

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

ASTSWMO
Conference

San Antonio, TX

March 5, 2009



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Status MEC HA Methodology

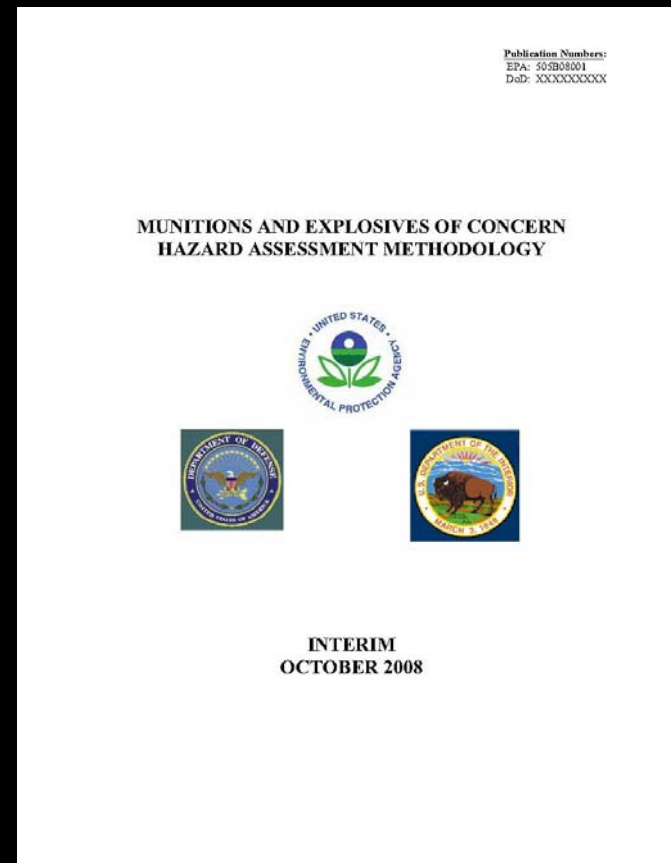
- EPA Concur
- SEC DEF I&E Concur
- OSD Concur
- Army Concur
- DDESB Concur
- ASTSWMO Letter of Support
- USAF & Navy Non-Concur
- DOI Pending

MEC HA Technical Work Group Website

www.epa.gov/fedfac/documents/munitions

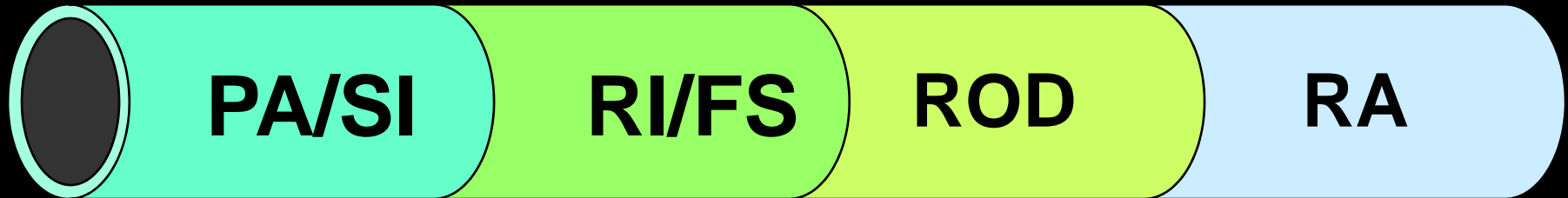
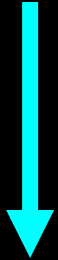
Key Terms

- MEC
- MRA/MRS
- MRSP
- Hazard Assessment
- Response Action



CERCLA PROCESS

MRSPP



**Hazard
Assessment**



Focus of this Training

- Overview of MEC HA
- Technical Framework Structure
 - Input Factors & Categories
 - Weights & Scores
- MRS Scoring Example
- MEC HA Input to CERCLA Alternative Evaluations

Overview of MEC HA Methodology

- CERCLA & NCP call for “**risk assessment**”
- Traditional risk assessment methods not applicable to MEC hazards
- Joint effort to develop consistent methodology for assessing MEC explosive hazards to people

Overview of MEC HA Methodology

- Designed to *compliment* MRSPP
- *Qualitative* tool, scoring values are *relative*
- *Emphasis* on EE/CA, RI/FS evaluations & analyses to *support* site-specific remedy selections

Overview: MEC HA Does...

- Promote consist HA Methodology
- Builds on SPP/TPP to help focus resources
- Promote communication through transparency
- Evaluate Baseline Explosive Hazards & support evaluation of CERCLA removal and remedial alternatives
- Give credit for taking action

Overview: MEC HA Does Not...

- *Set Data Quality Objectives*
- *Determine “How clean is clean ?”*
- *Make the cleanup decision*

Overview of MEC HA Methodology Document

- Chapter 1: Introduction
 - Scope, Benefits, CERCLA Role
- Chapter 2 :Technical Framework
 - Input Factors, Outputs
- Chapter 3 :Scoping the Hazard Assessment
 - Systematic planning process, MRS delineation, documentation,
- Chapter 4: Input Factors & Scoring
 - Detailed information on input factors, scoring
- Chapter 5: Output Hazard Levels
 - Qualitative descriptions; Input to removal, remedial decisions

Overview of MEC HA Methodology Document

- Appendix A: Automated Workbook
 - XL Format; ease of “what if” evaluations
- Appendix B : Automated “Camp Sample” example
- Appendix C: FAQs
- Appendix D: Scoring & Weighting Technical Basis

MEC HA Technical Framework Structure

MEC HA Structure

- Includes weighting, scoring, and combining input factors
- Uses use a relative numeric approach, similar to the EHE module of the MRSPP
- The organization of the structure follows severity, accessibility and sensitivity components
- Output – Hazard Levels

MEC HA Structure

The functional relationships addressed in the MEC HA are:

- **Severity:** The potential severity of the result should an MEC item function.
- **Accessibility:** The likelihood that a receptor will be able to interact with an MEC item.
- **Sensitivity:** The likelihood that an MEC item will function should a receptor interact with it.

MEC HA Structure

Severity: Input Factors

- Energetic Material Type
- Location of Additional Human Receptors
- *Proximity of Critical Infrastructure*
- *Proximity of Cultural Resources*
- *Proximity of Ecological Resources*

MEC HA Structure

Accessibility: Input Factors

- Site Accessibility
- Potential Contact Hours
- Amount of MEC
- Minimum MEC Depth Relative to Maximum Receptor Intrusive Depth
- Migration Potential

MEC HA Structure

Sensitivity: Input Factors

- MEC Classification
- MEC Size

Weights and Scores

- The input factor weights reflect the relative contributions of the input factors to the Hazard Levels
- The input factor category scores were developed to discern the relative effects of different removal or remedial alternatives and land use decisions on the Hazard Levels

Input Factor Weights

The input factor weights were developed with the following ideas in mind:

- Current methods cannot ensure that all MEC are found or removed
- The removal or remedial alternatives for MEC are all variants on reducing receptor access to MEC, either through land use controls, cleanups or both

Input Factor Weights

Explosive Hazard Component	Input Factor	Maximum Scores	Weights
Severity	Energetic Material Type	100	10%
	Location of Additional Human Receptors	30	3%
<i>Component total</i>		130	13%
Accessibility	Site Accessibility	80	8%
	Total Contact Hours	120	12%
	Amount of MEC	180	18%
	Minimum MEC Depth/Maximum Intrusive Depth	240	24%
	Migration Potential	30	3%
<i>Component total</i>		650	65%
Sensitivity	MEC Classification	180	18%
	MEC Size	40	4%
<i>Component total</i>		220	22%
Total Score		1,000	100%

MEC HA Structure

- Each input factor has two or more ***categories***
- The selected categories determine the input factor scores
- Input factor categories were developed to describe all reasonable land-based MRS conditions

MEC HA Structure

- Each category has scores for three MRS conditions:
 - The MRS at baseline
 - The MRS after a surface cleanup
 - The MRS after a subsurface cleanup
- This structure allows an MRS to be assessed with different removal or remedial alternatives, including LUCs

MEC HA Structure

- Scores for the **severity and sensitivity** input factors that **are not affected** by cleanup:
 - Energetic Material Type, MEC Classification, MEC Size scores are unchanged to represent the uncertainty about the completeness of MEC cleanups
 - Location of Additional Human Receptors will change only if land use changes bring about the construction or removal of a facility where people might congregate

MEC HA Structure

- Scores for the accessibility input factors that **can be changed** to represent changes in land use, the application of LUCs, or the implementation of cleanups:
 - LUCs or land use changes **can change** Accessibility, Potential contact hours, and Minimum MEC Depth Relative to Maximum Receptor Intrusive Depth
 - Cleanups **can change** Amount of MEC and Minimum MEC Depth Relative to Maximum Receptor Intrusive Depth

MEC HA Hazard Levels

- The Hazard Levels for the MEC HA are based on *relative numeric scores*
- Score Range is from 125 to 1000
- Score Range is broad enough to differentiate between hazard levels
- Uses a different range than the MRSPP

MEC HA Hazard Levels

The Hazard Level score ranges are:

- ***Hazard Level 1:*** ***840 - 1000***
- ***Hazard Level 2:*** ***725 - 835***
- ***Hazard Level 3:*** ***530 - 720***
- ***Hazard Level 4:*** ***125 - 525***

MEC HA Hazard Levels

The Hazard Levels descriptions are:

- **Hazard Level 1:** Sites with the highest hazard potential
- **Hazard Level 2:** Sites with a high hazard potential
- **Hazard Level 3:** Sites with a moderate hazard potential
- **Hazard Level 4:** Sites with low hazard potential

Input Factors

Descriptions and Scoring

Nine Input Factors

- Sensitivity
 - Energetic Material Type
 - Location of Additional Human Receptors
- Accessibility
 - Site Accessibility
 - Potential Contact Hours
 - Amount of MEC
 - Minimum MEC Depth Relative to Maximum Receptor Intrusive Depth
 - Migration Potential
- Severity
 - MEC Classification
 - MEC Size

Energetic Material Type

- The type of filler (for cased munitions) or explosives (for bulk explosives)
- The type of MEC will determine the category for this input factor
- Select the category with the highest score for known or suspected MEC

Energetic Material Type

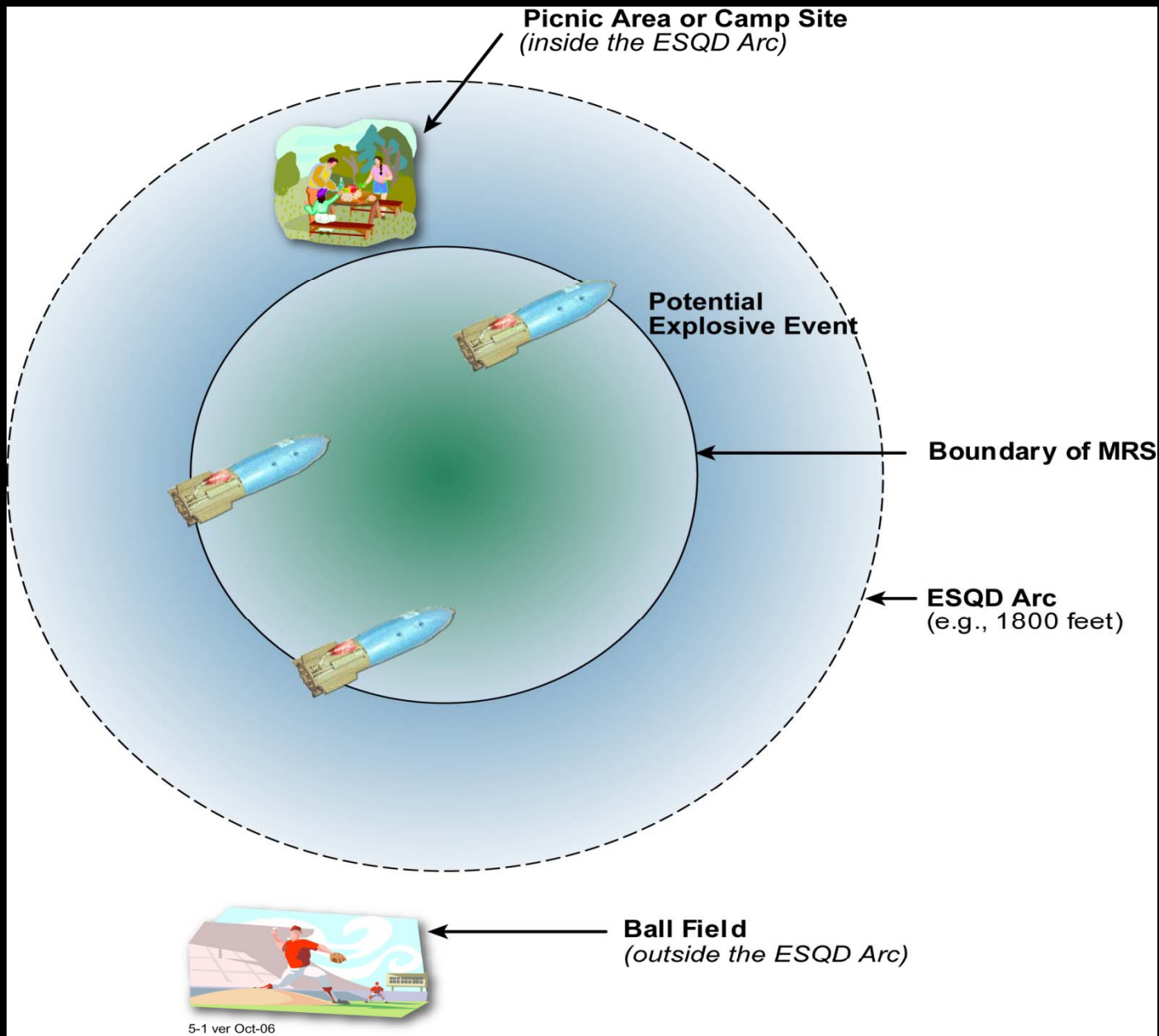
Category	Score		
	Baseline Condition	Surface MEC Cleanup	Subsurface MEC Cleanup
High explosives and low explosive filler in fragmenting rounds	100	100	100
White phosphorus	70	70	70
Pyrotechnic	60	60	60
Propellant	50	50	50
Spotting charge	40	40	40
Incendiary	30	30	30

Energetic Material Type

- The scores for this input factor do not change unless new information indicates that the original category is incorrect (e.g., a training range is found to have HE rounds)

Location of Additional Human Receptors

- Addresses secondary human receptors
- Locations of “places where people may congregate” (e.g., athletic fields, campgrounds, or inhabited buildings) within ESQD arc



Location of Additional Human Receptors

Category	Score		
	Baseline Condition	Surface MEC Cleanup	Subsurface MEC Cleanup
Inside the MRS or inside the ESQD arc surrounding the MRS	30	30	30
Outside of the ESQD arc	0	0	0

Location of Additional Human Receptors

- The ESQD arc can be obtained from the explosives safety submission (ESS) or the explosives siting plan (ESP)
- The category for this input factor will not change unless there are plans to either construct or remove a place where people congregate within the MRS or the ESQD arc.

Site Accessibility

- Represents the ease with which people can access the MRS
- Full Accessibility
 - No barriers to entry, including sites with signage but no fencing
- Moderate Accessibility
 - Some barriers to entry, such as barbed wire fencing or rough terrain
- Limited Accessibility
 - Significant barriers to entry, such as unguarded chain-link fences or requirements for special transportation to reach the site
- Very Limited Accessibility
 - Guarded chain-link fences, or terrain that requires special skills and equipment to access the site

Site Accessibility

Category	Score		
	Baseline Condition	Surface MEC Cleanup	Subsurface MEC Cleanup
Full accessibility	80	80	80
Moderate accessibility	55	55	55
Limited accessibility	15	15	15
Very limited accessibility	5	5	5

Site Accessibility

- The category for this input factor may change to represent changes to land use or the application of LUCs
- Cleanup will not change the scores for this input factor

Potential Contact Hours

- Human receptors activities at an MRS that may lead result in contact with MEC
- Based on estimates of the number of users per year, and the number of hours that each user engages in activities that may result in contact with MEC
- $(\text{number of users/year}) \times (\text{number of hours/use})$
= receptor hours/year

Potential Contact Hours

Category	Category Description
Many hours	$\geq 1,000,000$ receptor-hours/year
Some hours	100,000 to 999,999 receptor-hours/year
Few hours	10,000 to 99,999 receptor-hours/year
Very few hours	$< 10,000$ receptor-hours/year

Potential Contact Hours

Category	Score		
	Baseline Condition	Surface MEC Cleanup	Subsurface MEC Cleanup
Many hours	120	90	30
Some hours	70	50	20
Few hours	40	20	10
Very few hours	15	10	5

Potential Contact Hours

- The category for this input factor may change to reflect changes in land use or the application of LUCs
- The scores for this input factor are reduced with cleanup

Amount of MEC

- Represents the amount of MEC by the past munitions-related use of the MRS
- Scores are reduced to represent the effect of cleanups
- The category for this input factor will only change if information indicates the selected category is incorrect

Amount of MEC

Category	Score		
	Baseline Condition	Surface MEC Cleanup	Subsurface MEC Cleanup
Target area	180	120	30
OB/OD area	180	110	30
Function Test Range	165	90	25
Burial pit	140	140	10
Maneuver areas	115	15	5
Firing points	75	10	5
Safety buffer areas	30	10	5
Storage	25	10	5
Explosives-related industrial facility	20	10	5

Minimum MEC Depth Relative to the Maximum Receptor Intrusive Depth

- Represents the possible contact with MEC due to MEC location (surface or subsurface) and any receptor intrusive activities
- Requires information on the minimum MEC depth and the type of activities that will occur in the MRS

Minimum MEC Depth Relative to the Maximum Intrusive Depth

Category or Value	Score		
	Baseline Condition	Surface MEC Cleanup	Subsurface MEC Cleanup
Baseline Condition: MEC located surface and subsurface After Cleanup: Intrusive depth <i>overlaps</i> with subsurface MEC	240	150	95
Baseline Condition: MEC located surface and subsurface After Cleanup: Intrusive depth <i>does not overlap</i> with subsurface MEC	240	50	25
Baseline Condition: MEC located only subsurface Baseline Condition or After Cleanup: Intrusive depth <i>overlaps</i> with minimum MEC depth	150	N/A*	95
Baseline Condition: MEC located only subsurface Baseline Condition or After Cleanup: Intrusive depth <i>does not overlap</i> with minimum MEC depth	50	N/A*	25

*N/A: No surface cleanup if MEC is only located subsurface.

Minimum MEC Depth Relative to the Maximum Intrusive Depth

- The category for this input factor may change if:
 - The MRS has surface cleanup
 - The depth of intrusive activities change to either overlap, or no longer overlap, with the subsurface MEC
- The score for this category will change to represent surface and subsurface cleanups

Migration Potential

- Represents possibility that natural forces will lead to the migration of MEC to the surface
- Possible: Evidence indicates that it is possible for natural physical forces to expose subsurface MEC items or to move surface or subsurface MEC items
- Unlikely: Evidence indicates that MEC migration is unlikely

Migration Potential

Category	Score		
	Baseline Condition	Surface MEC Cleanup	Subsurface MEC Cleanup
Possible	30	30	10
Unlikely	10	10	10

Score is reduced for subsurface cleanup in the “Possible” category because removal of MEC reduces the likelihood of migration

MEC Classification

- Represents the likelihood that a MEC will detonate should a receptor come into contact with it
- The category for this input factor will not change unless new information shows that the selected category is incorrect
- The scores for this input factor do not change with cleanup

MEC Classification

Category	Category Description
UXO Special Case	UXO items with fuzes that are more likely to function with any movement or potential environmental conditions.
UXO	All other UXO items.
Fuzed DMM Special Case	DMM with a fuzing mechanism present, but not armed for use. DMM with special case fuzes can be armed and functioned through human activity (e.g., hand grenades).
Fuzed DMM	DMM with a fuzing mechanism present, but not armed for use. Fuzes on DMM in this category require high inertial energy to be armed. <i>This category also contains unarmed fuzes not installed in munitions.</i>
Unfuzed DMM	DMM without fuzing mechanisms. This category also includes boosters, bursters, and blasting caps.
Bulk explosives	Explosive material that is not contained in a cased munition or is present in soils or sediment.

MEC Classification – UXO or DMM?

- Assume UXO in target areas, safety buffers surrounding target areas, and QA function test ranges
- Assume DMM in maneuver areas, firing points, burial pits, and storage areas
- Assume bulk explosives in industrial facilities

MEC Classification – In OB/OD Areas

- Assume UXO in OB/OD areas if:
 - The OB/OD area is located adjacent to a range, indicating that it was sited to serve as a UXO disposal area
 - Historical evidence indicates that EOD teams used the OB/OD area to dispose of UXO
 - UXO has been found in the OB/OD area

MEC Classification – In OB/OD Areas (cont.)

- If none of the above apply, then it is probably more reasonable to assume that the OB/OD area only contains DMM
- DMM in OB/OD areas have “experienced abnormal environments” and should be *classified as UXO* until determined to be DMM by qualified personnel
- Assume that safety buffers surrounding OB/OD areas have the same MEC classification category as the OB/OD area

MEC Classification – Special Case MEC

- “Special Case” (UXO and DMM) munitions include:
 - All submunitions
 - Rifle propelled 40mm projectiles
 - All munitions with white phosphorus filler
 - High explosive anti-tank (HEAT) rounds
 - Hand grenades
 - All mortar rounds

MEC Classification

Category	Score		
	Baseline Condition	Surface MEC Cleanup	Subsurface MEC Cleanup
UXO Special Case	180	180	180
UXO	110	110	110
Fuzed DMM Special Case	105	105	105
Fuzed DMM	55	55	55
Unfuzed DMM	45	45	45
Bulk explosives	45	45	45

MEC Size

- Represents the ease with which MEC can be moved by a human receptor
- Small – MEC weighing less than 90 pounds
- Large – MEC weighing 90 pounds or more

MEC Size

Category	Score		
	Baseline Condition	Surface MEC Cleanup	Subsurface MEC Cleanup
Small	40	40	40
Large	0	0	0

MEC Size

- The category for this input factor will not change unless new information shows that the incorrect category was selected
- The scores for this category do not change with cleanup

MEC HA Hazard Levels

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Hazard Level 1 – Typical Characteristics

- High Explosive UXO “Special Case” on the surface
- Former Target Area or OB/OD Area
- Full or moderate accessibility
- Has not undergone thorough cleanup

Hazard Level 2 – Typical Characteristics

- UXO, or Fuzed DMM “Special Case” on the surface
- Intrusive activities that overlap with subsurface UXO, or Fuzed DMM “Special Case”
- Former target area, OB/OD area, function test range, or maneuver area
- Full or moderate accessibility

Hazard Level 3 – Typical Characteristics

- May have any type of MEC or past use. Primarily Propellant or lower, Firing points or lower
- MEC subsurface only: may be due to past clearance or by selecting Surface clearance column
- Moderate or limited accessibility or low number of contact hours or both

Hazard Level 4 – Typical Characteristics

- May have any type of MEC or past use. Primarily Propellant or lower, Firing points or lower
- MEC subsurface only – incomplete exposure pathway
- Very Limited Accessibility or low number of contact hours or both

Questions ??

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Training Examples