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ENERGY, INSTALLATIONS,
AND ENVIRONMENT

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

SUBJECT: Military Munitions Response Program Risk Management Methodology

The Office of the Secretary of Defense (OSD) developed the attached Military Munitions Response Program (MMRP) Risk Management Methodology (RMM) to provide a consistent process for understanding and evaluating risk at munitions response sites (MRSs) at active installations, Formerly Used Defense Sites, and Base Realignment and Closure locations. DoD encourages project teams to use the RMM to support risk-based decisions during the remedial investigation phase of the Comprehensive Environmental Response, Compensation, and Liability Act process.

The RMM is a qualitative risk evaluation tool that project teams can use to facilitate discussions about cleanup and build consensus for risk management decisions at MRSs. The RMM itself does not determine the level of risk at an MRS; it is only a tool to guide project team discussion about the level of risk. It maximizes transparency and enhances participation and collaboration among project team members throughout the cleanup process.

OSD could not have developed the RMM without input from the DoD Components through the DoD Munitions Response Subcommittee. In addition, OSD recognizes the importance of discussing risk management with external stakeholders and appreciates the input representatives from the U.S. Environmental Protection Agency, other federal agencies (e.g., U.S. Department of Agriculture, Department of Interior), and State regulatory agencies provided on the RMM through the Munitions Response Dialogue.

The RMM is available on the DoD Environment, Safety, and Occupational Health Network and Information Exchange. The primary point of contact for this matter is Mr. Brian Jordan, available at 703-409-8657 or brian.d.jordan6.civ@mail.mil.

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Paul D. Cramer
Principal Deputy Assistant Secretary of Defense
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Attachment:
As stated

Military Munitions Response Program
Risk Management Methodology

Table of Contents

I. Introduction

The Office of the Secretary of Defense (OSD) developed this updated Military Munitions Response Program (MMRP) Risk Management Methodology (RMM) document in close coordination with the U.S. Army Corps of Engineers (USACE) to help project teams prepare for and apply the RMM. OSD understands the importance of coordinating risk management with stakeholders and engaged with stakeholders when developing this RMM document. OSD appreciates the views, information, and advice representatives from the U.S. Environmental Protection Agency, other federal agencies (e.g., U.S. Department of Agriculture, Department of Interior), and State regulatory agencies provided through discussions during Munitions Response Dialogue meetings which made the RMM a better document that takes into account the wide variety of factors at munitions response sites (MRSs). To support use of the RMM and response action decision making, project teams can reference these Department of Defense (DoD) cleanup policies, as appropriate: DoD Instruction 4715.07, *Environmental Restoration Program*, and DoD Manual (DoDM) 4715.20, *Defense Environmental Restoration Program*. DoD Component-specific guidance for applying the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) is also applicable.

USACE originally developed the MMRP RMM tool to assess risk and develop response objectives for MRSs, making it a focal point for characterization and remedy selection. It is an important tool for DoD and regulators that can serve as the baseline risk assessment and facilitate communication about risk, response action goals, and protectiveness; maximize transparency; and enhance participation and collaboration among DoD, regulators, and stakeholders throughout the MMRP.

OSD supports the RMM as one tool in the munitions response toolbox. DoD encourages project teams to use the tool to guide decision making. OSD will not require the DoD Components to apply the RMM at older sites where DoD and the project team have finalized response action decisions. However, project teams may evaluate an older site using the RMM, if appropriate.

Why to Use the RMM

The RMM tool provides a consistent process to evaluate and support risk-based decisions at MRSs. It uses characteristics of munitions type and estimated distribution (e.g., depth of munitions, anomaly density) related to site access patterns and land use activities to evaluate the likelihood that receptors will encounter and interact with munitions and explosives of concern (MEC) and cause items to function and result in harm or death. The RMM itself does not determine the level of risk; it is only a tool to guide project team discussion to help these teams reach consensus on the level of risk.

The project team considers various site-specific factors that influence risks (i.e., the explosive hazard and exposure to the hazard), enabling them to identify suitable options for managing unacceptable risk and to support the development of remedial action alternatives. Specifically, after applying the RMM matrices to assess each risk scenario and developing remedial action objectives (RAOs) with clear goals and objectives, the project team can identify general response actions (GRAs) to support the feasibility study (FS). The GRAs should describe the viable

technologies that are protective of receptors under the range of current and reasonably anticipated future risk scenarios.

When to Use the RMM

Project teams can use the RMM at various project stages, as needed during the munitions response process. However, project teams most commonly use the RMM during the remedial investigation (RI) phase to support baseline MEC risk assessment. OSD designed the RMM for use at land-based MRSs; however, the process could be used at some marine MRSs with project team agreement.

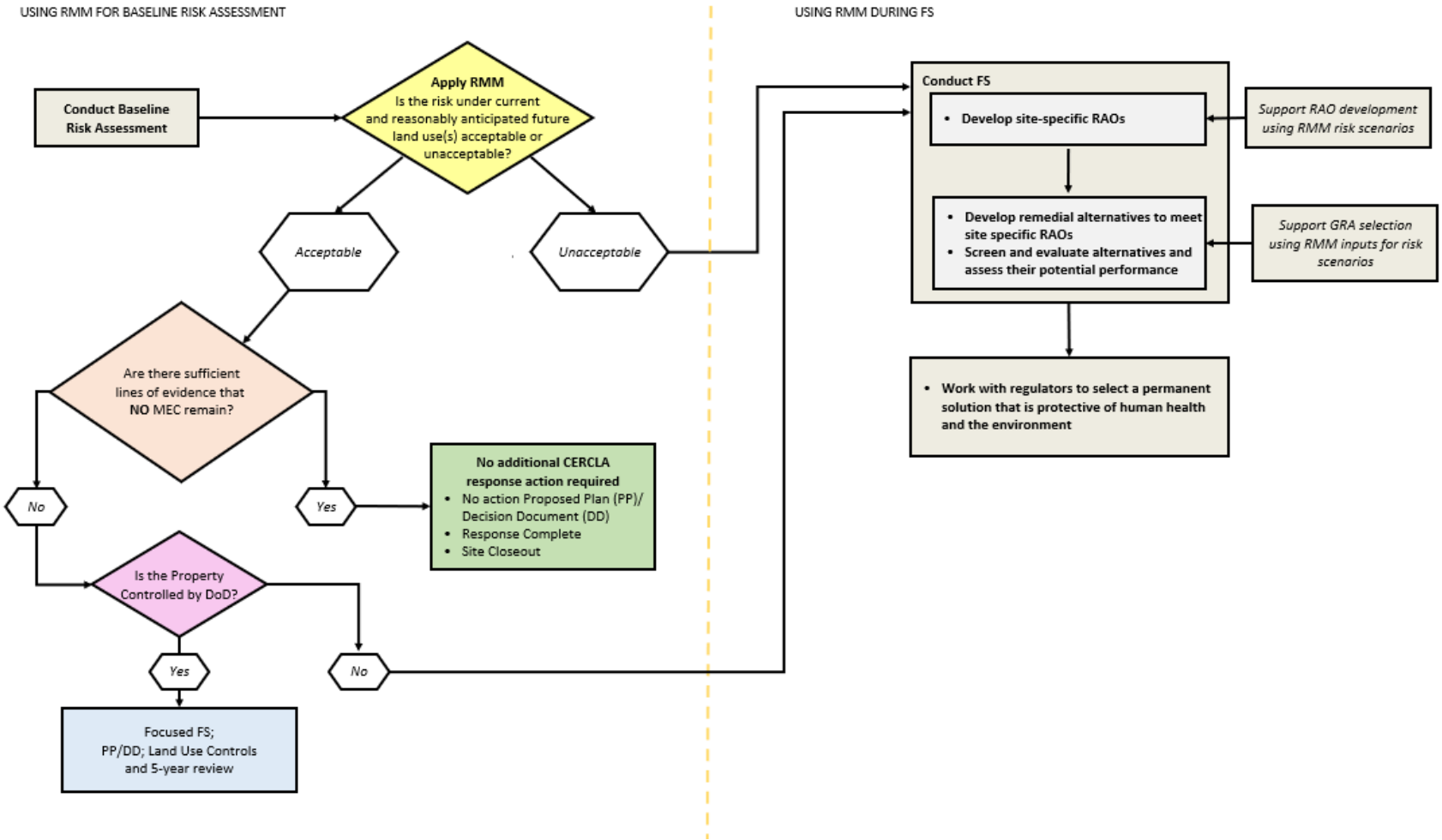
Overall, project teams should begin preparing for the RMM during the planning stages of the RI phase. Thinking about the RMM process early is essential to ensure teams collect sufficient data to support the baseline MEC risk assessment. Teams should discuss RMM input factors (e.g., land use and receptors) as part of the Systematic Planning Process described in the Uniform Federal Policy for Quality Assurance Project Plans, Munitions Response (MR) QAPP Toolkit Module 1. The RMM Process Flow Chart below explains how the RMM fits into the CERCLA process.

Left side of the chart: Shows next steps when the project team identifies unacceptable risk conditions exist within a risk scenario. DoD's control of the property is a consideration when the project team determines whether lines of evidence support acceptable risk.

Right side of the chart: Explains how the RMM supports the FS using risk scenario input to develop RAOs and select appropriate GRAs. Understanding how and where the RMM tool fits into the CERCLA process facilitates communication among the project team.

Acceptable risk: The project team uses the RMM to faciliate discussions about whether risk is acceptable or unacceptable based on site-specific conditions. OSD developed the matrices to ensure that the outcomes produced are reasonable for the related inputs (see Appendix IV for additional information). If the project team determines that a risk is acceptable, this DOES NOT necessarily mean the property is ready for unrestricted use/unlimited exposure (UU/UE) or that no further action is necessary. Furthermore, project teams determine acceptable risk after applying the RMM to individual risk scenarios, not the overall property. Also note that it is critical to evaluate risk for both current and reasonably anticipated future conditions. If something in the Conceptual Site Model (CSM) changes (e.g., land use), then the earlier RMM assessment should be re-evaluated.

RMM Process Flow Chart



How to Use the RMM

The RMM is a qualitative risk evaluation tool that provides project teams and other stakeholders with a framework for conducting the baseline risk assessment, and determining consensus on risk management decisions for MRSs. The RMM is NOT a "black box" where inputs drive precise outputs. Project teams should use the RMM to build consensus to facilitate discussion about risk management decisions that are appropriate for risk scenarios at their site.

DoD conducts investigations and other cleanup actions under CERCLA. DoD's MMRP follows the CERCLA process to fully investigate releases, prioritize response, and determine the appropriate response actions based on risk to human health and the environment. DoD developed the RMM for project teams to use as part of the CERCLA process. RMM supports evaluation of risk and facilitates discussion, but CERCLA guides decision making.

Project Team Makeup, Roles, and Responsibilities

Project teams are determined on a site-specific basis, but they will likely include the following individuals: DoD agency project manager, DoD and other technical and subject-matter experts (e.g., explosives safety, geophysics, public affairs personnel), regulators, specialists, consultants/contractors, stakeholders, and representatives from other Federal and state agencies. The expertise and disciplines of the people on the project team may vary depending on the nature and phase of the project. The personnel representing each organization should have authorization to make decisions for their respective organizations and fully engage in the planning and review process. More information on identifying key project personnel and communication pathways is available in the Uniform Federal Policy for Quality Assurance Project Plans, MR-QAPP Toolkit Module 1: RI/FS.

The project team should also gather input and apply the RMM in extensive collaboration with any other identified stakeholders who are not formally part of the project team. The project team should identify the responsibilities of stakeholders and other key project personnel for each organization performing tasks.

The project team should have an established organizational structure to identify lines of communication among team members, and agree on communication pathways and procedures during project planning for providing notifications, obtaining approvals, and generating the appropriate documentation when handling important communications.

The project team should hold project planning sessions that provide a concise record of participants, key decisions or agreements reached, and action items. Sessions should involve key technical personnel and decision makers needed for that specific stage of planning and documentation. Seeking the input of landowners, regulators, and other stakeholders is an integral part of these decisions. Information from direct consultation with the sources most directly connected with using or managing the site will not only provide the most accurate data for the assessment but will also foster stakeholder acceptance of the risk management decisions based on that data.

Identifying the right project team members and following these guidelines for organization and communication will support application of the RMM and decision making. More information on project teams in the munitions response process is available in the Uniform Federal Policy for Quality Assurance Project Plans, MR-QAPP Toolkit Module 1, and the Interstate Technology & Regulatory Council (IRTC), Quality Considerations for Multiple Aspects of Munitions Response Sites, QCMR-1.

How to Build Confidence in RMM Decisions

The success of the RMM depends on a lines-of-evidence approach. The lines-of-evidence approach is the process of gathering, weighing, and evaluating qualitative and quantitative data to come to a defensible conclusion. Several lines of qualitative and quantitative evidence (e.g., historical documents, master land use plans, interviews, anomaly density and characterizations) are necessary for applying the RMM as a baseline risk assessment.

The project team must have confidence in its data to support a lines-of-evidence approach to decision making. Some questions to ask to determine data usability are:

- Is the data relevant?
- Is there a sufficient quantity of data?
- Has the project team managed and documented any data uncertainty?
- Are data reliable and of sufficient quality?
- Did the project team collect the data according to acceptable methods?
- Did qualified personnel analyze and interpret the data?

Project teams should consult the MR-QAPP Module 1: RI/FS Worksheet 37 Data Usability Assessment to support confidence in data-driven decisions.

II. Project Team Steps to Apply the RMM

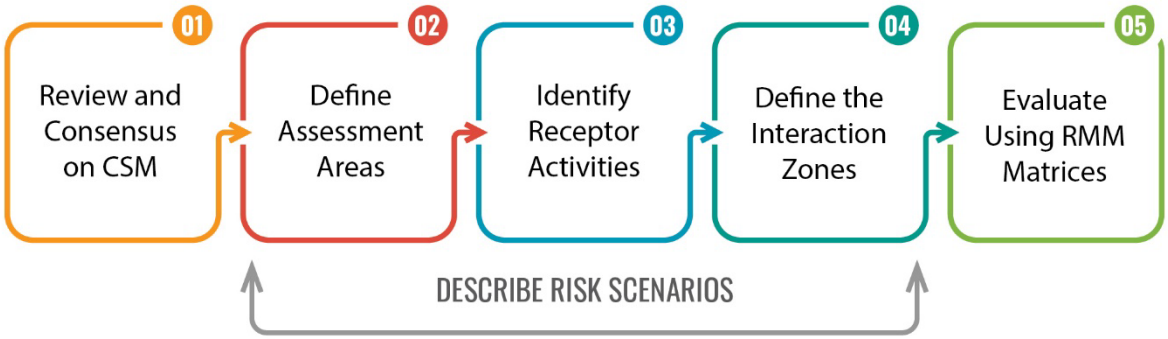
Introduction

The RMM enables project teams to consider various site-specific factors that influence risks from MEC at an MRS. The project team needs to follow specific steps to ensure accurate and appropriate site-specific information is available to support the risk evaluation. These steps include:

1. Review and Consensus on the CSM
2. Define Assessment Area(s)
3. Identify Receptor Activities
4. Define the Interaction Zones
5. Evaluate Using RMM Matrices

Once the project team completes these steps and comes to a consensus on all the information, they can then apply the RMM. Collectively, steps 2 through 4 define one or more "risk scenarios" that reflect the different risk conditions within the MRS. Figure 1 summarizes the project team steps to apply the RMM.

Figure 1: Project Team Steps to Apply the RMM

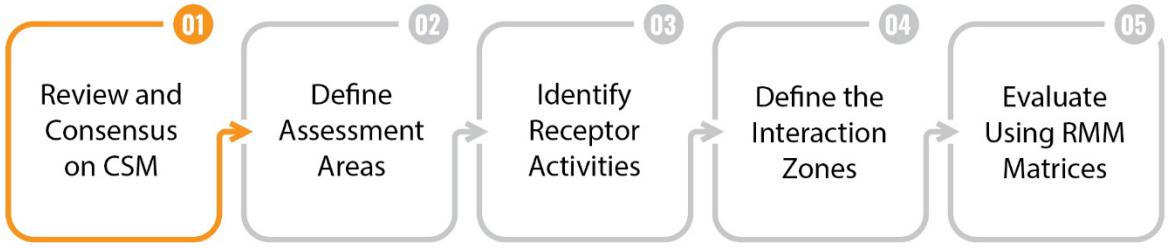


It is important for the project team to understand there is more than one way to develop risk scenarios. The process for developing risk scenarios explained in this document is only one option. The project team can use other approaches as long as it factors in suitable site-specific CSM information and lines of evidence to make reasonable determinations.

In addition, project teams, including regulators, should agree to and define all data needs for the RMM in the MR-QAPP. Data collection design should ensure the team verifies or updates all agreed-upon data needs during the RI for the revised CSM and baseline risk assessment.

An example detailing how a project team can apply each step of the RMM is outlined in Appendix I. The example is for a former WWII Practice Bombing Target MRS. For the purposes of this example, the information is laid out in a linear and organized fashion to follow the steps to apply the RMM.

Step 1: Review and Consensus on the CSM



Purpose: The CSM is a comprehensive, evolving model that depicts the current understanding of sources, pathways, and receptors, and may include text, figures, and tables to illustrate current site conditions. It enables the project team to visualize and communicate available information and the development of data quality objectives. The project team should account for uncertainties in the CSM by agreeing on reasonable assumptions, as appropriate.

A well-developed and -defined CSM is critical for effectively applying the RMM. The project team must review; update, if necessary; and come to a consensus on all elements of the CSM before moving to Step 2. Without consensus on MEC types, estimated MEC distribution, land use, receptors, receptor activities, access limitations/restrictions, and other risk-related conditions at the site, the project team will not have the information necessary to complete the next steps and apply the RMM matrices. If the project team is raising too many "what if" questions, then they should revisit the data, clarify lines of evidence, make appropriate assumptions, and possibly update the CSM further until the whole team achieves consensus on the information included in the CSM.

To ensure the CSM supports the RMM evaluation, the project team should discuss and record the key elements and data from the CSM included in Table 1.

Table 1: CSM Data Relevant to the RMM Evaluation

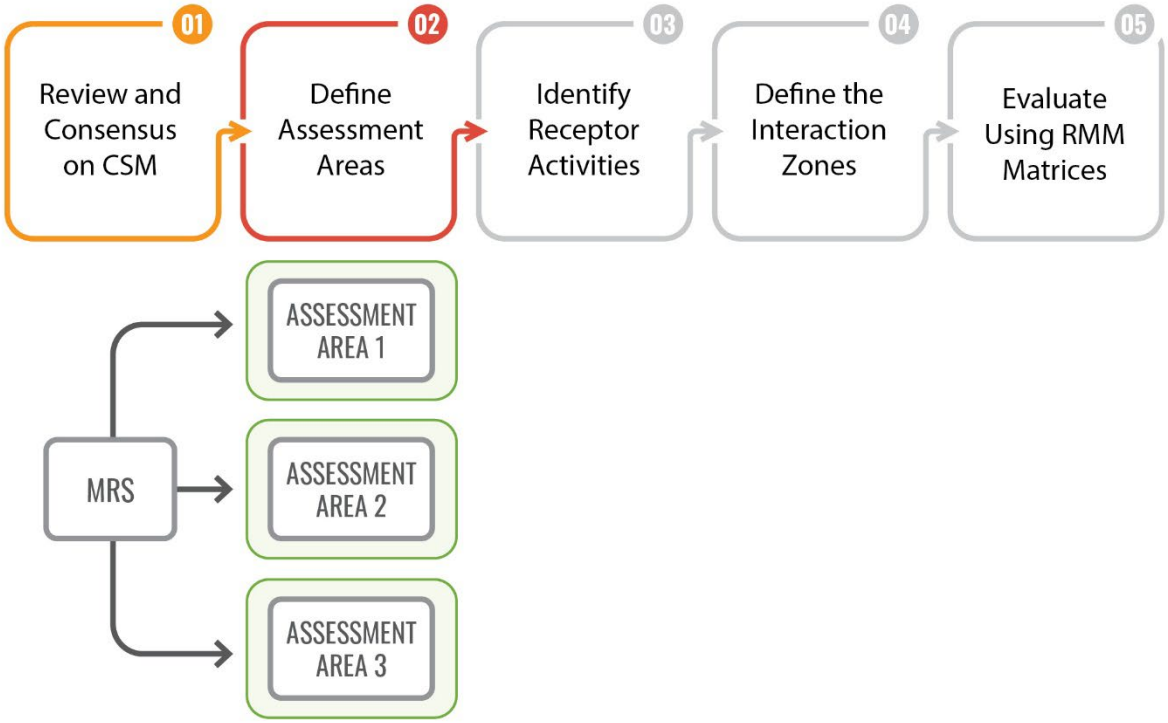
CSM DATA
HORIZONTAL LAND USE AND ACTIVITIES • Land uses within the MRS, including: ◦ Basic types of land use (residential, recreational, industrial, etc.) and their locations. ◦ Natural and cultural resources affecting site use. ◦ Access limitation/restrictions. • Description of receptors and potential activities: ◦ The type/nature of receptor activities (e.g., children at school with play area, recreators on hiking trails, industrial workers indoor/outdoor industrial complex, construction workers in construction footprint). ◦ Horizontal coverage of those activities relative to the aerial extent of MEC. ◦ The frequency of activities.
VERTICAL LAND USE AND ACTIVITIES • Receptor-based type of interaction (farming, recreational): ◦ Nature of intrusive activity (type, depth, e.g., shovel, 10 feet, etc.). ◦ Comparison of anticipated vertical MEC extent with the depth of land use activities. ◦ Frequency of activities.
CHARACTERIZATION OF MEC DISTRIBUTION (HORIZONTAL AND VERTICAL) • MRS munitions distribution characteristics, including: ◦ The horizontal extent of known and suspected MEC; high use area (HUA)/low use area (LUA) boundaries; no evidence of use (NEU) areas. Note that these and other key terms are defined in the glossary. ◦ Known and suspected types of MEC. ◦ Estimated vertical extent of known and suspected MEC.

For more information on CSMs, including additional CSM data, refer to the Munitions Response Quality Assurance Project Plan Toolkit: Module 1.

It is important for the project team to discuss the quality and confidence of their data. For this confidence, the project team can refer to the data usability assessments, uncertainty analyses, and other evaluations conducted during the RI.

Once the project team reviews and comes to a consensus on the CSM data, it can begin developing assessment areas, which is addressed under Step 2.

Step 2: Define the Assessment Area(s)



Purpose: An assessment area is a surface area inside an MRS within which land uses, potential amounts of MEC (e.g., high use area [HUA], low use area [LUA], or no evidence of use [NEU]), and receptor activities are similar, while being different from other assessment areas. Well-defined assessment areas will guide risk-based decisions and remedial alternative development in the FS.

MEC-related contamination within an MRS may differ regarding the munitions types, use, estimated distribution, and quantities. Current and reasonably anticipated future land use and receptor activities may also differ within an MRS. If these factors differ significantly, the qualitative risks associated with explosive hazards in the discrete areas are also likely to vary.

Multiple assessment areas may be developed when:

1) Different land use scenarios, activities, or conditions vary across the MRS (e.g., current and reasonably anticipated future land use types, frequency, and/or duration),
2) Munitions types and and/or MEC characteristics vary within an MRS, and/or
3) The estimated distribution of MEC differs across the MRS (e.g., target center, identified as an HUA vs. buffer or safety zones, identified as LUAs).

In such cases, the project team may identify two or more distinct risk scenarios, each of which will be the subject of a separate application of the RMM. However, if a project site is likely to be the subject of only one response action (e.g., the MRS is small), it may be evaluated using a single assessment area despite the potential for differing risk-related characteristics. In this event, the most conservative input factors[1] are selected for purposes of the RMM (i.e., the input factors resulting in the greatest risks from explosive hazards).

The project team needs to discuss and come to a consensus on identifying assessment area(s). Multiple assessment areas may be defined for an MRS, but the assessment areas identified must account for every acre of the MRS.

The project team will use the data in Table 1a to define the assessment areas.

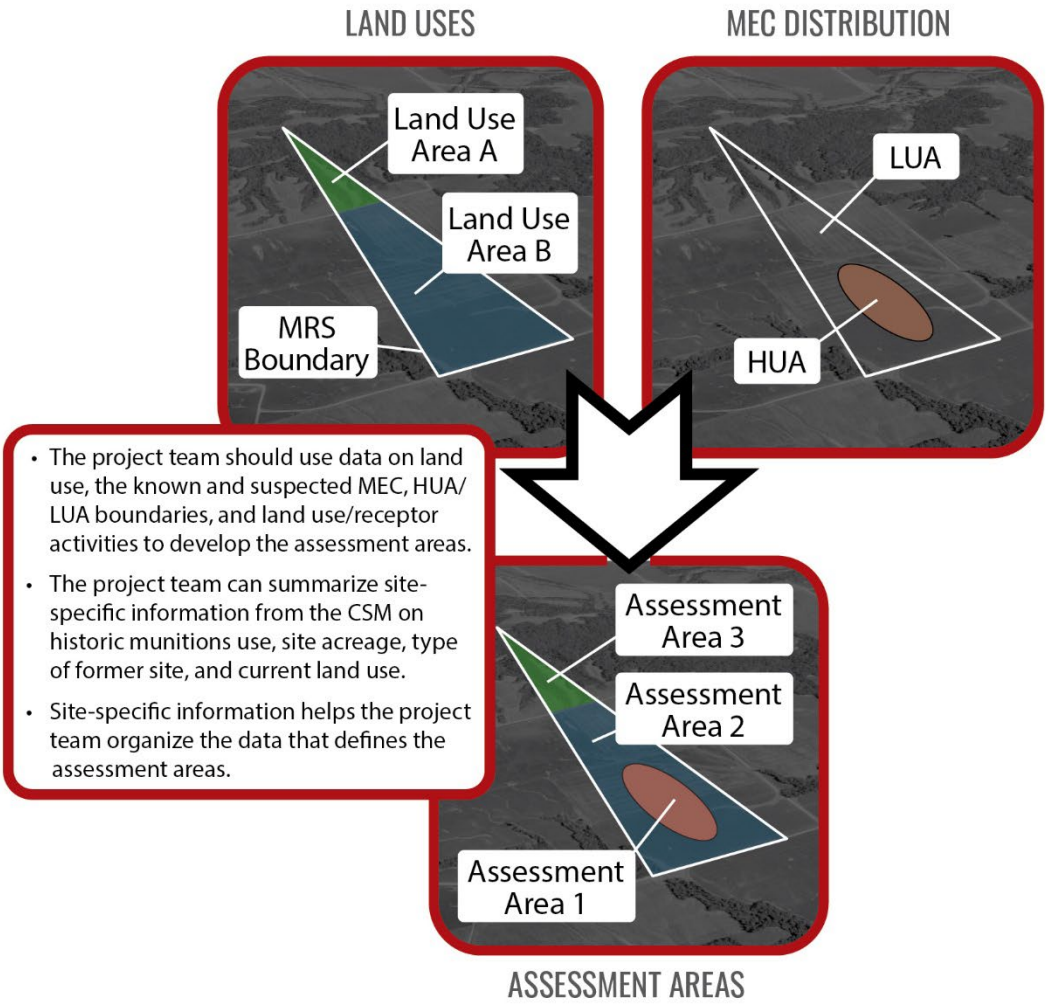
Table 1a: CSM Data Applicable to Assessment Area(s)

CSM DATA
HORIZONTAL LAND USE AND ACTIVITIES • Land uses within the MRS, including: ◦ Basic types of land use (residential, recreational, industrial, etc.) and their locations. ◦ Natural and cultural resources affecting site use. ◦ Access limitation/restrictions. • Description of receptors and potential activities: ◦ The type/nature of receptor activities (e.g., children at school with play area, recreators on hiking trails, industrial workers indoor/outdoor industrial complex, Construction workers in construction footprint). ◦ Horizontal coverage of those activities relative to the aerial extent of MEC. ◦ The frequency of activities.
CHARACTERIZATION OF MEC DISTRIBUTION (HORIZONTAL) • MRS munitions distribution characteristics, including: ◦ The horizontal extent of known and suspected MEC; HUA/LUA boundaries; NEU areas. Note that these and other key terms are defined in the glossary.

The project team should use data on current and reasonably anticipated future land use, the horizontal extent of known and suspected MEC, HUA/LUA boundaries, and land use/receptor activities to develop the assessment areas (Figure 2). If the project team is coming up with too many "what if" questions, then they should go back to Step 1 and discuss the CSM.

[1] Reasonable maximum exposure.

Figure 2: An Example of Using Land Uses and Estimated MEC Distribution to Define Assessment Areas



The example MRS above has two distinct land use areas, A and B, and two different estimated MEC distributions: an HUA and an LUA. This could result in three assessment areas: (1) Land Use Area A/LUA, (2) Land Use Area B/LUA, and (3) Land Use Area B/HUA.

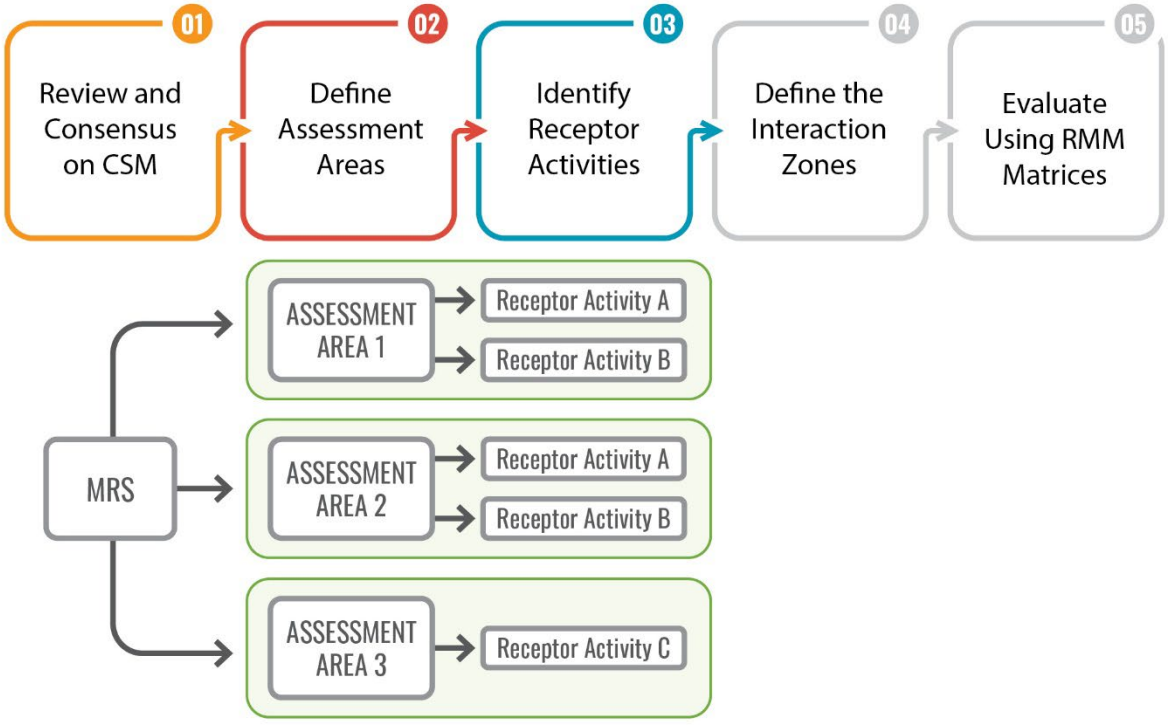
Current and reasonably anticipated future land use is often a deciding factor when defining assessment areas. The frequency and duration with which a receptor uses the land in a given area can help define assessment areas. For example, a trail across park land and the off-trail areas may be identified as separate assessment areas because hikers use the trail more frequently. Additionally, similar locations and receptor activities may be grouped to form an assessment area because similar risk management strategies will apply to the same areas/activities. For example, residential landscaping and gardening, or outdoor utility and maintenance work, may be grouped if those land uses occur in the same footprint.

Frequencies of receptor activities are a key component of defining an assessment area; however, frequency alone does not define an assessment area. Project teams need to factor in frequency of each receptor activity regardless of the number of receptors. Also, project teams need to understand that frequency may change depending on the activity.

It is important for project teams to understand there is no one right answer when defining assessment areas. The project team should use the lines-of-evidence approach to make the determinations best suited to the site and its RMM evaluation approach. Project teams should ultimately ensure that similar management strategies will apply to the complete assessment area. *Also, the project team may identify only one assessment area if it is based on the most conservative MEC characteristics and current and reasonably anticipated future land use activities (i.e., worst case regarding risks from explosive hazards). However, if a project team takes this approach, then this worst-case land use approach will drive all risk-based and land use decisions for the whole MRS.*

After defining the assessment area(s), the project team will identify receptor activities within each area, which is covered under Step 3.

Step 3: Identify Receptor Activities



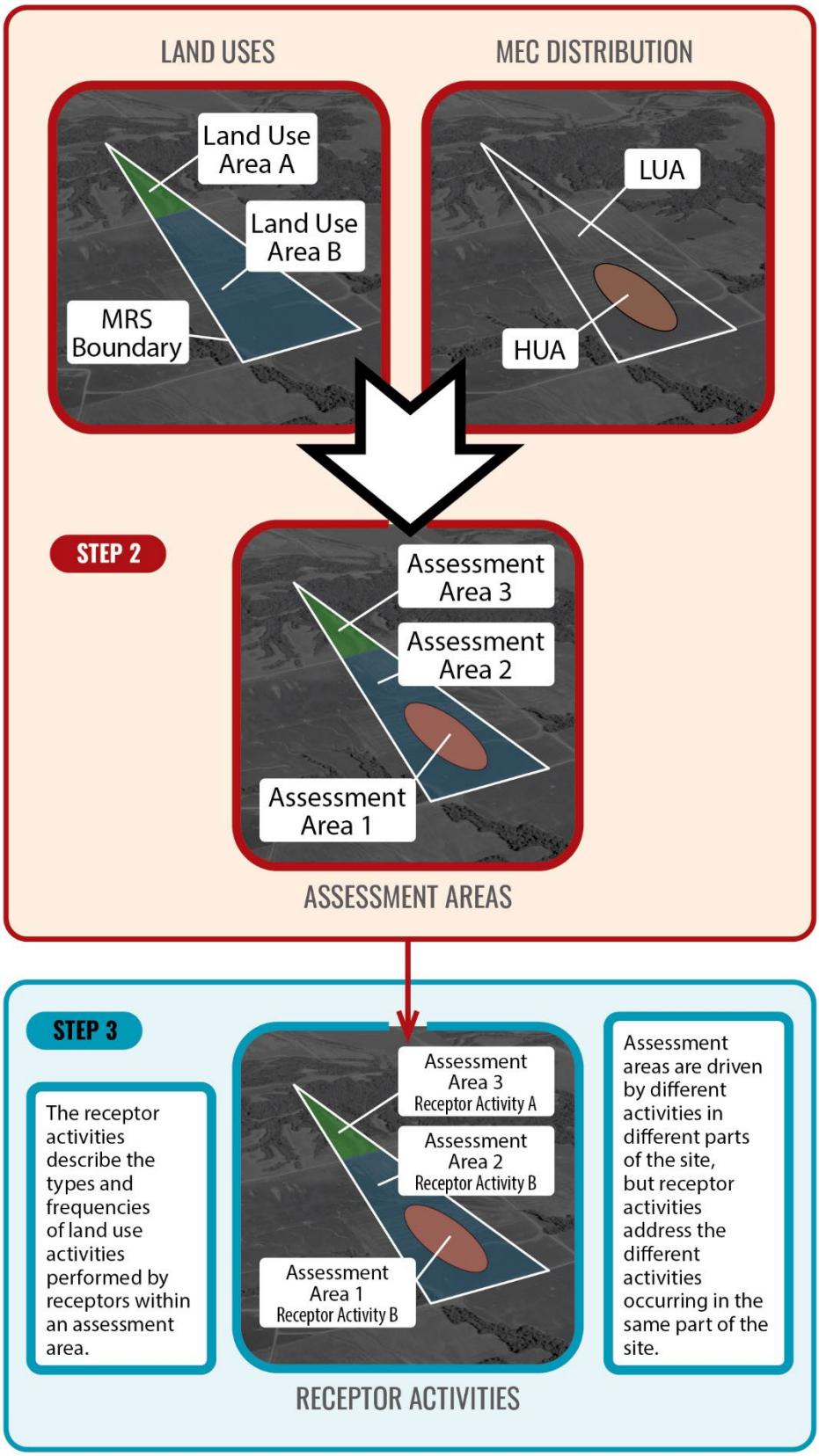
Purpose: The receptor activities describe the types and frequencies of current and reasonably anticipated future land use activities performed by receptors within an assessment area.

Assessment areas are driven by different activities in different parts of the site, but receptor activities address the different activities occurring in the same part of the site.

Figure 3 shows the culmination of using agreed-upon CSM land use and estimated MEC distribution data to determine assessment areas. The figure illustrates an MRS with three assessment areas based on estimated MEC distribution (i.e., HUA and LUA) and receptor activities for each assessment area. There are a total of three receptor activities (i.e., the same two receptor activities in Assessment Areas 1 and 2, and a different receptor activity in Assessment Area 3).

Specifically, in this example, the project team used its CSM data to identify two different land uses (Land Use Areas A and B) within the MRS boundary. Within Land Use Area B, the project team identified an LUA and HUA. The project team then considered receptor activities, including the types and frequencies of activities performed by receptors within each land use area and the horizontal extent of MEC, to create its assessment areas. Assessment Area 1 considers receptor activities in the HUA; Assessment Area 2 considers the same receptor activities identified in Assessment Area 1, but in the LUA; and Assessment Area 3 considers different receptor activities.

Figure 3: Receptor Activities



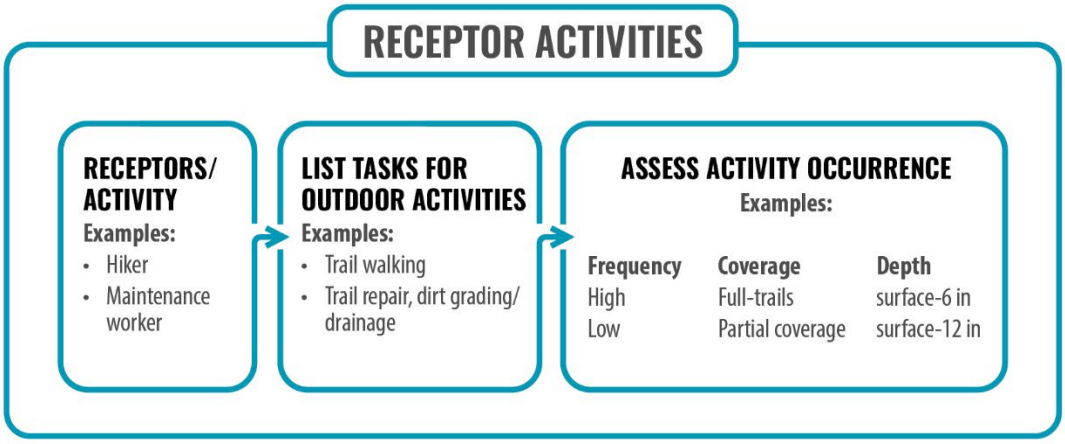
The land use activities are directly related to data in Table 1b.

Table 1b: CSM Data Applicable to Receptor Activities

CSM DATA
• Land use scenarios within the MRS, including: ◦ Land use activities. ◦ Horizontal extent (coverage) of those activities considering number of people and frequency of access. ◦ Intrusive depths of land use and the frequency of activities conducted. ◦ Access limitations/restrictions.

Project teams need to fully describe receptor types and their known or reasonably anticipated future land use activities, not just identify the type of land use. When discussing land use data, project teams should follow the flow diagram in Figure 4. The receptor, frequency, coverage, and depth data defined for trails in this figure are applicable only to this example and should not be used as the default receptor data for all occurrences of park trails.

Figure 4: Receptor Activity Data

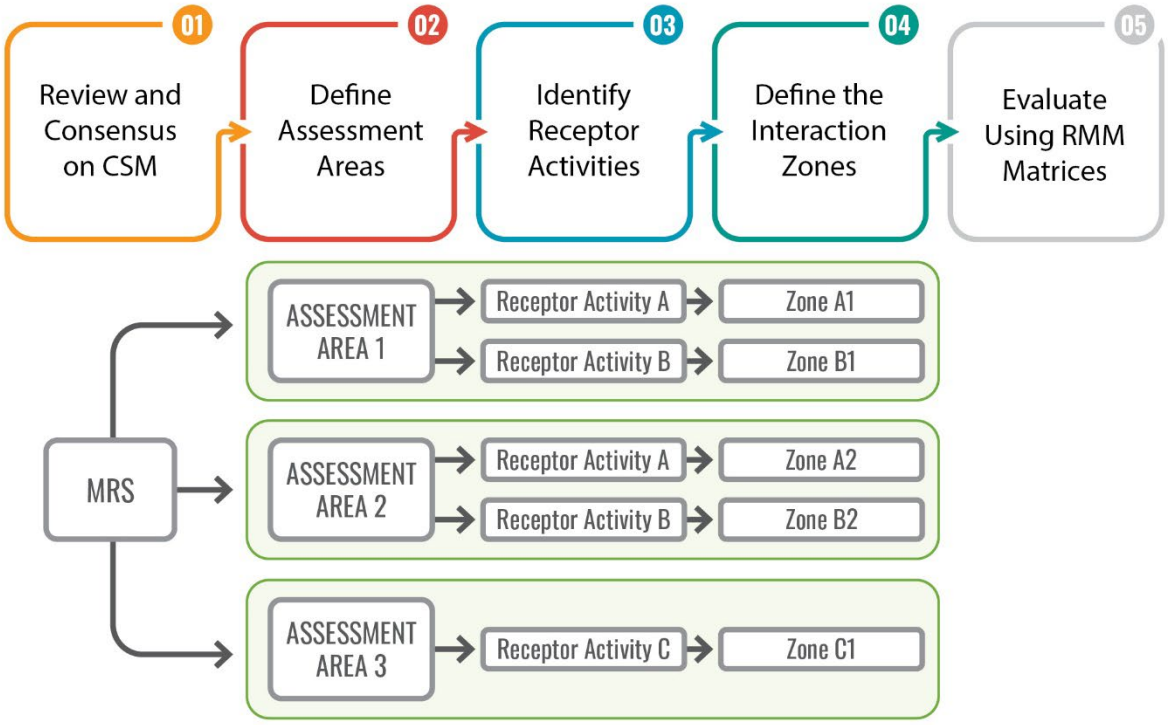


For example, if a project team has identified park trails as an assessment area, it will need to consider different activities along the trails (e.g., a hiker walking on the trail or a worker performing maintenance). As shown in Figure 4, the hikers' activity would be frequent, take place across the full trail, and involve mostly non-intrusive activities (i.e., the primary MEC risks would be from surface items). Hikers are not expected to conduct intrusive activities beyond the shallow subsurface. Maintenance workers on the trail could be repairing paths, clearing vegetation, spreading dirt/grading, and modifying drainage. Also, workers potentially will install signs. While the frequency of the maintenance activities would be much lower than the hikers' activities, and cover only part of the trail, they involve more intrusive activities and are likely to result in encounters or interactions with subsurface MEC. Based on this evaluation of a trail

system, three receptor activities are identified: (1) ground crews conducting trail maintenance, (2) ground crews possibly installing signs, and (3) hikers walking on trails.

Some assessment areas may have only a single receptor activity. *This is acceptable as long as it is based on the most conservative MEC characteristics and current and reasonably anticipated future land use activities (i.e., worst case regarding risks from explosive hazards). However, if the project team takes this approach, then this conservative assumption will drive all risk-based and land use decisions.*

Step 4: Define the Interaction Zones



Purpose: The interaction zone describes the volume of media beneath the surface (i.e., horizontal and vertical extents of soil or sediment) where a specific receptor may perform an activity. A unique interaction zone must be defined for each receptor activity based on its associated intrusive depths and frequencies.

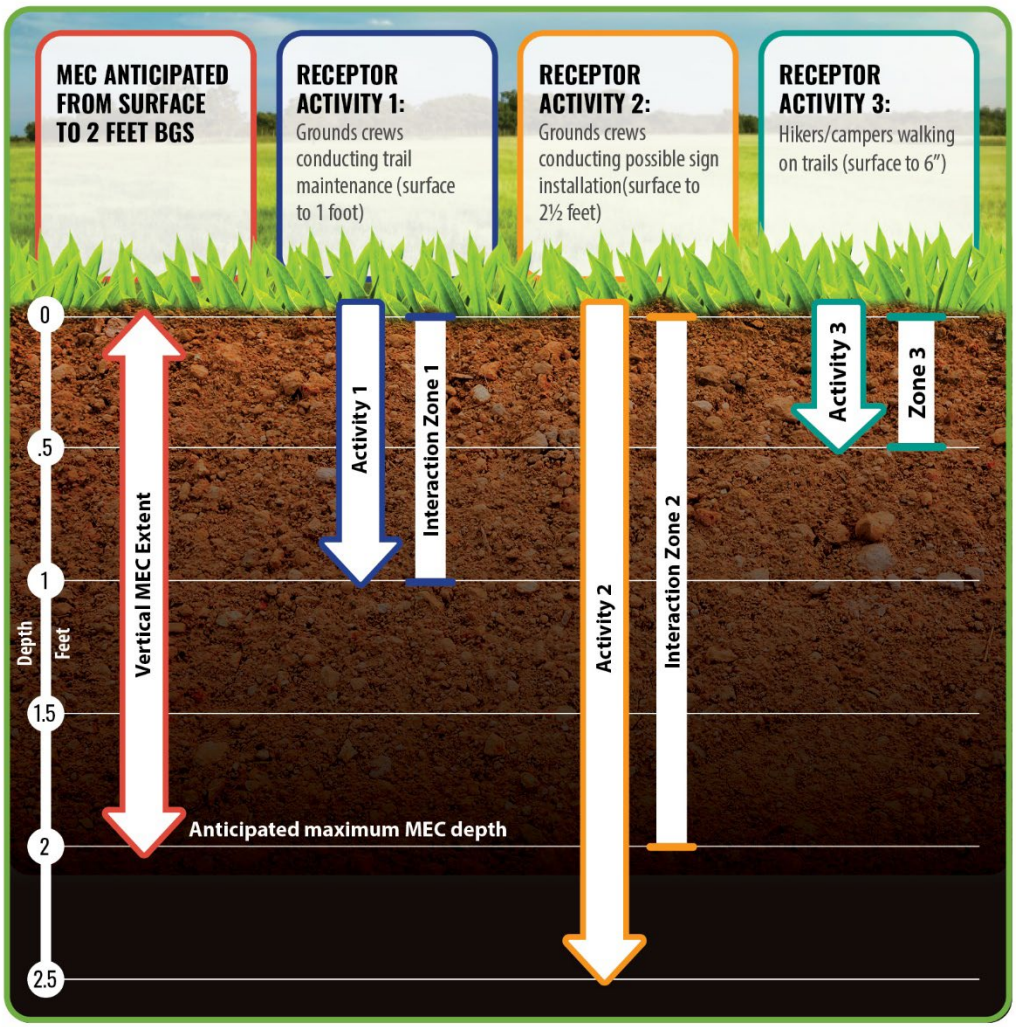
To define the interaction zone for each receptor activity, the project team needs to understand the anticipated vertical MEC extent and the current and reasonably anticipated future land use depths. The project team should refer to Table 1c.

Table 1c: CSM Data Applicable to Interaction Zones

CSM DATA
• Land use scenarios within the MRS, including: ◦ Land use activities. ◦ Horizontal extent (coverage) of those activities considering number of people and frequency of access. ◦ Intrusive depths of land use and the frequency of activities. ◦ Access limitations/restrictions. • Depth profile (i.e., vertical CSM): ◦ Comparison of anticipated vertical MEC extent with the depth of land use activities.

Figure 5 illustrates the example from above for the assessment area covering a trail system in a park. In this example, the anticipated vertical MEC extent goes from the ground surface to a depth of two feet below ground surface (bgs). The interaction zones for the identified receptor activities are as follows: (1) from surface down to one-foot bgs for ground crews conducting trail maintenance, (2) from surface down to two and a half feet bgs for ground crews possibly installing signs, and (3) from surface down to six inches bgs for hikers or campers walking on trails.

Figure 5: Defining the Interaction Zone



UU/UE Risk Scenarios

The project team should not use the RMM as the basis for concluding that UU/UE conditions have been achieved at an MRS.

Summary of Project Team Steps to Apply the RMM

Once the initial steps are complete, the project team will have developed one or more risk scenarios reflecting risk for the various receptors and current and reasonably anticipated future land use activities in all locations across the MRS. Each risk scenario will have a unique combination of assessment area, receptor activity, and interaction zone (see Figure 6). The project team will evaluate the RMM matrices for each of the risk scenarios.

Figure 6: Overview of Steps to Apply the RMM

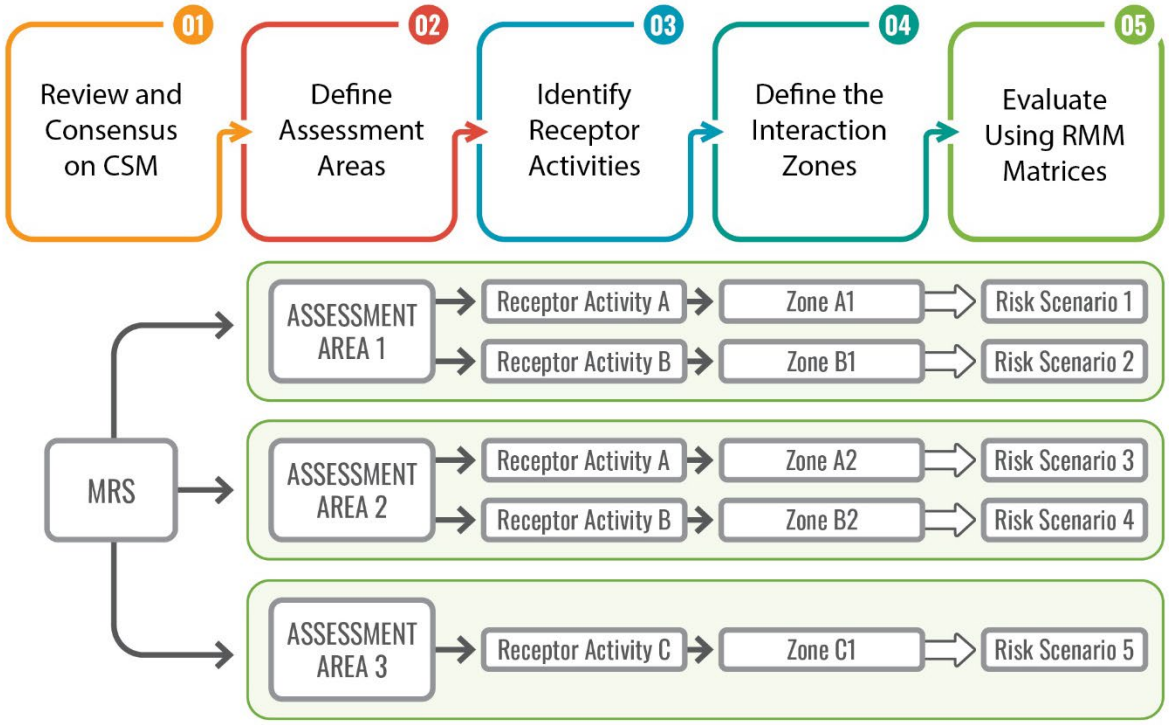


Table 2 summarizes the different phases of the RMM and how CSM data supports each phase. It also provides an overview of the matrices and how the project team will use the information collected and analyzed for each phase and supporting CSM data to apply the matrices.

Table 2: RMM Steps and How the CSM Supports Them

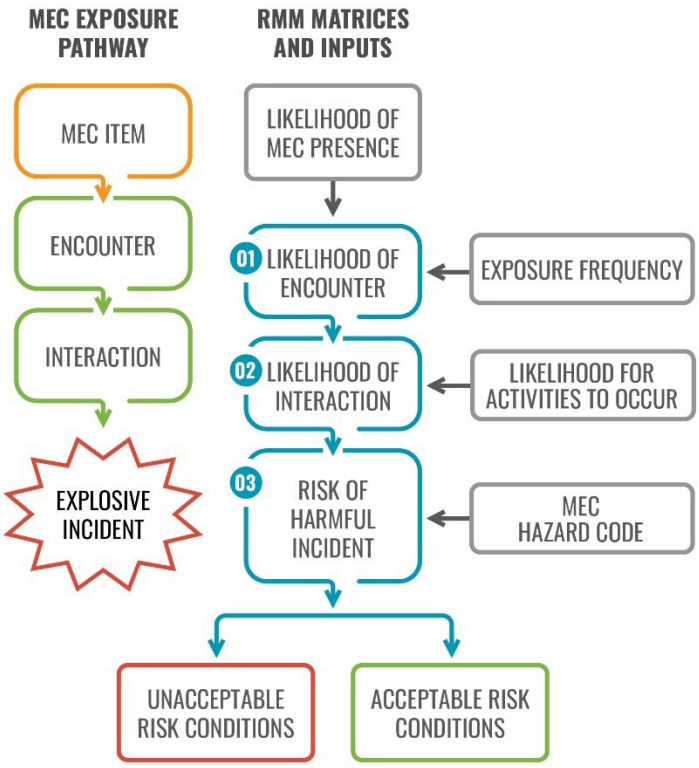
RMM STEP	PURPOSE	SUPPORTING CSM DATA
Define Assessment Areas	Describe discrete parts of the MRS based on similar levels of risk using data on land use and known or suspected MEC.	Land use data, including activities and coverage of those activities within the MRS MRS munitions distribution characteristics, specifically horizontal extent of known or suspected MEC and HUA and LUA boundaries; NEU areas
Identify Receptor Activities	Describe the different land use activities taking place within each assessment area.	Land use data, including activities, coverage of those activities within the MRS, and intrusive depths of land use and the frequency of activities conducted
Define Interaction Zones	Look at the depths of potential interaction with known or suspected MEC for each receptor activity.	Land use data, including activities, coverage of those activities within the MRS, and intrusive depths of land use and the frequency of activities Anticipated MEC depth

III. Baseline Risk Assessment Using the RMM Matrices

The RMM Matrices General Instructions

The RMM tool consists of three matrices: (1) Likelihood of Encounter, (2) Likelihood of Interaction, and (3) Risk of Harmful Incident. These matrices help the project team collect, organize, and analyze site-specific information and provide a qualitative risk evaluation for the MRS. The matrices relate directly to the elements of the MEC exposure pathway (Figure 7). Project teams select inputs for each matrix based on the CSM and use the inputs to evaluate whether acceptable or unacceptable risk conditions exist at the MRS under the various risk scenarios identified in the steps described in Section II. This section contains general instructions on how to apply the RMM matrices to each risk scenario using step-by-step directions.

Figure 7: MEC Exposure Pathway and RMM Matrices Inputs



Matrix 1: Likelihood of Encounter

LIKELIHOOD OF ENCOUNTER (Likelihood of MEC Presence vs. Exposure)		EXTENT OF EXPOSURE			
		Full (>90% coverage)	Partial	Limited	Minimal (<10% coverage)
LIKELIHOOD OF MEC PRESENCE	**HUA**: likelihood of MEC is **HIGH**.	5	5	5	5
	HUA: likelihood of MEC is **MODERATE**.	5	5	4	4
	LUA: likelihood of MEC is **LOW**.	3	2	2	1
	LUA: likelihood of MEC is **VERY LOW**.	2	2	1	1
	No evidence MEC remain **NEU:** no evidence of munitions use.	1	1	1	1

The goal of Matrix 1 is to understand the likelihood that receptors will encounter MEC in each risk scenario. An *encounter* is a chance event when a receptor gets sufficiently close to a MEC item that they might interact with it. An encounter does not require the receptor to observe the MEC item. In many cases, a receptor may be unaware they have encountered a MEC item, either because they have not observed it or because they have not recognized it as MEC. For example, a hiker walking through a wooded area where MEC are present might encounter a MEC item by seeing it on the surface. Alternatively, a maintenance or construction worker might encounter a MEC item while conducting activities, such as excavating soil, near buried MEC.

The main inputs to Matrix 1 are Likelihood of MEC Presence (rows) and Extent of Exposure (columns). The project team needs to follow the steps below to apply Matrix 1.

Step 1: Determine Likelihood of MEC Presence

The inputs for Likelihood of MEC Presence are a function of the degree to which MEC items may be present (high, moderate, low, very low, no evidence MEC remain, or NEU). The primary factor the project team uses in this evaluation is whether the assessment area is categorized as an HUA, LUA, no evidence MEC remain, or NEU based on the accepted data quality objectives for the investigation. Other factors in the CSM to consider include anomaly density, the amount of MEC and munitions debris (MD) items found during the investigation or historically, and the frequency, duration, and intensity of historic use. For example, the project team may consider the likelihood of MEC presence *high* in a HUA where a range target area was used for military training for 20 years and multiple saturated response areas and numerous MEC and MD were found during the field investigation. However, the project team may consider the MEC presence *moderate* if no saturated response areas exist, only MD were found during the field investigation, and the site was known to have been used only intermittently.

The project team should base its evaluations for LUAs on similar factors, although historic records will typically have more bearing as less field investigation data is usually available for LUAs. For example, an LUA made up of a safety buffer zone around a heavily used former target area might be considered an area where the likelihood of MEC presence is *low*, whereas a former maneuver area with minimal evidence of munitions use could be assessed as an LUA where the likelihood of MEC presence is *very low*. The project team should discuss and agree upon determinations of NEU before performing the risk assessment.

Note that the terms HUA, LUA, and NEU are defined in MR-QAPP Toolkit Module 1: RI/FS. The term "No evidence MEC remain" is a term developed for this document to differentiate between an area where a remedial response has been conducted to reliably remove MEC from the interaction zone and an NEU area (i.e., where multiple lines of evidence support a conclusion that munitions were never used).

The project team should select the most appropriate Likelihood of MEC Presence category (row) that best describes the MRS conditions, based on the site-specific information in the CSM. If there is doubt between two inputs, the project team should use the more conservative selection (i.e., higher Likelihood of MEC Presence).

Step 2: Determine Extent of Exposure

The inputs for Extent of Exposure are a function of the receptors' annual areal coverage/use of the assessment area under the various identified risk scenarios. The receptor has a higher likelihood to encounter a MEC item if it has greater coverage of the assessment area. The project team should make a qualitative estimate about the degree to which the receptors cover the assessment area. Qualitative estimates will fall into the following categories:

- Full Coverage—One or more receptors traverse and/or conduct activities on greater than or equal to 90% of the assessment area annually
- Partial Coverage—One or more receptors traverse and/or conduct activities on greater than or equal to 50% and less than 90% of the assessment area annually
- Limited Coverage—One or more receptors traverse and/or conduct activities on greater than or equal to 10% and less than 50% of the assessment area annually
- Minimal Coverage—One or more receptors traverse and/or conduct activities on less than 10% of the assessment area annually

In making these determinations, the project team should consider MRS characteristics and receptor activities (e.g., recreational, farming, construction, maintenance), frequency of activities, number of receptors, and presence of manmade or natural barriers that may prevent or limit access to or within the assessment area. The project team should select the most appropriate Extent of Exposure category (column) that best describes the MRS conditions based on the site-specific information.

For example, in any given year, a resident will most likely cover all of their back yard and a farmer might cover more than 90% of their cropland while they are planting, plowing, and harvesting (i.e., *full* coverage). Similarly, all the recreational users visiting a park will probably traverse more than 90% of the trails (i.e., *full* coverage) but those same receptors would cover less of the off-trail areas (e.g., *partial* or *limited* coverage). *Minimal* coverage would be expected in areas that are difficult to access (e.g., mountainous or very heavily vegetated areas), or are otherwise rarely used or traveled (e.g., remote wilderness areas). If the project team has any doubt between two inputs, they should use the more conservative selection (i.e., higher Extent of Exposure).

Step 3: Determine Likelihood of Encounter Rating

To determine the Likelihood of Encounter rating, the project team cross-references the selected Likelihood of MEC Presence category (row) with the selected Extent of Exposure category (column). The ratings range from 1 to 5, with 5 indicating the highest likelihood of encounter and 1 indicating the lowest likelihood of encounter.

The project team will use this rating as input to Matrix 2 to determine the Likelihood of Interaction.

Matrix 2: Likelihood of Interaction

LIKELIHOOD OF INTERACTION (Likelihood of Activities in Interaction Zone vs. Likelihood of Encounter)		LIKELIHOOD OF ENCOUNTER (FROM MATRIX 1)*				
		5 (highest)	4	3	2	1 (lowest)
FREQUENCY OF ACTIVITIES IN INTERACTION ZONE	**Frequent** activities occur in interaction zone that may result in an interaction with munitions	A	A	B	B	D
	Occasional activities occur in interaction zone that may result in an interaction with munitions	A	B	B	B	D
	Infrequent activities occur in interaction zone that may result in an interaction with munitions	B	B	B	C	E
	Unlikely that activities occur in interaction zone that may result in an interaction with munitions	B	C	C	C	E

The goal of Matrix 2 is to help the project team evaluate, for each risk scenario, the likelihood that receptors encountering MEC (rating from Matrix 1) could then interact with it. An *interaction* is when, upon encounter, the receptor imparts energy to the MEC item, either intentionally or unintentionally, such that it might function (note that this does not require the receptor to physically come into direct contact with the MEC item). For example, a hiker walking through a wooded area where MEC are present might intentionally pick up a MEC item they see on the surface. Alternatively, a construction worker may unintentionally interact with a MEC item while operating an excavator when they dig into soil containing MEC.

The main inputs to Matrix 2 are Likelihood of Encounter (rating from Matrix 1) and Frequency of Activities in the Interaction Zone (rows). The project team needs to follow the steps below to apply Matrix 2.

Step 1: Determine Likelihood of Encounter

For Matrix 2, the Likelihood of Encounter is derived directly from the output of Matrix 1 (see above).

Step 2: Determine Frequency of Activities in the Interaction Zone

The project team determines input for this factor by assessing the frequency of activities in the interaction zone for each identified risk scenario. The frequency of activities is determined based on site-specific factors for each risk scenario. The project team should discuss the types of activities in each risk scenario and reach a consensus for whether they will calculate frequency on a monthly, annual, or other basis. The project team should make a qualitative estimate on the frequency of activities that fall into the following four categories: frequent, occasional, infrequent, or unlikely.

A project team may assess frequency by how many times a receptor conducts an activity during the year (e.g., a team may consider every day for 30 minutes as *frequent*). Alternatively, for activities that happen a couple times a year, such as a construction project, a project team might consider the activity to be *frequent* if those activities occurred for multiple hours during a day for an extended period (e.g., 8 hours over the duration of the construction for a 2-4 week period). When construction activities are ongoing, the project team will likely always classify it as frequent because of its intensity.

For example, a project team has established an assessment area encompassing a trail network in a park, where the receptors include hikers and ground crews, and the anticipated vertical MEC extent goes to 36 inches bgs. The frequency with which a hiker on the trail in the assessment area might come into contact with soil in a defined 0 to 6-inch bgs interaction zone would be *frequent*. However, it would be *unlikely* for the same hiker on that trail to come into contact with soil in an interaction zone defined from 6 inches to 36 inches bgs. In the same trail assessment area, ground crews may conduct periodic maintenance activities throughout the year in the interaction zone from 0 to 24 inches bgs, making the frequency of those activities *occasional*. Those ground crews might also install signs along the trail, but less often than their maintenance,

leading to *infrequent* activities in the interaction zone from 24 to 36 inches bgs. Table 3 summarizes the different interaction zones described in this example.

Table 3: Example Interaction Zones for Example Trails Assessment Area

INTERACTION ZONE	HIKERS	GROUND CREWS
0-6 inches bgs	Frequent	Occasional
6-12 inches bgs	Unlikely	
12-24 inches bgs		
24-36 inches bgs		Infrequent

If there is doubt between two inputs, the project team should use the more conservative selection for a given interaction zone (i.e., higher Frequency of Activities in the Interaction Zone).

Step 3: Determine Likelihood of Interaction Rating

To determine the Likelihood of Interaction rating, the project team cross-references the selected Likelihood of Encounter category (column) with the selected Frequency of Activities in the Interaction Zone category (row). The ratings range from A to E, with A indicating the highest likelihood of encounter and E indicating the lowest likelihood of encounter.

The project team will use this rating as input to Matrix 3 to determine the Risk of a Harmful Incident.

Matrix 3: Risk of Harmful Incident

RISK OF HARMFUL INCIDENT (MEC Code vs. Likelihood of Interaction)		LIKELIHOOD OF INTERACTION (FROM MATRIX 2)				
		A	B	C	D	E
MUNITION MEC CODE	High (MEC Code 3)	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Acceptable
	Moderate (MEC Code 2)	Unacceptable	Unacceptable	Unacceptable	Acceptable	Acceptable
	Low (MEC Code 1)	Unacceptable	Unacceptable	Acceptable	Acceptable	Acceptable
	Presents No Explosive Hazard (MEC Code 0)	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
	No Evidence MEC Remain					
	NEU					

The goal of Matrix 3 is to help the project team evaluate the likelihood of an explosive incident. An *explosive incident* occurs when a receptor interacts with a MEC item and causes it to function or otherwise release energy, resulting in harm to one or more receptors. DoD is using the final Fort Ord Ordnance and Explosives Risk Assessment Protocol[2] (hereafter referred to as "the Fort Ord Protocol") as the basis for differentiating MEC explosive hazards. DoD, explosive safety experts, and the regulatory community collaboratively developed the Fort Ord Protocol.

For the purposes of the RMM, DoD pared down the Fort Ord Protocol to include a concise list of common Army munitions, and added common Navy and Air Force munitions. The modified list is referred to as "the MEC Codes." When evaluating a given risk scenario, project teams should reference the MEC Codes to describe relative severity of MEC items if they were to function.

The MEC Codes do not account for all MEC items. If the project team is evaluating a MEC item that is not contained in the MEC Codes, they can use the information and the factors below to determine the MEC Code for the item of concern.

Factors that determine the likelihood of an interaction causing an explosive incident and the harm the incident may cause include the fuzing, size, and filler of the MEC items. These factors are described using the following MEC Codes[3]:

- MEC Code 3—MEC that will likely cause the death of one or more individuals if they function because of an interaction. *Example: Most munitions with high explosive fill.*
- MEC Code 2—MEC that will likely cause major injury to, and in extreme cases could cause the death of, one or more individuals if they function because of an interaction. *Example: Most pyrotechnics and propellants.*
- MEC Code 1—MEC that will likely cause minor injury to, and in extreme cases could cause major injury to or death of, one or more individuals if they function because of an interaction. *Example: Most practice munitions.*
- MEC Code 0—Munitions items that present no explosive hazard.

If the assessment area is an NEU or there is no evidence MEC remain, then the project team will assign MEC Code 0. If the project team is discussing a MEC Code other than 0 for the NEU, then the project team must revisit the CSM and discuss whether it is more appropriate to classify the assessment area as an LUA. It is important to note there is no way to modify the MEC Code for a specific munitions item through response action.

Project teams have the flexibility to modify MEC Codes based on site-specific conditions with input from explosives safety experts. Specifically, the project team may account for the sensitivity of the MEC items due to their intrinsic construction, filler materials, type and condition of fuzing, or when varying degrees of energy are imparted directly on or in the vicinity

[2] The Fort Ord Protocol is available at: http://docs.fortordcleanup.com/ar_pdfs/AR-OE-0402G/22Aug05_USACE-memorandum.pdf.

[3] These MEC codes were previously developed for a munitions response project in California where a wide range of MEC were known or suspected to be present. The codes assigned to each MEC item used the fillers and fuzing of individual munitions to establish a scale regarding the probability of an item to cause harm.

of MEC items. For example, the project team may conclude that a MEC item with a MEC Code of 3 is less likely to function based on the sensitivity of its fuze in relation to actions of receptors (e.g., gardening as opposed to heavy earth-moving equipment). In this case, the project team might consider it appropriate to use a lower MEC Code to reflect the risk more accurately. The project team must make any MEC Code modifications with input from explosives safety experts and should clearly document the assumptions and rationale for the modification in the RI report or memorandum for record.

As a reminder, project teams should consult with their explosive safety experts when determining MEC Codes. Some example MEC Codes are shown in Table 4. The complete list of MEC Codes is included in Appendix II.

Table 4: Example MEC Codes

MEC ITEM DESCRIPTION	HAZARD CODE
Projectile 75mm, High Explosive, M48	3
Projectile, 37mm, High Explosive, M63	3
Mortar, 60mm, High Explosive, M49 series	3
Grenade, Hand, Fragment, MK2	3
Projectile, 105mm, Smoke, M84 series	2
Mortar, 60mm, Illumination, M83 series	2
Projectile, 40mm, Smoke, M680	1
Mortar, 4-inch, Practice, MK1 (Stokes)	1
Grenade, Hand, Practice, M21	1
Projectile, 76mm, AP-T, M62	0
Projectile, 20mm, Target Practice, M220	0
Grenade, Hand, Training, MK1A1	0

The main inputs to Matrix 3 are Likelihood of Interaction (rating from Matrix 2) and MEC Code (columns). The project team must follow the steps below to apply Matrix 3.

Step 1: Determine Likelihood of Interaction

For Matrix 3, the Likelihood of Interaction is derived directly from the output of Matrix 2.

Step 2: Determine MEC Code

The project team determines input for this factor by generating MEC Codes for each of the known or suspected MEC items included in the risk scenario being evaluated. The project team

should include explosive safety experts to ensure the known or suspected MEC items are accurately described and the assignment of the MEC Codes is appropriate. Where the project team generates more than one MEC Code in a given risk scenario, it MUST use the more conservative (i.e., highest) as the input to Matrix 3.

Step 3: Determine Risk of Harmful Incident

To determine the Risk of Harmful Incident, the project team cross-references the selected Likelihood of Interaction category (column) with the selected MEC Code (row). The result is either *acceptable* or *unacceptable*, which describes the project team's conclusion regarding the overall risk to human health under the evaluated risk scenario.

The project team should then repeat the analyses using Matrices 1 through 3 for each risk scenario identified during the initial steps.

Table 5 is a recap of how project teams select inputs for each matrix based on the CSM and use the inputs to evaluate whether acceptable or unacceptable risk conditions exist at the MRS under the various risk scenarios.

Table 5: RMM Matrices and How the CSM Supports Them

RMM MATRIX	PURPOSE	SUPPORTING CSM DATA
Apply Matrix 1 Likelihood of Encounter	Evaluate the likelihood a receptor might encounter a MEC item under each risk scenario.	HUA and LUA information, anomaly densities, intrusive results, and related RI conclusions Land use data, including receptor types, their known or anticipated activities, and frequencies
Apply Matrix 2 Likelihood of Interaction	Evaluate the likelihood a receptor might interact with an encountered MEC item under each risk scenario.	Land use data, including receptor types and their known or anticipated activities
Apply Matrix 3 Risk of Harmful Incident	Evaluate the likelihood a harmful incident might result if a receptor interacts with a MEC item under each risk scenario.	Known and suspected MEC

IV. Steps the Project Team Can Use in the FS After Completing the Baseline Risk Assessment

The RMM provides specific information on what contributes to risk. This information supports the development of RAOs and can guide the project team in identifying protective options to manage unacceptable risk. After applying the RMM matrices to assess each risk scenario and developing RAOs with clear goals and objectives, the project team will identify GRAs to support the FS. The identified GRAs should achieve the RAOs (i.e., be protective of receptors) under the range of current and reasonably anticipated future risk scenarios.

According to 40 *Code of Federal Regulations* § 300.430, "Remedial Investigation/Feasibility Study and Selection of Remedy," RAOs are made up of three elements: (1) contaminants and media of concern, (2) potential exposure pathways, and (3) remediation goals. The risk scenarios established for the MEC baseline risk assessment describe the exposure pathway(s)

that result in the unacceptable risk; therefore, these risk scenarios provide the first two components of the RAO: (1) contaminants and media of concern, including MEC types and estimated depth distribution, and (2) potential exposure pathway(s), including receptors and activities. For this reason, the project team can use the risk scenarios established for the MEC baseline risk assessment to guide the development of the first two components of the RAO. Once the project team has reached consensus on remediation goals for each risk scenario, they can then review the RMM matrices for each risk scenario to identify the main "risk drivers" (i.e., the elements of the exposure pathway that are the primary cause[s] of the unacceptable risk).

For each unacceptable risk scenario, the project team can review the RMM matrices to identify the factors that might be mitigated through a GRA, either singly or in combination, to address the unacceptable risk. This information can help to identify and justify all the GRAs that might mitigate risk for each risk scenario. Table 6 shows the RMM input factors and the project team's options for mitigating them. When looking at these input factors, individually or in combination, the project team can describe how each viable GRA might achieve acceptable risk (i.e., protectiveness) for a given risk scenario.

Table 6: GRAs for Managing MEC Risk[4]

RISK DRIVER (RMM INPUT FACTOR)	APPLICABLE GENERAL RESPONSE ACTIONS
Matrix 1: Likelihood of MEC Presence	Treatment to remove, or reduce the quantities of, MEC in the interaction zone, or containment (restrict access or protective cover)
Matrix 1: Extent of Exposure	Containment (restrict or control access) or Institutional Actions to modify receptor activities to reduce extent of exposure, or any combination thereof
Matrix 2: Frequency of Activities in the Interaction Zone	Containment (restrict or control access, or protective cover) or Institutional Actions to modify receptor activities to reduce frequency of intrusive activities, or any combination thereof

OSD may include further information on how this process might be conducted in future revisions of this document.

[4] CERCLA and the National Contingency Plan prefer and prioritize treatment over containment and institutional actions.

V. Glossary

Assessment Area: A surface area within an MRS defined by the logical intersection of potential amounts of MEC present (e.g., HUA, LUA, NEU) and the areas(s) over which one or more receptor groups perform their activities.

Conceptual Site Model (CSM): A comprehensive, evolving model of site conditions used to assist in the visualization and communication of available information and development of data quality objectives. The CSM may include text, figures, and tables to depict the current understanding of site conditions.

Encounter: A chance event during which a receptor gets sufficiently close to a MEC item that they might interact with it (this does not require the individual to interact with the MEC item). In many cases, a receptor may be unaware they have encountered a MEC item, either because they have not observed it or because they have not recognized it as MEC. This kind of encounter can result in an unintentional interaction.

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)
- Unless there is evidence to the contrary, the DoD Components should assume that the areas which present explosive hazards include:
    - Impact areas on operational ranges. Exceptions are ranges known to have been exclusively used for training with only small arms ammunition.
    - Former ranges known or suspected to contain MEC.
    - Outdoor demolitions areas, to include locations used for open burning or open detonation.
- Areas that are associated with military munitions production, demilitarization, renovation, or similar processes (e.g., operating buildings and any installed equipment) that generated explosives residues (e.g., dust, vapors, liquids) and that might have become contaminated with such residues in concentrations sufficient to present explosive hazards, to include areas receiving processing wastewater (e.g., settling ponds, drainage swales). (Defense Explosives Safety Regulation [DESR] 6055.09. Edition 1, January 13, 2019)

Explosive incident: Occurs when a receptor interacts with a MEC item and causes it to function or otherwise release energy, resulting in harm to one or more receptors. This includes events involving explosion or combustion.

General Response Action (GRA): There are seven GRAs available for munitions response. They are generally described as "Treatment Actions" to reduce the quantities or eliminate the presence of MEC within the risk scenario, "Containment Actions" to restrict or otherwise impede the possibility of interactions with MEC, "Institutional Actions" to change people's behavior when they encounter MEC, and the four possible combinations of those three—treatment and

containment actions, treatment and institutional actions, containment and institutional actions, and treatment, containment, and institutional actions.

High Explosive Fill: An explosive substance (e.g., RDX) carried in an ammunition container such as a projectile, mine, bomb, or grenade. (Munitions Response Site Prioritization Protocol [MRSPP] Primer)

High Use Area (HUA): A high-density area where munitions use has been confirmed. Unexploded ordnance (UXO) and/or discarded military munitions (DMM) are anticipated to be present in HUAs. (MR-QAPP, Module 1)

Interaction: When, upon encounter, the receptor imparts energy to the MEC item either intentionally or unintentionally such that it might function (this does not require the receptor to physically come into direct contact with the MEC item, e.g., energy transfer via hand tool, horizontal cable drilling, pressure bulb under a footstep or tire tread).

Interaction Zone: The volume of media beneath the surface (i.e., horizontal and vertical extents of soil or sediment) where a specific receptor may perform an activity. Each receptor activity must have an associated interaction zone based on intrusive depths and frequencies.

Low Use Areas (LUAs): - Low-density areas where the potential presence of munitions cannot be ruled out. (MR-QAPP, Module 1)

Military Munitions Response Program: This category was established to meet the Defense Environmental Restoration Program (DERP) goals in sections 2701(b)(2) and 2710 of Title 10, U.S. Code (U.S.C.), and includes munitions response areas (MRAs) and munitions response sites (MRSs) that are known or suspected to contain UXO, DMM, or munitions constituents (MC). The MMRP does not include UXO, DMM, or MC at operational ranges, operating storage or manufacturing facilities, or facilities that are used for or were permitted for the treatment or disposal of military munitions. The DoD Component may also include in the MMRP category sites where addressing the release of hazardous substances or pollutants or contaminants is incidental to the munitions response (MR). One of three DERP program categories. (DoDM 4715.20)

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 U.S.C. 101(e)(5); DMM, as defined in 10 U.S.C. 2710(e)(2); or MC (e.g., TNT, RDX), as defined in 10 U.S.C. 2710(e)(3), present in high enough concentrations to pose an explosive hazard. (32 CFR 179.3)

MEC Treatment: Any method, technique, or process, including neutralization, designed to change the physical or chemical character or composition of MEC to dispose of the MEC, or reduce it in quantity.

Munitions Debris (MD): Remnants of munitions (e.g., fragments, penetrators, projectiles, shell casings, links, fins) remaining after munitions use, demilitarization, or disposal. (DESR 6055.09. Edition 1, January 13, 2019)

Munitions Response Site (MRS): A discrete location within an MRA that is known to require an MR. (32 CFR 179.3)

No Evidence MEC Remain: An area where a remedial response has been conducted to reliably remove MEC from the interaction zone. This differs from an NEU area, which is defined in MR-QAPP, Module 1.

No Evidence of Use (NEU): An area where the weight of evidence indicates that there was no munitions use (e.g., no evidence of range fans, targets, maneuver areas, Open Burn/Open Detonation, transport, storage/staging). (1) Low anomaly density area for which the current CSM contains adequate evidence that no munitions were used in the area. This includes target locations indicated in the CSM where evidence now exists that a target was never constructed or the location was never used, or (2) high anomaly density area determined to be not related to munitions use. All available and relevant lines of evidence supporting this delineation (e.g., historical records review, historical photo interpretation, visual observations, interviews) must be considered.

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. (MRSPP Primer)

Project Teams: Determined on site-specific basis, but will likely include the following individuals: DoD agency project manager, DoD and other technical and subject-matter experts (e.g., explosives safety, geophysics, public affairs personnel), regulators, specialists, consultants/contractors, stakeholders, and representatives from other Federal and state agencies. Gathers input and applies the RMM in extensive collaboration with other stakeholders. Assumes responsibility for project data, and ensures the data meets the intended uses and is consistent throughout the project.

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. (MRSPP Primer)

Pyrotechnics: A mixture of chemicals which, when ignited, is capable of reacting exothermically to produce light, heat, smoke, sound, or gas. (MRSPP Primer)

Receptor Activity: A current or reasonably anticipated future land use activity and its related frequency as performed by a receptor within an assessment area (e.g., one activity for a group of individuals having frequent intrusive activities to six inches bgs, another activity performed by the same group but having infrequent intrusive activities to 12 inches bgs, and a second group of individuals having infrequent intrusive activities to 24 inches).

Risk Scenario: The conditions that reflect a unique combination of receptor activity and interaction zone within an assessment area that describe potential risk conditions to the associated receptors.

Subsurface: A munition that is entirely beneath the ground surface or submerged in a water body. (MRSPP Primer)

Surface: A munition that is entirely or partially exposed above the ground surface, or entirely or partially exposed above the surface of a water body. (MRSPP Primer)

Unexploded Ordnance (UXO): Military munitions that (1) have been primed, fuzed, 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 U.S.C. 101(e)(5))

VI. Acronyms

BGS	Below Ground Surface
CSM	Conceptual Site Model
FS	Feasibility Study
GRA	General Response Action
HUA	High Use Area
LUA	Low Use Area
MD	Munitions Debris
MEC	Munitions and Explosives of Concern
MMRP	Military Munitions Response Program
MRS	Munitions Response Site
NEU	No Evidence of Use
OSD	Office of the Secretary of Defense
RAO	Remedial Action Objective
RI	Remedial Investigation
RMM	Risk Management Methodology
USACE	U.S. Army Corps of Engineers
UXO	Unexploded Ordnance

VII. Frequently Asked Questions

What is the MMRP RMM?

The USACE developed the RMM as a tool for the DoD Components to assess risk and develop response objectives for MRSs. The RMM is a qualitative risk evaluation tool that provides project teams with a framework for conducting the baseline risk assessment and developing consensus on risk management decisions for MRSs. Rather than being a "black box" that produces output to drive projects toward specific decisions, project teams should use the RMM to build consensus and to facilitate discussion about risk management decisions, incorporating the RMM output with multiple lines of evidence. See *Section I, Introduction.*

Why did DoD develop the MMRP RMM?

DoD developed the RMM for several reasons (see *Section I, Introduction)*, including:

- Providing a universally accepted process to assess risks associated with explosives safety hazards because the existing baseline risk assessment process to assess chemical risks (i.e., MC and other chemicals of concern [CoCs]) under the CERCLA is not suitable for assessing explosives safety hazards associated with MEC;
- Meeting the National Contingency Plan (NCP) requirement for site-specific baseline risk assessments under CERCLA at MRS containing MEC;
- Providing a consistent, uniform process to assess risks associated with explosives safety hazards at DoD MRSs and support confidence in decision making;
- Providing a transparent process to facilitate communication among project teams and stakeholders about risk, response action goals, and protectiveness; and
- Enhancing participation and collaboration among DoD, Federal and state regulators, and stakeholders throughout the MMRP process.

Will OSD, the Office of the Deputy Assistant Secretary of Defense for Environment & Energy Resilience (ODASD(E&ER)), require DoD Components to reevaluate MRSs that have advanced past the RI/FS phases?

ODASD(E&ER) will not require DoD Components to apply the RMM to older MRSs that have advanced past the RI/FS to remedial action or long-term management (LTM) phases. Project teams may, however, reevaluate MRSs if considered appropriate. See *Section I, Introduction.*

Will OSD, ODASD(E&ER), mandate use of the RMM at all DoD MRSs?

ODASD(E&ER) will encourage DoD Components to use the RMM at its MRSs, where appropriate; however, ODASD(E&ER) will not require project teams to use the RMM. See *Section I, Introduction.*

Does the RMM address risks associated with MC?

No. If there is evidence that MC or other environmental CoCs are present at the MRS, then the project team should use the chemical risk assessment processes to evaluate the potential associated risks to human health and the environment. See *Section I, Why to Use the RMM.*

When should project teams use the RMM in the CERCLA Process?

Project teams should primarily use the RMM to evaluate risks from explosive safety hazards at MRSs during the RI phase to support a MEC baseline risk assessment. After applying the RMM matrices to assess each risk scenario and developing RAOs with clear goals and objectives, the project team can identify GRAs to support the FS. The RMM Process Flow Chart on page 5 illustrates how the RMM fits into the CERCLA process. See *Section I, When to Use the RMM,* and *How to Use the RMM*.

Does the output from the RMM establish a threshold for either further action or no further action at an MRS?

No. The RMM provides information to support the decision-making process, but it is not the decision itself. The results of using the RMM to assess risk at an MRS do not establish or imply a threshold above which action is required, or one below which no action is required. The project team should use the output from the RMM as part of a multiple lines-of-evidence approach to decide whether further response actions are required. See *Section IV, Steps the Project Team Can Use in the FS After Completing the Baseline Risk Assessment.*

Does the RMM output determine what is "acceptable risk" at an MRS?

The project team uses the RMM to facilitate discussions so that the project team understands the elements of risk and can make an informed decision about what is or is not acceptable. See *Section I, When to Use the RMM.*

If the project team decides that a risk scenario is acceptable does this mean the MRS meets the unlimited use and unrestricted exposure (UU/UE) criteria?

No. The project team should not use the RMM as the basis for concluding that UU/UE conditions have been achieved at an MRS. Acceptable risk does not mean the MRS is suitable for UU/UE. A risk scenario at an MRS could yield an "acceptable" result and still require land use controls, institutional controls, and subsequent five-year reviews. See *Section I, When to Use the RMM* and, *Section 2, Step 2: Define the Assessment Area(s)*.

What is the project team?

The project team is the group of DoD representatives, regulators, stakeholders, Federal and state agency representatives, and technical specialists (e.g., geologists, chemists, risk assessors, regulatory specialists) that execute a single project. Project teams are determined on a site-specific basis, and expertise and disciplines of the project team members may vary depending on the nature and phase of the project. The personnel representing each organization should be authorized to make decisions for their respective organizations and be fully engaged in the planning and review process. See *Section I, Project Team Makeup, Roles, and Responsibilities.*

What is the primary source of data and information for the RMM?

The primary data source for the RMM is a well-developed, well-defined CSM. The CSM is a comprehensive, living site model that depicts the project team's current understanding of the hazard sources, exposure pathways, and receptors. As the project team obtains new information on the MRS, it should update the CSM. The project team should come to consensus on the CSM for the MRS before applying the RMM, since the project team uses the CSM information as input in each element of the RMM. See *Section II, Step 1: Review and Consensus on CSM.*

Is there only one correct way to develop risk scenarios?

No. The process for developing risk scenarios in the RMM is one option. The project team can use other approaches if it factors in suitable site-specific CSM information and multiple lines of evidence to make reasonable determinations. See *Section II, Step 2: Define the Assessment Area(s).*

Can an MRS have only one assessment area?

Yes. It is acceptable for the project team to identify only one assessment area, if this reflects the most conservative MEC characteristics and current and reasonably anticipated future land use activities (i.e., worst case regarding risks from explosive hazards). However, if a project team identifies only one assessment area, then the worst-case land use approach will drive all risk-based and land use decisions. See *Section II, Step 2: Define the Assessment Area(s)*.

Can an assessment area have only one receptor activity?

Yes. Some assessment areas may only have a single receptor activity. This is acceptable as long as it is based on the most conservative MEC characteristics and current or reasonably anticipated future land use activities (i.e., worst case regarding risks from explosive hazards). However, if the project team identifies only one receptor activity, then this conservative assumption will drive all risk-based and land use decisions. See *Section II, Step 3: Identify Receptor Activities.*

What should the project team do when there is doubt about selecting an input in Matrix 1, 2 or 3?

If there is doubt between two inputs for the RMM matrices, the project team should use the more conservative selection (i.e., higher Likelihood of MEC Presence, higher Extent of Exposure, higher Frequency of Activities in the Interaction Zone). See *Section III, Step 1: Determine Likelihood of MEC Presence.*

Do the MEC Codes account for sensitivity of MEC items? If not, is there flexibility for project teams to account for sensitivity of MEC items?

The MEC Codes account for the relative severity of MEC items if they function. The MEC Codes do not account for the sensitivity of the MEC items (e.g., due to their intrinsic construction, type and condition of fuzing) when varying degrees of energy are imparted directly on or in the vicinity of the MEC items. However, project teams have the flexibility to modify MEC Codes based on site-specific conditions with input from explosives safety experts. For example, the project team may conclude that a MEC item with a MEC Code of 3 is less likely to

function based on the sensitivity of its fuze in relation to actions of receptors (e.g., gardening as opposed to heavy earth-moving equipment). In this case, the project team might consider it appropriate to use a lower MEC Code to reflect the risk more accurately. The project team must make any MEC Code modifications with input from explosives safety experts and should clearly document the assumptions and rationale for the modification in the RI report or memorandum for record. See *Section III, Matrix 3: Risk of Harmful Incident.*

Will DoD provide training on the RMM?

ODASD(E&ER) will roll out RMM training after finalizing this document. ODASD(E&ER) will also collect lessons learned and document issues for updating the RMM in the future.

How does the RMM relate to the MRSPP?

The RMM does not directly relate to the MRSPP but the DoD Components can use elements of the RMM evaluation to update an MRSPP evaluation, as necessary.

Appendix I: World War II (WWII) Practice Bombing Target Example

Project Team Steps to Apply the RMM

Introduction

This example details how a project team applies the RMM to a WWII Practice Bombing Target MRS. For the purposes of this example, the information is laid out in a linear and organized fashion to follow the steps to apply the RMM.

Step 1: Review and Come to a Consensus on the CSM

The example assumes that the project team has conducted the RI field data collection at the Practice Bombing Target MRS and has reviewed and reached a consensus on the updated CSM. Project teams must ensure that they use the detailed data included below.

The updated CSM for the Practice Bombing Target MRS is as follows:

Site History

DoD used the 162-acre MRS as a WWII air to ground low altitude practice bombing target. The target operated from 1941 to 1945. The only munitions documented in the CSM are 100-pound practice bombs and their associated spotting charges, and the project team did not identify any munitions-related incidents or explosive ordnance disposal reports for the MRS.

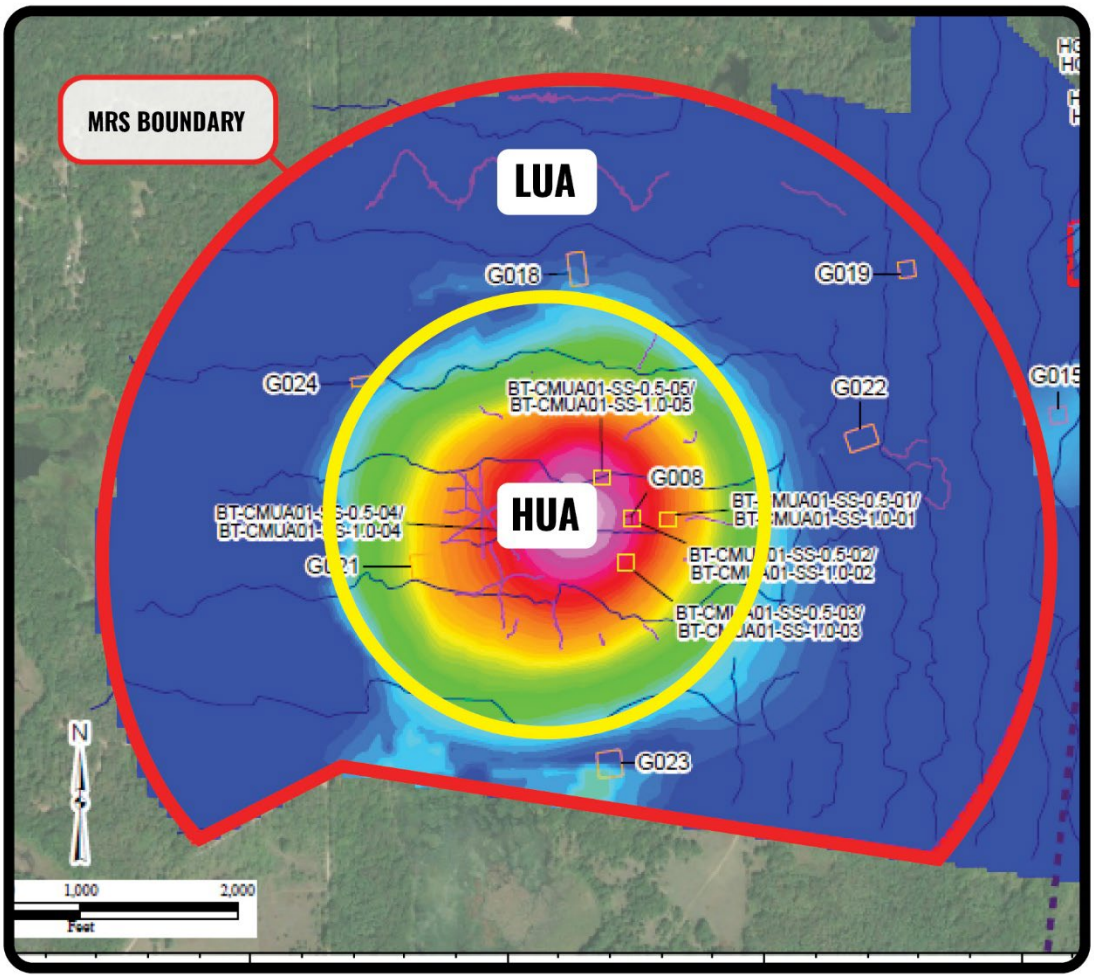
Land Use

The land use throughout the Practice Bombing Target MRS is currently agricultural, and no changes are reasonably anticipated. The property's rolling terrain is used for crop farming. Annual farming activities include plowing and planting in the spring, and harvesting in August and September. Up to five workers are involved in these activities each year, and they spend a maximum of three weeks per year within the area bounded by the MRS. The farming activities, which include mechanized plowing, planting, and harvesting, extend to a maximum of 18 inches bgs.

Results of Field Investigation

The results of the field investigation identified a 56-acre HUA in the center of the MRS. The HUA contains crumpled large thin-walled MD on the surface and several M1A1 spotting charges from the surface to a 6-inch depth. However, based on the estimated depth of MD observed and explosive safety experts judgment, the project team reached a consensus that the potential MEC depth for the MRS is 24 inches bgs. The project team's data usability assessment resulted in the acceptance of the data and supports high confidence in the differentiation of HUA and LUA and the depth. The Practice Bombing Target MRS, including the HUA and LUA boundaries, is shown in Figure 8.

Figure 8: WWII Practice Bombing Target MRS Map



Step 2: Define Assessment Area(s)

Having reviewed and reached a consensus on the CSM for the MRS, the project team uses that data to consider whether it is appropriate to identify different assessment areas for the RMM evaluation. To support this part of the process, the team looks at estimated munitions distribution and land use activities, and coverage of those activities within the MRS boundary, considering number of people and frequency of access for the Practice Bombing Target MRS. The land use activities and coverage are the same throughout the MRS; however, the estimated munitions distribution is characterized by the HUA and LUA. Based on these characteristics, the project team decides that it is appropriate to divide the site into two assessment areas—one for the HUA and another for the LUA (see Figure 9).

Figure 9: WWII Practice Bombing Target MRS Assessment Areas

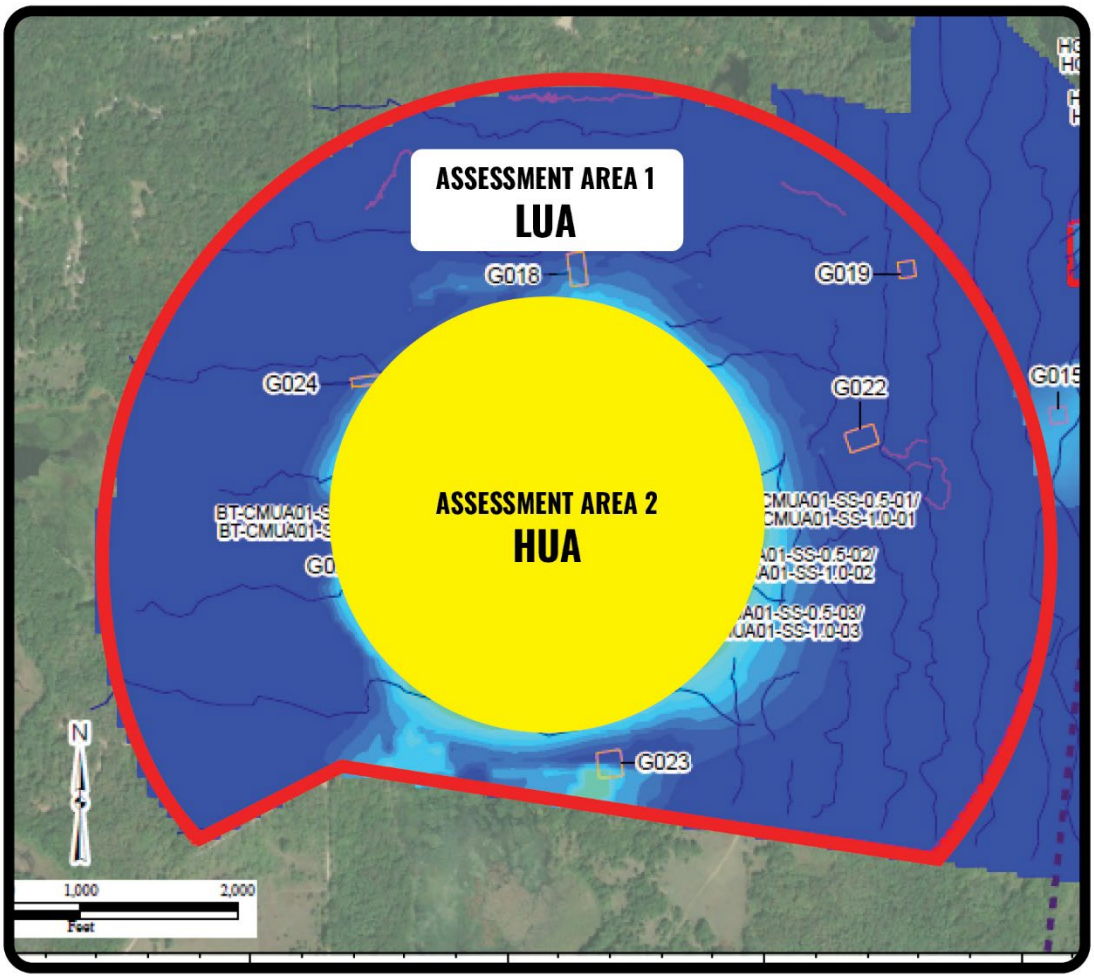
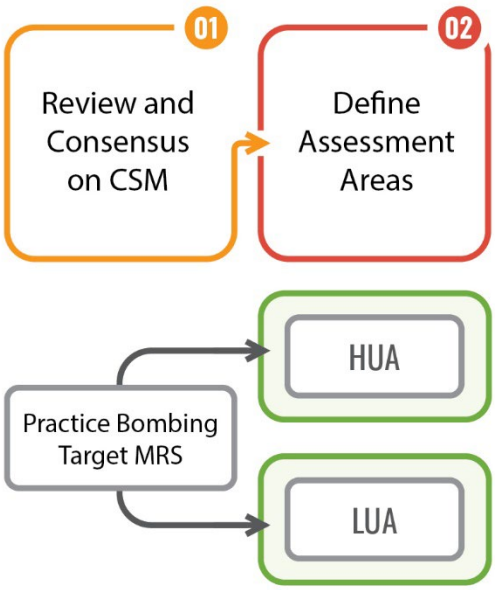


Figure 10 summarizes the steps completed thus far before applying the RMM.

Figure 10: Project Team Steps to Apply the RMM—Assessment Areas



Step 3: Identify Receptor Activities

Next, the project team identifies receptor activities for the each of the assessment areas at the Practice Bombing Target MRS. Receptor activities look at the land use activities occurring in each assessment area.

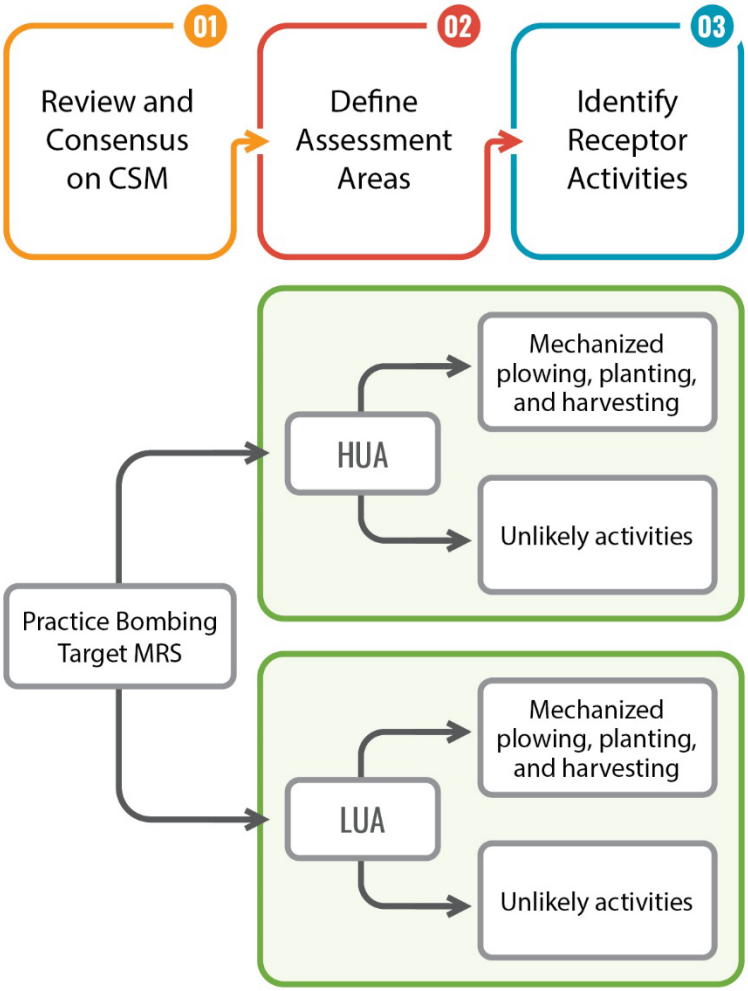
For Assessment Area 1 (LUA), there are two land use activities: (1) mechanized plowing, planting, and harvesting and (2) other intrusive activities occurring to the estimated maximum MEC depth that may occur but are unlikely. There are no reasonably anticipated future land use changes. Therefore, the project team identified two receptor activities for Assessment Area 1.

For Assessment Area 2 (HUA), there are two land use activities: (1) mechanized plowing, planting, and harvesting and (2) other intrusive activities occurring to the estimated maximum MEC depth that may occur but are unlikely. There are no reasonably anticipated future land use changes. Therefore, the project team identified two receptor activity for Assessment Area 2.

For the Practice Bombing Target MRS, the project team decides it will evaluate four receptor activities.

Figure 11 summarizes the steps completed thus far before applying the RMM.

Figure 11: Project Team Steps to Apply the RMM—Receptor Activities



Step 4: Define the Interaction Zone(s)

Finally, the project team defines the interaction zones for all the identified receptor activities.

For the receptor activity in Assessment Area 1 (LUA), the project team considers the depth profile of the land use activities and the vertical extent of MEC. Using the CSM, the project team sees that farming activities extend to a maximum of 18 inches bgs and the potential vertical extent of MEC for the MRS is 24 inches bgs.

For the receptor activity in Assessment Area 2 (HUA), the project team considers the depth profile of the land use activities and the vertical extent of MEC. Using the CSM, the project

team sees that farming activities extend to a maximum of 18 inches bgs and the potential vertical extent of MEC for the MRS is 24 inches bgs.

Figure 12 summarizes the interaction zones for receptor activities 1 and 2.

Figure 12: WWII Practice Bombing Target MRS Interaction Zones (for the Receptor Activity in the HUA and LUA)

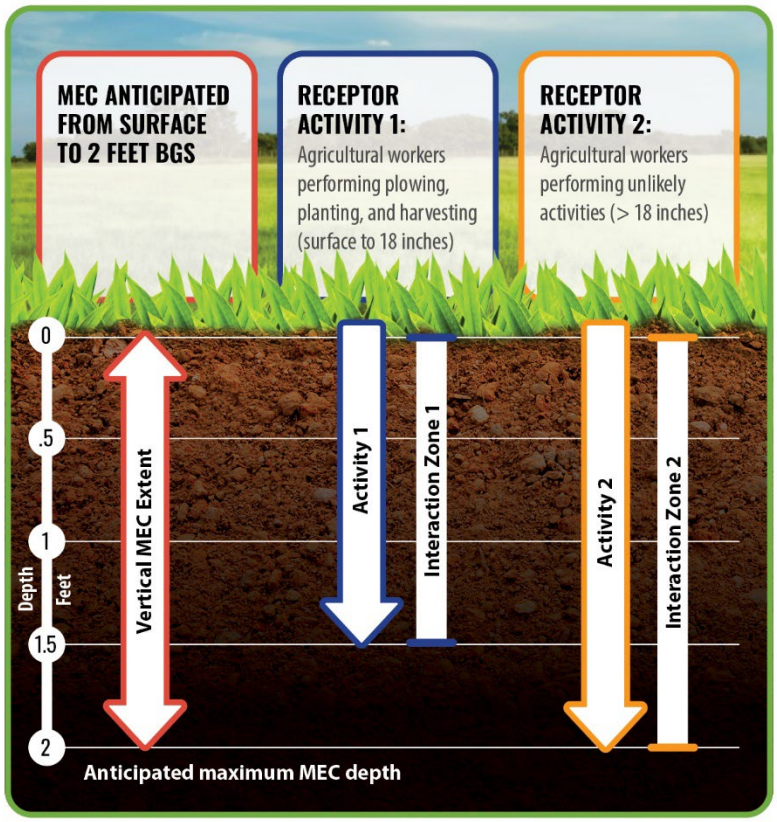


Figure 13 summarizes the steps completed thus far before applying the RMM.

Figure 13: Project Team Steps to Apply the RMM—Interaction Zones

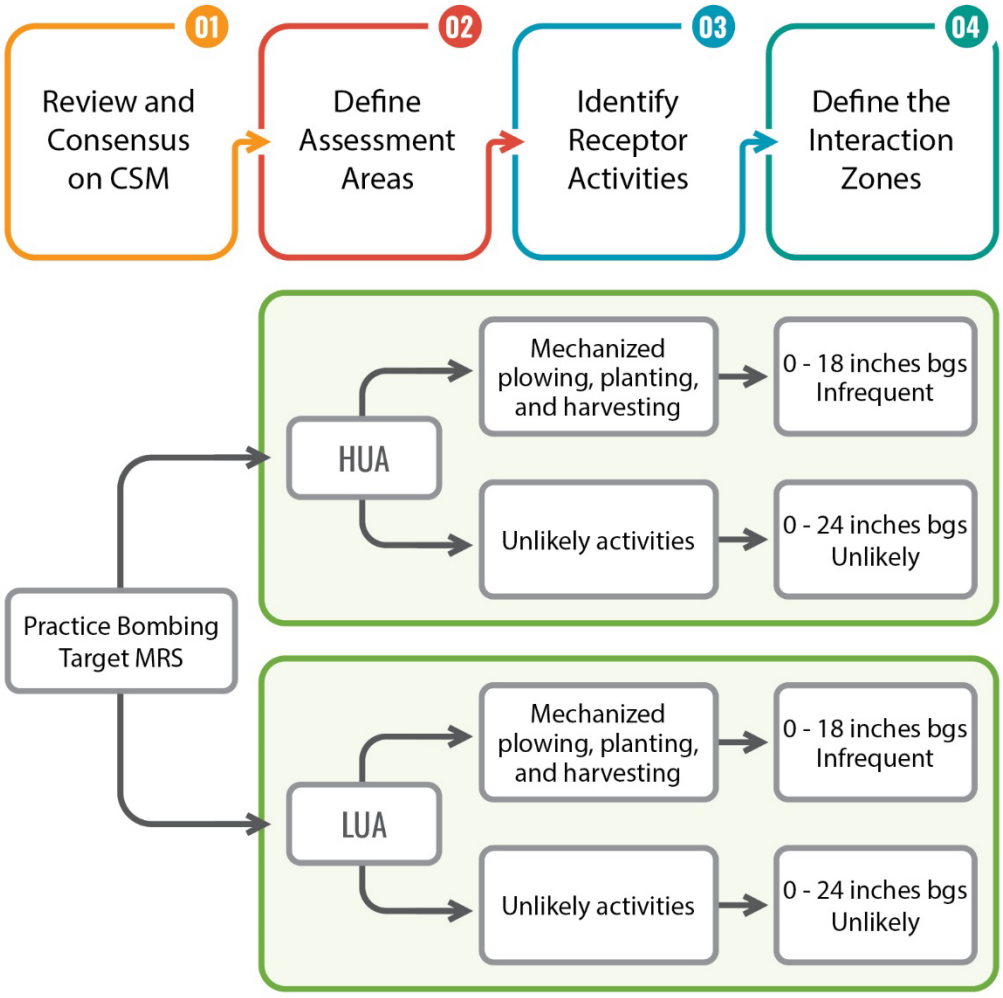
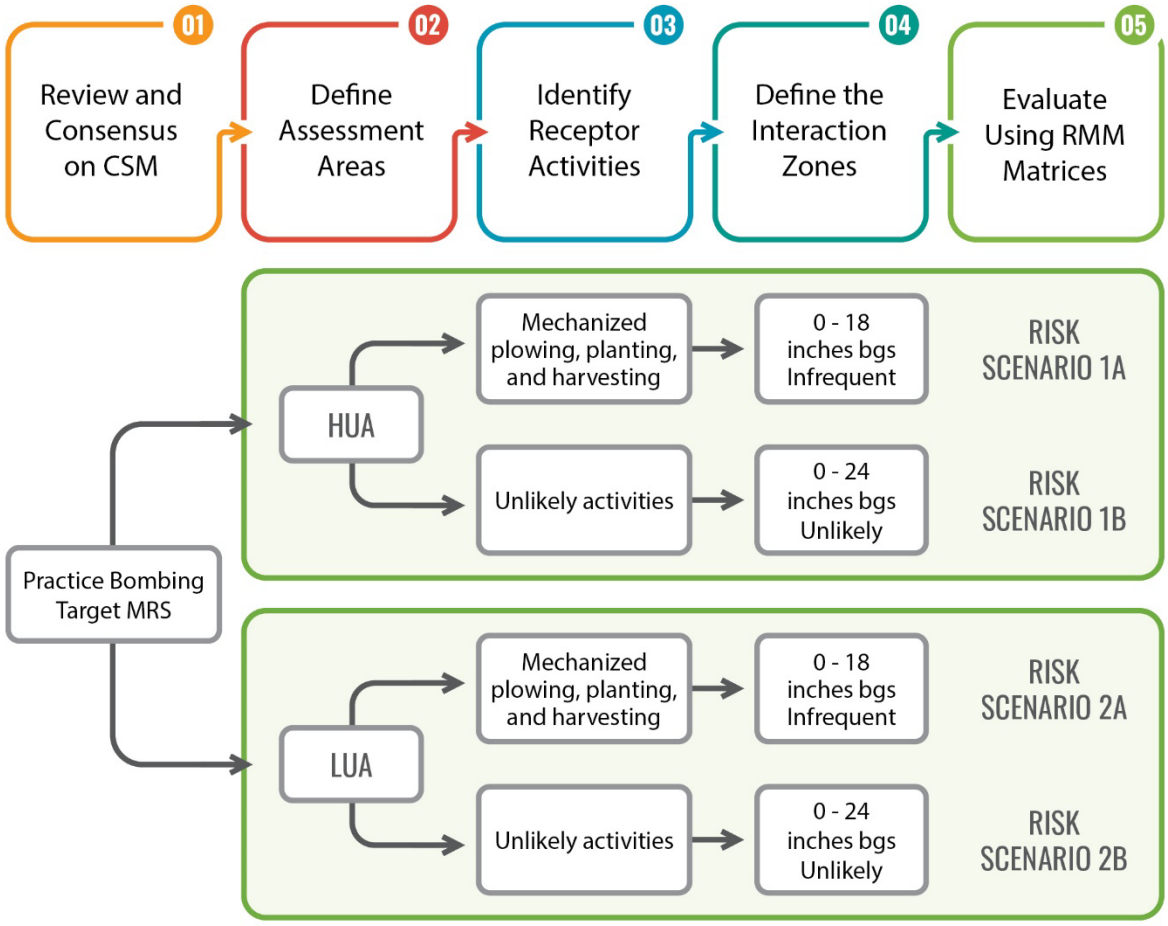


Figure 14: Project Team Steps to Apply the RMM—Summary



Baseline Risk Assessment Using the RMM

Matrix 1

To conduct the risk assessment, the project team applies the RMM matrices to each of the four MRS risk scenarios. Beginning with Matrix 1, for risk scenario 1A (i.e., HUA, agricultural, 0-18 inches bgs), the project team selects *full* extent of exposure because the agricultural activities cover the entire area annually. They decide the likelihood of encounter is *moderate* based on anomaly density and the amount of MEC/MD. When they cross-reference the two input factors, they determine their Matrix 1 rating is *5*.

For risk scenario 1B (i.e., HUA, unlikely activities, 0-24 inches bgs), it is more difficult for the project team to decide the extent of exposure because they are unlikely activities. The project team reaches consensus that there is *limited* extent of exposure. They select *moderate* likelihood of encounter based on anomaly density and the amount of MEC/MD found. Based on the two input factors, the Matrix 1 rating is *4*.

For risk scenario 2A (i.e., LUA, agricultural, 0-18 inches bgs), the project team selects *full* extent of exposure because the agricultural activities cover the entire area each year. The project team is split between low and very low likelihood of encounter so they select the more conservative option, *low*. Based on the two input factors, the Matrix 1 rating is *3*.

For risk scenario 2B (i.e., LUA, unlikely activities, 0-24 inches bgs), it is again difficult for the project team to decide the extent of exposure because they are unlikely activities. The project team selects *limited* extent of exposure. Based on anomaly density and the amount of MEC/MD found, the project team selects *low* likelihood of encounter. Based on the two input factors, the Matrix 1 rating is *2*.

Note: Matrix ratings are not "black and white." Each matrix rating depends on qualitative evaluations and project team consensus.

Table 7: Matrix 1 Summary

LIKELIHOOD OF ENCOUNTER (Likelihood of MEC Presence vs. Exposure)		EXTENT OF EXPOSURE			
		Full	Partial	Limited	Minimal
LIKELIHOOD OF MEC PRESENCE	**HUA**: likelihood of MEC is **HIGH**.	5	5	5	5
	HUA: likelihood of MEC is **MODERATE**.	5	5	4	4
	LUA: likelihood of MEC is **LOW**.	3	2	2	1
	LUA: likelihood of MEC is **VERY LOW**.	2	2	1	1
	No evidence MEC remain / **NEU:** no evidence of munitions use.	1	1	1	1

Shading Key
Risk Scenario 1A ■ Risk Scenario 1B ■ Risk Scenario 2A ■ Risk Scenario 2B ■

Matrix 2

For Matrix 2, risk scenario 1A, the project team uses the likelihood of encounter rating of *5* from Matrix 1. They select *infrequent* for the frequency of activities in the interaction zone since agricultural activities occur up to three weeks each year. When they cross-reference the two input factors, they determine their Matrix 2 rating is *B*.

The project team also determines Matrix 2 ratings for the remaining risk scenarios.

For risk scenario 1B, the likelihood of interaction from Matrix 1 is a rating of *4*. The project team considers it unlikely that the workers would perform intrusive activities beyond 18 inches bgs, so they select *unlikely* for frequency of activities in the interaction zone. Based on the two input factors, the Matrix 2 rating is *C*.

For risk scenario 2A, the likelihood of interaction from Matrix 1 is a rating of *3*. Again, the project team selects *infrequent* for the frequency of activities in the interaction zone since

agricultural activities occur up to three weeks each year. Based on the two input factors, the Matrix 2 rating is *B*.

For risk scenario 2B, the likelihood of interaction from Matrix 1 is a rating of *2*. Again, the project team considers it unlikely that the workers would perform intrusive activities beyond 18 inches bgs, so they select *unlikely* for frequency of activities in the interaction zone. Based on the two input factors, the Matrix 2 rating is *C*.

Table 8: Matrix 2 Summary

LIKELIHOOD OF INTERACTION (Likelihood of Activities in Interaction Zone vs. Likelihood of Encounter)		LIKELIHOOD OF ENCOUNTER (FROM MATRIX 1)				
		5	4	3	2	1
FREQUENCY OF ACTIVITIES IN INTERACTION ZONE	**Frequent** activities occur in interaction zone	A	A	B	B	D
	Occasional activities occur in interaction zone	A	B	B	B	D
	Infrequent activities occur in interaction zone	B	B	B	C	E
	Unlikely that activities occur in interaction zone	B	C	C	C	E

Shading Key
Risk Scenario 1A ■ Risk Scenario 1B ■ Risk Scenario 2A ■ Risk Scenario 2B ■

Matrix 3

For Matrix 3, risk scenario 1A, the project team uses the likelihood of encounter rating of *B* from Matrix 2. They select *low (MEC Code 1)* for the MEC code because there is an M1A1 spotting charge. When they cross-reference the two input factors, they determine their Matrix 3 rating is *unacceptable*.

The project team also determines Matrix 3 ratings for the remaining risk scenarios.

For risk scenario 1B, the likelihood of interaction from Matrix 2 is a rating of *C*. They select *low (MEC Code 1)* for the MEC Code because there is an M1A1 spotting charge. When they cross-reference the two input factors, they determine their Matrix 3 rating is *acceptable*.

For risk scenario 2A, the likelihood of interaction from Matrix 2 is a rating of *B*. They select *low (MEC Code 1)* for the MEC code because there is an M1A1 spotting charge. When they cross-reference the two input factors, they determine their Matrix 3 rating is *unacceptable*.

For risk scenario 2B, the likelihood of interaction from Matrix 2 is a rating of *C*. They select *low (MEC Code 1)* for the MEC code because there is an M1A1 spotting charge. When they cross-reference the two input factors, they determine their Matrix 3 rating is *acceptable*.

Table 9: Matrix 3 Summary

RISK OF HARMFUL INCIDENT (MEC Code vs. Likelihood of Interaction)		LIKELIHOOD OF INTERACTION (FROM MATRIX 2)				
		A	B	C	D	E
MUNITION MEC CODE	High (MEC Code 3)	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Acceptable
	Moderate (MEC Code 2)	Unacceptable	Unacceptable	Unacceptable	Acceptable	Acceptable
	Low (MEC Code 1)	Unacceptable	Unacceptable	Acceptable	Acceptable	Acceptable
	Presents No Explosive Hazard (MEC Code 0)	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
	No Evidence MEC Remain					
	NEU					

Shading Key
Risk Scenario 1A ■ Risk Scenario 1B ■ Risk Scenario 2A ■ Risk Scenario 2B ■

Baseline Risk Assessment Conclusions

Based on the result of the baseline risk assessment, there is unacceptable risk for risk scenarios 1A and 2A. The interaction zones for risk scenario 1A and 2A are from 0 to 18 inches bgs, so the project team needs to address the risks down to 18 inches within the HUA and LUA. The RMM Process Flow Chart in Section I outlines the steps the project team should follow after identifying acceptable and unacceptable risk.

Appendix II: MEC Codes

The MEC Codes in this table are provided for use with the RMM (see Matrix 3, Risk of Harmful Incident). This list was modified from the final Fort Ord Protocol, which was developed collaboratively by DoD, explosive safety experts, and the regulatory community. For the purposes of the RMM, DoD pared down the Fort Ord Protocol to include a concise list of common Army munitions, and added common Navy and Air Force munitions. When evaluating a given risk scenario, project teams should reference the MEC Codes to describe relative severity of MEC items if they were to function. The MEC Codes in this table are shown for the items in the form of UXO. If MEC items are present as fuzed or unfuzed DMM, the project team may consider modifying the MEC Codes as appropriate, though this must be done in consultation with explosives safety experts.

The MEC Codes do not include all MEC items: if a project team is evaluating a MEC item that is not listed here, they can use the information and the factors in the RMM to determine a MEC Code for the item of concern. Additionally, project teams have the flexibility to modify the below MEC Codes based on site-specific conditions using input from explosives safety experts. Specifically, the project team may account for the sensitivity of the MEC items due to their intrinsic construction, filler materials, type and condition of fuzing, or when varying degrees of energy are imparted directly on or in the vicinity of MEC items.

Mil Dep	Munitions Item	Munitions Group	Sub-Group	Size / Caliber	Type	Mark / Model	MEC Hazard Code
Air Force	Bomb; 50-lb.; Photoflash; AN-M46	Bomb	Photoflash	50-lb.	Illumination	AN-M46	2
Air Force	Bomb; 50-lb.; Photoflash; M46	Bomb	Photoflash	50-lb.	Illumination	M46	2
Air Force	Bomb; 4-lb.; Incendiary; AN-M50 Series	Bomb		4-lb.	Incendiary	AN-M50 series	3
Air Force	Bomb; 3-lb.; Practice; AN-Mk 23 Series	Bomb		3-lb.	Practice	AN-Mk 23 series	1
Air Force	Bomb; 25-lb.; Practice; BDU-33 series	Bomb		25-lb.	Practice	BDU-33 series	1
Air Force	Bomb; 25-lb; Fragmentation; Mk III	Bomb		25-lb.	Fragmentation	Mk III	3
Air Force	Bomb; 20-lb.; Fragmentation; AN-M41	Bomb		20-lb.	Fragmentation	AN-M41	3
Air Force	Bomb; 20-lb.; Fragmentation; AN-M41A1	Bomb		20-lb.	Fragmentation	AN-M41A1	3
Air Force	Bomb; 20-lb.; Fragmentation; M41	Bomb		20-lb.	Fragmentation	M41	3
Air Force	Bomb; 20-lb.; Fragmentation; M41A1	Bomb		20-lb.	Fragmentation	M41A1	3
Air Force	Bomb; 17-lb; Fragmentation; Mk II	Bomb		17-lb.	Fragmentation	Mk II	3
Air Force	Bomb; 13-lb.; Practice; Mk 19	Bomb		13-lb.	Practice	Mk 19	1
Air Force	Bomb; 100-lb.; GP; AN-M30	Bomb	General Purpose	100-lb.	HE	AN-M30	3
Air Force	Bomb; 100-lb.; Photoflash; AN-M46	Bomb	Photoflash	100-lb.	Illumination	AN-M46	2
Air Force	Bomb; 100-lb.; Incendiary; AN-M47A4	Bomb		100-lb.	Incendiary	AN-M47A4	3
Air Force	Bomb; 100-lb.; Practice; M38A2	Bomb		100-lb.	Practice	M38A2	1
Air Force	Bomb; 10-lb.; Incendiary; M74	Bomb		10-lb.	Incendiary	M74	3
Air Force	Projectile; 75mm HEAT; M66	Projectile		75mm	HEAT	M66	3
Air Force	Projectile; 37mm HE; Mk II	Projectile		37mm	HE	Mk II	3
Air Force	Cartridge; 20mm; HEI; M97A2	Projectile	Cartridge	20mm	HEI	M97A2	3
Air Force	Projectile; 105mm; HE; M38A1	Projectile		105mm	HE	M38A1	3
Air Force	Rocket Warhead; 2.75 inch; HE Fragmentation; M151	Rocket	Warhead	2.75-inch	HE, Fragmentation	M151	3
Air Force	Rocket Warhead; 2.75-inch; HE; M229	Rocket	Warhead	2.75-inch	HE	M229	3
Air Force	Rocket; 2.75-inch; Illumination; M257	Rocket		2.75-inch	Illumination	M257	2
Air Force	Rocket; 2.36-inch; HEAT; T12 Series	Rocket		2.36-inch	HEAT	T12 series	3
Army	Activator; Practice; M1	Activator			Practice	M1	1
Army	Blasting Cap; electric; M6	Blasting cap	Electric		HE	M6	1
Army	Blasting Cap; non-electric; M7	Blasting cap	Non-Electric		HE	M7	1
Army	Burster; Field; Incendiary; M4	Burster			HE	M4	3
Army	Cartridge; ignition; M2 series	Cartridge	Ignition		Pyrotechnic mixture	M2 series	1
Army	Cartridge; ignition; M4 series	Cartridge	Ignition		Pyrotechnic mixture	M4 series	1
Army	M7 Auxiliary Grenade Cartridge booster charge	Cartridge	Grenade, booster charge		Smokeless powder	M7	1
Army	Charge; Propelling; M1A1	Charge	Propelling	155mm	Smokeless powder	M1A1	1
Army	Charge; demolition; TNT; 0.5 lb	Charge	Demolition	0.5-lb.	TNT		2

Mil Dep	Munitions Item	Munitions Group	Sub-Group	Size / Caliber	Type	Mark / Model	MEC Hazard Code
Army	Charge; nitrostarch; 0.25lb	Charge	Demolition	0.25-lb.	Nitrostarch		2
Army	Charge; demolition; TNT; 0.25 lb	Charge	Demolition	0.25-lb.	TNT		2
Army	Cutter; line; M2	Cutter	line		Propellant charge - small	M2	1
Army	Firing device; pull; M1	Firing device	Pull			M1	1
Army	Firing device; release; M1	Firing device	Release			M1	1
Army	Firing device; multi-option; M142	Firing device	Multi-option			M142	1
Army	Firing device; pressure; M1A1	Firing device	Pressure			M1A1	1
Army	Firing device; pull friction; M2	Firing device	Pull friction			M2	1
Army	Firing device; tension and release; M3	Firing device	release			M3	1
Army	Firing device; release; M5	Firing device	Release			M5	1
Army	Firing device; combination; MK1	Firing device	Combination			MK1	1
Army	Flare; parachute; trip; M48	Flare	Parachute		Pyrotechnic	M48	2
Army	Flare; aircraft; parachute; M9A1	Flare	Parachute		Pyrotechnic	M9A1	2
Army	Flare; Trip; M49	Flare	Trip		Pyrotechnic	M49	1
Army	Fuze; time; blasting; M700	Fuze		Fuze	blasting	M700	1
Army	Fuze; Bomb; Nose; M103	Fuze	Bomb	Fuze	Booster Charge	M103	2
Army	Fuze; Rocket; M404	Fuze	Rocket	Fuze	Small Primary Explosive and Burster Charges	M404	2
Army	Fuze; Rocket; M405	Fuze	Rocket	Fuze	Inert	M405	0
Army	Fuze; Projectile; Base Detonating; M534A1	Fuze	Projectile	Fuze	Base Detonating	M534A1	2
Army	Fuze; Mine; combination; M10 series	Fuze	Mine	Fuze	Combination	M10 series	1
Army	Fuze; Grenade; Hand; M10A3 series	Fuze	Grenade	Fuze	small explosive charge	M10A3 series	1
Army	Fuze; Projectile; combination; M1907	Fuze	Projectile	Fuze	Combination	M1907	1
Army	Fuze; Mine; anti-tank; Practice; M1A1	Fuze	Mine	Fuze	Practice	M1A1	1
Army	Fuze; Grenade; igniting; M201	Fuze	Grenade	Fuze	igniting	M201	1
Army	Fuze; Grenade; Hand; M204 series	Fuze	Grenade	Fuze	fuze	M204 series	1
Army	Fuze; Grenade; Hand; M205	Fuze	Grenade	Fuze	pyrotechnic delay igniting fuze	M205	1
Army	Fuze; Grenade; Hand; M206 series	Fuze	Grenade	Fuze	small explosive charge	M206 series	1
Army	Fuze; Smoke Pot; electric; M209	Fuze	Pot	Fuze	electric	M209	1
Army	Fuze; Grenade; Hand; M213	Fuze	Grenade	Fuze	small explosive charge	M213	1
Army	Fuze; Grenade; Hand; M215	Fuze	Grenade	Fuze	small explosive charge	M215	1
Army	Fuze; Grenade; Hand; M217	Fuze	Grenade	Fuze	small explosive charge	M217	1
Army	Fuze; Grenade; Hand; M218E1	Fuze	Grenade	Fuze	small explosive charge	M218E1	1
Army	Fuze; Grenade; Hand; M219	Fuze	Grenade	Fuze	small explosive charge	M219	1
Army	Fuze; Grenade; Hand; Practice; M228	Fuze	Grenade	Fuze	Practice	M228	1
Army	Fuze; Projectile; M38 series	Fuze	Projectile	Fuze	Small Primary Explosive and Buster Charges	M38 series	2
Army	Fuze; Projectile; base detonating; Practice; M38 w/o Booster	Fuze	Projectile	Fuze	Practice	M38 w/o Booster	1
Army	Fuze; Projectile; point detonating; M46	Fuze	Projectile	Fuze	Booster Cup and Small HE Charge	M46	2
Army	Fuze; Projectile; M48 series	Fuze	Projectile	Fuze	Small Primary Explosive and Buster Charges	M48 series	2

Mil Dep	Munitions Item	Munitions Group	Sub-Group	Size / Caliber	Type	Mark / Model	MEC Hazard Code
Army	Fuze; Projectile; M503A2	Fuze	Projectile	Fuze	Small Primary Explosive and Buster Charges	M503A2	2
Army	Fuze; Projectile; M51series	Fuze	Projectile	Fuze	Small Primary Explosive and Buster Charges	M51series	2
Army	Fuze; Projectile; point detonating; M52 series	Fuze	Projectile	Fuze	Booster Cup and Small HE Charge	M52 series	2
Army	Fuze; Projectile; M521	Fuze	Projectile	Fuze	Small Primary Explosive and Buster Charges	M521	2
Army	Fuze; Projectile; M524 series	Fuze	Projectile	Fuze	Small Primary Explosive and Buster Charges	M524 series	2
Army	Fuze; Projectile; M525	Fuze	Projectile	Fuze	Fuze	M525	2
Army	Fuze; Projectile; point detonating; M53 series	Fuze	Projectile	Fuze	Booster Cup and Small HE Charge	M53 series	2
Army	Fuze; Projectile; proximity; M532	Fuze	Projectile	Fuze	Booster Cup and Small HE Charge	M532	2
Army	Fuze; Projectile; M54	Fuze	Projectile	Fuze	Small Primary Explosive and Buster Charges	M54	2
Army	Fuze; Projectile; M548	Fuze	Projectile	Fuze	Small Primary Explosive and Buster Charges	M548	2
Army	Fuze; Projectile; M55	Fuze	Projectile	Fuze	Small Primary Explosive and Buster Charges	M55	2
Army	Fuze; Projectile; M557	Fuze	Projectile	Fuze	Small Primary Explosive and Buster Charges	M557	2
Army	Fuze; Projectile; M571	Fuze	Projectile	Fuze	Small Primary Explosive and Buster Charges	M571	2
Army	Fuze; Projectile; M58	Fuze	Projectile	Fuze	Small Primary Explosive and Buster Charges	M58	2
Army	Fuze; Projectile; base detonating; Practice; M58 w/o booster	Fuze	Projectile	Fuze	Practice	M58 w/o booster	1
Army	Fuze; chemical; Mine; anti-tank; M600	Fuze	Mine	Fuze	Chemical, Anti-tank	M600	0
Army	Fuze; Mine; anti-tank; Practice; M604	Fuze	Mine	Fuze	Practice	M604	1
Army	Fuze; Projectile; time (fixed); M65	Fuze	Projectile	Fuze	Primer, powder time-ring charge, black powder pellet, and black powder expelling charge.	M65	2
Army	Fuze; Projectile; M68	Fuze	Projectile	Fuze	Small Primary Explosive and Buster Charges	M68	2
Army	Fuze; Mine; combination; M6A1	Fuze	Mine	Fuze	combination	M6A1	1
Army	Fuze; Projectile; mechanical time super quick; M772	Fuze	Projectile	Fuze	mechanical time super quick	M772	1
Army	Fuze; Projectile; M8	Fuze	Projectile	Fuze	Small Primary Explosive and Buster Charges	M8	2
Army	Fuze; Projectile; time; M84 series	Fuze	Projectile	Fuze	Small Primary Explosive and Buster Charges	M84 series	2

Mil Dep	Munitions Item	Munitions Group	Sub-Group	Size / Caliber	Type	Mark / Model	MEC Hazard Code
Army	Fuze; Projectile; M9	Fuze	Projectile	Fuze	Small Primary Explosive and Buster Charges	M9	2
Army	Fuze; Projectile; Mk I	Fuze	Projectile	Fuze	Small Primary Explosive and Buster Charges	Mk I	2
Army	Fuze; Projectile; Mk IV	Fuze	Projectile	Fuze	Small Primary Explosive and Buster Charges	Mk IV	2
Army	Fuze; trench mortar; Mk VI	Fuze	Trench mortar	Fuze	Small Primary Explosive and Buster Charges	Mk VI	2
Army	Grenade; Rifle; AT; Practice; M11	Grenade		Rifle	Practice	M11	0
Army	Grenade; Rifle; AT; Practice; M11A series	Grenade		Rifle	Practice	M11A series	0
Army	Grenade; Rifle; M17	Grenade		Rifle	EC powder & Primer/detonator	M17	3
Army	Grenade; Rifle; Smoke; WP; M19A1	Grenade		Rifle	Smoke (WP)	M19A1	3
Army	Grenade; Rifle; Smoke; M22 series	Grenade		Rifle	Smoke	M22 series	1
Army	Grenade; Rifle; Smoke; M23 series	Grenade		Rifle	Smoke	M23 series	1
Army	Grenade; Rifle; HEAT; M28	Grenade		Rifle	HEAT	M28	3
Army	Grenade; Rifle; HEAT; M31	Grenade		Rifle	HEAT	M31	3
Army	Grenade; Rifle; anti-tank; M9 series	Grenade		Rifle	Anti-tank	M9 series	3
Army	Grenade; Rifle; White Phosphorus; VB	Grenade		Rifle	WP	VB	3
Army	Grenade; Hand; Riot; CN1; ABC-M25A1	Grenade	Riot	Hand	CN1	ABC-M25A1	1
Army	Grenade; Hand; Riot; CS; ABC-M25A2	Grenade	Riot	Hand	CS	ABC-M25A2	1
Army	Grenade; Hand; Incendiary; AN-M14	Grenade		Hand	Incendiary	AN-M14	1
Army	Grenade; Hand; Smoke; HC; AN-M8	Grenade		Hand	Smoke (HC)	AN-M8	1
Army	Grenade; Hand; Smoke; WP; M15	Grenade		Hand	Smoke (WP)	M15	3
Army	Grenade; Hand; Smoke; M18 series	Grenade		Hand	Smoke	M18 series	1
Army	Grenade; Hand; Practice; M21	Grenade		Hand	Practice	M21	1
Army	Grenade; Hand; Riot; M25	Grenade	Riot	Hand	CN	M25	1
Army	Grenade; Hand; Practice; M30	Grenade		Hand	Practice	M30	1
Army	Grenade; Hand; Smoke; WP; M34	Grenade		Hand	Smoke (WP)	M34	3
Army	Grenade; Hand; Smoke; M48	Grenade		Hand	Smoke	M48	1
Army	Grenade; Hand; Practice; M62	Grenade		Hand	Practice	M62	1
Army	Grenade; Hand; fragmentation; M67	Grenade		Hand	Fragmentation	M67	3
Army	Grenade; Hand; Practice; M69	Grenade		Hand	Practice	M69	1
Army	Grenade; Hand; Riot; CN; M7 Series	Grenade	Riot	Hand	CN	M7 SERIES	1
Army	Grenade; General Purpose; Practice; M75	Grenade	General purpose	Hand	Practice	M75	1
Army	Grenade; Hand Riot; CS; M7A3	Grenade	Riot	Hand	CS	M7A3	1
Army	Grenade; Hand; Illumination; Mk1	Grenade		Hand	Illumination	Mk1	1
Army	Grenade; Hand; training; Mk1A1	Grenade		Hand	Training	Mk1A1	0
Army	Grenade; Fragmentation; Mk2	Grenade		Hand	Fragmentation	Mk2	3
Army	Grenade; Hand; Fragmentation; Mk2	Grenade		Hand	Fragmentation	Mk2	3
Army	Grenade; Hand; Practice; Mk2	Grenade		Hand	Practice	Mk2	1
Army	Grenade; Hand; offensive; Mk3	Grenade		Hand	HE, Fragmentation, or WP	Mk3	3
Army	Igniter; time Fuze; blasting; M2	Igniter	Fuze, time		Primer	M2	1
Army	Igniter; M2	Igniter			WP	M23	3

Mil Dep	Munitions Item	Munitions Group	Sub-Group	Size / Caliber	Type	Mark / Model	MEC Hazard Code
Army	Igniter; fuze; time; M60	Igniter	Fuze, time		Primer	M60	1
Army	Mine; anti-personnel; M18A1 (claymore)	Mine	Anti-personnel		HE	M18A1	3
Army	Mine; anti-tank; Practice; M10	Mine	Anti-tank		Practice	M10	1
Army	Mine; anti-personnel; Practice; M12	Mine	Anti-personnel		Practice	M12	1
Army	Mine; anti-personnel; Practice; M16	Mine	Anti-personnel		Practice	M16	0
Army	Mine; anti-personnel; Practice M16A1	Mine	Anti-personnel		Practice	M16A1	0
Army	Mine; anti-personnel; Practice; M18A1	Mine	Anti-personnel		Practice	M18A1	0
Army	Mine; anti-tank; Practice; M1A1	Mine	Anti-tank		Practice	M1A1	1
Army	Mine; Anti-tank; M20	Mine	Anti-tank		AT	M20	1
Army	Mine; anti-tank; Practice; M20	Mine	Anti-tank		Practice	M20	1
Army	Mine; Anti-personnel; Practice; M2A1B1	Mine	Anti-personnel		Practice	M2A1B1	1
Army	Mine; Anti-personnel; Practice; M8 series	Mine	Anti-personnel		Practice	M8 series	1
Army	Mine; anti-tank; Simulator; M80	Mine	Anti-tank		Simulator	M80	0
Army	Mine; Anti-personnel; Practice; Non-metallic; T-34	Mine	Anti-personnel		Practice	T-34	1
Army	Missile; guided; HEAT; M222 (DRAGON)	Missile	Guided		HEAT	M222, DRAGON	3
Army	Missile; guided; Practice; M231 (Dragon)	Missile	Guided		Practice	M231, DRAGON	1
Army	Mortar; 81mm; Illumination; M301 series	Mortar		81mm	Illumination	M301 series	2
Army	Mortar; 81mm; HE; M362	Mortar		81mm	HE	M362	3
Army	Mortar; 81mm; HE; M374 series	Mortar		81mm	HE	M374 series	3
Army	Mortar; 81mm; Smoke; WP; M375 Series	Mortar		81mm	Smoke (WP)	M375 Series	3
Army	Mortar; 81mm; HE; M43 series	Mortar		81mm	HE	M43 series	3
Army	Mortar; 81mm; Practice; M43 series	Mortar		81mm	Practice	M43 series	2
Army	Mortar; 81mm; HE; M56	Mortar		81mm	HE	M56	3
Army	Mortar; 81mm; Smoke; WP; M57 series	Mortar		81mm	Smoke (WP)	M57 series	3
Army	Mortar; 81mm; Training; M68	Mortar		81mm	Training	M68	0
Army	Mortar; 81mm; Illumination; M853A1	Mortar		81mm	Illumination	M853A1	2
Army	Mortar; 81mm; Flare Shell; T-23 (experimental)	Mortar		81mm	Flare	T-23	1
Army	Mortar; 60mm; Smoke; WP; M302	Mortar		60mm	Smoke (WP)	M302	3
Army	Mortar; 60mm; HE; M49 series	Mortar		60mm	HE	M49 series	3
Army	Mortar; 60mm; Practice; M50 series	Mortar		60mm	Practice	M50 series	2
Army	Mortar; 60mm; Training; M69	Mortar		60mm	Training	M69	0
Army	Mortar; 60mm; HE; M720	Mortar		60mm	HE	M720	3
Army	Mortar; 60mm; Illumination; M721	Mortar		60mm	Illumination	M721	2
Army	Mortar; 60mm; Illumination; M83 series	Mortar		60mm	Illumination	M83 series	2
Army	Mortar; 60mm; HE; 4-inch; MK1 (stokes)	Mortar		4-inch	HE	Mk I (Stokes)	3
Army	Mortar; 4-inch; Practice; 4-inch; Mk 1 (stokes)	Mortar		4-inch	Practice	Mk I (Stokes)	1
Army	Mortar; 4-inch; Screening Smoke; FM (Stokes)	Mortar		4-inch	Screening smoke (FM)	Stokes	3
Army	Mortar; 4-inch; Smoke; HC; Stokes	Mortar		4-inch	Smoke (HC)	Stokes	2
Army	Mortar; 4-inch; White Phosphorus; Stokes	Mortar		4-inch	WP	Stokes	3
Army	Mortar; 4.2-inch; HE; M3 series	Mortar		4.2-inch	HE	M3 series	3
Army	Mortar; 4.2-inch; Smoke; WP; M328	Mortar		4.2-inch	Smoke (WP)	M328	3
Army	Mortar; 4.2-inch; HE; M329 series	Mortar		4.2-inch	HE	M329 series	3
Army	Mortar; 4.2-inch; Illumination; M335 series	Mortar		4.2-inch	Illumination	M335 series	2
Army	Mortar; 3-inch; Practice; Mk 1	Mortar		3-inch	Practice	Mk 1	1

Mil Dep	Munitions Item	Munitions Group	Sub-Group	Size / Caliber	Type	Mark / Model	MEC Hazard Code
Army	Mortar; 3-inch; HE; MK I (Stokes)	Mortar		3-inch	HE	Mk I (Stokes)	3
Army	Mortar; 3-inch; Practice; Mk III (Stokes)	Mortar		3-inch	Practice	Mk III (Stokes)	1
Army	Pot; Smoke; Screening; 5lb;	Pot		5-lb.	Smoke, screening		1
Army	Pot; Smoke; Screening; 2.5lb; M1	Pot		2.5-lb.	Smoke, screening	M1	1
Army	Pot; Smoke; Screening; 10lb; M1	Pot		10-lb.	Smoke, screening	M1	1
Army	Pot; Smoke; Mk 3	Pot			Smoke	Mk 3	1
Army	Primer; igniter tube; M5	Primer	Igniter tube		Primer, smokeless powder	M5	1
Army	Primer; igniter tube; M57	Primer	Igniter tube		Primer, smokeless powder	M57	1
Army	Primer; ignition; percussion; M82	Primer	Percussion		Primer, smokeless powder	M82	1
Army	Primer; ignition; percussion; Mk 2	Primer	Percussion		Primer, smokeless powder	Mk 2	1
Army	Projectile; 90mm; HEAT; M348	Projectile		90mm	HEAT	M348	3
Army	Projectile; 90mm; HEAT; M371A1	Projectile		90mm	HEAT	M371A1	3
Army	Projectile; 90mm; HE-T; M71	Projectile		90mm	HE-T	M71	3
Army	Projectile; 8-inch; HE; M106 Series	Projectile		8-inch	HE	M106 Series	3
Army	Projectile; 84mm; HEAT; RAP/551	Projectile	RAP	84mm	HEAT	FFV 551	3
Army	Projectile; 84mm; HEAT; M134 (AT4)	Projectile		84mm	HEAT	M134 (AT4)	3
Army	Projectile; 84mm; HEAT; M136 series	Projectile		84mm	HEAT	M136 series	3
Army	Projectile; 76mm; AP-T; M339	Projectile		76mm	AP-T	M339	0
Army	Projectile; 76mm; HE; M352	Projectile		76mm	HE	M352	3
Army	Projectile; 76mm; Canister; M363	Projectile	Canister	76mm	Inert - Steel balls	M363	0
Army	Cartridge, 76mm, Canister, M363	Projectile	Cartridge	76mm	Propelling charge and primer + steel balls	M363	1
Army	Projectile; 76mm; AP-T; M62	Projectile		76mm	AP-T	M62	0
Army	Projectile; 75mm; HE; M309	Projectile		75mm	HE	M309	3
Army	Projectile; 75mm; Smoke; WP; M311	Projectile		75mm	Smoke (WP)	M311	3
Army	Cartridge; 75mm; blank; M337	Projectile	Cartridge	75mm	Blank	M337	2
Army	Projectile; 75mm; HE; M41A1	Projectile		75mm	HE	M41A1	3
Army	Projectile; 75mm; HE; M48	Projectile		75mm	HE	M48	3
Army	Projectile; 75mm; HE; MK 1	Projectile		75mm	HE	MK 1	3
Army	Projectile; 75mm; Shrapnel; Mk 1	Projectile		75mm	Shrapnel	Mk 1	3
Army	Projectile; 57mm; HE; M306 series	Projectile		57mm	HE	M306 series	3
Army	Projectile; 57mm; TP; M306 series	Projectile		57mm	TP	M306 series	1
Army	Projectile; 57mm; HEAT; M307	Projectile		57mm	HEAT	M307	3
Army	Projectile; 57mm; Smoke; WP; M308 series	Projectile		57mm	Smoke (WP)	M308 series	3
Army	Projectile; 57mm; AP-T; M64	Projectile		57mm	AP-T	M64	0
Army	Projectile; 57mm; AP-T; M70	Projectile		57mm	AP-T	M70	0
Army	Projectile; 57mm; AP-T; M78	Projectile		57mm	AP-T	M78	0
Army	Projectile; 40mm; HE; M381	Projectile		40mm	HE	M381	3
Army	Projectile; 40mm; Practice; M382	Projectile		40mm	Practice	M382	1
Army	Projectile; 40mm; HE; M383	Projectile		40mm	HE	M383	3
Army	Projectile; 40mm; HE; M384	Projectile		40mm	HE	M384	3
Army	Projectile; 40mm; Practice; M385	Projectile		40mm	Practice	M385	0

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Army	Projectile; 40mm; HE; M386	Projectile		40mm	HE	M386	3
Army	Projectile; 40mm; HE; M397	Projectile		40mm	HE	M397	3
Army	Projectile; 40mm; Practice; M407A1	Projectile		40mm	Practice	M407A1	1
Army	Projectile; 40mm; HEDP; M430	Projectile		40mm	HEDP	M430	3
Army	Projectile; 40mm; HEDP; M433	Projectile		40mm	HEDP	M433	3
Army	Projectile; 40mm; HE; M441	Projectile		40mm	HE	M441	3
Army	Cartridge; 40mm; Multipurpose; M576	Projectile	Cartridge	40mm	Expelling charge	M576	1
Army	Projectile; 40mm; Signal; M583A1	Projectile		40mm	Signal	M583A1	1
Army	Projectile; 40mm; Cluster; M585	Projectile	cluster	40mm	Star	M585	1
Army	Projectile; 40mm; CS; M651	Projectile		40mm	CS	M651	1
Army	Projectile; 40mm; Parachute; star; M661	Projectile	Parachute	40mm	Star	M661	1
Army	Projectile; 40mm; Parachute; star; M662	Projectile	Parachute	40mm	Star	M662	1
Army	Projectile; 40mm; Canopy; yellow Smoke; M676	Projectile	canopy	40mm	Smoke (Yellow)	M676	1
Army	Projectile; 40mm; HE-T; M677	Projectile		40mm	HE-T	M677	3
Army	Projectile; 40mm; Smoke; M680	Projectile		40mm	Smoke	M680	1
Army	Projectile; 40mm; Smoke; M682	Projectile		40mm	Smoke	M682	1
Army	Projectile; 40mm; Smoke; M713 series	Projectile		40mm	Smoke	M713 series	1
Army	Projectile; 40mm; Practice; M781	Projectile		40mm	Practice	M781	0
Army	Projectile; 40mm; Practice; M918	Projectile		40mm	Practice	M918	1
Army	Projectile; 40mm; HE-T; MK2 series	Projectile		40mm	HE-T	MK2 series	3
Army	Projectile; 3-inch; Hotchkiss	Projectile		3-inch	HE	Hotchkiss	3
Army	Projectile; 3-inch; Practice M42 series	Projectile		3-inch	Practice	M42 series	2
Army	Projectile, 3-inch Common, Mk 3 Mod 7	Projectile	Common	3-inch	HE	Mk 3 Mod 7	3
Army	Projectile; 37mm; HE; M43	Projectile		37mm	HE	M43	3
Army	Projectile; 37mm; AP-T; M51 series	Projectile		37mm	AP-T	M51 series	0
Army	Projectile; 37mm; HE; M54	Projectile		37mm	HE	M54	3
Army	Projectile; 37mm; TP; M55	Projectile		37mm	Target Practice	M55	1
Army	Projectile; 37mm; APC-T; M59	Projectile		37mm	APC-T	M59	0
Army	Projectile; 37mm; HE; M63	Projectile		37mm	HE	M63	3
Army	Cartridge, 37mm TP, M63 Mod 1	Projectile		37mm	TP	M63 Mod 1	2
Army	Projectile; 37mm; AP-T; M74	Projectile		37mm	AP-T	M74	0
Army	Projectile; 37mm; AP-T; M80	Projectile		37mm	AP-T	M80	0
Army	Projectile; 37mm; LE; Mk 1	Projectile		37mm	LE	Mk 1	3
Army	Projectile; 37mm; HE; MK II	Projectile		37mm	HE	MK II	3
Army	Projectile; 37mm; LE; MK II	Projectile		37mm	LE	MK II	3
Army	Projectile; 37mm; LE; MK1	Projectile		37mm	LE	MK1	3
Army	Cartridge; 35mm; Riot Control; E 23; Civilian	Projectile	Cartridge	35mm	Riot control	E 23	1
Army	Projectile; 30mm; TP; M788	Projectile		30mm	TP	M788	0
Army	Projectile; 3.2-inch; Shrapnel	Projectile		3.2-inch	Shrapnel	--	3
Army	Projectile; 25mm; subcaliber; M379	Projectile	Subcaliber	25mm		M379	1
Army	Projectile; 25mm; subcaliber; TP-T; M793	Projectile	Subcaliber	25mm	TP-T	M793	1
Army	Projectile; 22mm; subcaliber; Practice; M744	Projectile	Subcaliber	22mm	Primer and pyrotechnic mixture	M744	1
Army	Projectile; 20mm; TP; M204	Projectile		20mm	TP	M204	0

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Army	Cartridge; 20mm; TP; M204	Projectile	Cartridge	20mm	TP	M204	1
Army	Projectile; 20mm; TP-T; M206A1	Projectile		20mm	TP-T	M206A1	0
Army	Projectile; 20mm; TP; M220	Projectile		20mm	TP	M220	0
Army	Projectile; 20mm; AP; Incendiary; M53	Projectile		20mm	AP, Incendiary	M53	1
Army	Cartridge; 20mm; TP; M55A22	Projectile	Cartridge	20mm	TP	M55A2	0
Army	Cartridge; 20mm HEI; M56A1, M56A2, M56A3, M56A4	Projectile	Cartridge	20mm	HE, Incendiary	M56A3, M56A4	3
Army	Projectile; 20mm; high explosive Incendiary; M56A3	Projectile		20mm	HEI	M56A3	3
Army	Projectile; 20mm; AP-T; M95	Projectile		20mm	AP-T	M95	0
Army	Projectile; 20mm; Incendiary; M96	Projectile		20mm	Incendiary	M96	2
Army	Cartridge, 20mm HEI, M97A2	Projectile	Cartridge	20mm	HE, Incendiary	M97A2	3
Army	Projectile; 20mm; target Practice (TP); M99	Projectile		20mm	TP	M99	0
Army	Projectile; 20mm; Practice; Mk 105	Projectile		20mm	Practice	Mk 105	0
Army	Projectile; 20mm; Practice; Mk 11	Projectile		20mm	TP	Mk 11	0
Army	Projectile; 20-lb. to 60-lb.; Livens; M1, M2, M2A1	Projectile	Livens Projector	20-lb. to 60-lb.	Smoke	M1, M2, M2A1 (FM, FS)	3
Army	Projectile; 155mm; HE; M107	Projectile		155mm	HE	M107	3
Army	Projectile; 155mm; Smoke; BE; M116 series	Projectile		155mm	Smoke	M116 series	2
Army	Projectile; 155mm; Illumination; M118 series	Projectile		155mm	Illumination	M118 series	2
Army	Projectile; 155mm; Illumination; M485 series	Projectile		155mm	Illumination	M485 series	2
Army	Projectile; 155mm; Shrapnel; Mk 1	Projectile		155mm	Shrapnel	Mk 1	3
Army	Projectile; 14.5mm; Practice; Subcaliber; M183A1	Projectile	Subcaliber	14.5mm	pyrotechnic mixture	M183A1	1
Army	Projectile; 105mm; HE; M1	Projectile		105mm	HE	M1	3
Army	Projectile; 105mm; Illumination; M314 series	Projectile		105mm	Illumination	M314 series	2
Army	Projectile; 105mm; TP-T; M67 series	Projectile	Target Practice	105mm	TP-T	M67 series	0
Army	Projectile; 105mm; Smoke; HC; M84 series	Projectile		105mm	Smoke (HC)	M84 series	2
Army	Propellant; wafers; mortar; 60mm;	Propellant	Mortar	60mm		wafers	1
Army	Pyrotechnic; Mixture; 2-lb.;	Pyrotechnic	mixture	2-lb.	Smoke		1
Army	Pyrotechnic; Mixture; Smoke; 1-lb.; M22	Pyrotechnic	mixture	1-lb.	Smoke	M22	1
Army	Pyrotechnic; Mixture; 0.5-lb.; M22	Pyrotechnic	mixture	0.5-lb.	Smoke	M22	1
Army	Pyrotechnic; Mixture; 0.25-lb.;	Pyrotechnic	mixture	0.25-lb.	Smoke		1
Army	Rocket, 83mm SMAW-HEDP, Mk 1	Rocket	SMAW	83mm	HE	Mk 1, HEDP	3
Army	Rocket; 66mm; HEAT; M72 series	Rocket		66mm	HEAT	M72 series	3
Army	Rocket; 66mm; Incendiary; TPA; M74	Rocket		66mm	Incendiary, TPA	M74	3
Army	Rocket; 4.5-inch; Practice; M17	Rocket		4.5-inch	Practice	M17	0
Army	Rocket; Barrage; 4.5-inch; HE; Mk 3	Rocket	Barrage	4.5-inch	HE	Mk 3	3
Army	Rocket; Barrage; 4.5-inch; Practice; Mk 3	Rocket		4.5-inch	Practice	Mk 3	0
Army	Rocket; Barrage; 4.5-inch; MK I 3; MOD 0	Rocket	Barrage	4.5-inch	HE	Mk I 3, MOD 0	3
Army	Rocket; 35mm; Practice; Subcaliber; M73	Rocket	Practice, Subcaliber	35mm	Primer and pyrotechnic mixture	M73	1
Army	Rocket; 3.5-inch; HEAT; M28 series	Rocket		3.5-inch	HEAT	M28 series	3
Army	Rocket; 3.5-inch; Practice; M29 series	Rocket		3.5-inch	Practice	M29 series	0
Army	Rocket; 3.5-inch; Smoke; WP; M30	Rocket		3.5-inch	Smoke (WP)	M30	3
Army	Rocket; 2.75-inch; HE; M247	Rocket	Subcaliber	2.75-inch	HE	M247	3
Army	Rocket; 2.36-inch; Smoke; WP; M10	Rocket		2.36-inch	Smoke (WP)	M10	3

Mil Dep	Munitions Item	Munitions Group	Sub-Group	Size / Caliber	Type	Mark / Model	MEC Hazard Code
Army	Rocket; 2.36-inch; HEAT; 2.36-inch; M6	Rocket		2.36-inch	HEAT	M6	3
Army	Rocket; 2.36-inch; Practice; M7	Rocket		2.36-inch	Practice	M7	0
Army	Rocket; guidance motors/igniters (Dragon)	Rocket	Guided, Motors/Igniters		Propellant	Dragon	1
Army	Signal; Smoke; Ground; parachute; M129 series	Signal	Smoke		Smoke	M129 series	2
Army	Signal; Smoke; Ground; M62	Signal	Smoke		Smoke	M62	1
Army	Signal; Smoke; Ground; M65 series	Signal	Smoke		Smoke	M65 series	1
Army	Signal; Illumination; aircraft; AN-M37 series	Signal			Illumination	AN-M37 series	1
Army	Signal; Illumination; AN-M38A2	Signal			Illumination	AN-M38A2	1
Army	Signal; Illumination; AN-M39A2	Signal			Illumination	AN-M39A2	1
Army	Signal; Illumination; AN-M42A2	Signal			Illumination	AN-M42A2	1
Army	Signal; Illumination; AN-M43 series	Signal			Illumination	AN-M43 series	1
Army	Signal; Illumination; AN-M44 series	Signal			Illumination	AN-M44 series	1
Army	Signal; Illumination; AN-M54A2	Signal			Illumination	AN-M54A2	1
Army	Signal; Smoke and Illumination; marine; AN-Mk 13;MOD 0	Signal			Smoke and illumination	AN-Mk 13, MOD 0	1
Army	Signal; Illumination; comet 1260	Signal			Illumination	Comet 1260	1
Army	Signal; Illumination; Ground; M125 series	Signal			Illumination	M125 series	2
Army	Signal; Illumination; Ground; green star cluster; M125A1	Signal			Illumination	M125A1	1
Army	Signal; Illumination; Ground; M126 series	Signal			Illumination	M126 series	2
Army	Signal; Illumination; Ground; M127 series	Signal			Illumination	M127 series	2
Army	Signal; Smoke; Ground; M128A1	Signal			Smoke	M128A1	2
Army	Signal; Smoke; Ground; M129A1	Signal			Smoke	M129A1	2
Army	Signal; Illumination; Ground; M131	Signal			Illumination	M131	2
Army	Signal; Illumination; Ground; M158	Signal			Illumination	M158	2
Army	Signal; Illumination; Ground; M159	Signal			Illumination	M159	2
Army	Signal; Smoke; Ground; M166 series	Signal			Smoke	M166 series	1
Army	Signal; Smoke; Ground; M168	Signal			Smoke	M168	1
Army	Signal; Ground; Rifle; parachute; M17 series	Signal	Parachute, rifle		Illumination	M17 series	1
Army	Signal; Rifle; Illumination; M17A1	Signal			Illumination	M17A1	1
Army	Signal; Illumination; M187	Signal			Illumination	M187	1
Army	Signal; Illumination; M188	Signal			Illumination	M188	1
Army	Signal; Illumination; M189	Signal			Illumination	M189	1
Army	Signal; Illumination; Ground; parachute; Rifle; M19 series	Signal			Illumination	M19 series	1
Army	Signal; Illumination; M190	Signal			Illumination	M190	1
Army	Signal; Illumination; M195	Signal			Illumination	M195	1
Army	Signal; Illumination; Ground; M20A1	Signal			Illumination	M20A1	1
Army	Signal; Illumination; Ground; M21A1	Signal			Illumination	M21A1	1
Army	Signal; Illumination; M51A1	Signal			Illumination	M51A1	1
Army	Signal; Illumination; Ground; M52A1	Signal			Illumination	M52A1	1
Army	Simulator; Projectile; Ground burst; M115A2	Simulator	Projectile		Photoflash Powder	M115A2	2
Army	Simulator; Projectile; airburst; M27A1B1	Simulator	Projectile, airburst		Pyrotechnic mixture	M27A1B1	1
Army	Simulator; Projectile; airburst; M74 series	Simulator	Projectile, airburst		Primer and pyrotechnic mixture	M74 series	1
Army	Simulator; Grenade; Hand; M116A1	Simulator	Grenade		Photoflash Powder	M116A1	2

Mil Dep	Munitions Item	Munitions Group	Sub-Group	Size / Caliber	Type	Mark / Model	MEC Hazard Code
Army	Simulator; flash artillery; M110	Simulator	Flash artillery		Pyrotechnic mixture	M110	1
Army	Simulator; Flash artillery; M21	Simulator	Flash artillery		Pyrotechnic mixture	M21	1
Army	Simulator; explosive booby trap; flash; M117	Simulator	Explosive booby trap		Flash	M117	1
Army	Simulator; explosive booby trap; Illumination; M118	Simulator	Explosive booby trap		Illumination	M118	1
Army	Simulator; explosive booby trap; whistling; M119	Simulator	Explosive booby trap		Whistling	M119	1
Army	Simulator; Detonation; explosive; M80	Simulator	Detonation		Pyrotechnic mixture	M80	1
Army	Simulator; Blast; stinger; civilian; M15	Simulator	Blast		Pyrotechnic mixture	M15, civilian	2
Army	Simulator; launching; Anti-tank Guided Missile and Rocket; M22	Simulator	Launching		Primer and pyrotechnic mixture	M22	1
Army	Squib; Rocket; Simulator	Squib	Rocket, simulator		Pyrotechnic mixture		1
Army	Squib; electric	Squib	Electric		Pyrotechnic mixture		1
Navy	76mm HE-M77 Naval Ammunition	Projectile		76mm	HE / Fragmentation	M77 Naval Ammunition	3
Navy	HE-SAPOMER (High Explosive Semi-Armor Piercing OTO Munition Extended Range):	Projectile		76mm	HE	SAPOMER	3
Navy	EX 171; Extended Range Guided Munition (ERGM)	Projectile	ERGM / Rocket	5-inch	HE	EX 171	3
Navy	Mark 91 Illum-MT	Projectile		5-inch	Illumination	Mark 91	2
Navy	Projectile; 5-inch; HC; Mk 41 Mod 0	Projectile		5-inch	HE	Mk 41 Mod 0	3
Navy	Projectile; 5-inch; Special Common; Mk 42 Mod 0; 1	Projectile	Special Common	5-inch	HE	Mk 42 Mod 0, 1	3
Navy	Projectile; 5-inch; Special Common; Mk 46 Mod 1; 2	Projectile	Special Common	5-inch	HE	Mk 46 Mod 1, 2	3
Navy	Projectile; 5-inch; AA Common; Mk 47 Mod 0; 1	Projectile	Common	5-inch	HE	Mk 47 Mod 0, 1	3
Navy	Mark 80 HE-PD	Projectile		5-inch	HE	Mk 80 HE-PD	3
Navy	Projectile; 5-inch; Window	Projectile	Window	5-inch	Black powder	Window	2
Navy	57mm Mk 295 Mod 0 3P-HE Fuzed Cartridge	Projectile	Cartridge	57mm	HE	Mk 295 Mod 0 3P	3
Navy	Cartridge; 40mm; HEI-T; SD; Mk 2	Projectile	Cartridge	40mm	HEI-T	SD, Mk2	3
Navy	Cartridge; 40mm; HE-T; SD; Mk 2	Projectile	Cartridge	40mm	HE-T	SD, Mk2	3
Navy	Projectile; 3-inch; AA; Mk 27 Mod 1; 2, 3	Projectile	Anti-aircraft	3-inch	HE	Mk 27 Mod 1-3	3
Navy	(U.S. Projectile; 3-inch) AA Mark 34 Mod 1	Projectile	Anti-aircraft	3-inch	HE	Mk 34 Mod 1	3
Navy	Cartridge; 37mm; TP-T; M55A1	Projectile	Cartridge	37mm	TP-T	M55A1	1
Navy	Cartridge; 37mm; HE-T; SD; M54	Projectile	Cartridge	37mm	HE-T	SD, M54	3
Navy	Cartridge; 20mm; HE-T; Mk 4 Mod 1 - 28; Mk 7	Projectile	Cartridge	20mm	HE-T	Mk 4 Mod 1-28 Mk 7	3
Navy	Cartridge; 20mm; HE; HEI; Mk 3 Mod 1 - 64	Projectile	Cartridge	20mm	HE, HEI	Mk 3 Mod 1-64	3
Navy	Projectile; 1.1-inch; AA; Mk 1 Mod 0 - 28; Mk SD 1	Projectile	Anti-aircraft	1.1-inch	AA (Anti-aircraft)	Mk 1 Mod 0-28 Mk SD 1	3

Appendix III: RMM Summary Worksheet

ASSESSMENT AREA:

RISK SCENARIO:

Matrix 1: Likelihood of Encounter

LIKELIHOOD OF ENCOUNTER (Likelihood of MEC Presence vs. Exposure)		EXTENT OF EXPOSURE			
		Full (>90% coverage)	Partial	Limited	Minimal (<10% coverage)
LIKELIHOOD OF MEC PRESENCE	**HUA**: likelihood of MEC is **HIGH**.	5	5	5	5
	HUA: likelihood of MEC is **MODERATE**.	5	5	4	4
	LUA: likelihood of MEC is **LOW**.	3	2	2	1
	LUA: likelihood of MEC is **VERY LOW**.	2	2	1	1
	No evidence MEC remain	1	1	1	1
	NEU: no evidence of munitions use.				

Rationale for Selected Extent of Exposure:

Rationale for Selected Likelihood of MEC Presence:

Matrix 2: Likelihood of Interaction

LIKELIHOOD OF INTERACTION (Likelihood of Activities in Interaction Zone vs. Likelihood of Encounter)		LIKELIHOOD OF ENCOUNTER (FROM MATRIX 1)*				
		5 (highest)	4	3	2	1 (lowest)
FREQUENCY OF ACTIVITIES IN INTERACTION ZONE	**Frequent** activities occur in interaction zone that may result in an interaction with munitions	A	A	B	B	D
	Occasional activities occur in interaction zone that may result in an interaction with munitions	A	B	B	B	D
	Infrequent activities occur in interaction zone that may result in an interaction with munitions	B	B	B	C	E
	Unlikely that activities occur in interaction zone that may result in an interaction with munitions	B	C	C	C	E

Rationale for Selected Likelihood of Activities in Interaction Zone:

Matrix 3: Risk of Harmful Incident

RISK OF HARMFUL INCIDENT (MEC Code vs. Likelihood of Interaction)		LIKELIHOOD OF INTERACTION (FROM MATRIX 2)				
		A	B	C	D	E
MUNITION MEC CODE	High (MEC Code 3)	Unacceptable	Unacceptable	Unacceptable	Unacceptable	Acceptable
	Moderate (MEC Code 2)	Unacceptable	Unacceptable	Unacceptable	Acceptable	Acceptable
	Low (MEC Code 1)	Unacceptable	Unacceptable	Acceptable	Acceptable	Acceptable
	Presents No Explosive Hazard (MEC Code 0)	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
	No Evidence MEC Remain					
	NEU					

Rationale for Selected MEC Code:

Appendix IV: RMM Matrix Scenario Summaries

The tables below present the results of every possible RMM scenario, showing whether the outcome will be an *acceptable* or *unacceptable* risk of explosive incident for each combination of matrix inputs. OSD produced these summary tables to check that the various outcomes were considered reasonable for the related inputs. OSD slightly refined the matrices in response to this evaluation. For example, when the Likelihood of MEC Presence is *high* and the MEC Code is *1* or higher, the risk of harmful incident should always be *unacceptable*, regardless of other factors. Various outcomes that are reflected in the matrices are listed below.

MEC Code 0, No Evidence MEC Remain, or NEU

If the munition item presents no explosive hazard (MEC Code 0), there is no evidence MEC remain, or it is an NEU area, the risk of harmful incident is always *acceptable*.

MEC Code 3

If the munition item is a MEC Code 3, the risk of harmful incident is always *unacceptable* unless:

1) The likelihood of MEC presence is LOW (LUA LOW), the extent of exposure is minimal, and the frequency of activities in the interaction zone is infrequent or unlikely.

2) The likelihood of MEC presence is VERY LOW (LUA VERY LOW), the extent of exposure is limited or minimal, and the frequency of activities in the interaction zone is infrequent or unlikely.

HUA HIGH

If the likelihood of MEC presence is HIGH (HUA HIGH), the risk of harmful incident is always *unacceptable*.

HUA MODERATE

If the likelihood of MEC presence is MODERATE (HUA MODERATE), the risk of harmful incident is almost always *unacceptable.* The only exceptions are when the extent of exposure is limited or minimal, the frequency of activities in the interaction zone is unlikely, and the munition item is a MEC Code 1 then the risk of harmful incident is *acceptable*.

LUA LOW

If the likelihood of MEC presence is LOW (LUA LOW) and the extent of exposure is full, the risk of harmful incident is always *unacceptable* unless the frequency of activities in the interaction zone is unlikely, and the munition item is a MEC Code 1.

If the likelihood of MEC presence is LOW (LUA LOW) and the extent of exposure is partial or limited, the risk of harmful incident is always *unacceptable* unless the frequency of activities in the interaction zone is infrequent or unlikely and the munition item is a MEC Code 1.

If the likelihood of MEC presence is LOW (LUA LOW) and the extent of exposure is minimal, the risk of harmful incident is always *acceptable* unless the frequency of activities in the interaction zone is frequent or occasional and the munition item is a MEC Code 3.

LUA VERY LOW

If the likelihood of MEC presence is VERY LOW (LUA VERY LOW) and the extent of exposure is full or partial, the risk of harmful incident is always *unacceptable* unless the frequency of activities in the interaction zone is infrequent or unlikely and the munition item is a MEC Code 1.

If the likelihood of MEC presence is VERY LOW (LUA VERY LOW) and the extent of exposure is limited or minimal, the risk of harmful incident is always *acceptable* unless the frequency of activities in the interaction zone is frequent or occasional and the munition item is a MEC Code 3.

HUA: Likelihood of MEC Is High

LIKELIHOOD OF MEC PRESENCE	EXTENT OF EXPOSURE	MATRIX 1 RESULT	FREQUENCY OF ACTIVITIES IN THE INTERACTION ZONE	MATRIX 2 RESULT	MUNITION MEC CODE	MATRIX 3 RESULT
HUA: Likelihood of MEC is high	Full	5	Frequent	A	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Occasional	A	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Infrequent	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Unlikely	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
	Partial	5	Frequent	A	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Occasional	A	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Infrequent	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Unlikely	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
	Limited	5	Frequent	A	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Occasional	A	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Infrequent	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Unlikely	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
	Minimal	5	Frequent	A	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Occasional	A	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Infrequent	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Unlikely	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable

HUA: Likelihood of MEC Is Moderate

LIKELIHOOD OF MEC PRESENCE	EXTENT OF EXPOSURE	MATRIX 1 RESULT	FREQUENCY OF ACTIVITIES IN THE INTERACTION ZONE	MATRIX 2 RESULT	MUNITION MEC CODE	MATRIX 3 RESULT
HUA: Likelihood of MEC is moderate	Full	5	Frequent	A	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Occasional	A	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Infrequent	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Unlikely	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
	Partial	5	Frequent	A	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Occasional	A	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Infrequent	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Unlikely	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
	Limited	4	Frequent	A	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Occasional	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Infrequent	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Unlikely	C	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Acceptable
	Minimal	4	Frequent	A	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Occasional	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Infrequent	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Unlikely	C	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Acceptable

LUA: Likelihood of MEC is Low

LIKELIHOOD OF MEC PRESENCE	EXTENT OF EXPOSURE	MATRIX 1 RESULT	FREQUENCY OF ACTIVITIES IN THE INTERACTION ZONE	MATRIX 2 RESULT	MUNITION MEC CODE	MATRIX 3 RESULT
LUA: Likelihood of MEC is low	Full	3	Frequent	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Occasional	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Infrequent	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Unlikely	C	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Acceptable
	Partial	2	Frequent	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Occasional	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Infrequent	C	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Acceptable
			Unlikely	C	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Acceptable
	Limited	2	Frequent	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Occasional	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Infrequent	C	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Acceptable
			Unlikely	C	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Acceptable
	Minimal	1	Frequent	D	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Acceptable
					Low (MEC Code 1)	Acceptable
			Occasional	D	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Acceptable
					Low (MEC Code 1)	Acceptable
			Infrequent	E	High (MEC Code 3)	Acceptable
					Moderate (MEC Code 2)	Acceptable
					Low (MEC Code 1)	Acceptable
			Unlikely	E	High (MEC Code 3)	Acceptable
					Moderate (MEC Code 2)	Acceptable
					Low (MEC Code 1)	Acceptable

LUA: Likelihood of MEC Is Very Low

LIKELIHOOD OF MEC PRESENCE	EXTENT OF EXPOSURE	MATRIX 1 RESULT	FREQUENCY OF ACTIVITIES IN THE INTERACTION ZONE	MATRIX 2 RESULT	MUNITION MEC CODE	MATRIX 3 RESULT
LUA: Likelihood of MEC is very low	Full	2	Frequent	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Occasional	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Infrequent	C	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Acceptable
			Unlikely	C	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Acceptable
	Partial	2	Frequent	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Occasional	B	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Unacceptable
			Infrequent	C	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Acceptable
			Unlikely	C	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Unacceptable
					Low (MEC Code 1)	Acceptable
	Limited	1	Frequent	D	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Acceptable
					Low (MEC Code 1)	Acceptable
			Occasional	D	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Acceptable
					Low (MEC Code 1)	Acceptable
			Infrequent	E	High (MEC Code 3)	Acceptable
					Moderate (MEC Code 2)	Acceptable
					Low (MEC Code 1)	Acceptable
			Unlikely	E	High (MEC Code 3)	Acceptable
					Moderate (MEC Code 2)	Acceptable
					Low (MEC Code 1)	Acceptable
	Minimal	1	Frequent	D	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Acceptable
					Low (MEC Code 1)	Acceptable
			Occasional	D	High (MEC Code 3)	Unacceptable
					Moderate (MEC Code 2)	Acceptable
					Low (MEC Code 1)	Acceptable
			Infrequent	E	High (MEC Code 3)	Acceptable
					Moderate (MEC Code 2)	Acceptable
					Low (MEC Code 1)	Acceptable
			Unlikely	E	High (MEC Code 3)	Acceptable
					Moderate (MEC Code 2)	Acceptable
					Low (MEC Code 1)	Acceptable