may require special management and protection. Critical habitat may include an area that is not currently occupied by the species but that will be needed for its recovery. (US Fish and Wildlife Service)

Cultural Resources. Recognized cultural, traditional, spiritual, religious, or historical features (e.g., structures, artifacts, symbolism) on the MRS. Requirements for determining if a particular feature is a cultural resource are found in the *National Historical Preservation Act, Native American Graves Protection* and *Repatriation Act, Archeological Resources Protection Act, Executive Order 13007*, and the *American Indian Religious Freedom Act*. (Definition based on 32 CFR Part 179, Appendix A, Tables 9 and 19)

CWM, Bulk Container. All nonmunitions-configured containers of CA (e.g., a ton container) and CAIS K941, toxic gas set M–1 and CAIS K942, toxic gas set M–2/E11. (32 CFR 179.3)

CWM Configuration. Data element that assesses the potential CWM hazards at an MRS based on the chemical warfare-related activities that occurred at the MRS. (Definition based on 32 CFR Part 179, Appendix A, Table 11)

CWM/DMM. CWM that are DMM, to include CAIS K941, toxic gas set M-1; and CAIS K942, toxic gas set M-2/E11. (Definition based on 32 CFR Part 179, Appendix A, Table 11 and 12)

CWM, Explosively Configured. All munitions that contain a CA fill and any explosive component. Examples are M55 rockets with CA, the M23 VX mine, and the M360 105-mm GB artillery cartridge. (32 CFR 179.3)

CWM Hazard Evaluation (CHE) Module. Provides an evaluation of the chemical hazards associated with the physiological effects of CWM. The CHE Module is used only when CWM are known or suspected of being present at an MRS. Like the EHE Module, the CHE Module has three factors, each of which has two to four data elements that are intended to assess the conditions at an MRS. (32 CFR 179.6)

CWM Hazard Factor. Evaluates the unique characteristics of CWM. The CWM Hazard Factor consists of the data elements CWM Configuration and Sources of CWM and constitutes 40 percent of the CHE Module score. (Definition based on 32 CFR 179.6)

CWM Mixed with UXO. The CWM known or suspected of being present at the MRS are explosively configured CWM/DMM that have not been damaged, or nonexplosively configured CWM/DMM, or CWM not configured as a munition, that are commingled with conventional munitions that are UXO. (Definition based on 32 CFR Part 179, Appendix A, Table 11)

CWM, Nonexplosively Configured. All munitions that contain a CA fill, but that do not contain any explosive components. Examples are any chemical munition that does not contain explosive components and VX or mustard agent spray canisters. (32 CFR 179.3)

CWM/UXO. CWM that are UXO. (Definition based on 32 CFR Part 179, Appendix A, Table 11 and 12)

Damaged. A munition is considered damaged when the integrity of the munition is compromised by cracks, leaks, or other damage.

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Data Element. A part of a factor within the EHE and CHE Modules. Each data element has a range of classifications with associated scores to describe MRS-specific conditions. (Definition based on 32 CFR 179.6)

Defense Environmental Restoration Program (DERP). Program that addresses hazardous substances, pollutants, contaminants, and, in some cases, military munitions remaining from past operations at military installations and formerly used defense sites. DERP was established by Section 211 of the *Superfund Amendments and Reauthorization Act (SARA)* of 1986. (10 USC 2702-2706 and 10 USC 2810-2811)

Defense Site. Locations that are or were owned by, leased to, or otherwise possessed or used by the Department. The term does not include any operational range, operating storage or manufacturing facility, or facility that is used for or was permitted for the treatment or disposal of military munitions. (10 USC 2710(e)(1))

Discarded Military Munitions (DMM). Military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for the purpose of disposal. The term does not include UXO, military munitions that are being held for future use or planned disposal, or military munitions that have been properly disposed of consistent with applicable environmental law and regulations. (10 USC 2710(e)(2))

DoD Control. The MRS is on land or a water body that is owned, leased, or otherwise possessed by DoD. With respect to property that is leased or otherwise possessed, DoD must control access to the MRS 24 hours per day, every day of the calendar year. (Definition based on 32 CFR Part 179, Appendix A, Tables 5 and 15)

Dummy Munitions. Reproductions of munitions that are produced from a variety of wholly inert materials (e.g., wood, metal, plastic) for many purposes (e.g., display, instruction, special tests).

Ease of Access. Data element that focuses on the extent to which barriers prevent access or entry to the MRS. (Definition based on 32 CFR Part 179, Appendix A, Tables 4 and 14)

Ecological and/or Cultural Resources. Data element that considers threatened/endangered species, critical habitats, historical sites, cultural items, American Indian and Alaska Native sacred sites, and other similar resources on the MRS. Focuses only on resources found on the MRS, not those outside the boundary. (Definition based on 32 CFR Part 179, Appendix A, Tables 9 and 19)

Ecological Receptors. Receptors limited to critical habitats and other environments that could reasonably be impacted by an MRS. (Definition based on 32 CFR Part 179, Appendix A)

Ecological Resources. Threatened or endangered species (designated under the *Endangered Species Act* [*ESA*]) present on the MRS; or the MRS is designated under the *ESA* as critical habitat for a threatened or endangered species; or there are identified sensitive ecosystems such as wetlands or breeding grounds present on the MRS. (Definition based on 32 CFR Part 179, Appendix A, Tables 9 and 19)

Educational. Of or relating to the knowledge or skill obtained or developed by a learning process. (Merriam-Webster Online Dictionary)

Evaluation Pending. (1) An alternative module rating used when there are known or suspected hazards present, but sufficient information is not available to determine the module rating, or (2) an alternative MRS rating used to indicate that an MRS requires further evaluation. (Definition based on 32 CFR 179.6)

Evidence of No CWM. Following an investigation of the MRS, there is physical and/or historical evidence that CWM are not present. (Definition based on 32 CFR Part 179, Appendix A, Tables 11-13)

Evidence of No Munitions. Following an investigation of the MRS, there is physical and/or historical evidence that UXO or DMM are not present. (Definition based on 32 CFR Part 179, Appendix A, Tables 1-3)

Evident. Classification within the Migration Pathway Factor assigned when analytical data or observable evidence indicates that contamination is present at, is moving toward, or has moved to a point of exposure. (Definition based on the *Relative Risk Site Evaluation Primer* [Revised Edition, Summer 1997] and 32 CFR Part 179, Appendix A, Tables 21-26)

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Explosive Hazard. A condition where danger exists because explosives are present that may react (e.g., detonate, deflagrate) in a mishap with potential unacceptable effects (e.g., death, injury, damage) to people, property, operational capability, or the environment. (32 CFR 179.3)

Explosive Hazard Evaluation (EHE) Module. Provides a single, consistent, Department-wide approach for the evaluation of explosive hazards. This module is used when there is a known or suspected presence of an explosive hazard. The EHE Module is composed of three factors, each of which has two to four data elements that are intended to assess the specific conditions at an MRS. (Definition based on 32 CFR 179.6)

Explosive Hazard Factor. Characterizes the nature of the explosive hazard. The Explosive Hazard Factor consists of the data elements Munitions Type and Source of Hazard and constitutes 40 percent of the EHE Module score. (Definition based on 32 CFR 179.6)

Explosives. Includes any chemical compound or mechanical mixture which, when subjected to heat, impact, friction, detonation, or other suitable initiation, undergoes a very rapid chemical change with the evolution of large volumes of highly heated gases which exert pressures in the surrounding medium. The term applies to high explosives, propellants, and pyrotechnics that either detonate, deflagrate, burn vigorously, generate heat, light, smoke, or sound. (*Ammunition and Explosives Ashore*: *Safety Regulations for Handling, Storing, Production, Renovation, and Shipping* [NAVSEA OP-5, 7th Revision, Change 4, June 2005])

Exposure Point. A location of potential contact between a receptor and a chemical or physical agent. (*Relative Risk Site Evaluation Primer* [Revised Edition, Summer 1997])

Factor. Categories of information within each module used to assess the hazards posed by UXO, DMM, or MC. Factors are assigned values. The EHE Module factors are Explosive Hazard, Accessibility, and Receptor; the CHE Module factors are CWM Hazard, Accessibility, and Receptor; and the HHE Module factors are Contamination Hazard, Migration Pathway, and Receptor. (Definition based on 32 CFR 179.6)

Feasibility Study (FS). A study undertaken by the lead agency to develop and evaluate options for remedial action. The FS emphasizes data analysis and is generally performed concurrently and in an interactive fashion with the RI, using data gathered during the RI. The RI data are used to define the objectives of the response action, to develop remedial action alternatives, and to undertake an initial screening and detailed analysis of the alternatives. The term also refers to a report that describes the results of the study. (40 CFR 300.5)

Firing Point. The point or location at which a weapon system is placed for firing. (Definition based on "firing position" in Range Safety, DA PAM 385-63)

Forestry. The science and art of cultivating, maintaining, and developing forests. (Merriam-Webster Online Dictionary)

Former Range. Ranges for which a formal decision has been made to close the range or that have been put to a use that is incompatible with continued use as a military range.

Formerly Used Defense Sites (FUDS). A facility or site (property) that 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. By the DERP policy, the FUDS program is limited to those real properties that were transferred from DoD control prior to October 17, 1986. FUDS properties can be located within the 50 States, District of Columbia, Territories, Commonwealths, and possessions of the United States. (US Army Engineer Regulation 200-3-1 FUDS Program Policy)

Fuze. A device used to cause the primary munition, or portion/segment thereof, to function. (Definition based on "fuze" in General Ammunition, TM 9-1300-200)

Fuzed. A primary munition that has a fuze already attached or incorporated into the munition. (Definition based on "fuze" in General Ammunition, TM 9-1300-200)

Groundwater. Precipitation or water from surface water bodies (e.g., oceans, lakes, streams) that soaks into the soil/bedrock and is stored underground. (Merriam-Webster Online Dictionary)

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Health Hazard Evaluation (HHE) Module. A consistent DoD-wide approach for evaluating the relative risk to human health and the environment posed by MC. The HHE builds on the Relative Risk Site Evaluation framework that is used in the IRP and has been modified to address the unique requirements of MRSs. The HHE Module shall be used for evaluating the potential hazards posed by MC and other chemical contaminants. The HHE Module is intended to evaluate MC at sites. (32 CFR 179.6)

High Explosive. An explosive substance designed to function by detonation (e.g., main charge, booster or primary explosives). (DoD Ammunition and Explosives Safety Standards, DoD 6055.9-STD)

High Explosive Fill. An explosive substance (e.g., RDX) carried in an ammunition container such as a projectile, mine, bomb, or grenade. (Definition based on "filler" in the *DoD Dictionary of Military and Associated Terms*)

Historical Evidence. The investigation (1) found written documents or records, (2) documented interviews of persons with knowledge of site conditions, or (3) found and verified other forms of information. (Definition based on 32 CFR Part 179, Appendix A, Tables 1-3 and 11-13)

Identified. Classification within the HHE Receptor Factor assigned when identified receptors have access to media in which contamination has moved or can move. (Definition based on the *Relative Risk Site Evaluation Primer* [Revised Edition, Summer 1997] and 32 CFR Part 179, Appendix A, Tables 21-26)

Incendiary. A CA used primarily for igniting combustible substances with which it is in contact by generating sufficient heat to cause ignition. (*Ammunition and Explosives Ashore*: *Safety Regulations for Handling, Storing, Production, Renovation, and Shipping* [NAVSEA OP-5, 7th Revision, Change 4, June 2005])

Incomplete Barrier. There is not a barrier preventing access to an MRS or there is a barrier preventing access to parts of the MRS, but not the entire MRS. (Definition based on 32 CFR Part 179, Appendix A, Tables 4 and 14)

Industrial. Of, relating to, or resulting from the sector of the economy made up of manufacturing enterprises. (Merriam-Webster Online Dictionary)

Industrial Operating Facilities. Facilities including materials, special tooling, and other industrial facilities used to produce essential material to support the national military objectives. Industrial operating facilities include munitions maintenance, manufacturing, and demilitarization facilities. (Merriam-Webster Online Dictionary)

Information Repository. A collection of copies of all the information related to a response action (i.e., a remedial or removal action) that has been made available to the public established at or near the location of the response action. (Definition based on 40 CFR 300.430)

Inhabited Structures. Permanent or temporary structures, other than Department-related structures, that are routinely occupied by one or more persons for any portion of a day. (Definition based on 32 CFR Part 179, Appendix A, Tables 7 and 17)

Installation Restoration Program (IRP). Program designed to focus on releases of hazardous substances, pollutants, or contaminants that pose environmental health and safety risks at military installations and formerly used defense sites. This program is within DERP. (10 USC 2701)

Limited. Classification within the HHE Receptor Factor assigned when there is little or no potential for receptors that have access to a media in which contamination has moved or can move. (Definition based on the *Relative Risk Site Evaluation Primer* [Revised Edition, Summer 1997] and 32 CFR Part 179, Appendix A, Tables 21-26)

Location of CWM. Data element that evaluates whether the presence of CWM is confirmed or suspected, the proximity of CWM to the surface, and whether there is potential for CWM to be brought to the surface. (Definition based on 32 CFR Part 179, Appendix A, Table 13)

Location of Munitions. Data element that evaluates whether the presence of munitions (UXO or DMM) is confirmed or suspected, the proximity of munitions to the surface, and whether there is potential for munitions to be brought to the surface. (Definition based on 32 CFR Part 179, Appendix A, Table 3)

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Long-Term Management (LTM). Term used for environmental monitoring, review of site conditions, and/or maintenance of a remedial action to ensure continued protection as designed once a site achieves Response Complete. Examples of LTM include landfill cap maintenance, leachate disposal, fence monitoring and repair, five-year review execution, and land use control enforcement actions. This term should be used until no further environmental restoration response actions are appropriate or anticipated. LTM is reserved for monitoring once a site achieves Response Complete, and should not be used to refer to monitoring after Remedy in Place, (this includes sites for which the selected remedy is natural attenuation). (*Management Guidance for the DERP*, September 2001)

Low Explosive. An explosive with a low rate of combustion. Examples of low explosives are smokeless and black powders. (Definition based on "low explosive" in Explosives and Demolitions, FM5-250)

Management Action Plan (MAP). A key document for managing the environmental restoration program at an installation or FUDS. The MAP describes an integrated, coordinated approach for conducting all environmental restoration activities required at an installation or FUDS. (Definition based on *Management Guidance for the DERP*, September 2001)

Maneuver Area. The area needed for movement to place troops, ships, or aircraft in a position of advantage over the enemy or for tactical exercises carried out at sea, in the air, on the ground, or on a map in imitation of war. (Definition based on "maneuver" in the *DoD Dictionary of Military and Associated Terms*)

Migration Pathway Factor (MPF). Indicates environmental migration pathways, and contributes a level of High (H), Medium (M), or Low (L) based on Evident, Potential or Confined pathways, respectively. (Definition based on the *Relative Risk Site Evaluation Primer* [Revised Edition, Summer 1997] and 32 CFR 179.6)

Military Munitions. All ammunition products and components produced for or used by the armed forces for national defense and security, including ammunition products or components under the control of the DoD, the Coast Guard, the DOE, and the National Guard. The term includes confined gaseous, liquid, and solid propellants; explosives, pyrotechnics, chemical and riot control agents, smokes, and incendiaries, including bulk explosives and chemical warfare agents; chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, and demolition charges; and devices and components of any item thereof. The term does not include wholly inert items, improvised explosive devices, and nuclear weapons, nuclear devices, and nuclear components, other than nonnuclear components of nuclear devices that are managed under the nuclear weapons program of the DOE after all required sanitization operations under the *Atomic Energy Act of 1954* (42 USC 2011 et seq.) have been completed. (10 USC 101(e)(4))

Military Munitions Response Program (MMRP). Formerly known as the OE Cleanup Program, which is part of the DERP, the MMRP is the program under which DoD carries out environmental restoration activities. The MMRP is a category under the DERP that requires Components to identify munitions response sites requiring action. (10 USC 2710)

Military Range. Designated land and water areas set aside, managed, and used to research, develop, test, and evaluate military munitions, other ordnance, or weapon systems, or to train military personnel in their use and handling. Ranges include firing lines and positions, maneuver areas, firing lanes, test pads, detonation pads, impact areas, and buffer zones with restricted access and exclusionary areas. (40 CFR 266.201)

Minimal. Classification within the Contaminant Hazard Factor assigned when the sum of the contaminant ratios is less than two. (Definition based on the *Relative Risk Site Evaluation Primer* [Revised Edition, Summer 1997] and 32 CFR Part 179, Appendix A, Tables 21-26)

Missile or Air Defense Artillery Emplacements. A missile defense or ADA placed in a prepared position, such as a mounting or silo, for one or more weapons or pieces of equipment, for protection against hostile fire or bombardment, and from which they can execute their tasks. (Definition based on "emplacement" in the *DoD Dictionary of Military and Associated Terms*)

Moderate. Classification within the Contaminant Hazard Factor assigned when the sum of the contaminant ratios is between 2 and 100. (Definition based on the *Relative Risk Site Evaluation Primer* [Revised Edition, Summer 1997] and 32 CFR Part 179, Appendix A, Tables 21-26)

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Monitoring. The act of listening, carrying out surveillance on, and/or recording the emissions of one's own or allied forces for the purposes of maintaining and improving procedural standards and security, or for reference, as applicable. (*DoD Dictionary of Military and Associated Terms*)

MRS Project Team. A team assembled by the Component responsible for conducting a munitions response at an MRS. The MRS Project Team may be composed of representatives from DoD, the regulatory community, federal land managers, the local community, and other affected stakeholders. DoD personnel should include technical personnel (e.g., UXO qualified personnel, explosives or chemical safety personnel) knowledgeable of any known or suspected hazards at the MRS. The MRS Project Team is responsible for the application of the Protocol.

Munitions and Explosives of Concern (MEC). Specific categories of military munitions that may pose unique explosives safety risks, such as UXO, as defined in 10 USC 101(e)(5); discarded military munitions, as defined in 10 USC 2710(e)(2); or munitions constituents (e.g., TNT, RDX), as defined in 10 USC 2710 (e)(3), present in high enough concentrations to pose an explosive hazard. (32 CFR 179.3)

Munitions Constituents (MC). Any materials originating from UXO, DMM, or other military munitions, including explosive and nonexplosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions. (10 USC 2710(e)(3))

Munitions Response. Response actions, including investigation, removal actions, and remedial actions, to address the explosive safety, human health, or environmental risks presented by UXO, DMM, or MC, or to support a determination that no removal or remedial action is required. (32 CFR 179.3)

Munitions Response Area (MRA). Any area on a defense site that is known or suspected to contain UXO, DMM, or MC. Example MRAs include former ranges and munitions burial areas. An MRA is comprised of one or more munitions response sites. (32 CFR 179.3)

Munitions Response Site (MRS). A discrete location within an MRA that is known to require a munitions response. (32 CFR 179.3)

Munitions Response Site Prioritization Protocol (MRSPP). A tool adopted by DoD to assign a relative priority for munitions responses to each location in the Department's inventory of defense sites known or suspected of containing UXO, DMM, or MC. (32 CFR 179)

Munitions Treatment Open Burn/Open Detonation (OB/OD) Unit. A location where UXO or DMM (e.g., munitions, bulk explosives, bulk pyrotechnic, or bulk propellants) were burned or detonated for the purpose of treatment prior to disposal. (Definition based on 32 CFR Part 179, Appendix A, Table 2)

Munitions Type. Data element that assesses the potential explosive hazard posed by MEC, given the types of munitions potentially present at an MRS. (Definition based on 32 CFR Part 179, Appendix A, Table 1)

No Known or Suspected Hazard. (1) An alternative module rating reserved for MRSs that do not require evaluation under one or more of the modules, or (2) an alternative MRS rating used to indicate that an MRS has no known or suspected hazards. (Definition based on 32 CFR 179.6)

No Longer Required. (1) An alternative module rating used when the MRS no longer requires an assigned priority because DoD has conducted a response, all objectives set out in the decision document for the MRS have been achieved, and no further action, except for long-term management and recurring reviews, is required, or (2) an alternative MRS rating used to indicate that an MRS no longer requires prioritization. (Definition based on 32 CFR 179.6)

Non-DoD Control. The MRS is a location that is no longer owned by, leased to, or otherwise possessed or used by DoD. Examples are privately owned land or water bodies; land or water bodies owned or controlled by state, tribal, or local governments; and land or water bodies managed by other federal agencies. (Definition based on 32 CFR Part 179, Appendix A, Table 5 and 15)

Nonexplosively Configured. All munitions that do not contain any explosive components. An example is VX or mustard agent spray canisters.

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Open Burn (OB). An open-air combustion process by which excess, unserviceable, or obsolete munitions are destroyed to eliminate their inherent explosive hazards. (*DoD Ammunition and Explosives Safety Standards*, DoD 6055.9-STD)

Open Detonation (OD). An open-air process used for the treatment of excess, unserviceable, or obsolete munitions whereby an explosive donor charge initiates the munitions being treated. (*DoD Ammunition and Explosives Safety Standards*, DoD 6055.9-STD)

Operational Range. A range that is under the jurisdiction, custody, or control of the Secretary of a military department and that is used for range activities; or although not currently being used for range activities, that is still considered by the Secretary to be a range and has not been put to a new use that is incompatible with range activities. (10 USC 101(e)(3))

Parks and Recreational Areas. An area of land set aside for public use as (1) a piece of land with few or no buildings within or adjoining a town, maintained for recreational and ornamental purposes; (2) a landscaped city square; or (3) a large tract of rural land kept in its natural state and usually reserved for the enjoyment and recreation of visitors. (Merriam-Webster Online Dictionary)

Physical Constraint. A restriction (e.g., pavement, water depth greater than 120 feet) that prevents direct access to objects beneath. (Definition based on 32 CFR Part 179, Appendix A, Table 3 and 13)

Physical Evidence. (1) Recorded observations from on-site investigations, such as finding intact UXO or DMM, or munitions debris (e.g., fragments, penetrators, projectiles, shell casings, links, fins); (2) the results of field or laboratory sampling and analysis procedures; or (3) the results of geophysical investigations. (Definition based on 32 CFR Part 179, Appendix A, Tables 1-3 and 11-13)

Population Density. Data Element based on the number of people per square mile in the county where an MRS is located per US Census data. (Definition based on 32 CFR Part 179, Appendix A, Tables 6 and 16).

Population Near Hazard. Data Element based on the number of inhabited structures on the MRS and within two miles of the MRS boundary. (Definition based on 32 CFR Part 179, Appendix A, Tables 7 and 17)

Potential. (1) Classification within the Migration Pathway Factor assigned when contamination has moved only slightly beyond the source, could move but is not moving sufficiently to select Evident or Confined; or (2) classification within the Receptor Factor assigned when receptors have access to the source to which contamination has moved or can move. (Definition based on the *Relative Risk Site Evaluation Primer* [Revised Edition, Summer 1997] and 32 CFR Part 179, Appendix A, Tables 21-26).

Practice Munitions. Munitions that contain inert filler (e.g., wax, sand, concrete), a spotting charge (i.e., a small charge of red phosphorus, photoflash powder, or black powder used to indicate the point of impact), and a fuze. (32 CFR Part 179, Appendix A, Table 1)

Practice Munitions Range. A former military range on which only practice munitions without sensitive fuzes were used. (Definition based on 32 CFR Part 179, Appendix A, Table 2)

Preliminary Assessment (PA). A review of existing information and an off-site reconnaissance, if appropriate, to determine if a release may require additional investigation or action. A PA may include an on-site reconnaissance, if appropriate. (Definition based on 40 CFR 300.5)

Preliminary Remediation Goals (PRGs). Concentration levels set for individual chemicals that, for carcinogens, correspond to a specific cancer risk level of one in one million and, for noncarcinogens, correspond to a Hazard Quotient of one. They are generally selected when Applicable or Relevant and Appropriate Requirements are not available. (*Relative Risk Site Evaluation Primer* [Revised Edition, Summer 1997])

Primary Explosives. Highly sensitive compounds that are typically used in detonators and primers. A reaction is easily triggered by heat, spark, impact, or friction. Examples of primary explosives are lead azide and mercury fulminate. (*DoD Ammunition and Explosives Safety Standards*, DoD 6055.9-STD)

Primed. A charge ready in all aspects for ignition. (Definition based on "primed charge" in the *DoD Dictionary of Military and Associated Terms*)

Note: All terms in this Glossary are only defined for use with the Munitions Response Site Prioritization Protocol.

Propellants. Substances or mixtures of substances used for propelling projectiles and missiles, or to generate gases for powering auxiliary devices. When ignited, propellants burn at a controlled rate to produce quantities of gas capable of performing work but they must be capable of functioning in their application without undergoing a deflagration-to-detonation transition. (*Ammunition and Explosives Ashore*: *Safety Regulations for Handling, Storing, Production, Renovation, and Shipping* [7th Revision, Change 4, June 2005])

Pyrotechnics. A mixture of chemicals which, when ignited, is capable of reacting exothermically to produce light, heat, smoke, sound, or gas. (*DoD Dictionary of Military and Associated Terms*)

Range. A designated land or water area that is set aside, managed, and used for range activities of the DoD. Such term includes the following: firing lines and positions, maneuver areas, firing lanes, test pads, detonation pads, impact areas, electronic scoring sites, buffer zones with restricted access, and exclusionary areas and airspace areas designated for military use in accordance with regulations and procedures prescribed by the Administrator of the Federal Aviation Administration. (10 USC 101(e)(1))

Range Activities. Research, development, testing, and evaluation of military munitions, other ordnance, and weapons systems; and the training of members of the armed forces in the use and handling of military munitions, other ordnance, and weapons systems. (10 USC 101(e)(2))

Ratings. Assigned to hazard evaluation modules based on the factor values. The highest module rating (A is highest; G is lowest) becomes the MRS Priority. (Definition based on 32 CFR 179.6)

Receptor. A human individual or individuals, ecological population, or sensitive environment subject to, or potentially subject to, the hazard of contaminant exposure. (*Relative Risk Site Evaluation Primer* [Revised Edition, Summer 1997])

Receptor Factor. Focuses on human and ecological populations that may be impacted by the presence of MEC for the EHE Module, CWM for the CHE Module, or MC and any incidental nonmunitions-related contaminants for the HHE Module. The Receptor Factor for the EHE and CHE Modules consists of the data elements Population Density, Population Near Hazard, Types of Activities/Structures, and Ecological and/or Cultural Resources, and constitutes 20 percent of the EHE and CHE Module scores. For the HHE Module, the Receptor Factor contributes a level of High (H), Medium (M), or Low (L) based on Identified, Potential, or Limited receptors, respectively. (Definition based on the *Relative Risk Site Evaluation Primer* [Revised Edition, Summer 1997] and 32 CFR 179.6)

Reference Dose (RfD). An estimated daily exposure level of a contaminant to a human population below which no adverse noncancer health effects are anticipated. (*Relative Risk Site Evaluation Primer* [Revised Edition, Summer 1997])

Relative Risk Site Evaluation (RRSE). The RRSE framework serves as the basis for the HHE Module. Methodology used by DoD to evaluate the relative risk posed at an IRP site in relation to other IRP sites. It is based on the nature and extent of contamination at an IRP site, the potential for contaminants to migrate, and the populations and ecosystems that could be impacted.

Remedial Investigation (RI). A process undertaken by the lead agency to determine the nature and extent of the problem presented by the release. The RI emphasizes data collection and site characterization, and is generally performed concurrently and in an interactive fashion with the feasibility study. The RI includes sampling and monitoring, as necessary, and includes the gathering of sufficient information to determine the necessity for remedial action and to support the evaluation of remedial alternatives. (40 CFR 300.5)

Remedy in Place (RIP). Designation that a final remedial action has been constructed and implemented and is operating as planned in the remedial design. Because operation of the remedy is ongoing, the site cannot be considered Response Complete. (Definition based on *Management Guidance for the DERP*, September 2001)

Research, Development, Testing, and Evaluation (RDT&E) Facility. The MRS is at a facility that formerly was involved in non-live-fire RDT&E activities (including static testing) involving CWM, and there are CWM/DMM suspected of being present on the surface or in the subsurface. (Definition based on 32 CFR Part 179, Appendix A, Table 12)

Note: All terms in this Glossary are only defined for use with the Munitions Response Site Prioritization Protocol.

Residential. Of, relating to, or having a place where one actually lives as distinguished from a domicile or place of temporary sojourn. (Merriam-Webster Online Dictionary)

Response Complete (RC). Milestone reached when the selected remedy has achieved cleanup goals specified in the ROD or decision document. (*Department of the Navy Environmental Restoration Program Manual*, August 2006)

Restoration Advisory Board (RAB). An advisory group for the environmental restoration process that includes members of the public, the installation, and regulatory agencies. The purpose of a RAB is to gain effective input from stakeholders on cleanup activities and to increase installation responsiveness to community environmental restoration concerns. (ODUSD(I&E)/Environmental Management Office Glossary of Terms)

Scores. Numeric classifications, ranging from zero to a maximum score, assigned to each data element within the EHE and CHE Modules. (Definition based on 32 CFR 179.6)

Secondary Explosives. Generally less sensitive to initiation than primary explosives and are typically used in booster and main charge applications. A severe shock is usually required to trigger a reaction. Examples are TNT, RDX or cyclonite, cyclotetramethylene-tetranitramine (HMX) (also known as octogen), and tetryl. (*DoD Ammunition and Explosives Safety Standards*, DoD 6055.9-STD)

Sediment. Sediments are formed from the deposition of solid material that include the clay and silts on the bottom of a water body (e.g., ocean, lake, stream). (Merriam-Webster Online Dictionary)

Sensitive. All UXO that are considered likely to function upon any interaction with exposed persons (e.g., submunitions, 40mm HE grenades, white phosphorus [WP] munitions, high explosive antitank [HEAT] munitions, and practice munitions with sensitive fuzes, but excluding all other practice munitions); all hand grenades containing energetic filler; and bulk primary explosives, or mixtures of these with environmental media such that the mixture poses an explosive hazard. (Definition based on 32 CFR Part 179, Appendix A, Table 1)

Significant. Classification within the Contaminant Hazard Factor assigned when the sum of the contaminant ratios is greater than 100. (Definition based on the *Relative Risk Site Evaluation Primer* [Revised Edition, Summer 1997] and 32 CFR Part 179, Appendix A, Tables 21-26)

Site Inspection (SI). An on-site investigation to determine whether there is a release or potential release and the nature of the associated threats. The purpose is to augment the data collected in the preliminary assessment and to generate, if necessary, sampling and other field data to determine if further action or investigation is appropriate. (40 CFR 300.5)

Slope Factor (SF). A plausible upper-bound estimate of the probability of a response per unit intake of a chemical over a lifetime. The slope factor is used to estimate an upper-bound probability of an individual developing cancer as a result of a lifetime of exposure to a particular level of a carcinogen. (*Relative Risk Site Evaluation Primer* [Revised Edition, Summer 1997])

Small Arms Ammunition. Ammunition, without projectiles that contain explosives (other than tracers), that is .50 caliber or below, or for shotguns. (*DoD Ammunition and Explosives Safety Standards*, DoD 6055.9-STD)

Small Arms Range. A range where only small arms ammunition was used. (Definition based on 32 CFR Part 179, Appendix A, Table 2)

Source of Hazard. Data element that assesses the potential explosive risk at an MRS based on the MRS's previous uses. (Definition based on 32 CFR Part 179, Appendix A, Table 2)

Sources of CWM. Data element that addresses the type of CWM activities conducted, the extent CWM may be present, and its potential condition. (Definition based on 32 CFR Part 179, Appendix A, Table 12)

Stable Condition. Naturally occurring phenomena or intrusive activities are not likely to expose subsurface UXO or DMM. (Definition based on 32 CFR Part 179, Appendix A, Tables 3 and 13)

Note: All terms in this Glossary are only defined for use with the Munitions Response Site Prioritization Protocol.

Stakeholders. Includes federal, state, and local officials, community organizations, property owners, and others having a personal interest or involvement, or having a monetary or commercial involvement in the real property which is to undergo a munitions response action. (Definition based on *Engineering and Design - Ordnance and Explosives Response,* EM 1110-1-4009)

Status of Property. Data element that differentiates between an MRS that is currently under DoD's control and an MRS that has been transferred out of DoD control. (Definition based on 32 CFR Part 179, Appendix A, Tables 5 and 15).

Storage or Transfer Points. The MRS is a location where munitions were stored or handled for transfer between different modes of transportation (e.g., rail to truck, truck to weapon system). (Definition based on 32 CFR Part 179, Appendix A, Table 2)

Subsistence. The act or state of to maintain or support with provisions. (Merriam-Webster Online Dictionary)

Subsurface. The munition is entirely beneath the ground surface or submerged in a water body. (Definition based on 32 CFR Part 179, Appendix A, Tables 3 and 13)

Surface. The munition is entirely or partially exposed above the ground surface, or entirely or partially exposed above the surface of a water body. (Definition based on 32 CFR Part 179, Appendix A, Tables 3 and 13)

Surface Soil. The layer of soil on the surface (with a depth of 0 to 6 inches). (Merriam-Webster Online Dictionary)

Surface Water. Precipitation that collects in surface water bodies (e.g., oceans, lakes, streams) or groundwater that discharges to the surface from springs. (Merriam-Webster Online Dictionary)

Suspected. The presence of a munition hazard is suggested from physical or historical evidence. (Definition based on 32 CFR Part 179, Appendix A, Tables 3 and 13)

Technical Review Committee (TRC). A group of technical experts that is responsible for reviewing technical reports and data for a site. A TRC is established at installations for the purpose of reviewing and commenting on actions and proposed actions concerning releases or threatened releases at the installation. The TRC consists of at least one representative from the installation, a representative of EPA, appropriate state and local authorities, and a public representative of the community involved. (ODUSD(I&E)/Environmental Management Office Glossary of Terms)

Threatened and Endangered Species. Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range and any species which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the Secretary to constitute a pest whose protection under the provisions of this Act would present an overwhelming and overriding risk to man. (*Endangered Species Act*)

Training Facility Using CWM or CAIS. A location that formerly was involved in training activities involving CWM and/or CAIS (e.g., training in recognition of CWM, decontamination training), and CWM/DMM or CAIS/DMM are suspected of being present on the surface or in the subsurface. (Definition based on 32 CFR Part 179, Appendix A, Table 12)

Types of Activities/Structures. Data element that assesses the nature of the population near the hazard. Provides an indication of the extent, type, and intrusiveness of activities at an MRS, likelihood of people being on or within a two-mile radius of an MRS, and accounts for permanent and transient populations. (Definition based on 32 CFR Part 179, Appendix A, Tables 8 and 18)

Undamaged Munitions. A munition is considered undamaged when the integrity of the munition is not compromised by cracks, leaks, or other damage. (*DoD Dictionary of Military and Associated Terms*)

Unexploded Ordnance (UXO). Military munitions that (1) have been primed, fused, armed, or otherwise prepared for action; (2) have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and (3) remain unexploded, whether by malfunction, design, or any other cause. (10 USC 101(e)(5))

Note: All terms in this Glossary are only defined for use with the Munitions Response Site Prioritization Protocol.

United States. In a geographic sense, the States, territories, and possessions and associated navigable waters, contiguous zones, and ocean waters of which the natural resources are under the exclusive management authority of the United States. (10 USC 2710(e)(10))

Unused Munitions. Those munitions that have not been fired, dropped, launched, placed, or otherwise used. Such munitions include, but may not be limited to, military munitions in DoD's stockpile that are available for issue; munitions issued to using units that have not been used; and munitions that were not used that were disposed of without authorization, lost or stolen. (Definition based on the *Munitions Rule Implementation Policy*)

Used or Fired Military Munitions: Those military munitions that have been primed, fuzed, armed, or otherwise prepared for action, and that have been fired, dropped, launched, projected, placed, or otherwise used. Such munitions include, but may not be limited to, malfunctions, misfires (e.g., fail to properly fire), and UXO. Small arms ammunition that may have been used, but that misfired are not considered UXO. (Definition based on the *Munitions Rule Implementation Policy*)

Values. Designations assigned to each factor. Factor values are used to determine the module rating. (Definition based on 32 CFR 179.6)

Warehousing. To place or store in a place in which goods or merchandise are stored; a storehouse, especially in a bonded or government warehouse. (Merriam-Webster Online Dictionary)

Wholly Inert. Those munitions (e.g., dummy) or munitions components (e.g., ogive, rotating band, adapter and lifting plugs) that have never contained reactive materials (i.e., explosives, chemical agents, chemicals such as pyrophoric chemicals). (Note: Once an inert item is employed as a component of a military munition, it may no longer be considered wholly inert.)

Note: All terms in this Glossary are only defined for use with the Munitions Response Site Prioritization Protocol.

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Appendix D: Acronyms

AC	Hydrogen Cyanide
ADA	Air Defense Artillery
ARC	Annual Report to Congress
ASTSWMO	Association of State and Territorial Solid Waste Management Officials
ATSDR	Agency for Toxic Substances and Disease Registry
BRAC	Base Realignment and Closure
CA	Chemical Agent
CAA	Clean Air Act
CAIS	Chemical Agent Identification Sets
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CG	Carbonyl Dichloride
CHE	Chemical Warfare Materiel Hazard Evaluation
CHF	Contaminant Hazard Factor
CK	Cyanogen Chloride
CRV	Carcinogen Reference Value
CTT	Closed, Transferred, or Transferring
CWA	Clean Water Act
CWM	Chemical Warfare Materiel
DDESB	Department of Defense Explosives Safety Board
DEP	Defense Environmental Programs
DERP	Defense Environmental Restoration Program
DLA	Defense Logistics Agency
DMM	Discarded Military Munitions
DoD	Department of Defense
DOE	Department of Energy
DOI	Department of the Interior
DRE	Detailed Risk Evaluation
ECOS	Environmental Council of States
EE/CA	Engineering Evaluation/Cost Analysis
EHE	Explosive Hazard Evaluation
EO	Executive Order
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FFRRO	Federal Facilities Restoration and Reuse Office
FR	Federal Register
FS	Feasibility Study
FUDS	Formerly Used Defense Sites
FY	Fiscal Year
HE	High Explosive
HEAT	High Explosive Antitank
HHE	Health Hazard Evaluation
HMX	High Melting Explosive
HRS	Hazard Ranking System
IRP	Installation Restoration Program
ITRC	Interstate Technology and Regulatory Council
LTM	Long-Term Management
MACS	Munitions Analytical Compliance System
MAP	Management Action Plan
MC	Munitions Constituents

MEC	Munitions and Explosives of Concern
MIDAS	Munitions Items Disposition Action System
MMRP	Military Munitions Response Program
MPF	Migration Pathway Factor
MRA	Munitions Response Area
MRS	Munitions Response Site
MRSPP	Munitions Response Site Prioritization Protocol
NAAG	National Association of Attorneys General
NALEMP	Native American Lands Environmental Mitigation Program
NCP	National Contingency Plan
NDAA	National Defense Authorization Act
NHPA	National Historic Preservation Act
NOAA	National Oceanic and Atmospheric Administration
NOSSA	Naval Ordnance Safety & Security Activity
OB/OD	Open Burning/Open Detonation
ODUSD(I&E)	Office of the Deputy Under Secretary of Defense (Installations & Environment)
OE	Ordnance and Explosive
OESO	Ordnance Environmental Support Office
PA	Preliminary Assessment
PRGs	Preliminary Remediation Goals
QA	Quality Assurance
QRE	Qualitative Risk Evaluation
R3	Resource Recovery and Recycling
R3M	Range Rule Risk Methodology
RA-C	Remedial Action Construction
RA-O	Remedial Action Operation
RAB	Restoration Advisory Board
RAC	Risk Assessment Code
RC	Response Complete
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RDT&E	Research, Development, Testing, and Evaluation
RDX	Royal Detonation Explosive
RfD	Reference Dose
RI	Remedial Investigation
RIP	Remedy In Place
ROD	Record of Decision
RRSE	Relative Risk Site Evaluation
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SF	Slope Factor
SI	Site Inspection
SQuiRTs	Screening Quick Reference Tables
SRE	Streamlined Risk Evaluation
TNT	Trinitrotoluene
TRC	Technical Review Committee
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
UXO	Unexploded Ordnance
WP	White Phosphorus

Appendix E: References

REFERENCE	WEB SITE	DESCRIPTION
Defense Environmental Restoration Program		
Defense Environmental Programs (DEP) Annual Report to Congress (ARC)	https://www.denix.osd.mil/denix/Public/Library/Cleanup/CleanupOfc/arc/index.html	Provides electronic copies of current and past reports dating back to 1994.
Defense Environmental Restoration Program (DERP)	http://www.access.gpo.gov/uscode/title10/subtitlea_partiv_chapter160_.html	Provides links to 10 USC 2701-2708.
Department of Defense (DoD) Environmental Management Office	https://www.denix.osd.mil/denix/Public/Library/Cleanup/CleanupOfc/index.html	Provides information to the public on DoD's effort to address environmental contamination at active and closing bases and former properties, while protecting human health and the environment.
Inventory of UXO, DMM, and MC at Defense Sites	http://deparc.egovservices.net/de-parc/do/mmrp	Provides the legal authority to develop the Protocol contained in 10 USC 2710.
Management Guidance for the DERP	https://www.denix.osd.mil/denix/Public/ES-Programs/Cleanup/guida.html	Provides a PDF version of this document.
Military Munitions Response Program (MMRP)	https://www.denix.osd.mil/denix/Public/News/OSD/MMRP/mmrp.html	Provides the public and DoD personnel with information regarding the MMRP and the MRSPP.
Munitions Response Site Prioritization Protocol (MMRP)	https://www.denix.osd.mil/denix/Public/Library/Cleanup/CleanupOfc/whats_new/FinalProtocolRule.pdf	Provides a link to the Protocol final rule as published in the Federal Register.
Laws and Regulations		
Clean Air Act (CAA)	http://www.access.gpo.gov/uscode/title42/chapter85_.html	Provides links to 42 USC 7401-7671.
Clean Water Act (CWA) Section 304(a)	http://www.epa.gov/region5/water/pdf/ecwa_t3.pdf	Includes information and guidelines on the CWA from 33 USC 1314.
Code of Federal Regulations (CFR)	http://www.gpoaccess.gov/cfr/index.html	Provides the index for the CFR.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)	http://www.access.gpo.gov/uscode/title42/chapter103_.html	Provides links to 42 USC 9601-9675.
Endangered Species Act (ESA)	http://www.access.gpo.gov/uscode/title16/chapter35_.html	Provides links to 16 USC 1531-1544.
Executive Orders (EOs) 12580 and 13016	http://www.archives.gov/federal-register/executive-orders/1987.html	Includes the EO Disposition Tables for the year 1987. EO 12580 is the Superfund Implementation and EO 13016 is an amendment of EO 12580.

REFERENCE	WEB SITE	DESCRIPTION
Federal Register (FR)	http://www.gpoaccess.gov/fr/index.html	Provides an index for the FR.
National Contingency Plan (NCP)	http://www.access.gpo.gov/nara/cfr/waisidx_00/40cfr300_00.html	Provides links to 40 CFR Part 300.
National Historic Preservation Act (NHPA)	http://www.achp.gov/nhpp.html	Provides an online copy of the NHPA of 1966 as amended through 2000 (with annotations).
Resource Conservation and Recovery Act (RCRA)	http://www.access.gpo.gov/uscode/title42/chapter82_.html	Provides links to 42 USC 6901-6992(k).
Safe Drinking Water Act (SDWA)	http://www.access.gpo.gov/uscode/title42/chapter6a_subchapterxii_.html	Provides links to 42 USC 300(f)-300(j).
Threatened and Endangered Species List	http://www.fws.gov/endangered/wildlife.html	Provides the public with the regulatory profile for a listed species using its common or scientific name.
United States Code (USC)	http://www.gpoaccess.gov/uscode/index.html	Provides an index for the USC.
Munitions		
Chemical Agents and Munitions	http://www.access.gpo.gov/uscode/title50a/title50a.html	Provides the text to US Code Title 50, Appendix – War and National Defense.
Defense Ammunition Center AmmoHelp	https://www3.dac.army.mil/ammohelp	Provides a Web-based tool used by government and military ammunition users to generate questions applicable to ammunition logistics operations.
Defense Ammunition Center Munitions Items Disposition Action System (MIDAS)	https://midas.dac.army.mil	Provides ammunition constituents data that support logistics assessment capabilities, such as resource recovery and recycling (R3) and environmental safety and health considerations.
EPA Guidelines for Munitions Response, October 2003	http://www.epa.gov/fedfac/pdf/oe_guidelines_draft_10-24-03.pdf	Provides a PDF version of this draft document.
EPA Handbook on the Management of Ordnance and Explosives at Closed, Transferred, and Transferring (CTT) Ranges and Other Sites	http://www.epa.gov/fedfac/pdf/IFUXOCTTHandbook.pdf	Provides a PDF version of the draft handbook, EPA 505-B-01-001, February 2002.

REFERENCE	WEB SITE	DESCRIPTION
Munitions Analytical Compliance System (MACS)	http://sandbox.chemply.com/default.asp	Provides ammunition environmental safety and health assessment capabilities to the ammunition logistics community.
Munitions Constituents (MC)	http://www.gpo.gov/uscode/title10/title10.html	Provides a link to USC Title 10, which contains the definition of munitions constituents.
Organizations		
Association of State and Territorial Solid Waste Management Officials (ASTSWMO)	http://www.astswmo.org	Provides the home page for the ASTSWMO, containing information on committees, publications, and news.
Department of Defense Explosives Safety Board (DDESB)	http://www.ddesb.pentagon.mil/	Includes DoD Directive 6055.9E and DoD Explosives Safety Standard 6055.9. It also contains the DoD Contractors' Safety Manual for Ammunition and Explosives.
Environmental Council of the States (ECOS)	http://www.ecos.org	Provides the home page for the ECOS, containing information on committees, policy, projects, publications, events, and news.
Hazard Assessment for Munitions and Explosives of Concern (MEC) Workgroup	http://www.epa.gov/swerffrr/documents/hazard_assess_wrkgrp.htm	Contains information about Federal Facilities Restoration and Reuse Office (FFRRO) and the Hazard Assessment for MEC Workgroup. Provides links to publications and other munitions-related Web sites.
Interstate Technology and Regulatory Council (ITRC)	http://www.itrcweb.org	Provides information on industry and stakeholders regulatory acceptance of environmental technologies.
National Association of Attorneys General (NAAG)	http://www.naag.org	Includes legal and law enforcement issues, policy research and analysis of issues, and communication between the states' chief legal officers and all levels of government.
Naval Ordnance Safety & Security Activity (NOSSA)	http://www.nossa.navsea.navy.mil/	Provides links to product areas and services, such as the Ordnance Environmental Support Office (OESO).
US Army Corps of Engineers Military Munitions Center of Expertise	http://www.hnd.usace.army.mil/oew/CX_mission.aspx	Provides recent conference presentations, reference documents, and the latest innovative technology developments.
US Census Bureau	http://www.census.gov	Provides the public with all types of US Census data.

REFERENCE	WEB SITE	DESCRIPTION
US Environmental Protection Agency (EPA)	http://www.epa.gov/	Provides the home page, containing links to topics, programs, and resources.
Relative Risk Site Evaluation		
Ecological Risk Assessment Guidance	http://www.epa.gov/superfund/programs/nrd/era.htm	Provides a link to an EPA Web site describing the Ecological Risk Assessment process under CERCLA.
Guidelines for Groundwater Classifications	http://www.epa.gov/epaoswer/hazwaste/ca/resource/guidance/gw/gwclass.htm	Identifies the Guidelines for Groundwater Classification under the EPA Groundwater Protection Strategy. The Web site defines key words and concepts for the classification system, and describes procedures and data requirements to assist in classifying groundwater.
National Oceanic and Atmospheric Administration (NOAA) Sediment Screening Values	http://response.restoration.noaa.gov/cpr/sediment/squirt/squirt.html	Presents NOAA's Screening Quick Reference Tables (SQuiRTs), which include screening concentrations for inorganic and organic contaminants in various environmental media.
Ontario Ministry of Environment Sediment Standards	http://www.ene.gov.on.ca/envision/gp	Presents the soil, groundwater, and sediment standards for use under Part XV.1 of the Environmental Protection Act, dated March 9, 2004. The document consists of prescribed contaminants and the applicable site conditions standards for those contaminants within the Environmental Protection Act. The document provides directions how to read the tables.
Preliminary Remediation Goals (PRGs)	http://www.epa.gov/region09/waste/sfund/prg/	Provides highlights of the PRGs for Region 9.
Relative Risk Site Evaluation Primer	http://www.denix.osd.mil/denix/Public/Library/Cleanup/CleanupOfc/Documents/Cleanup/relrisk_relrisk.html	Provides links to the text of the Relative Risk Site Evaluation Primer by chapter.
Other		
Community Relations Plans	http://www.denix.osd.mil/denix/Public/Library/Cleanup/CleanupOfc/stakeholder/crp.html	Provides a link to information on community relations plans.

REFERENCES	WEB SITE	DESCRIPTION
Cultural Resources Information	http://www.doi.gov	Provides access to the US Department of the Interior Bureau of Reclamation and Bureau of Indian Affairs. Includes links to declarations as well as government, inter-tribal organizations, environmental, and cultural Web sites.
DoD Dictionary of Military Terms	http://www.dtic.mil/doctrine/jel/doddict/index.html	Provides dictionary of military terms, acronyms, and abbreviations.

OFFICE OF THE DEPUTY UNDER SECRETARY OF DEFENSE
INSTALLATIONS AND ENVIRONMENT
OFFICE OF ENVIRONMENTAL MANAGEMENT