Military Munitions Support Services Webinar

FROM RISK TO REMEDIAL ALTERNATIVES

MMRP Feasibility Studies

28 August 2025

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MILITARY MUNITIONS SUPPORT SERVICES

M2S2 WEBINAR OVERVIEW – AUGUST 2025

Agenda

- Overview
  - Allyson Charbonnet (USACE EM CX)
- RMM: Thinking About Risk Scenarios
  - James Salisbury (USACE EM CX)
- Developing Site-Specific Remedial Alternatives for MRSs
  - James Salisbury (USACE EM CX)
- Exercise in Finding Viable Remedial Alternatives for an MRS
  - Marc Anderson (USACE Omaha)
- Alternatives Panels for MMRP Feasibility Studies
  - Julie Burdey (USACE EM CX)

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RMM: THINKING ABOUT RISK SCENARIOS

Presented by:

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USACE Environmental & Munitions Center of Expertise (EM CX)

28 August 2025

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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.

CRAMER.PAUL.D.1146906539

Paul D. Cramer
Principal Deputy Assistant Secretary of Defense
(Energy, Installations, and Environment)

Attachment:
As stated

WHY WE'RE DISCUSSING THIS

Common issue for the Risk Management Methodology (RMM) is using too few risk scenarios

– Some RMM evaluations only identify one

It is possible to evaluate risk using a single risk scenario

– Must be *absolute worst case*

HOWEVER, this is likely **NOT** the *best* way to do it

– Potentially ignores multiple risk pathways

– Does not tell the whole story

Most MRSs likely should have at least two or three risk scenarios

– Complex MRSs may have many more

Using too few risk scenarios may not describe the situation clearly enough to support sound risk management decisions

MOST MRSs ARE NOT HOMOGENEOUS

Risk of MEC exposure typically varies

- Different likelihoods of MEC presence
  - e.g., High Use Areas (HUAs), Low Use Areas (LUAs), an No Evidence of Use (NEU) areas
- Different receptor activities
  - Types of activities AND frequencies

Likelihood of MEC Presence	Types of Activities	
	HIGHER RISK → High likelihood, Lots of activity	High likelihood, Little activity
	Low likelihood, Lots of activity	Low likelihood, Little activity → LOWER RISK

So, it makes sense for us to consider these details when we evaluate risk

Using risk scenarios **HELPS** the RI/FS

- Improves the baseline MEC risk assessment
  - Outlines higher risk and lower risk areas
  - Shows areas where risk may be acceptable
- Supports development of Remedial Action Objectives (RAOs)
  - Contributes two of the three RAO elements
    - Contaminants and location(s)
    - Exposure pathways
- Guides development of remedial alternatives for the Feasibility Study
  - For some alternatives, MEC removal could be focused on higher risk areas
  - LUCs (only) could be proposed in lower risk areas

THE GOLDILOCKS PROBLEM

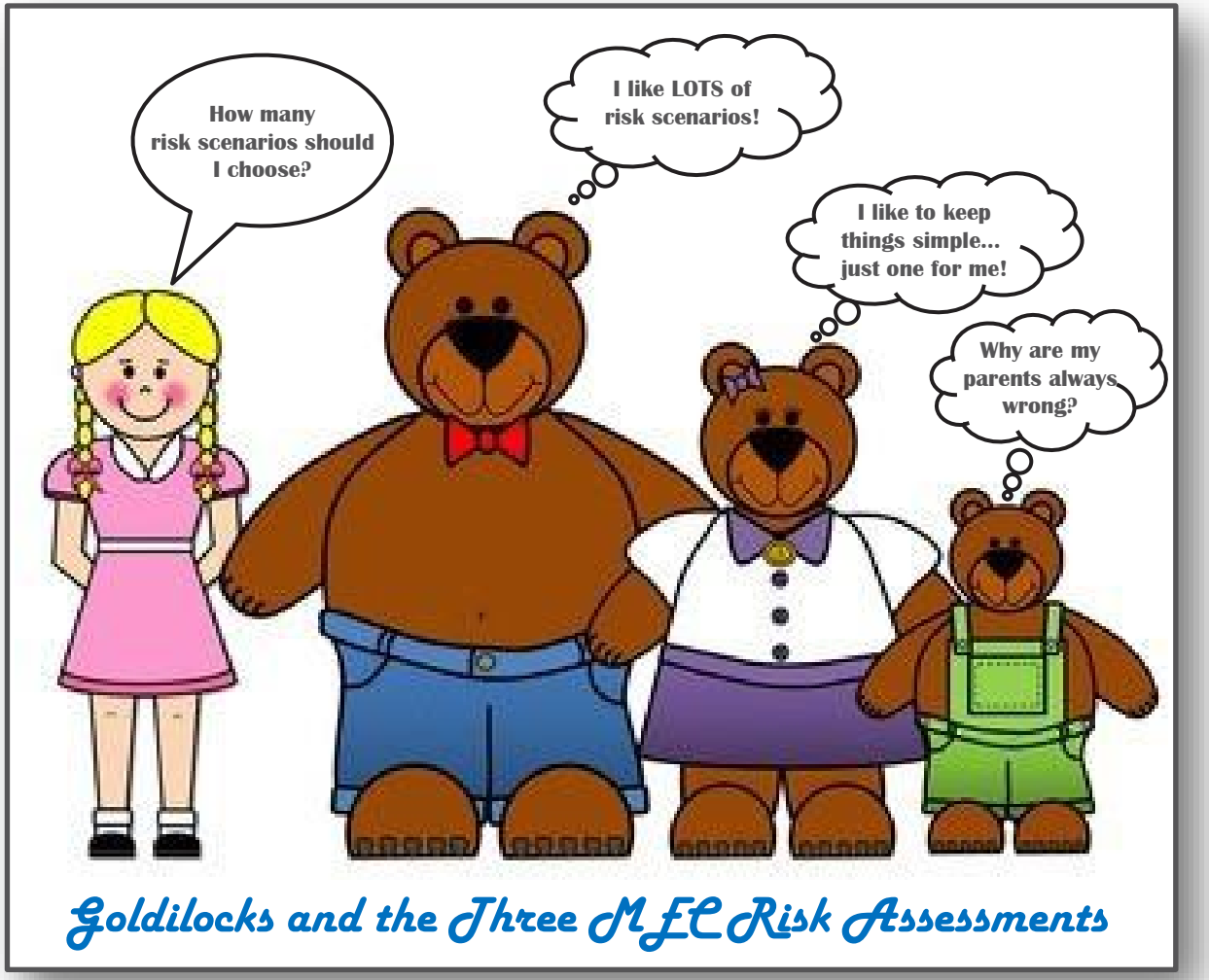
What are the best ways to do this?

– What does “too few” risk scenarios look like?
– Can we have too many risk scenarios?
– Is there a number that is “just right”?

NO!

– The “right” number of risk scenarios depends on your site and your project team
  - Each MRS is different
    – Different likelihoods of MEC presence
    – Different receptor activities
  - So, the number of risk scenarios will likely vary from MRS to MRS

BUT our approach to identifying them can be similar



SO, WHERE DO WE START?

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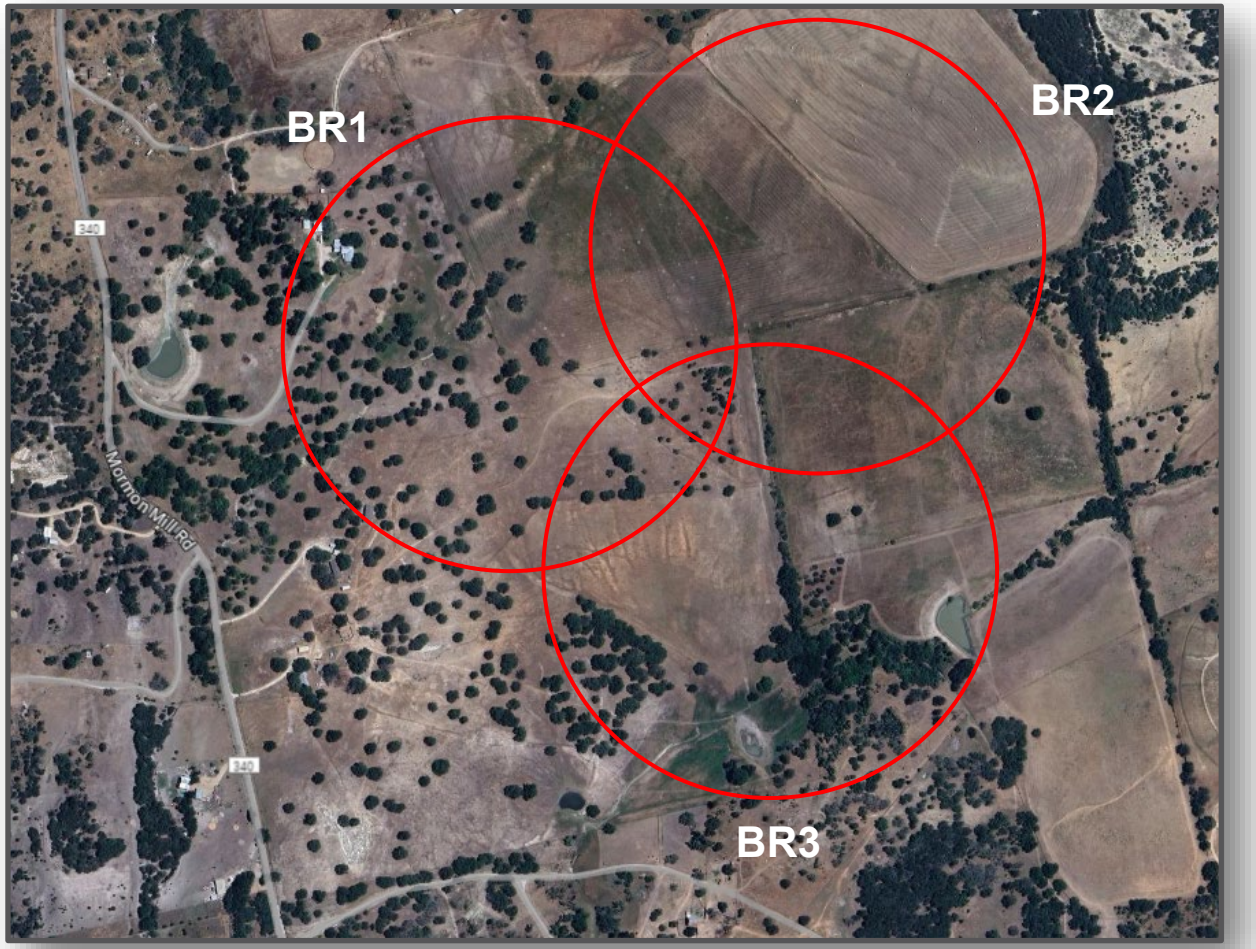
It should not surprise anyone that we start by looking at

- Different likelihoods of MEC presence
  - e.g., HUA, LUA, NEU
- Different receptor activities
  - Types of activities AND frequencies

These are the variables affecting risk of MEC exposure

- In other words,…

Likelihood of MEC Presence	Types of Activities	
HIGHER RISK	High likelihood, Lots of activity	High likelihood, Little activity
	Low likelihood, Lots of activity	Low likelihood, Little activity LOWER RISK

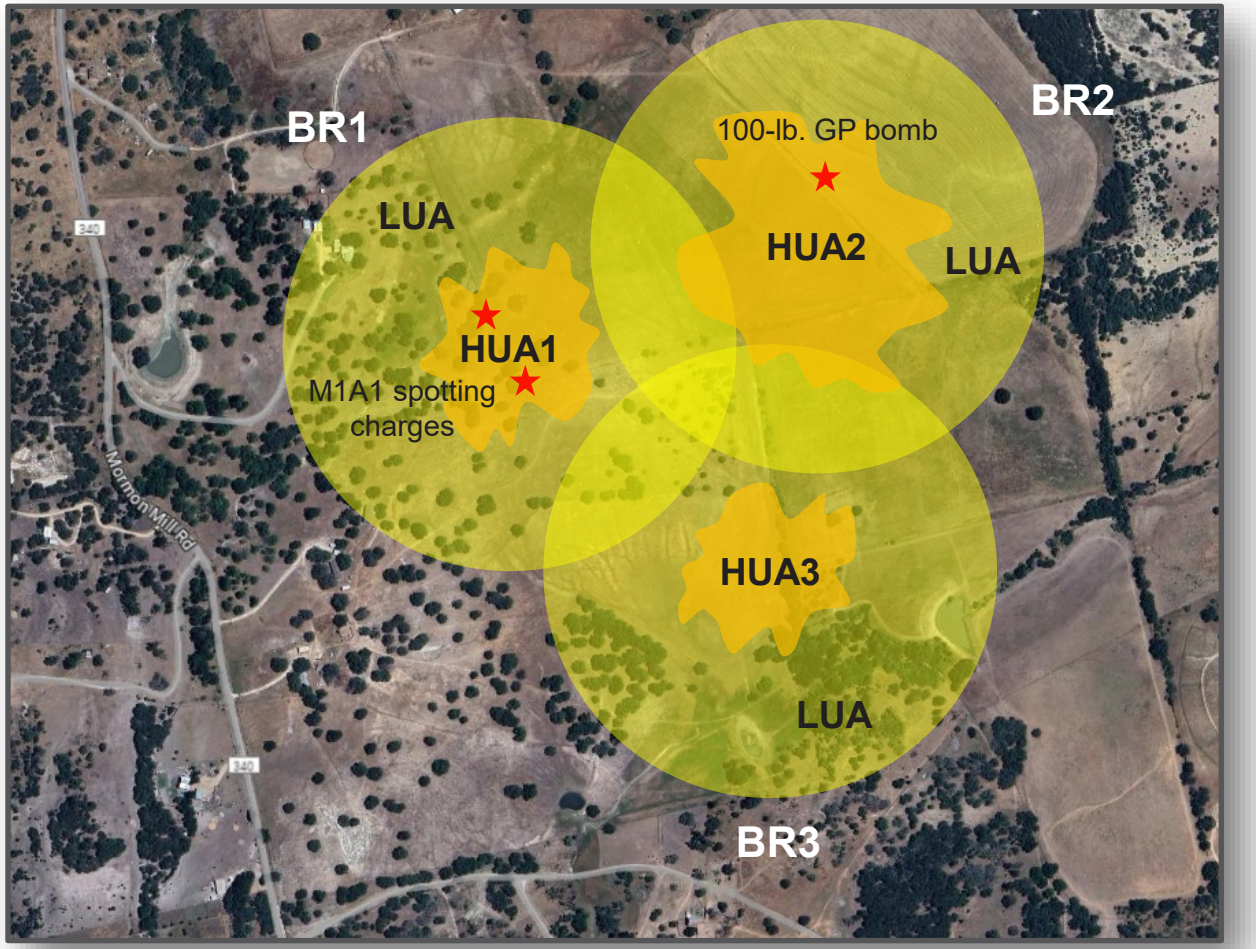


Let's look at how we might do this for the Maydup AAF Bombing Ranges MRS!

DIFFERENT LIKELIHOODS OF MEC PRESENCE

MEC contamination example

- Known and suspected MEC
  - Bomb, 100-lb., General Purpose, AN-M30
  - Bomb, 100-lb., Practice, M38A2
  - Charge, spotting, M1A1
- Characterization results
  - Three HUAs identified
  - Remaining areas are LUAs (no NEU areas)
  - Three MEC found (*shown*)
    - One 100-lb. GP bomb (at 90cm bgs)
    - Two M1A1 spotting charges
  - Multiple MD items found (*not shown*)*
    - Associated with bombs and spotting charges; included bomb fragments
  - Vertical profile
    - 100-lb. GP bombs up to 1.2m bgs est.
    - 100-lb. practice bombs up to 60cm bgs est.
    - M1A1 spotting charges up to 30cm bgs est.

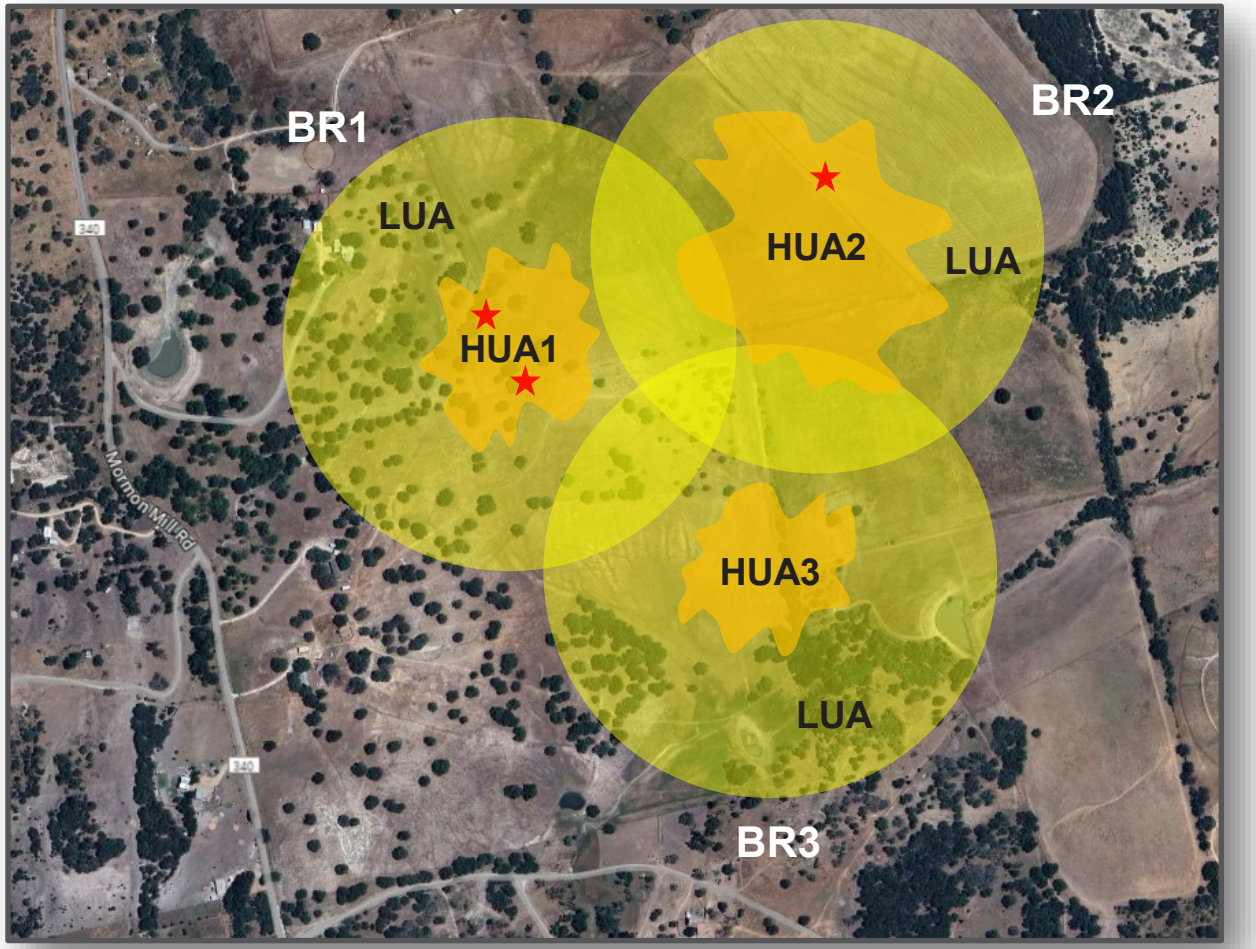


DIFFERENT LIKELIHOODS OF MEC PRESENCE, CONT'D.

Maydup AAF Bombing Ranges MRS has

- Three (3) areas where MEC are most likely to be present
  - HUA 1
  - HUA 2
  - HUA 3
- One (1) contiguous area where MEC are less likely to be present
  - LUA
- No areas where MEC are not expected
  - No NEU areas

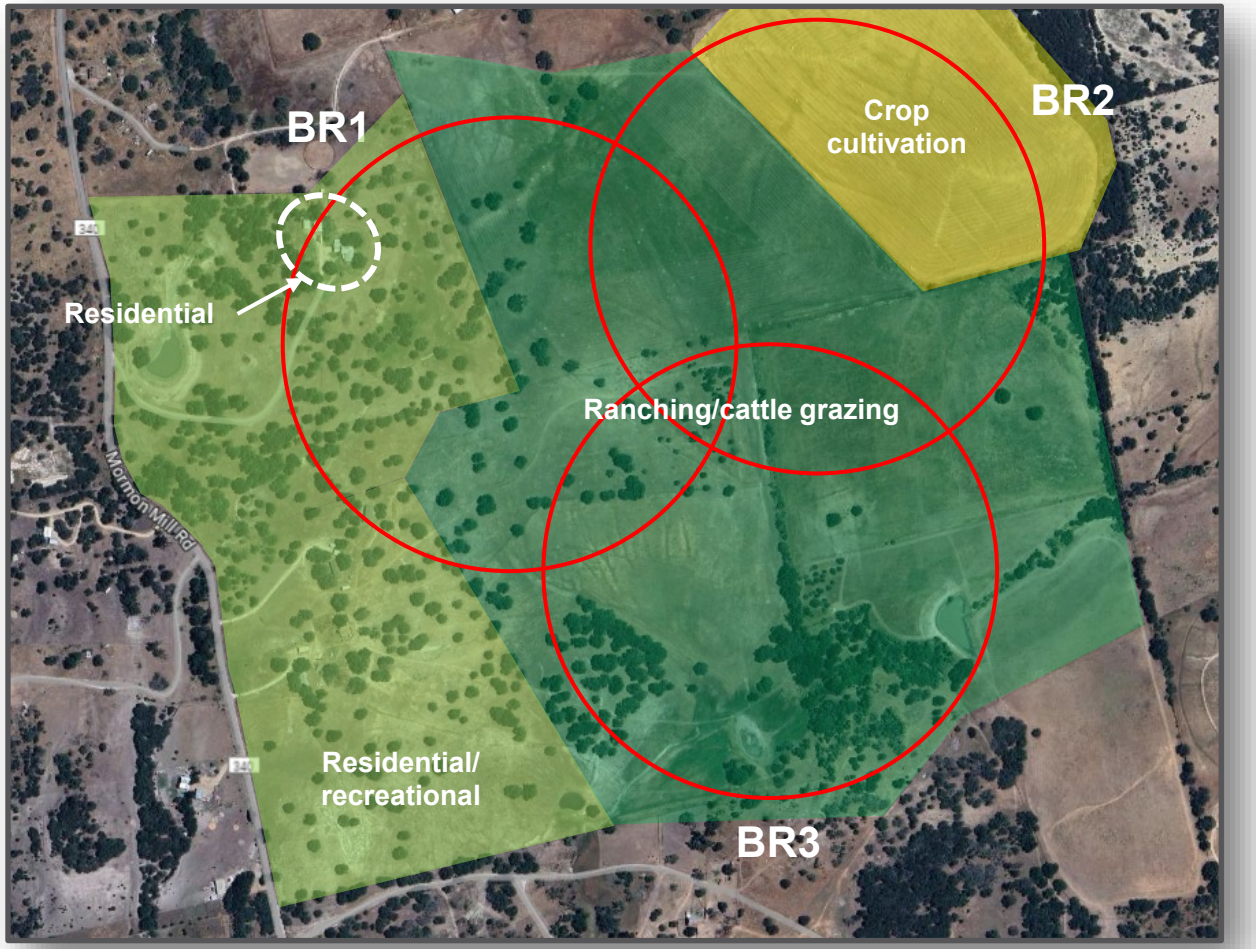
Four (4) areas with different likelihood of MEC presence



DIFFERENT RECEPTOR ACTIVITIES

Land use/receptor activities example

- Crop cultivation
  - Occasional crop management: inspection, plowing, and harvesting
  - Intrusive up to 60cm bgs
- Residential (ranch house and vicinity)
  - Frequent outdoor recreation, gardening, landscaping
  - Some intrusive up to 30cm bgs
- Residential/recreational
  - Occasional outdoor recreation, mowing
  - Non-intrusive
- Ranching/cattle grazing
  - Infrequent cattle handling/management, boundary fence maintenance
  - Mostly non-intrusive, some intrusive around boundary fences up to 30cm bgs



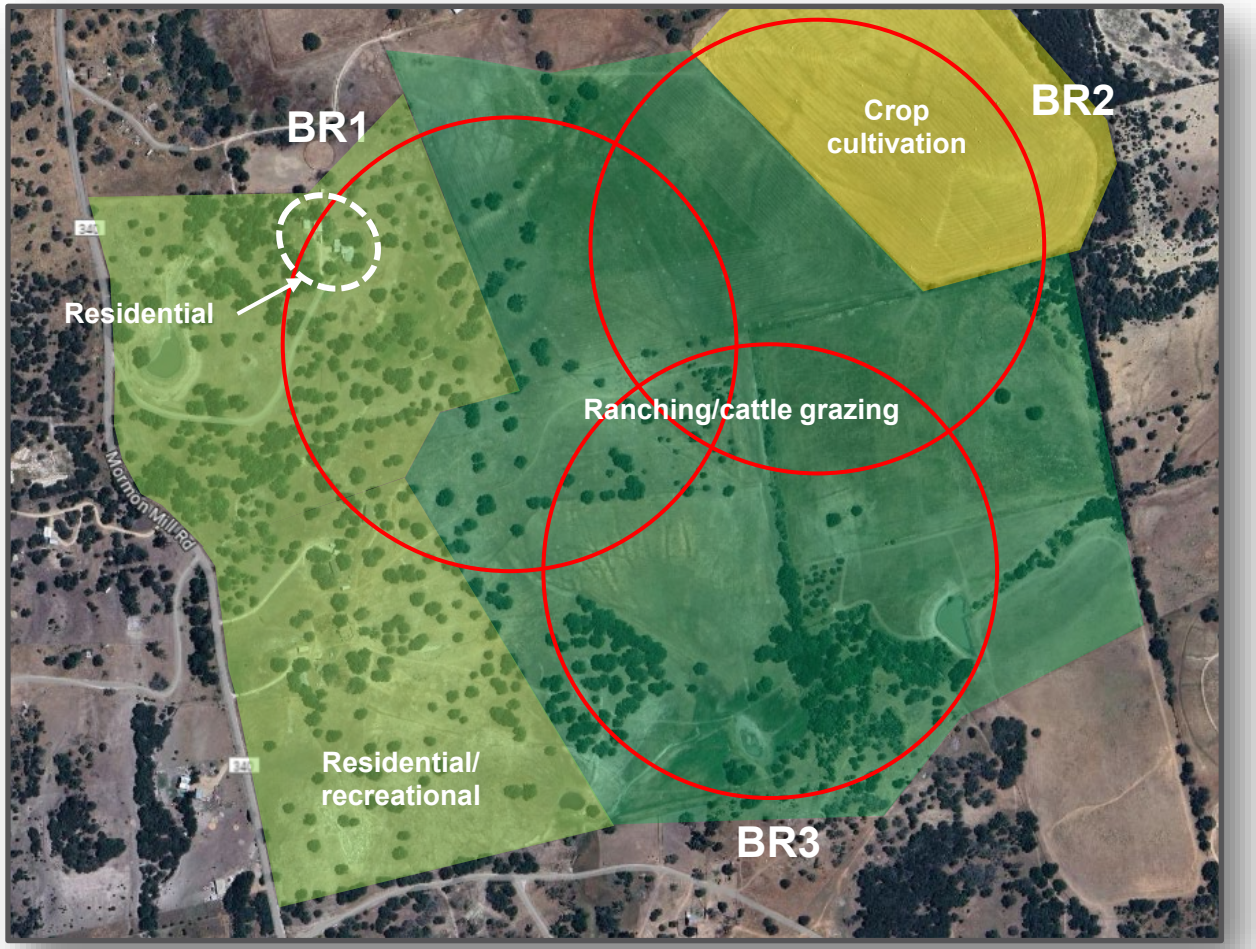
DIFFERENT RECEPTOR ACTIVITIES, CONT'D.

Maydup AAF Bombing Ranges MRS has

- Frequently-accessed residential areas
  - Intrusive and non-intrusive activities
- Occasionally-accessed residential areas
  - Non-intrusive activities only
- Occasionally-accessed agricultural areas
  - Intrusive and non-intrusive activities
- Infrequently-accessed cattle ranching areas
  - Intrusive and non-intrusive activities

Four (4) general areas with different types of activities

- Some of which contain >1 activity and/or both intrusive and non-intrusive activities



DIVIDING THE MRS INTO RISK ASSESSMENT AREAS

DIVIDING THE MRS INTO RISK ASSESSMENT AREAS

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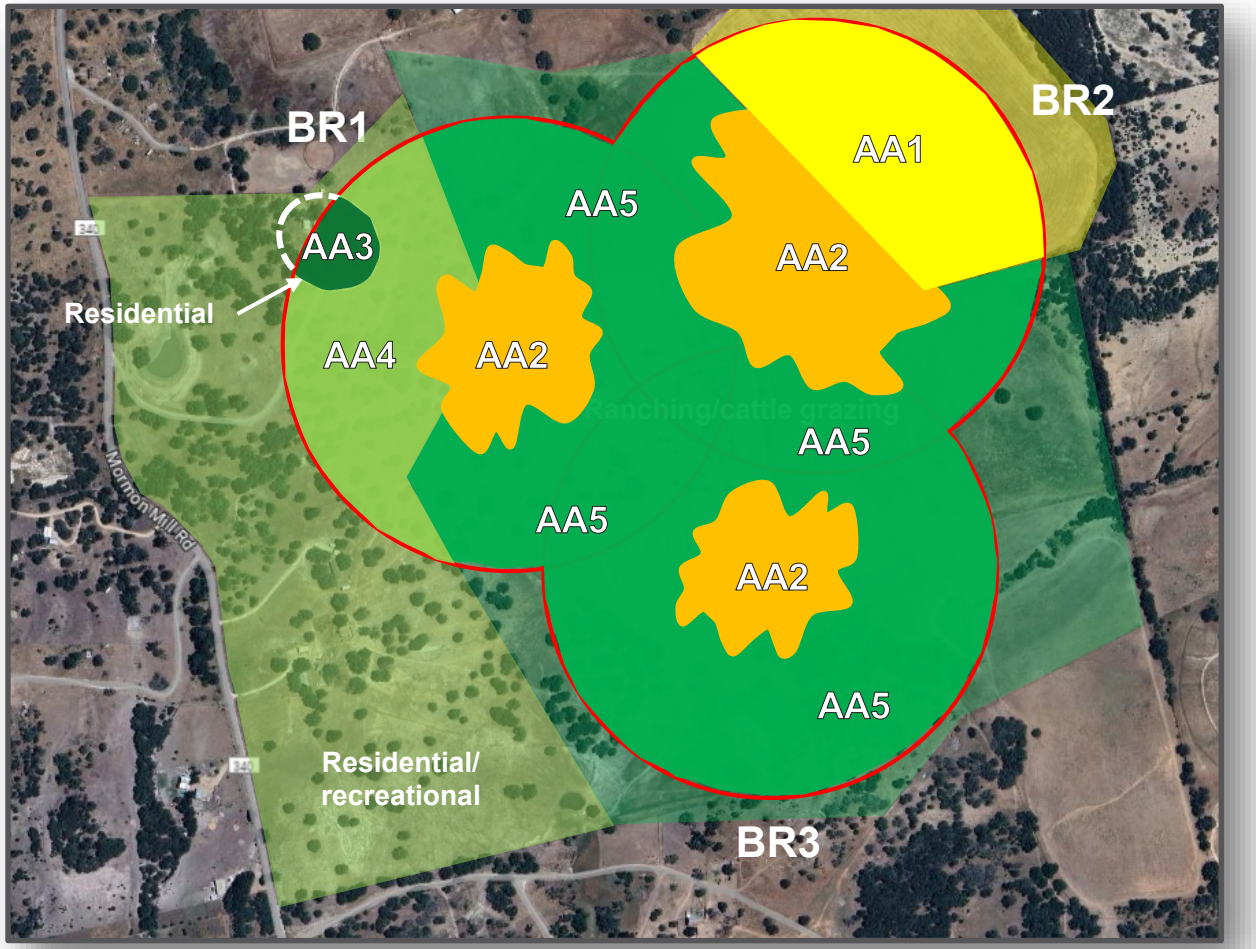
Likelihood of MEC Presence	Types of Activities	
	HIGHER RISK → High likelihood, Lots of activity	High likelihood, Little activity
	Low likelihood, Lots of activity	Low likelihood, Little activity → LOWER RISK

What do we have at this MRS?

- AA1: HUAs/LUAs with occasional crop management (intrusive and non-intrusive)
- AA2: HUAs with occasional/infrequent residential and cattle ranching activity (mostly non-intrusive)
- AA3: LUA with frequent residential activity (intrusive and non-intrusive)
- AA4: LUA with occasional residential activity (non-intrusive)
- AA5: LUA with infrequent cattle ranching activity (mostly non-intrusive)

HIGHER RISK

LOWER RISK



IDENTIFYING RISK SCENARIOS

Five Assessment Areas for RMM

- AA1: HUA/LUA (crop cultivation)
  - RS1a: Crop management – inspection and harvesting
  - RS1b: Crop management – plowing
- AA2: HUAs (residential/ranching)
  - RS2a: Outdoor recreation, mowing
  - RS2b: Cattle handling/management
  - RS2c: Boundary fence maintenance
- AA3: LUA (residential)
  - RS3: Outdoor recreation, gardening, landscaping
- AA4: LUA (residential/recreational)
  - RS4: Outdoor recreation, mowing
- AA5: LUA (ranching)
  - RS5a: Cattle handling/management
  - RS5b: Boundary fence maintenance

FINAL THOUGHTS

MRSs are not homogeneous

– Risk of MEC exposure can vary throughout
  - Different likelihoods of MEC presence
  - Different receptor activities

Likelihood of MEC Presence	Types of Activities	
	HIGHER RISK → High likelihood, Lots of activity	High likelihood, Little activity
	Low likelihood, Lots of activity	Low likelihood, Little activity → LOWER RISK

That is why we look at *Risk Scenarios*

– The "right" number of risk scenarios depends on your site and your project team
  - # of risk scenarios varies from MRS to MRS

Doing this also **HELPS** the RI/FS

– Improves the baseline MEC risk assessment
– Supports development of RAOs
– Guides development of remedial alternatives for the Feasibility Study

The initial effort is worth it, and will pay off in later stages of the process

QUESTIONS?

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DEVELOPING SITE-SPECIFIC REMEDIAL ALTERNATIVES

Presented by:

James Salisbury

(Yes, it's me again... Sorry)

USACE Environmental & Munitions Center of Expertise (EM CX)

28 August 2025

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Chapter 11
Feasibility study for munitions response

11–1. Introduction

This chapter is intended to provide an overview of the steps to complete an FS for munitions response. It includes discussions of defining remedial goals, developing remedial strategies for MR projects, and conducting an institutional analysis to support the development of alternatives and support alternatives analysis.

a. According to the National Contingency Plan, (NCP, 40 CFR 300.430[e]), "The primary objective of the FS is to ensure appropriate remedial alternatives are developed and evaluated and an appropriate remedy selected." Note that the FS should not recommend or select a remedial alternative for implementation; these tasks are performed in the Proposed Plan (PP) and Record of Decision (ROD). The RI and FS are separate tasks. The RI informs the work performed in the FS, and each should be reported individually, with the RI completed first. It should be noted that the baseline risk assessment completed in the RI serves to identify the need for response action and the need for the FS.

b. Required content for FUDS FSs is found in the FUDS Handbook Supplement to ER 200-3-1. Additional DoD guidance on the subject can be found in DoDM 4715.20. The process for performing the FS is described in EPA 540/G-89/004: Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final. Before beginning the FS, the PDT should review the results of the RI and the baseline risk assessment. These activities are described in Chapters 8 through 10. The FS should include a summary of those work products.

11–2. Developing the remedial action objective and remediation goals

40 CFR Part 300.430(e)(2)(i) states the lead agency is required to establish remedial action objectives (RAOs) that specify contaminants and media of concern, potential exposure pathways, and remediation goals. The purpose of the RAO is to clearly define the PDT's expectations for what the remedial response needs to achieve to be protective of human health and the environment (i.e., the conditions that need to be modified within the risk scenarios such that there are no longer any unacceptable risks). The remediation goals collectively describe the PDT's definition of "protectiveness," and set a standard for the development and evaluation of remedial alternatives. This means when the PDT agrees an alternative will achieve the remediation goals (i.e., it is protective), then, by definition, the unacceptable risk will be eliminated if that alternative were to be implemented as described and the underlying CSM is shown to be valid.

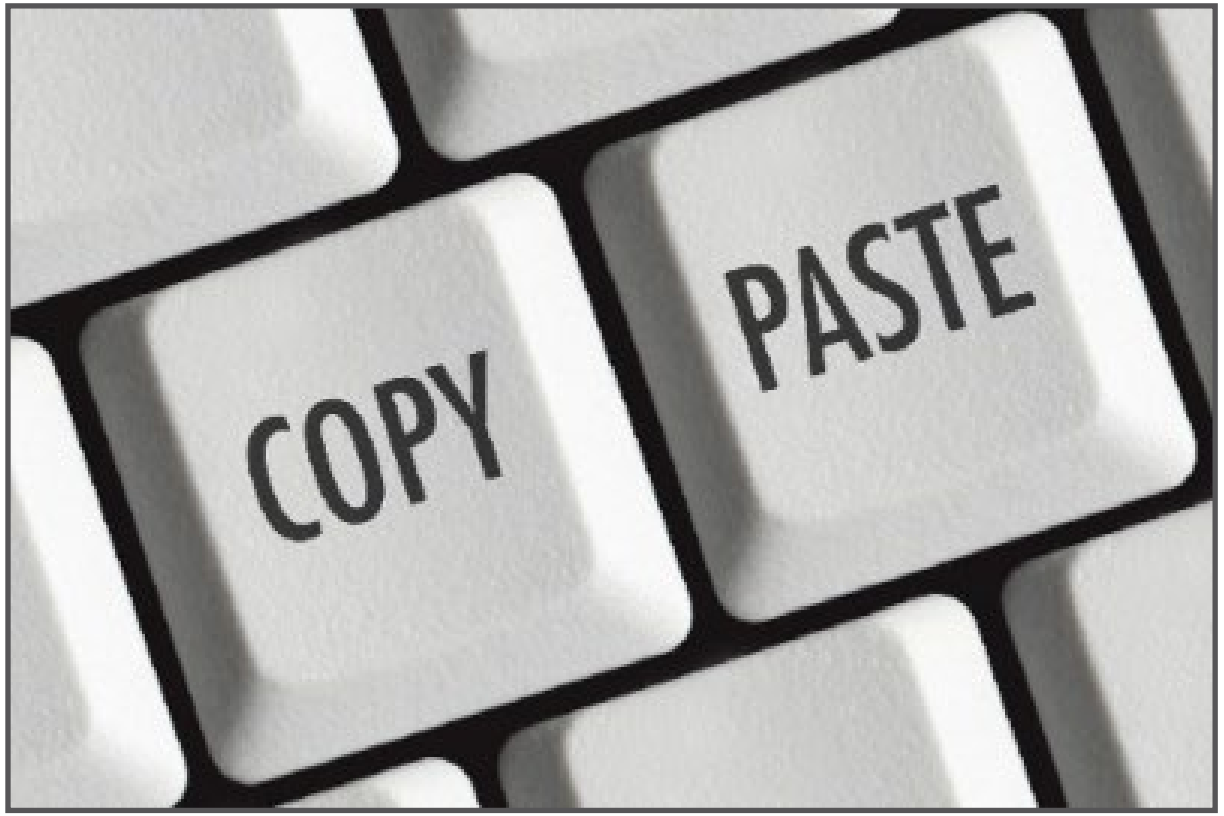
a. *RAOs for MEC.* The RAO for MEC is written to define the standard of protectiveness for the site regarding explosive hazards. The RAO is written to clearly describe that protectiveness is achieved when the exposure pathway between receptor and MEC for each distinct receptor group no longer constitutes an unacceptable risk scenario. For MEC, this exposure pathway involves an encounter with a MEC item, followed by interaction with that item that might result in an explosive incident. Figure 11-1 shows the chain of events that lead to an explosive incident and where that exposure route can be mitigated to reduce risk. Removing the source of explosive hazards (i.e., MEC items) reduces, the risk to receptors. Managing or controlling access

#5

COMMON PROBLEM WITH REMEDIAL ALTERNATIVES

Using the same ones over and over and over and over and over and over and over and

- Many ~~Most~~ FSs identify the same remedial alternatives ***every time***
  - LUCs only
  - Surface removal and LUCs
  - Subsurface removal and LUCs
    - Using AGC or DGM
  - Subsurface removal for UU/UE
    - Using AGC or DGM, or dig/sift
- But most often these alternatives are not suitable for every site
  - Some FSs even say they aren't protective!
    - Then why describe & evaluate them?



But how can we kick this habit?

KICKING THE HABIT

The first step

– **STOP** using old FS templates
  - At least for descriptions of remedial alternatives
– It seems easier, but it won't get the best result
  - And it's not SITE-SPECIFIC!

The second step

– **START** thinking about
  - Policy requirements
  - Conceptual Site Model (CSM), Risk Management Methodology (RMM) risk scenarios, and Remedial Action Objectives (RAOs)
  - CERCLA FS "balancing" criteria
  - Remedial technology differences

CONSIDER POLICY REQUIREMENTS

National Contingency Plan

– *Preference* for treatment
  - i.e., MEC detection and removal

DERP Manual

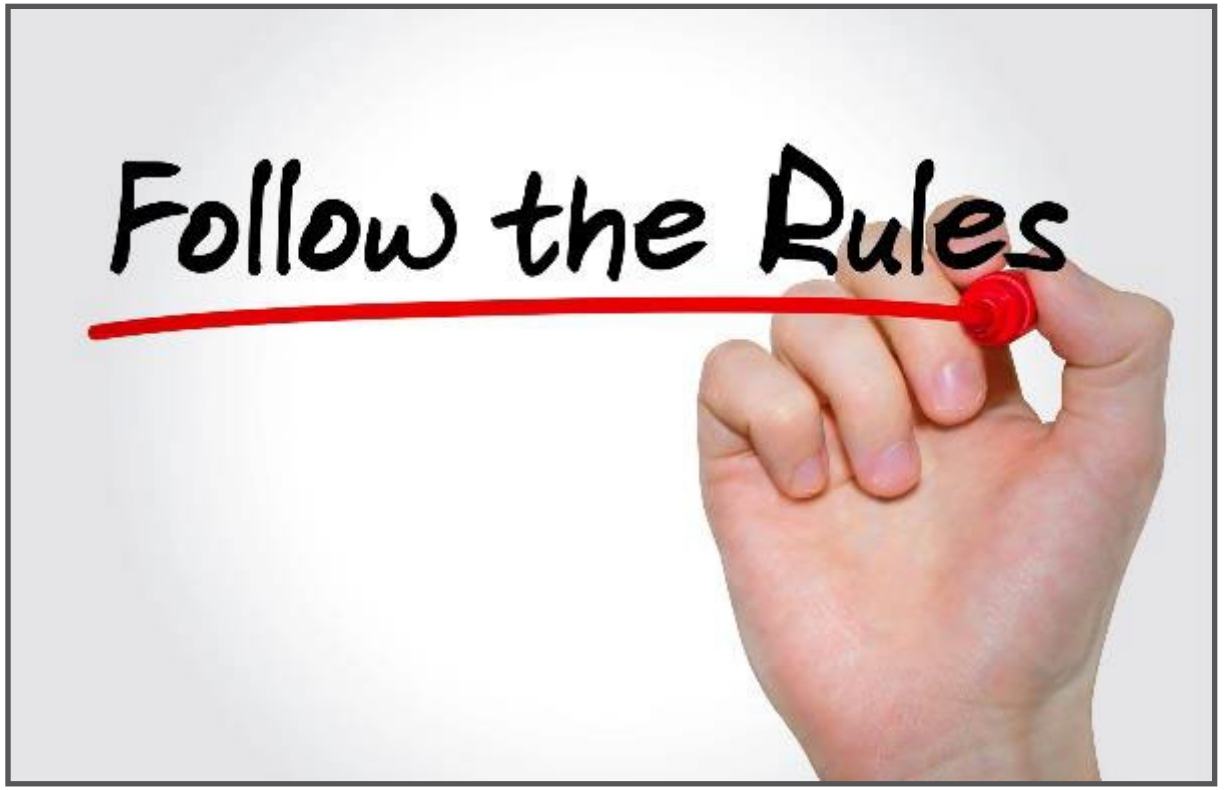
– Must look at the No Action alternative
– Must consider alternatives that
  - Achieve conditions allowing for UU/UE
  - *Include* land use controls (LUCs)

DoD/EPA UXO Management Principles, March 2000

– *Preference* for digital data collection

FUDS policy

– *Preference* for AGC technologies for MEC removal at FUDS



Policy documents describe both *minimum requirements* and *preferences*

CONSIDER CSM, RMM RISK SCENARIOS, AND RAOs

Conceptual Site Model

- Are there areas where MEC removal could/should be focused?
  - Areas with greatest risk of exposure
    - e.g., HUAs with high activity
- Are there constraints on remedial alternatives?
  - Topography and/or vegetation
  - Sensitive ecological/cultural resources
  - Developed areas

RMM Risk Scenarios

- Can highlight focus areas and pathways

Remedial Action Objectives

- Remedial alternative components must mitigate risk for all exposure pathways
  - Receptors, activities, and locations
  - Depths for MEC and activities

CONTAMINANT/MEDIA	POTENTIAL EXPOSURE PATHWAY(S)		
	Assessment Area(s)	Receptors and Exposure Pathways	Interaction Zone
IN SOIL: ▪ Bomb, 100-lb., GP, AN-M30 (up to 4 feet bgs est.) ▪ Bomb, 100-lb., Practice, M38A2 (up to 2 feet bgs est.) ▪ Charge, spotting, M1A1 (up to 1 feet bgs est.)	HUA/LUA (crop cultivation)	Crop management – inspection and harvesting	Surface only
		Crop management – plowing	0-60cm bgs
	HUAs (residential/ranching)	Outdoor recreation, mowing	Surface only
		Cattle handling/management	Surface only
		Boundary fence maintenance	0-30cm bgs
	LUA (residential)	Outdoor recreation, gardening, landscaping	0-30cm bgs
	LUA (residential/recreational)	Outdoor recreation, mowing	Surface only
	LUA (ranching)	Cattle handling/management	Surface only
		Boundary fence maintenance	0-30cm bgs

For *each remedial alternative*, how is the risk mitigated for each receptor in the RAO?

CONSIDER BALANCING CRITERIA

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There are nine criteria used to evaluate remedial alternatives in the FS

- Two threshold criteria
- Five balancing criteria
- Two modifying criteria

Every alternative must meet the two threshold criteria

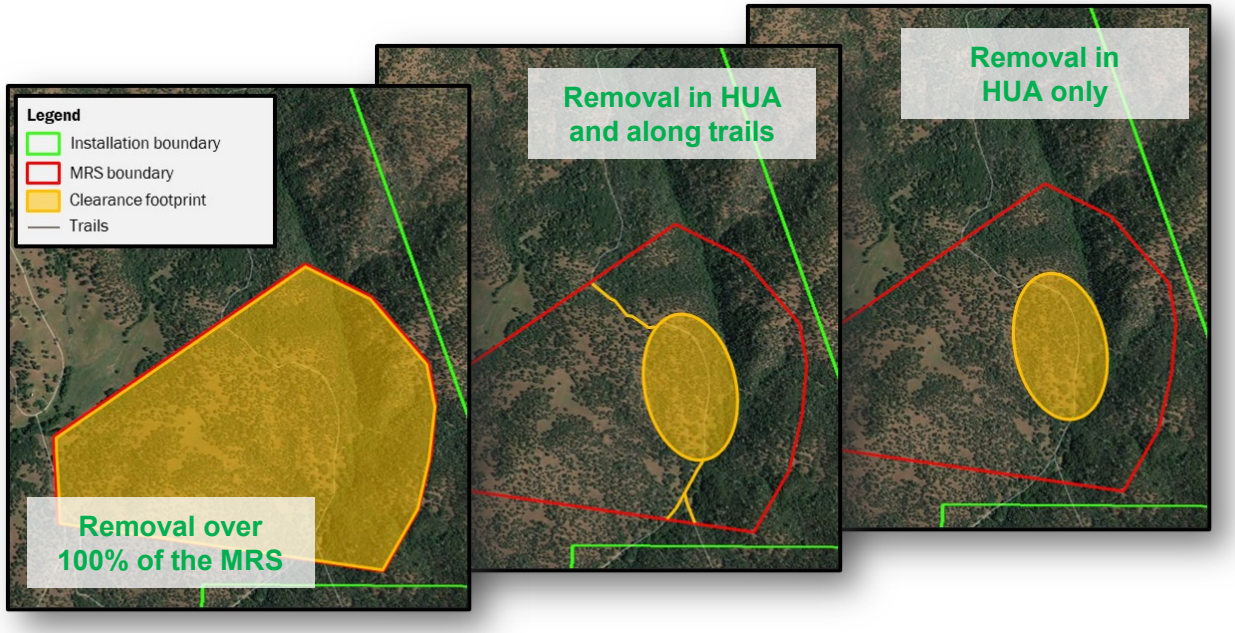
- Overall protection of human health and the environment
  - i.e., must achieve the remediation goals for the remedial action objectives (RAOs)
- Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)
  - i.e., must comply with ARARs

Threshold Criteria	**Overall protection of human health and the environment**
	Compliance with ARARs
Primary Balancing Criteria	**Long-term effectiveness and permanence**
	Reduction of toxicity, mobility or volume through treatment
	Short-term effectiveness
	Implementability
	Cost
Modifying Criteria	**State acceptance**
	Community acceptance

CONSIDER BALANCING CRITERIA, CONT'D.

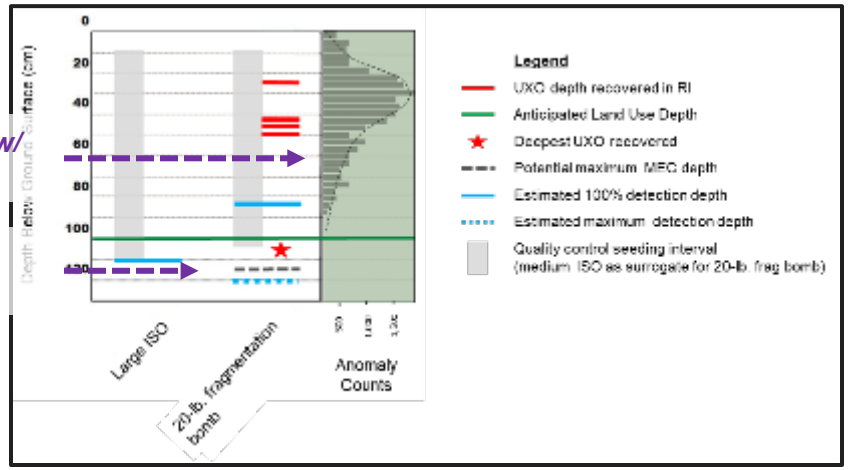
But some balancing criteria suggest how remedial alternatives can differ

- Long-term effectiveness and permanence
  - Magnitude of residual risk
    - Amount of MEC removal involved
  - Adequacy and reliability of controls
    - Proportions of MEC removal and LUCs
    - Planned maintenance for LUCs
- Reduction of toxicity, mobility, or volume through treatment
  - The amount of treatment being done
    - Amount of MEC removal involved
  - How alternative satisfies the preference for treatment as a principal element
    - Amount of MEC removal involved



Removal of HD portion w/ LUCs for residual risk

Removal to maximum estimated MEC depth



CONSIDER BALANCING CRITERIA, CONT'D.

- Short-term effectiveness (effects?)
  - Environmental impacts of remedial action
    - Quantities or extent of vegetation removal
  - Time until response complete is achieved
    - Phased implementation

Less suitable elements for suggesting different approaches

  - Protection of public *during* remedial action
    - MEC removal vs. LUCs
  - Protection of workers *during* remedial action
    - MEC removal vs. LUCs
- Implementability
  - Technical feasibility
  - Administrative feasibility
  - Availability of services and materials
- Cost

CONSIDER REMEDIAL TECHNOLOGY DIFFERENCES

MEC removal methods

- AGC vs DGM vs. analog
- Digital vs. analog
- Dig and sift
- Removal on slopes or in ponds using engineering methods

Land use controls

- We have ***options***; don't just say "…and LUCs"
  - Engineering controls
    - Fencing
    - Covers
  - Educational controls
    - Signs
    - Information pamphlets
    - Meetings and websites
  - And maybe a few others as well…

Technology combinations can be used to create a range of remedial alternatives

DIFFERENCES BETWEEN REMEDIAL ALTERNATIVES

Differences **DON'T** need to be extreme

– i.e., LUCs only vs. complete MEC removal

Largely boils down to differences in

– MEC removal footprint(s)
– Removal depth(s)
– Where/how technologies are applied
– Different combinations of LUCs

But remember alternatives must be protective and comply with ARARs

- i.e., achieve the RAO across the ***whole*** MRS
  – Mitigate risk for ***all*** exposure pathways

Think about the following questions

– Is a UU/UE alternative viable?
  - (We must consider one anyway)
– Is MEC removal viable across the whole MRS?
– Which LUCs will be protective for receptors?
– Is a LUCs only alternative protective/viable?
– Are there areas where MEC removal could or should be focused?
  - i.e., areas with greatest risk for exposure
    – For example, HUAs with high activity

Our goal is to develop a range of implementable, site-specific remedial alternatives that are protective and comply with ARARs

LET'S LOOK AT A (*POSSIBLY FAMILIAR?*) EXAMPLE

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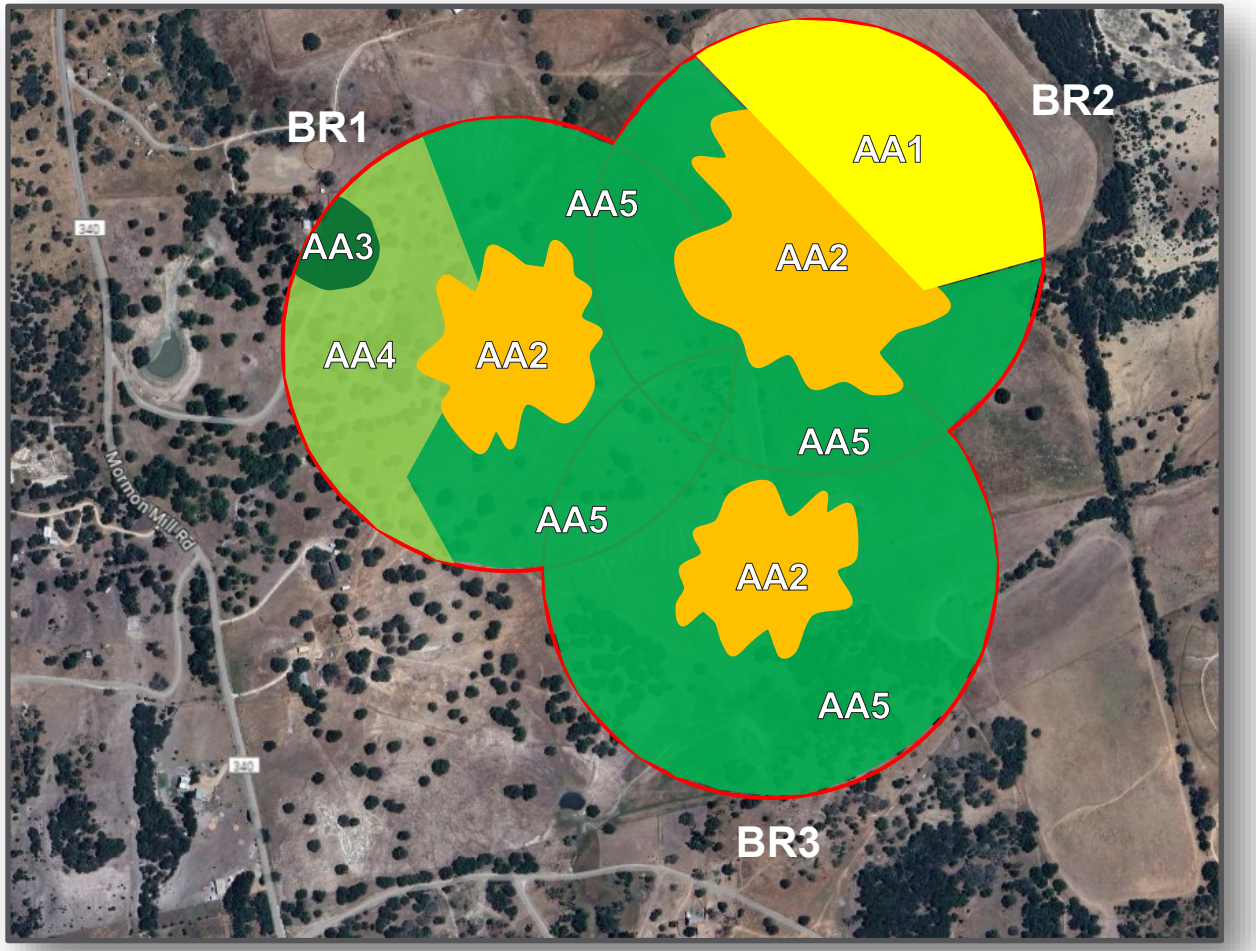
MAYDUP AAF BOMBING RANGES MRS – RMM RESULTS

5 Assessment Areas, 9 Risk Scenarios

- AA1: HUA/LUA (crop cultivation)
  - RS1a: Crop management – inspection and harvesting
  - RS1b: Crop management – plowing
- AA2: HUAs (residential/ranching)
  - RS2a: Outdoor recreation, mowing
  - RS2b: Cattle handling/management
  - RS2c: Boundary fence maintenance
- AA3: LUA (residential)
  - RS3: Outdoor recreation, gardening, landscaping
- AA4: LUA (residential/recreational)
  - RS4: Outdoor recreation, mowing
- AA5: LUA (ranching)
  - RS5a: Cattle handling/management
  - RS5b: Boundary fence maintenance



*Unacceptable risk conditions assessed for **ALL** risk scenarios*

MAYDUP AAF BOMBING RANGES MRS – RAOs

CONTAMINANT/MEDIA	POTENTIAL EXPOSURE PATHWAY(S)			Remediation Goal
	Assessment Area(s)	Receptors and Exposure Pathways	Interaction Zone	
IN SOIL: ▪ Bomb, 100-lb., GP, AN-M30 (*up to 4 feet bgs est.*) ▪ Bomb, 100-lb., Practice, M38A2 (*up to 2 feet bgs est.*) ▪ Charge, spotting, M1A1 (*up to 1 feet bgs est.*)	HUA/LUA (crop cultivation)	Crop management – inspection and harvesting	Surface only	Mitigate all exposure pathways to eliminate unacceptable risk conditions
		Crop management – plowing	0-60cm bgs	
	HUAs (residential/ranching)	Outdoor recreation, mowing	Surface only	
		Cattle handling/management	Surface only	
		Boundary fence maintenance	0-30cm bgs	
	LUA (residential)	Outdoor recreation, gardening, landscaping	0-30cm bgs	
	LUA (residential/recreational)	Outdoor recreation, mowing	Surface only	
	LUA (ranching)	Cattle handling/management	Surface only	
		Boundary fence maintenance	0-30cm bgs	

Constraints on the remedial alternatives:

- Per the Institutional Analysis, educational controls are the only implementable LUCs for this MRS (i.e., Public Notices and Information Pamphlets, Education Seminars and Meetings, and Websites). The landowners will not allow posting of warning signs.
- The landowners will not allow the removal of mature trees (>3” dia.) or dig and sift as a MEC removal technology.

MAYDUP AAF BOMBING RANGES MRS – ALTERNATIVES

Answers to the suggested questions

- Is a UU/UE alternative viable?
  - Requires MEC removal beneath trees, so is not implementable
    - But still need to comply with DERP requirements
  - **ALTERNATIVE:**

    2. Subsurface Removal to Allow UU/UE
- Is MEC removal viable across the whole MRS?
  - Yes, but no removal beneath buildings or trees greater then 3” dia., so will be exception areas
  - **ALTERNATIVE:**

    3. Subsurface Removal throughout MRS
    - No MEC removal conducted beneath buildings or trees greater then 3” dia.

MAYDUP AAF BOMBING RANGES MRS – ALTERNATIVES, CONT'D.

Answers to the suggested questions, cont'd.

- Which LUCs will be protective for receptors?
  - Informational pamphlets, maintain website
  - Signs not implementable
- Is a LUCs only alternative protective/viable?
  - No – LUCs not protective for AA1
  - However
    - Should be protective for AA3, AA4, and AA5
    - Could also be protective for AA2 in cattle ranching areas
  - **ALTERNATIVES:**
    - **No LUCs only alternative**
    - But will have alternatives *including* LUCs to comply with DERP requirements (see next slide)

MAYDUP AAF BOMBING RANGES MRS – ALTERNATIVES, CONT'D.

Answers to the suggested questions, cont'd.

– Are there areas where MEC removal could or should be focused?

- AA1, AA2, and AA3 are highest risk areas
  – HUAs and frequently accessed areas
- **ALTERNATIVES:**

4. Subsurface Removal at AA1, 2, 3, and 4 with Surface Removal at AA5, and LUCs

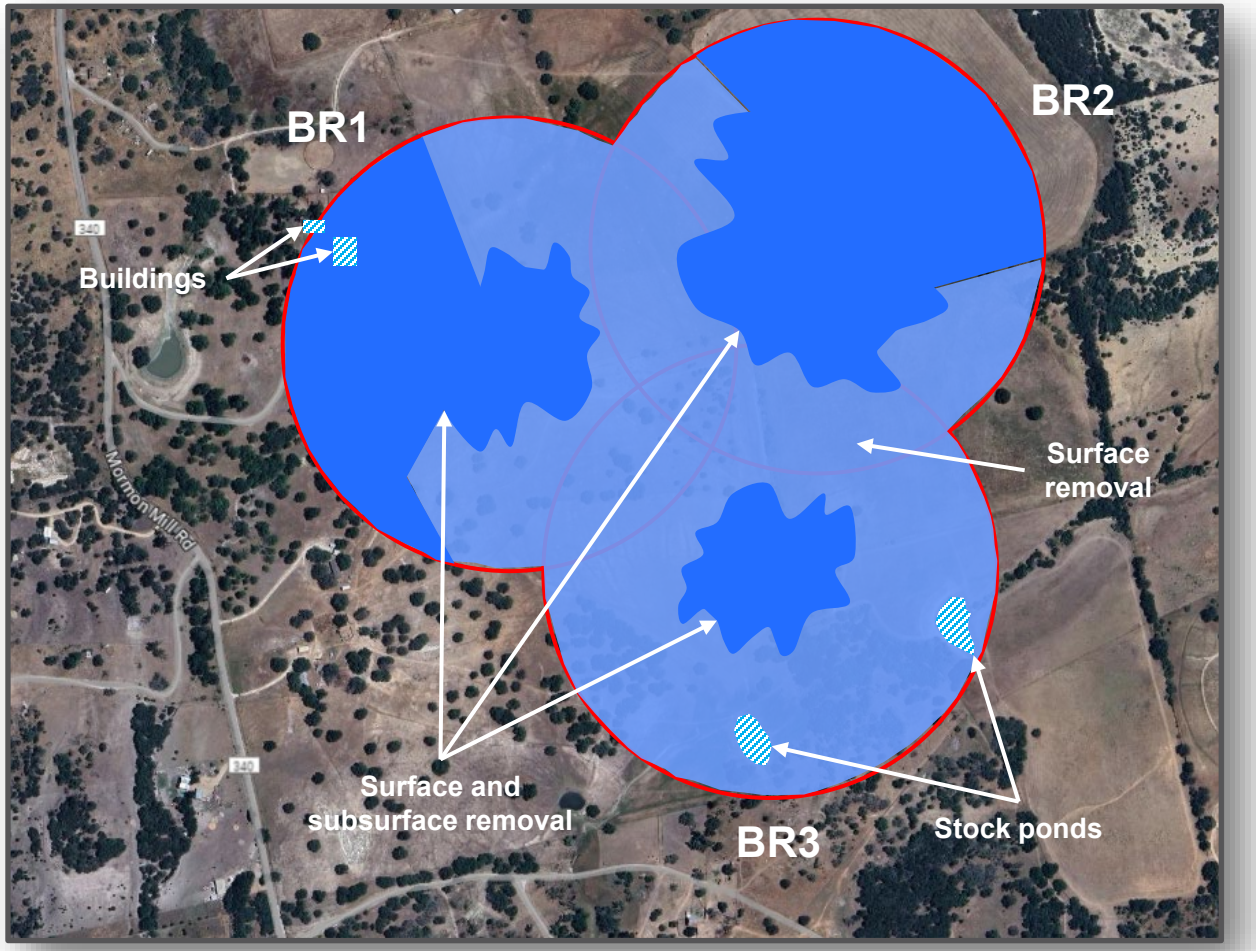
5. Subsurface Removal at AA1, 2, and 3 with Surface Removal at AA4 and 5, and LUCs

6. Subsurface Removal at AA1, 3, and 4, and AA2 fence lines, with Surface Removal at AA2 and 5, and LUCs

MAYDUP AAF BOMBING RANGES MRS – ALTERNATIVE 4

Alt 4: Subsurf. Removal at AA1, 2, 3, & 4 with Surf. Removal at AA5, & LUCs

- Surface and subsurface removal using AGC for anomaly detection and classification to 60cm bgs
  - Use anomaly reduction or conduct post-removal AGC surveys for SRAs
  - TOI detected beyond 60cm bgs will be excavated
  - **Achieves RAO** through removal of MEC to max. estimated depths throughout interaction zones in HUAs and residential/cultivated (high activity) LUAs
- Surface removal using instrument-aided visual surveys
  - **Achieves RAO** through removal of MEC on surface in cattle ranching (lower activity) areas
    - Residual risk managed through LUC implementation
- BIP or consolidated shots for MEC disposal
  - Post-detonation sampling to **comply with ARARs**
- Regular mailings of informational pamphlets to landowners; maintain website
  - **Achieves RAO** by reducing likelihood of MEC interaction in lower activity LUAs by increasing hazard awareness

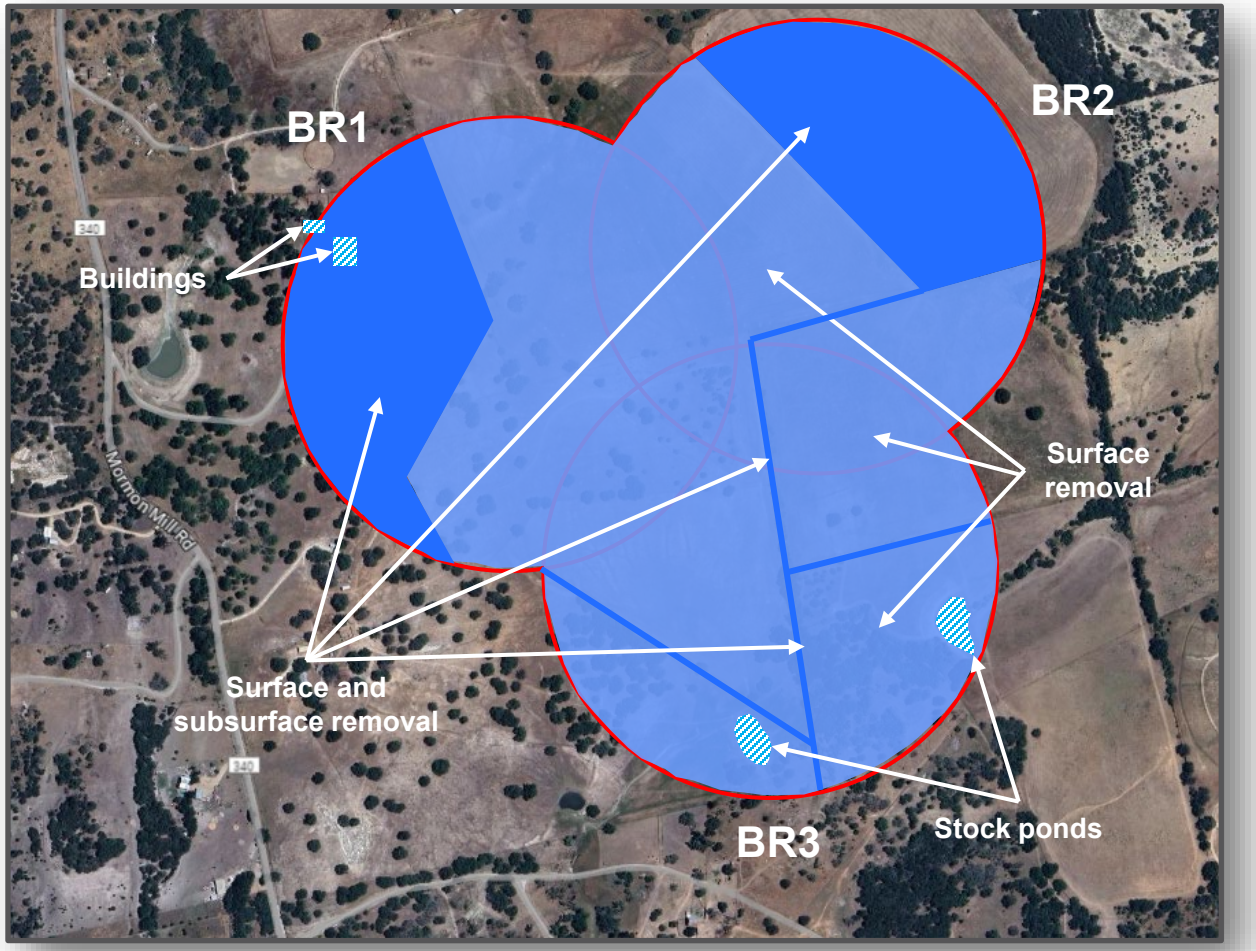


- Exception areas:
  - No MEC removal conducted beneath buildings or trees greater then 3” dia., or in stock ponds

MAYDUP AAF BOMBING RANGES MRS – ALTERNATIVE 6

Alt 6: Subsurf. Removal at AA1, 3, and 4, and AA2 fence lines, with Surf. Removal at AA2 and 5, and LUCs

- Surface and subsurface removal using AGC for anomaly detection and classification to 60cm bgs
  - Use anomaly reduction or conduct post-removal AGC surveys for SRAs
  - TOI detected beyond 60cm bgs will be excavated
  - **Achieves RAO** through removal of MEC to max. estimated depths throughout interaction zones along fences & in residential/cultivated (high activity) LUAs
- Surface removal using instrument-aided visual surveys
  - **Achieves RAO** through removal of MEC on surface in cattle ranching (lower activity) areas
    - Residual risk managed through LUC implementation
- BIP or consolidated shots for MEC disposal
  - Post-detonation sampling to **comply with ARARs**
- Regular mailings of informational pamphlets to landowners; maintain website
  - **Achieves RAO** by reducing likelihood of MEC interaction in lower activity LUAs by increasing hazard awareness



- Exception areas:
  - No MEC removal conducted beneath buildings or trees greater then 3” dia., or in stock ponds

U.S. ARMY

MAYDUP AAF BOMBING RANGES MRS – ALTERNATIVES, CONT'D.

No.	ALTERNATIVE NAME	MAJOR COMPONENTS	COMMENTS
1	No Action	None	Evaluation of the No-Action alternative is required
2	Subsurface Removal to Allow UU/UE	▪ Surface and subsurface MEC removal in MRS using AGC for anomaly detection and classification to 1.2m bgs ▪ Use anomaly reduction or conduct post-removal AGC surveys for SRAs ▪ BIP or consolidated shots for MEC disposal	▪ Requires MEC removal beneath trees, so is **not implementable** ▪ However, evaluation of alternative to allow UU/UE required under DERP
3	Subsurface Removal throughout MRS	▪ Surface and subsurface MEC removal in MRS using AGC for anomaly detection and classification to 60cm bgs ▪ Use anomaly reduction or conduct post-removal AGC surveys for SRAs ▪ BIP or consolidated shots for MEC disposal	▪ No MEC removal conducted beneath buildings or trees greater then 3" dia. ▪ TOI detected beyond 60cm bgs will be excavated
4	Subsurface Removal at AA1, 2, 3, and 4 with Surface Removal at AA5, and LUCs	▪ Surface and subsurface MEC removal in AA1, 2, 3, and 4 using AGC for anomaly detection and classification to 60cm bgs ▪ Use anomaly reduction or conduct post-removal AGC surveys for SRAs ▪ Surface MEC removal in AA4 using instrument-aided visual surveys ▪ BIP or consolidated shots for MEC disposal ▪ Regular mailings of informational pamphlets to landowners; maintain website	▪ No MEC removal conducted beneath buildings or trees greater then 3" dia. ▪ TOI detected beyond 60cm bgs will be excavated ▪ Post-detonation sampling to comply with ARARs
5	Subsurface Removal at AA1, 2, and 5 with Surface Removal at AA3 and 4, and LUCs	▪ Surface and subsurface MEC removal in AA1, 2, 3, and 4 using AGC for anomaly detection and classification to 60cm bgs ▪ Use anomaly reduction or conduct post-removal AGC surveys for SRAs ▪ Surface MEC removal in AA4 using instrument-aided visual surveys ▪ BIP or consolidated shots for MEC disposal ▪ Regular mailings of informational pamphlets to landowners; maintain website	▪ No MEC removal conducted beneath buildings or trees greater then 3" dia. ▪ TOI detected beyond 60cm bgs will be excavated ▪ Post-detonation sampling to comply with ARARs
6	Subsurface Removal at AA2, 3, and 5, and AA1 fence lines, with Surface Removal at AA1 and 4, and LUCs	▪ Surface and subsurface MEC removal in AA1, 2, and 3, and along AA4 fence lines, using AGC for anomaly detection and classification to 60cm bgs ▪ Use anomaly reduction or conduct post-removal AGC surveys for SRAs ▪ Surface MEC removal in AA1 and 4 using instrument-aided visual surveys ▪ BIP or consolidated shots for MEC disposal ▪ Regular mailings of informational pamphlets to landowners; maintain website	▪ Only surface removal in HUAs in cattle ranching areas (except for fence lines) ▪ No MEC removal conducted beneath buildings or trees greater then 3" dia. ▪ TOI detected beyond 60cm bgs will be excavated ▪ Post-detonation sampling to comply with ARARs

MAYDUP AAF BOMBING RANGES MRS – ALTERNATIVES, CONT'D.

No.	ALTERNATIVE NAME	MAJOR COMPONENTS	COMMENTS
1	No Action	None	Evaluation of the No Action alternative is required
2	Subsurface Removal to Allow UU/UE	▪ Surface and subsurface MEC removal in MRS using AGC for anomaly detection and classification to 1 [illegible] ▪ Use anomaly reduction or conduct post-removal AGC surveys for SRAs ▪ BIP or consolidated shots for MEC disposal	▪ Requires MEC removal beneath trees, so is **not implementable** ▪ However, evaluation of alternative to allow UU/UE required under DERP
3	Subsurface Removal throughout MRS	▪ Surface and subsurface MEC removal in MRS using AGC for anomaly detection and classification to 60cm bgs ▪ Use anomaly reduction or conduct post-removal AGC surveys for SRAs ▪ BIP or consolidated shots for MEC disposal	▪ No MEC removal conducted beneath buildings or trees greater then 3" dia., or in stock ponds ▪ TOI detected beyond 60cm bgs will be excavated
4	Subsurface Removal at AA1, 2, 3, and 5 with Surface Removal at AA4, and LUCs	▪ Surface and subsurface MEC removal in AA1, 2, 3, and 5 using AGC for anomaly detection and classification to 60cm bgs ▪ Use anomaly reduction or conduct post-removal AGC surveys for SRAs ▪ Surface MEC removal in AA4 using instrument-aided visual surveys ▪ BIP or consolidated shots for MEC disposal ▪ Regular mailings of informational pamphlets to landowners; maintain website	▪ No MEC removal conducted beneath buildings or trees greater then 3" dia., or in stock ponds ▪ TOI detected beyond 60cm bgs will be excavated ▪ Post-detonation sampling to comply with ARARs
5	Subsurface Removal at AA1, 2, and 5 with Surface Removal at AA3 and 4, and LUCs	▪ Surface and subsurface MEC removal in AA1, 2, 3, and 5 using AGC for anomaly detection and classification to 60cm bgs ▪ Use anomaly reduction or conduct post-removal AGC surveys for SRAs ▪ Surface MEC removal in AA4 using instrument-aided visual surveys ▪ BIP or consolidated shots for MEC disposal ▪ Regular mailings of informational pamphlets to landowners; maintain website	▪ No MEC removal conducted beneath buildings or trees greater then 3" dia., or in stock ponds ▪ TOI detected beyond 60cm bgs will be excavated ▪ Post-detonation sampling to comply with ARARs
6	Subsurface Removal at AA2, 3, and 5, and AA1 fence lines, with Surface Removal at AA1 and 4, and LUCs	▪ Surface and subsurface MEC removal in AA2, 3, and 5, and along AA1 fence lines, using AGC for anomaly detection and classification to 60cm bgs ▪ Use anomaly reduction or conduct post-removal AGC surveys for SRAs ▪ Surface MEC removal in AA1 and 4 using instrument-aided visual surveys ▪ BIP or consolidated shots for MEC disposal ▪ Regular mailings of informational pamphlets to landowners; maintain website	▪ Only surface removal in HUAs in cattle ranching areas (except for fence lines) ▪ No MEC removal conducted beneath buildings or trees greater then 3" dia., or in stock ponds ▪ TOI detected beyond 60cm bgs will be excavated ▪ Post-detonation sampling to comply with ARARs

To comply with DERP Manual

- **No Action alternative**
- **Alternative that allows for UU/UE**
- **Alternative(s) that use(s) LUCs**

Not protective

Not implementable

We must have BOTH

Multiple, viable site-specific alternatives

KEY TAKEAWAYS

Kick the old FS alternatives habits!

– **STOP** using old FS templates

– **START** thinking about

- Policy requirements
- CSM, RMM risk scenarios, and RAOs
- CERCLA FS “balancing” criteria
- Remedial technology differences

Differences **DON’T** need to be extreme

– i.e., LUCs only vs. complete MEC removal

Largely boils down to differences in

– MEC removal footprint(s)

– Removal depth(s)

– Where/how technologies are applied

– Combinations of LUCs

QUESTIONS?

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