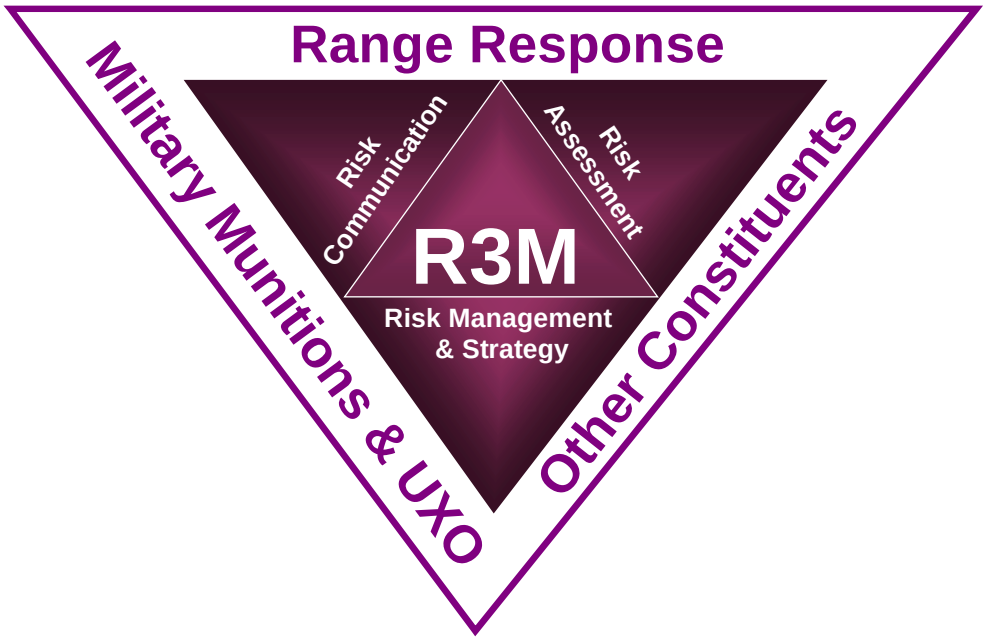
INTERIM R3M
RANGE RULE RISK METHODOLOGY

A Process for Managing, Assessing, & Communicating Risk on Closed, Transferred, or Transferring U.S. Ranges

INTERIM PROCEDURES MANUAL



Department of Defense

March 2000

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EXECUTIVE SUMMARY

Ranges across the United States have been used for military training and testing weapons to prepare for World War I, World War II, Korea, Vietnam, and other conflicts. These ranges may contain unexploded ordnance (e.g., rounds that did not explode upon impact) and other constituents (such as chemicals and hazardous residue).

While the public was not using these areas, the military managed these areas to protect human health of military personnel. But through the years, particularly as the military has downsized, many of these former ranges have been closed, transferred, or are in the process of being transferred, so that they can be used for other purposes. As a consequence, the Department of Defense (DoD) recognizes these areas need to be examined closely for hazards, and action must be taken to reduce risk to the public.

DoD has developed a comprehensive process for managing, assessing, and communicating risk on these former ranges located within the United States. Under the proposed Range Rule (1997), DoD has developed the Range Rule Risk Methodology (R3M), a process to effectively manage risks posed by unexploded ordnance and other constituents often found on former military ranges.

Developed by representatives from DoD, EPA, state and tribal regulatory authorities, and a wide variety of other stakeholders, the R3M (referred to as the Risk Methodology throughout this Procedures Manual) involves seven steps that ensure safety to human health and the environment by providing the Project Team (representatives from DoD, Federal, state, and Tribal regulatory agencies, and the public) with the tools necessary to:

- Gather sufficient, accurate data to make informed decisions
- Weigh factors to make informed decisions concerning response actions
- Keep stakeholders involved in the risk management process and
- Begin taking proactive action immediately to reduce risk associated with unexploded ordnance and other constituents.

This Interim Procedures Manual focuses on risk reduction and is aimed at the assessment and development of response actions at closed, transferred, and transferring ranges. The goal of this Interim Procedures Manual is to support promulgation and initial implementation of the Range Rule. It will evolve to include updates, additional tools, and criteria for Step 6 Recurring Review and Step 7 Close-Out. Additionally, it will provide tools for determining whether Close-Out is warranted at any step in the Risk Methodology. Finally, it will incorporate the valuable lessons learned by Project Teams as they begin to address risks using the tools provided in this Procedures Manual that follows.

OVERVIEW

To address human health, environmental, and explosives safety concerns, DoD has developed a comprehensive process for managing, assessing, and communicating risk on former ranges located within the United States. Under the proposed Range Rule (1997)[1], DoD has developed the R3M, a process to effectively manage risks posed by unexploded ordnance and other constituents often found on former military ranges.

Developed by representatives from DoD, EPA, state and tribal regulatory authorities, and a wide variety of other stakeholders, the R3M (referred to as the Risk Methodology throughout this Procedures Manual) involves the following seven steps[2]:

1. Range Identification
2. Range Assessment
3. Range Evaluation
4. Response Selection
5. Site-Specific Action
6. Recurring Review
7. Close-Out

This Procedures Manual provides the Project Team (representatives from DoD, Federal, state, and Tribal regulatory agencies, and the public) the tools necessary to:

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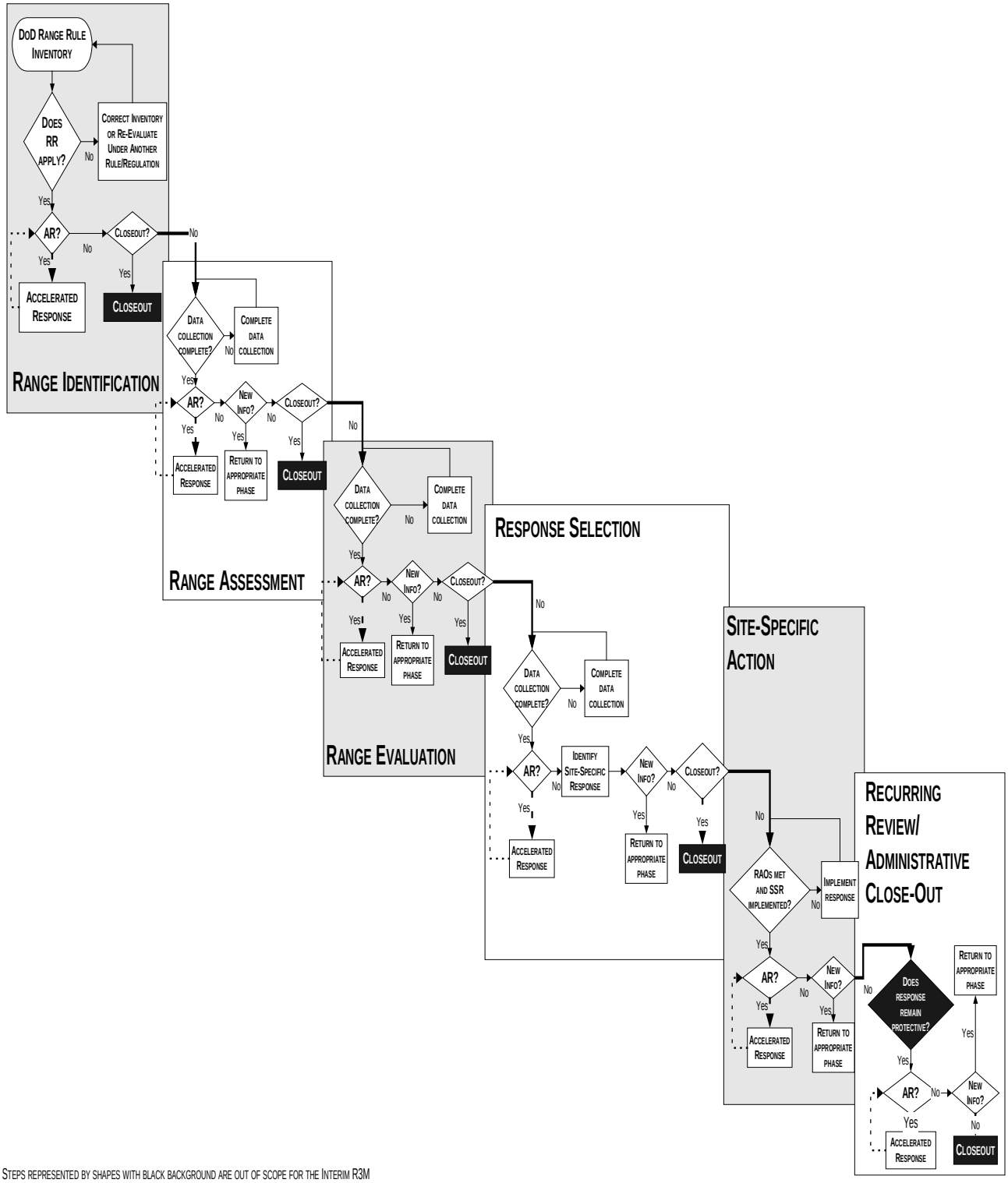
[1] Numerous comments were received on the Proposed Range Rule during the public comment period. Those comments are currently being addressed and the Proposed Range Rule is being revised. However, due to rule making requirements the Interim R3M reflects requirements of the Proposed Range Rule. Once responses to comments on the Proposed Range Rule are available to the public, the Interim R3M will be revised.

[2] In the Proposed Range Rule, these steps are called: Range Identification Phase, Range Assessment and Accelerated Response Phase, Detailed Range Evaluation, Site-Specific Response Phase, Recurring Reviews, and Administrative Close-Out

The R3M Process



Steps represented by shapes with black background are out of scope for the Interim R3M

Definitions provided in margin have been simplified to enhance readability. Expanded definitions can be found in the Glossary of this Procedures Manual.

Unexploded Ordnance (UXO): *In this document, the term "unexploded ordnance" is used to address both military munitions and unexploded ordnance on closed, transferred, and transferring ranges. A military munition becomes unexploded ordnance only after it has been employed and failed to function properly.*

Other Constituents: *Potentially hazardous chemicals that are located on or originate from closed, transferring or transferred ranges and are released from military munitions or unexploded ordnance, or resulted from other activities on military ranges.*

Risk: *A consideration of two factors: 1) The probability that something negative will occur (i.e., an encounter with **UXO** or **other constituents**); 2) The consequences of that negative event (i.e., the consequences of exposure to UXO or other constituents). See Appendix 1 – Nature of Risk for additional risk-related concepts.*

Address risks: *The Project Team seeks to analyze, select, implement and evaluate actions to reduce any risks to human health and the environment as a result of UXO or other constituents that may be located on the ranges that are closed, transferred or transferring.*

A Framework for Effective Risk Management

Ranges across the country have been used for military training and testing of weapons to prepare for World War I, World War II, Korea, Vietnam, and other conflicts. These ranges may contain materials as a result of military training and testing including **unexploded ordnance** (e.g., rounds that did not explode when fired) and **other constituents** (e.g., chemicals and hazardous residue).

While the public was not using these areas, the military managed them to protect human health of military personnel. But through the years, particularly as the military has downsized, many of these former ranges have been closed, transferred, or are in the process of being transferred, so that they can be used for other purposes. As a consequence, DoD recognizes that these areas need to be examined closely for hazards, and action must be taken to reduce risk to the public.

Risk is the probability that a substance or situation will produce harm under specific conditions. It is an important part of the Risk Methodology as Project Teams try to assess, manage, and communicate risk to minimize any effects unexploded ordnance or other constituents may have on people or the environment.

In response to this recognized need, the Range Rule was proposed on September 26, 1997. The proposed Range Rule identifies a process for evaluating appropriate actions to manage, assess, and communicate risk on **closed**, **transferred**, and **transferring** military ranges. This process:

- **Addresses explosives safety and other constituent risks**
- Protects human health and the environment
- Seeks stakeholder involvement
- Focuses on informed risk management decision-making and action rather than on protracted study
- Draws upon lessons learned from related environmental programs

This Procedures Manual has been developed to provide tools for Project Teams to collect data so that decision-makers can make informed decisions concerning action and keep stakeholders involved as required under the proposed Range Rule.

Proactively Addressing Challenges in Managing Risk on Former Ranges

Project Teams must proactively address several challenges as they manage risk on closed, transferred, and transferring ranges:

Obtaining Sufficient, Accurate Data – While information exists concerning each range, the Project Team must work hard to find data since it is located in a wide variety of locations and forms. To make informed decisions, the Project Team must collect sufficient information concerning the condition of the range and the hazards that exist there.

Working Within Current Technology Limitations – No existing state-of-the-art technology can find all UXO in all types of typography and to all depths. Explosives ordnance disposal (EOD) teams often detect UXO by removing vegetation, marking off grids, and moving foot by foot across marked areas with hand-held detection instruments. Each detected anomaly must then be excavated, often by pick and shovel, to be examined. Although significant strides are being made to improve these technologies, current methods tend to be slow, tedious, and expensive.

Protecting the Environment – Many of the former ranges located throughout the United States are some of the best-preserved lands in the world, harboring a wide variety of endangered plant and animal species. For DoD to be a good environmental steward, any risk management actions taken on former ranges must carefully consider the environment. Environmental considerations are often a big challenge since some risk-reduction actions require clearing vegetation and trees to allow EOD teams to see the ground and remove UXO.

Protecting Workers and the Public– Because many munitions did not function as designed or are waiting to function, the resulting UXO is unpredictable and inherently dangerous. Consequently, addressing UXO and other constituents requires highly trained experts and special safety procedures. Any risk-reduction activity must consider the risk to these trained personnel as well as the risk to the community

Closed Range:
A former military range that is now being used in an incompatible capacity. Closed Ranges are still under the control of DoD.

Transferred Range:
A military range that is no longer under military control. The transfer may have been a deed or lease or other special consideration under which DoD used the property.

Transferring Range:
A military range that is proposed to be leased, transferred or released from DoD to a new owner. Transfers may be by deed, lease, or other special consideration in which DoD used the property.

Project Team:
A working partnership between the U.S. Environmental Protection Agency, State, Tribal, local stakeholders, Restoration Advisory Boards, Technical Review Committees, and the general public. They are responsible for scoping response actions, preparing plans and reports, managing the project, and coordinating public involvement.

Well aware of these challenges in managing risk, DoD is committed to addressing the situation proactively. The Risk Methodology detailed in this manual is based upon the following premises:

The Project Team must use an acceptable and logical data gathering approach – Because decision makers must have an accurate picture of range conditions and hazards to make informed decisions, the Risk Methodology uses the **Data Quality Objective (DQO)** process for planning effective data gathering.

DQO:
The Data Quality Objective process, developed by EPA, ensures that the appropriate type, quality, and quantity of data are gathered to make informed decisions. Planning worksheets and Appendix 2 describe how to establish DQOs in each step.

Stakeholders must be involved in the process – Because reducing risk at former ranges is a complex issue that has many possible outcomes, stakeholders must understand the many variables inherent in informed decision-making and participate in the process. Only by understanding the wants and concerns of stakeholders through an inclusive decision-making process can DoD ensure appropriate risk-reduction actions.

The Project Team must continually make progress, while remaining flexible – Rather than focusing on protracted study, the Risk Methodology focuses on action. As new data emerges, the Project Team must remain flexible and adapt actions accordingly. As new technologies emerge, for example, the Project Team must consider that technology in determining appropriate action to manage risk.

The Project Team must protect human health and the environment throughout the process – At any point in the process, decision-makers will take action (**accelerated response**) if an immediate threat to human health or the environment is discovered. Accelerated responses are designed to be performed quickly rather than waiting for additional studies. This quick response ensures that protecting human health and the environment remains the central priority throughout the Risk Methodology. Before undertaking response actions, DoD must first consider the explosives safety risk inherent in locating, investigating, evaluating, and responding to areas where UXO are known or suspected to be present.

Accelerated Response:
An immediate action to reduce risk performed when decision-makers determine that there is an immediate threat to human health or the environment.

Based upon these premises, the Risk Methodology (outlined below) sets forth a standardized approach for effectively managing risks inherent on former ranges.

Overview of the Risk Methodology

The **Risk Methodology** is a systematic, logical approach for ensuring that risk-reduction actions are effective in protecting human health and the environment, technically feasible, fiscally responsible, and consistent with the intended land use. This seven-step approach applies the principles of EPA's Data Quality Objective (DQO) process, Comprehensive Environmental Response, Compensation, and Liability Act (**CERCLA**), and the National Oil and Hazardous Substances Pollution Contingency Plan (**NCP**) with DoD's explosives safety requirement and other applicable laws and regulations.

Below is a brief overview of the **Range Rule Risk Methodology (R3M) process**. This process is illustrated in Figure 1. During each step of this process, stakeholders (including the public) are kept consistently informed and involved:

Step 1 – Range Identification

As the Project Team begins the process, their first job is to verify that the property is a closed, transferred, or transferring range and subject to the Range Rule. If data suggests that there is an immediate danger to human health or the environment, an accelerated response may also be undertaken.

Step 2 – Range Assessment

Once the Project Team has determined that the property is subject to the Range Rule, they conduct a preliminary study to assess the nature of hazards in the area. If any immediate danger to human health or the environment is discovered during this step, an accelerated response may be undertaken.

Step 3 – Range Evaluation

Based upon the range assessment, the Project Team undertakes a more detailed study to further evaluate the hazards. Sampling and field work are performed to gain a deeper understanding concerning the specific location and type of hazards. As in the other steps, accelerated response is undertaken if necessary.

Step 4 – Response Selection

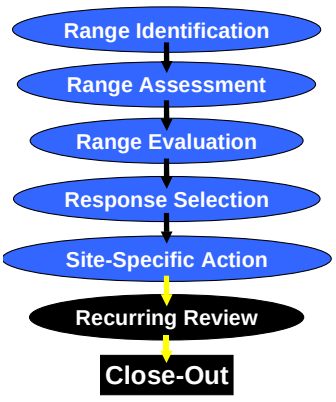
Based upon the extensive data collected in Steps 2 and 3, the Project Team now weighs possible response actions and selects the most appropriate action(s) to meet risk-reduction goals. In deciding appropriate action, the Project Team weighs nine criteria[3]:

Risk Methodology: *The R3M is DoD's standardized approach for effectively managing risk on former ranges.*

CERCLA: *Environmental law giving the federal government broad authority to regulate hazardous substances, respond to emergencies, and develop long-term solutions for serious hazardous waste problems.*

NCP: *Provides organizational structure and procedures for responding to discharges and releases of hazardous substances, pollutants, and contaminants.*

R3M Process: *Each step increases in scope and complexity. Each step could include implementing an accelerated response, returning to an earlier step, or proceeding to the Close-Out Step (currently not an option in this Interim Procedures Manual).*



[3] These criteria are based upon the nine criteria established by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP)

ARARs: *Applicable or relevant and appropriate requirements are any state or federal statute that pertains to protection of human life and the environment in addressing specific conditions or use of a particular cleanup technology.*

1) Overall protection of human health and the environment
2) Compliance with ARAR's
3) Long term effectiveness and Permanence
4) Reduction in Toxicity, Mobility and Volume
5) Short term effectiveness
6) Implementability
7) Cost
8) Acceptance by appropriate regulatory agencies or agencies with jurisdiction over affected resources
9) Community acceptance

Accelerated response is also undertaken as needed.

Step 5 – Site-Specific Action

After the Project Team has selected the most appropriate risk-reduction actions given current and future land use, they implement and evaluate these actions to determine whether the action met established goals and whether risk was effectively reduced. Accelerated response is also undertaken if appropriate.

Step 6 – Recurring Review

After implementing the action, the Project Team reevaluates site conditions to determine whether the action continues to protect human health and the environment. During this step, new technologies and information can be considered to determine if additional actions are warranted. Accelerated response is also undertaken as needed.

Step 7 – Close-Out

When decision-makers have sufficiently determined that actions continue to protect human health and the environment, Close-Out can be considered. However, operations and maintenance activities may still be occurring. (The Final R3M Risk Methodology Procedures Manual will include criteria and tools for making this final determination; until these criteria are fully established, all closed, transferred, and transferring ranges will continue to be subject to recurring review). Accelerated response continues to be undertaken as needed.

The following sections of detail each step of the approach and provide Project Teams the comprehensive tools necessary for making informed decisions.

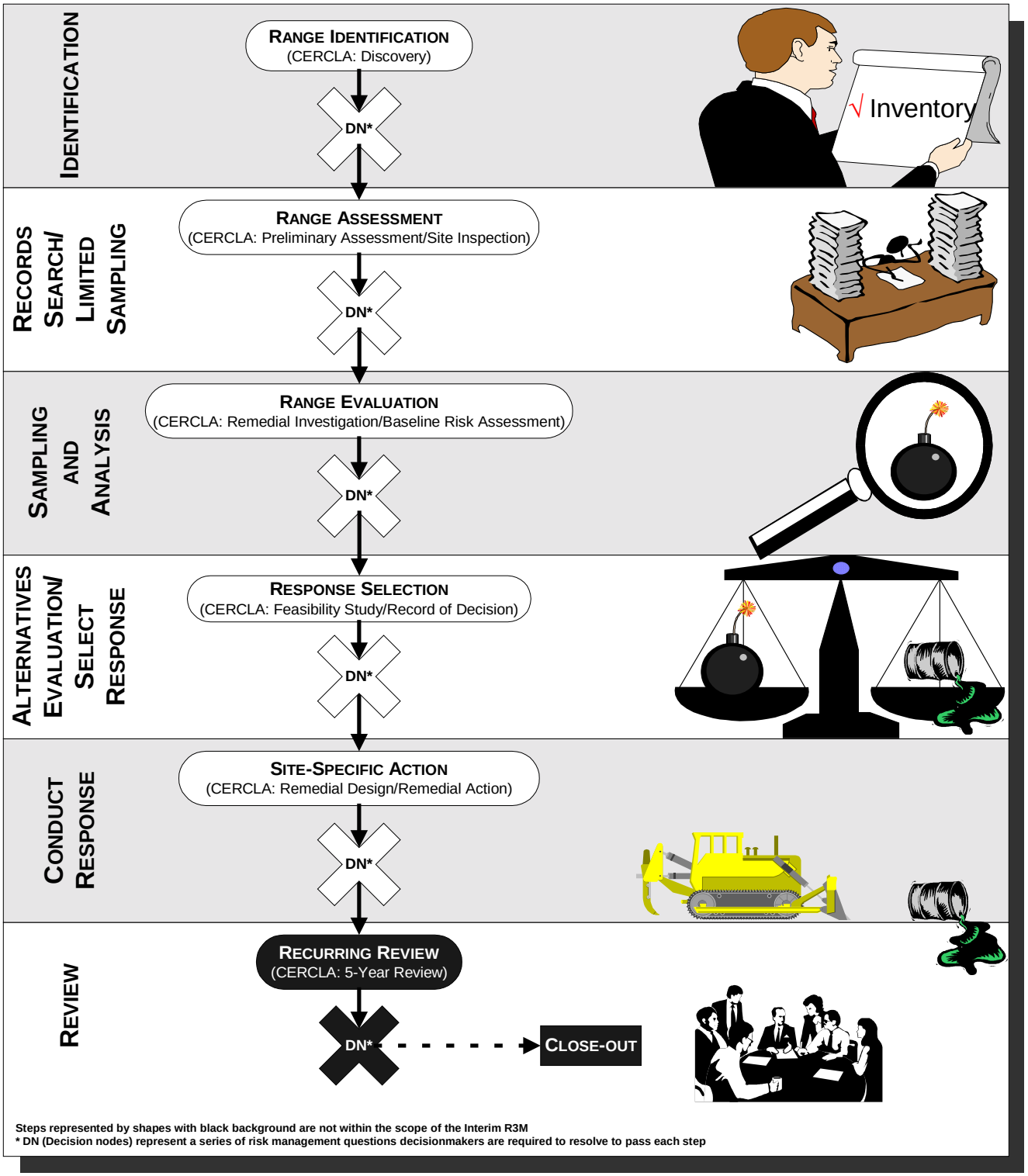


Figure 1. Diagram of Interim R3M Process

STEP 1 – RANGE IDENTIFICATION

The first of seven steps in the Risk Methodology, **Range Identification** requires the Project Team to:

- Verify that the property is subject to the Range Rule.
- Determine if there is an immediate threat to the public or environment, which requires an Accelerated Response.
- Determine if additional data is needed before advancing to **Step 2 – Range Assessment**.

The Range Identification worksheets and decision-making process will walk decision-makers through a data collection and thought process necessary for completing **Step 1**.

What Data Must Be Collected

The Project Team will begin gathering documentation that will expand with each step of the Risk Methodology. Many of the historical and archival documents will provide in-depth information necessary for steps that follow. The majority of these documents will be available from the DoD office responsible for the property or a local information repository previously established. These documents once gathered and organized may be cross-referenced during later steps in the process.

National Inventory *refers to DoD National Inventory of Closed, Transferred and Transferring Ranges.*

In this step, the Project Team will gather data to verify whether the property is classified as a "range" and, potentially subject to the Range Rule. The Project Team should first determine whether the property is listed on the **National Inventory**, which is currently under development. If the property is listed on the Inventory, the Project Team must collect **one** piece of information to verify that the property should be on the inventory.

If the Inventory has not been completed yet, but the Project Team believes that the property should be categorized as a "range," the Team will need to identify information from at least **one** of the following sources. Following this procedure, notify the responsible DoD component to be considered for inclusion on the National Inventory:

- Maps, environmental studies and surveys
- Reports of accidental encounters
- Real estate records
- EOD Response Reports
- Other federal agencies, state, tribal, local, regulatory or
- Stakeholder claims or documentation

Once the Project Team has verified that the property is a range, the decision-makers must then determine if it is "closed," "transferred" or "transferring," by contacting the DoD component responsible for the property.

Field work is not needed to complete Step 1. However, an assessment is necessary to determine if there are immediate threats to human health and/or the environment. The Project Team should consider taking immediate action under Accelerated Response if, based on the information gathered, unexploded ordnance or other constituents are present that would pose an immediate threat to human health or the environment. A worksheet containing reports and requirements will appear in each step of the R3M process. This worksheet will enable the Project Team to track legal and process obligations, concurrence and deadlines for each step.

What Should Be Communicated With Stakeholders

During this process, the Project Team will begin to establish a working partnership with the Environmental Protection Agency, State, Tribal, local stakeholders, Restoration Advisory Boards, Technical Review Committees and the general public. There is the opportunity to establish early contact with these interested parties during **Step 1- Range Identification.**

During **Step 1**, communicating the following information would enhance stakeholder involvement and may be submitted for inclusion in publicly-accessible records:

- Whether the area is covered under the Range Rule.
- What potential threats to human health and the environment exist (based upon information collected).
- What action will be taken next to further this process
- What are the stakeholders' main concerns and how they are best addressed.

What Reports Are Required

The DoD component is responsible for adding the following information to the permanent land record during Step 1:

- Known or possible military range
- Unique identifier
- Common range name
- Potential hazards
- DoD Point of Contact.

Suggested Training Course Topics:

- *Sampling Methodologies*
- *Risk Assessment (Human Health and Ecological)*
- *Risk Communication*
- *Risk Management*

*Stakeholders and the public will be given access to information collected throughout the **Range Identification Step** in a variety of ways including written notification, informal meetings and public availability sessions, newspaper announcements and formal reports. Each of these communication tools seeks to provide clear information concerning the work being done and seeks stakeholder input to the **Risk Methodology.** Appendix 3 contains examples of these different types of tools.*

WORKSHEET 1a – RANGE IDENTIFICATION BASIC PROJECT AND CONTACT INFORMATION

*This worksheet is intended to help the Project Team collect and analyze information necessary to complete **Step 1 – Range Identification** of the Risk Methodology. Information collected and decisions made using this worksheet will help the Project Team document and report the information, provide public records, and communicate with stakeholders.*

The Project Team will complete the following worksheets for each sector, parcel, or unit of the range. These worksheets are contained on a disc. If the Project Team does not have the capability to use the disc, make copies of the following worksheets for each sector, parcel, or unit evaluated.

RANGE & SECTOR NAME:	
LOCATION: *(City, State, Approximate Acreage)*	
LAND OWNER:	

PROJECT TEAM MEMBERS

(Members will make up the core team conducting the Risk Methodology. Team members are subject to change and should be reconfirmed at each step to ensure accurate contact information.)

DoD Contact: *(Note if Restoration Advisory Board Co-Chair)*	Phone: E-mail:
Environmental Protection Agency Contact:	Phone: E-mail:
State Contact:	Phone: E-mail:
Tribal Contact:	Phone: E-mail:
DoD Information Contact:	Phone: E-mail:
Restoration Advisory Board Co-Chair	Phone: E-mail:
Technical Review Committee	Phone: E-mail:
Other Members (if applicable)	

INFORMATION REPOSITORY

Location 1: Address: Phone: E-mail:	Location 2: (if applicable) Address: Phone: E-mail:
Location 3: (if applicable) Address: Phone: E-mail:	

WORKSHEET 1b - RANGE IDENTIFICATION REPORTING (*to be completed from following worksheets*)	
Start Date:	
Completion Date:	
Communication Activities:	Document any communications with stakeholders
Determined Action:	Accelerated Response Step 2- Range Assessment Other _____
Information Submitted:	Stakeholders Date: Information Repository Date: Other _____

DECISION-MAKING PROCESS

Step 1 – Range Identification

This process has been organized in a practical manner to help the Project Team approach Range Identification in order to Plan, Gather Data, and Decide courses of action. This will ensure that all necessary factors are available at the time the Team will need them for consideration.

RISK METHODOLOGY

RANGE IDENTIFICATION

➢ *PLAN*

GATHER DATA

DECIDE

RANGE ASSESSMENT

RANGE EVALUATION

RESPONSE SELECTION

SITE-SPECIFIC ACTION

RECURRING REVIEW

CLOSE-OUT

☐ PLAN

To ensure that data gathering strategy will result in accurate, appropriate data collection, use the Range Identification Planning Worksheet below. More information about each of the steps and their individual components outlined in the Planning Worksheet refer to Appendix 2. Although the entire data quality objectives is not applicable to this data collection effort, the following worksheet will assist the Project Team in meeting the underlying goal of the Range Identification Step, to ensure the Range Rule is applicable to the site and to take any necessary immediate action.

WORKSHEET 1c - RANGE IDENTIFICATION PLANNING

What Is The Situation?

- The Project Team should define the problem and objective of Range Identification. This should be a simple statement declaring what the Project Team intends to accomplish at this point in the process.
- The team may want to enhance the general situation provided based on site-specific conditions (e.g. Conceptual Site Model, resources, time constraints).

General Situation:	Collect data to verify the property is considered a closed, transferred or transferring range and subject to the Range Rule.
Site Specific Situation: *If applicable*	

What Decisions Must Be Made?

- The Project Team must build upon the specific objectives identified above and pinpoint both the decisions and how the decisions will be made during this step of the process.
- This information will be used to define data which will be valuable and which data are required when making these decisions.

1) Is this range a closed, transferred, or transferring range and subject to the Range Rule?	Determine whether the information needed to verify the property as a closed, transferring or transferred range is available.

2) Is there an immediate threat to human health and the environment caused by unexploded ordnance or other constituents?	Evaluate existing information and information in the Accelerated Response Section to determine if an accelerated response is appropriate. Other:

What Data Will Be Used in Making These Decisions?

- The Project Team will need to design a record search to locate documents necessary for gathering data to make the decisions identified above.
- Locations for record search will be chosen as a result of the Range Identification Planning worksheet. At this point in the planning process consider the appropriate documents and sources[4] for this information.

What information sources and locations are most applicable to the record search? *Check sources that are available and applicable to the situation and decisions described previously in this worksheet. Gather at least one piece of information from the following possible sources.*	**Suggested Information Sources for Step 1 Record Search:** — Maps of site/ installation — Environmental studies and survey — Reports of accidental encounters with unexploded ordnance or munitions — Real Estate records — EOD Response Reports — Other federal agency, state, tribal, local regulatory or stakeholder claims or documentation — National Inventory of Closed, Transferred or Transferring Ranges — Other:

How Will Decisions be Made?

- To design a data collection effort, it is important to understand how decisions are being made. The DQOs should be focused on providing the necessary information to make the required decisions at this point in the process.

Review the "Decide" part of the Range Assessment Step.	

[4] A list of information repositories (potential sources for information) is included in Appendix 2.

☐ GATHER DATA

WORKSHEET 1d - RANGE IDENTIFICATION GATHER DATA

All gathered data and information should be documented and attached to this worksheet along with any documents created based on findings.

Is the property a CTT range?

☐ The property appears on the DoD National Inventory of Closed, Transferred and Transferring Ranges.

(Note: The National Inventory is currently under development by all the military services. The final document will be available 18 months after the Range Rule becomes a final rule. The Final Range Rule document will contain a DoD point of contact, and telephone number.)

☐ If there is NOT an Inventory or the property is not listed on the inventory, but the Project Team believes that the property SHOULD be categorized as a range.

☐ Project Team has gathered at least one of the following sources as supporting documentation to substantiate inclusion of the range on the DoD National Inventory:

- Maps of site/installation
- Environmental studies and surveys
- Reports of accidental encounters with unexploded ordnance or munitions
- Real estate records
- EOD Response Reports
- Other federal agency, state, tribal, local, regulatory or stakeholder claims or documentation

What is the status of the range?

☐ CLOSED

☐ TRANSFERRED

☐ TRANSFERRING

☐ OTHER (e.g., active, inactive, battlefield, not a range)

Specify:

Contact the DoD component listed on the Basic Project and Contact Information Worksheet.

Are there any pre-existing agreements (e.g. Federal Facilities Agreement), or other information about decisions made concerning management of this property that may disqualify the "range" from the Range Rule Process?

☐ **YES:** (Note date, partners and agreement; attach copy to worksheet).

— Agreements

— Project Team has decided to use pre-existing agreement to guide process

☐ **NO:** Range Rule and R3M apply

Based on the gathered information, is there reason to take immediate action under Accelerated Response?

(Field work is not needed to meet the minimum requirements for the data needed to complete Range Identification. However, an assessment is necessary concerning safety if the property is open or accessible to people.)

☐ **YES:** Immediate threat because one or more of the following are evident:

— Unexploded ordnance or munitions present an immediate threat to human health or the environment.

— Potentially hazardous constituents are present that may cause immediate and dangerous threats to human health or the environment.

Proceed to Accelerated Response Section

☐ **NO:** Proceed to Range Identification Decide section

☐ DECIDE

WORKSHEET 1e - RANGE IDENTIFICATION DECIDE

Based upon the data gathered, make the two identified decisions:

1. Is this range a Closed, Transferred, or Transferring Range and subject to the Range Rule?

_____ **YES:** This range appears on DoD National Inventory of Closed, Transferred and Transferring Ranges as a:

_____Closed Range
_____Transferred Range
_____Transferring Range

AND

_____**YES:** I have the following:

_____ One piece of supporting documentation from data gathered that verifies that the range should be considered a CTT range.

_____ No documentation of pre-existing agreements or other information that may disqualify this property from management under the Range Rule Process.

OR

_____ Pre-existing agreement exists, but the Project Team has decided to use the Range Rule and its accompanying R3M process to guide range response decision-making.

_____ **NO:** I have the following:

_____ Documentation of pre-existing Records of Decision, agreements or other information that may disqualify this property from management under the Range Rule Process.

Document findings and the process to be used.

OR

_____ Have not completed requirements under "Yes".

Examples of immediate threats:
UXO present on the surface and uncontrolled access to the range

Other constituents present immediate toxicological threats to human health or the environment.

2. Is there an immediate threat to human health or the environment requiring an Accelerated Response to this range?

_____**YES:** Proceed to Accelerated Response actions (page 127) to ensure quickest response to protect human health and the environment.

_____**NO:** Proceed to **Step 2 – Range Assessment**.

STEP 2 – RANGE ASSESSMENT

The second step of the Risk Methodology, **Range Assessment** requires the Project Team to:

- Collect preliminary data to estimate the location, amount, and type of unexploded ordnance and other constituents.
- Distinguish between areas that pose minimal risk to human health or the environment versus those areas that pose greater risk.
- Determine what additional data must be collected in order to make informed decisions as the Risk Methodology continues.

The **Range Assessment Worksheet** will guide the Project Team through a data collection and thought process necessary for completing Step 2.

What Data Must Be Collected

Range Assessment, a "transition step" between Range Identification and Range Evaluation, allows the Project Team to determine what additional data needs to be collected to make informed decisions concerning action.

In Step 2, the Project Team will gather data to estimate the location, amount and type of unexploded ordnance or other constituents at closed, transferred and transferring ranges through a historical search and if applicable a site visit. The Team may have already gathered some of this data in **Step 1,** but in **Step 2 - Range Assessment**, the Team will review this data, assess its relevance to Step 2, and gather additional data necessary to estimate the risks on the range and determine the need to further consider other constituents.

If at any point the Project Team determines that there is an immediate threat to human health or the environment, immediate action should be considered under **Accelerated Response**.

How Data Will Be Evaluated

The data collected during Step 2 will provide the Project Team with a history of the property based on existing documentation. The documentation will allow the Project Team to determine a military history of the property, what type of training and testing occurred, what type of munitions were used, potential locations and amounts. The documentation may also provide information about any reported incidents of munitions found on the property and associated risks. Any previous sampling, surveying or actions taken on the range may also be documented and provide valuable resources for use as the Project Team begins addressing the range through the **Risk Methodology**.

What Should Be Communicated With Stakeholders

During **Step 2**, communicating the following information would enhance stakeholder involvement and may be submitted for inclusion in publicly-accessible records:

- Estimated locations, amounts, and types of unexploded ordnance, or other constituents.
- Risks posed to human health and the environment.
- Stakeholders' main concerns and how they are best addressed.
- Sampling technologies.
- Next action in this process and why.
- Communities can become involved and influence decisions.

*Stakeholders and the public will be given access to information collected throughout the **Range Assessment Step** in a variety of ways including written notification, informal meetings and public availability sessions, newspaper announcements and formal reports. Each of these communication tools seeks to provide clear information concerning the work being done and seeks stakeholder input to the **Risk Methodology.***

All documents (Final Report, Decision Documents and supporting information) should be provided to appropriate government agencies, the landowner, and for inclusion in publicly accessible records.

What Reports Are Required

The DoD component is responsible for the following reports and other documentation during Step 2:

- Written notice to Federal, Tribal and State agencies of start of Range Assessment Step
- Request from Federal, Tribal and State agencies to assign a point of contact to represent their agency and contact member for participation on the Project Team
- Range Assessment Draft Work Plan (EPA, State, Tribal & Land Owner)
- Range Assessment Draft Report (EPA, State, Tribal & Land Owner)
- Notice of Availability for Range Assessment Report will be published in major local paper (45 day comment period)
- Public Availability Session if requested
- Responses to comments from the public
- Formal Decision Documents as needed
- Final **Range Assessment** Report

WORKSHEET 2a – RANGE ASSESSMENT BASIC PROJECT AND CONTACT INFORMATION

This worksheet is intended to help the Project Team collect and analyze information necessary to complete Step 2 - Range Assessment of the Risk Methodology. Information annotated and decisions made using this worksheet will help the Project Team document and report the information to DoD, provide publicly accessible records, and communicate with stakeholders. The Project Team will complete the following worksheets for each sector, parcel, or unit of the range. These worksheets are contained on a disc. If the Project Team does not have the capability to use the disc, make copies of the following worksheets for each sector, parcel, or unit evaluated.

RANGE & SECTOR NAME:
LOCATION: *(City, State, Approximate Acreage)*
LANDOWNER:

PROJECT TEAM MEMBERS

(Team members are subject to change and should be reconfirmed at each step to ensure accurate contact information.)

DoD Contact: *(Note if Restoration Advisory Board Co-Chair)*	Phone: E-mail:
Environmental Protection Agency Contact:	Phone: E-mail:
State Contact:	Phone: E-mail:
Tribal Contact:	Phone: E-mail:
DoD Information Contact:	Phone: E-mail:
Restoration Advisory Board Co-Chair	Phone: E-mail:
Technical Review Committee	Phone: E-mail:
Other Members:	

INFORMATION REPOSITORY

Location 1: Address: Phone: E-mail:	Location 2: (if applicable) Address: Phone: E-mail:
Location 3: (if applicable) Address: Phone: E-mail:	

WORKSHEET 2b - RANGE ASSESSMENT REPORTING

This worksheet will help the Project Team track requirements for reporting to stakeholders, provide information to publicly accessible records, and manage concurrence when required.

Request contact person for each stakeholder:	Federal Date Requested:_____ State Date Requested:_____ Tribal Date Requested:_____ Other _____ Date Requested:_____
Range Assessment Commencement Notice:	Federal Date Sent:_____ State Date Sent:_____ Tribal Date Sent:_____ Other _____ Date Sent:_____
Project Work Plan: Submitted To:	Date Started:_____ Date Completed:_____ Federal Date Sent:_____ Concurrence: _____ State Date Sent:_____ Concurrence: _____ Tribal Date Sent:_____ Concurrence: _____ Other _____ Date Sent:_____ Concurrence: _____
Field Work	Date Started:_____ Date Completed:_____
Draft Range Assessment Report: Submitted To:	Date Completed:_____ Federal Date Sent:_____ Comments Received: _____ State Date Sent:_____ Comments Received: _____ Tribal Date Sent:_____ Comments Received: _____ Land Owner Date Sent: _____ Comments Received: _____ Other _____ Date Sent:_____ Comments Received: ____
Notice of Availability *(45 day comment period)*	Name of Newspaper Publication Date(s):
Public Availability Session requested?	Yes No Date held:_____
Response Summary Report	Date Completed:
Final Range Assessment Report/ Decision Document	Date Completed:_____ Federal Date Sent:_____ State Date Sent:_____ Tribal Date Sent:_____ Other _____ Date Sent:_____
All "Final" documents mailed to:	Government Agencies (Names & Dates Sent): Land Owner Date Sent:_____ Information Repository Date Sent:_____ Other _____ Date Sent:_____

DECISION-MAKING PROCESS

Step 2 – Range Assessment

This process has been organized in a practical manner to help the Project Team approach Range Identification in order to Plan, Gather Data, and Decide courses of action. This will ensure that all necessary factors are available at the time needed for consideration.

RISK METHODOLOGY

- *RANGE IDENTIFICATION*
- *RANGE ASSESSMENT*
- ➢ *PLAN*
  - *GATHER DATA*
  - *DECIDE*
- *RANGE EVALUATION*
- *RESPONSE SELECTION*
- *SITE-SPECIFIC ACTION*
- *RECURRING REVIEW*
- *CLOSE-OUT*

☐ PLAN

To ensure that the data gathering strategy will result in accurate, appropriate data collection, use the Range Assessment Planning Worksheet below to help establish Data Quality Objectives[5] for the particular range, sector, parcel or unit. More information about each of the steps and their individual components outlined in the Planning Worksheet refer to Appendix 2. The data quality objectives will assist the Project Team in meeting the underlying goal of the Range Assessment Step, roughly distinguishing between areas that pose minimum risk to human health or the environment from those that pose greater risk. In addition, these worksheets will assist in developing a range-specific geophysical prove-out (Appendix 4). These objectives should be focused on defining a records search and if applicable a site visit.

NOTE*: The proposed Range Rule encourages accelerating the response process by delineating areas within the range where immediate response activities are necessary. During Step 2, Range Assessment, effort should be spent collecting data that are needed to plan both the more comprehensive data collection effort of Step 3, Range Evaluation and any necessary Accelerated Responses.*

During this planning process it is also important to recognize the Interim R3M does not identify ***action levels*** *for evaluating explosives safety risk, therefore distinguishing areas that pose minimal explosives safety risk is not possible. By using the action levels identified by regulatory agencies, determining areas that pose minimal risk associated with other constituents is possible. Please keep this concept in mind when completing the Range Assessment Planning Worksheet and developing DQOs.*

Action Level:
Numerical value that causes a decision-maker to choose one of the alternative actions. It may be a regulatory standard, risk-based level, technology limitation, or reference-based standard.

[5] The Data Quality Objective process, based on *EPA's Guidance for the Data Quality Objective Process (1994a)* is presented in greater detailed in Appendix 2.

RISK METHODOLOGY

- *RANGE IDENTIFICATION*
- *RANGE ASSESSMENT*
- ➢ *PLAN*
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- *SITE-SPECIFIC ACTION*
- *RECURRING REVIEW*
- *CLOSE-OUT*

Conceptual Site Model: *Functional description of the problem, which often illustrates the relationships between location of waste sources and contamination; types and expected concentrations of contaminants; potentially contaminated media and migration pathways; and, potential human and ecological receptors.*

WORKSHEET 2c - RANGE ASSESSMENT PLANNING

☐ **PLANNING FOR UXO INVESTIGATION**

☐ **PLANNING FOR OTHER CONSTITUENT INVESTIGATION**

What Is The Situation?

- The Project Team should define the problem and objective of Step 2, Range Assessment. This should be a simple statement declaring what the Project Team intends to accomplish at this point in the process.
- The Team may want to enhance the general situation provided based on site-specific conditions (e.g. Conceptual Site Model, resources, time constraints).

General Situation:	The Project Team will distinguish between areas that pose minimal risk to human health or the environment to those that pose greater risk.
— Describe and attach the Conceptual Site Model illustrating the specific situation (e.g., sources, receptors, pathways, etc.).	
— Describe and attach the resources and/or time constraints may affect the situation.	
— Describe and attach any known information about the land owner, geology, hydrogeology, UXO type, UXO depth, range characteristics, topography, soil, wildlife, land use (current/future/next planned) etc. that may affect the situation.	
— Document any other considerations for the situation.	
Provide a Site-Specific situation (considering the components above), if determined necessary by the Project Team:	

What Decisions Must Be Made?

- The Project Team must build upon the specific objectives identified above and pinpoint both the decisions and how the decisions will be made during this step of the process.
- This information will be used to define data which will be valuable and which data are required when making these decisions
- Later sections of this worksheet will describe which data will be used and how decisions will be made using the collected data.

1) Is there an immediate threat to human health and the environment caused by unexploded ordnance or other constituents?	Evaluate existing information and information in the Accelerated Response Section to determine if an accelerated response is appropriate. Other:

2) What is the explosives safety risk on range sector or parcel?	Determine if the information needed to assess baseline explosives safety risk is available. If enough information is available to design a more detailed study, then proceed to continue data collection and assess baseline explosives safety risk in Step 3, Range Evaluation. Other:
3) Does the Project Team need to continue to consider other constituents during the Step 3?	Identify sources of standards or criteria against which data will be evaluated. Decisions will result in either: eliminating other constituents from further consideration while continuing to evaluate explosives safety risk; or, continuing to evaluate for both risks. Other:

What Data Will Be Used in Making These Decisions?

- The Project Team will need to design a record search to locate documents necessary for gathering data to make the decisions identified above. A site reconnaissance or limited sampling may also be part of this effort but are not required.
- Completing this Planning worksheet will help the Project Team choose locations and data sources for the record search. At this point in the planning process consider the appropriate documents and sources[6] for this information.

What information exists and how was that information obtained? *Indicate how the data was obtained (i.e. from estimation or known). If information is not known based on data collected in the previous steps then indicate unknown. Use the Explosives Safety Risk Tool (page 57) to obtain more information about the terms/categories to the right.*	Depth below land surface: Migration/erosion: Intrusion level of activity: UXO hazard type: Fuzing: Amount of energetic material: Frequency of exposure: UXO density: Intensity of activity: Portability: Presence of natural resources: Presence of cultural resources: Other:

[6] A list of information repositories (potential sources for information) is included in Appendix 2.

RISK METHODOLOGY

- *RANGE IDENTIFICATION*
- *RANGE ASSESSMENT*
- ➢ *PLAN*
  - *GATHER DATA*
  - *DECIDE*
- *RANGE EVALUATION*
- *RESPONSE SELECTION*
- *SITE-SPECIFIC ACTION*
- *RECURRING REVIEW*
- *CLOSE-OUT*

Perimeter Survey:
Site reconnaissance around the range perimeter

Site Environs Survey:
Visual survey or inventory of ecosystems and environmental areas of concern

What information sources and locations are most applicable to the record search? *Check sources that are available and applicable to the situation and decisions described previously in this worksheet.*	**Suggested Information Sources for Step 2 Record Search:** — Maps of site/ installation — Environmental studies, surveys or assessments — Reports of accidental encounters with unexploded ordnance or munitions — Real Estate records — EOD reports — Other federal agency, state, tribal, local, regulatory or stakeholder claims/documentation — Record of Decision for environmental cleanup — Historical records/internet search/State Historic Preservation Officer — Newspaper accounts (past and present) — Aerial photograph analysis / photo documentation — Interviews with DoD, civilian, & government personnel — Interviews with state, tribal or other knowledgeable information sources — Range Control records (dud books, historical EOD responses, location of targets and firing points) — Chemical sample results — Access logs from Range Control, Visitor Center, and property owner — Property re-use, transfer plans (zoning plans and deeds) and installation master plans. — Results from previous surface clearances, geophysical surveys, and sampling programs — National Priority List (NPL), related site assessments, and scoring packages — Visual survey/reconnaissance — Descriptions of environmental, cultural, and historical conditions — State, local, regional or tribal planning commissions — Perimeter survey — Site environs survey — Source characterization — Target identification — Site sketch — Health and safety considerations — Other:

Current Land Use:
Realistic assumptions about how the former range property is currently being used.

Next Planned Land Use:
Realistic assumptions about how the former range property will be used immediately following the response actions.

Reasonably Anticipated Future Land Use:
Realistic assumptions concerning how the former range property will be used in the future.

What Are the Limits to Collecting Data?

- Determining the limits to collecting the data is based on the boundaries of the study area. Setting boundaries will allow resources to be focused on collecting the necessary data to make informed decisions during Step 2, Range Assessment.
- The answers to the questions below will allow the Project Team to identify those factors that may weigh heavily or limit the design of the data collection effort for Step 2, Range Assessment.

Population of Interest:

Objects: Describe and attach information on:	— How many UXO and what types exist? **AND/OR** — What are the other constituents and their concentrations?
Media: Which environmental media are involved?	— Air — Surface Soil — Subsurface Soil — Surface Water — Groundwater — Sediment — Other:
People: Will current or future land use play a role in the location or focus of data collection?	**Identify and Check** — Current Land use Specify: — Next Planned Land use Specify: — Reasonably Anticipated Future Land use Specify:
Based on available information, are any highly sensitive or exposed sub-populations present?	— Specify:
List any other factors that will play into the population of interest of the data collection in Step 2?	

Time-based Boundaries:

Describe and attach information on:

— When decisions will be made.
— Whether site conditions may change before decisions are made.
— Whether data will still be representative of conditions when decisions are made or response action is to be taken.

Physical Boundaries:

Describe and attach information on:

— Will a phased investigation that will approach be used? If so, how? *A phased approach based on what is found in Range Identification (e.g. location, depth, or types of munitions) could focus, limit or refine the design of this data collection effort.*

— The sectors, parcels or units the Project Team has identified in order to effectively conduct the investigation. How were they defined? *Consider how these sub-areas may focus or refine the design of the data collection effort (e.g. types of munitions, physical features, reuse categories, risk).*

— The safety considerations that may focus, limit or refine the design of this data collection effort (e.g. unconventional munitions, other constituent hazards).

— The physical conditions on the sector, parcel or unit that are expected to cause safety concerns and should be factored into the design of the data collection effort (e.g. seasonal, meteorological, terrain, vegetation, geologic or geophysical constraints).

— Any special considerations due to the interaction between or overlapping of other constituents and explosives safety concerns (e.g. will unexploded ordnance impact soil sample collection or well installation).

— Any special consideration due to receptors on or off site which may affect the design of the data collection effort (e.g. quantity distance arcs, current land user or owner).

— The physical conditions on the sector, parcel or unit that are expected to cause logistical constraints that should be factored into the design of the data collection effort (e.g. access, availability of personnel or equipment, funding).

— The environmental considerations which should be considered in designing (location or timing) the data collection effort (e.g. migratory birds, endangered species, wetlands, cultural resources).

— Any other physical or temporal factors that will affect the boundaries of the data collection in Step 2, Range Assessment.

Scale of Decision-Making:

Describe and attach information on:

— The role of risk-based decision-making on the site.

— The role of regulatory requirements in guiding how decisions are made (e.g. Solid Waste Management Unit boundaries). Be sure to list requirements.

— The role of technological limitations in decision-making (e.g. clearance to a specific depth). Describe limitations.

— The role financial considerations will have in decision-making (e.g. funding for characterization vice response). Describe financial considerations.

Check or list any other factors that will play into the scale of the decisions being made in Step 2.	— Availability of Past or Current Information — Personnel for Interviews — Classified Material — Damaged or Ruined files — Other:

Practical Constraints:

Time of Year:	
Time to complete sampling and clean-up:	
People; surrounding land use:	
Climate and Weather:	
Funding, Personnel equipment, other:	

How Will Decisions be Made?

- To design a data collection effort, it is important to understand how decisions are being made. The DQOs should be focused on providing the necessary information to make the required decisions at this point in the process.

Review the "Decide" part of the Range Assessment Step.

What are the Tolerable Limits of Decision Error [7]

Tolerable Limits:
Amount of decision error decision-makers are willing to accept. In some cases the limit may not be quantitative (e.g., explosives safety).

Decision Error:
Consequences of making an incorrect decision based on unavoidable uncertainties in the data. In other words, a different decision would have been made if there was no uncertainty.

Action Level:
Numerical value that causes a decision-maker to choose one of the alternative actions. It may be a regulatory standard, risk-based level, technology limitation, or reference-based standard. In some cases, the level may not be quantified (e.g., explosives safety).

- The **tolerable limits** of **decision error** will likely be different for explosives safety than for other constituents. For explosives safety, where a parameter of interest can be estimated from data, but there are no **action levels**, the limits of decision error will likely be qualitative. For the purpose of the Range Assessment Phase, it is likely qualitative decision rules will suffice for data collection. Therefore this portion of the planning worksheet is to assist in developing Qualitative tolerable limits. If a Project Team is sampling in an effort to determine the need for the further consideration of other constituents, then quantitative limits on decision error may be necessary. Under that situation the project team should refer to this section of the Range Evaluation Worksheet in Appendix 2 for more information.
- Use the following questions to determine the appropriate confidence level for the data being collected at this stage in the process:

Will a quantitative limit on decision error be developed either for the explosives safety or other constituent component of the study?	— **YES:** Go to "Quantitative Evaluation of Tolerable Decision Error Limits" and develop tolerable decision errors for other constituents and/or explosives safety (Appendix 2) — **NO:** Go to "Qualitative Evaluation of Tolerable Decision Error Limits" to develop tolerable decision errors for explosives safety and other constituents below.

[7] See **Appendix 2** for more information on decision error.

Qualitative Evaluation of Tolerable Limits of Decision Error:

This process is aimed at laying out the information sources and determining the desired confidence level for each source. Based on this information and a number of other factors (e.g., reasonably anticipated future land use, mitigating circumstances), the Project Team should determine if they are willing to accept the listed confidence limits. In the table below some of the inputs to the decision have been identified, the Project Team needs to identify any other inputs to the decision, the possible sources of information and their associated (relative) confidence levels. Additional information and examples are provided in Appendix 2.

Input to the Decisions	**Sources** (Location/Type/ Approach)	**Confidence** (High-Low)
UXO Inputs (UXO depth, hazard type, fuzing, amount of energetic material, UXO density, and Portability)		
Exposure and Access Inputs (Intrusion level of activity, frequency of exposure, intensity of activity, portability)		
Additional Inputs (Migration/erosion, natural resources, cultural resources)		
Other:		

Pros and Cons of each type of decision error:

Justification of Confidence Levels: An explanation of the considerations to the right is included in Appendix 2. This analysis will be used to support the selected confidence limits the Project Team members are willing to accept for each of the identified sources.	**Human Health:**
	Ecological
	Economic:
	Social:
	Policies:
	Legal:

Overall Combined Consequences Based on consideration of the tolerable limits for each of the consequences listed above, determine the appropriate tolerable level of confidence.	— Consider the consequences discussed above. — Evaluate the table under the "Qualitative Tolerable Limits on Decision Error" - the table illustrates the confidence levels associated with the sources
From the table above list the sources and associated confidence levels that have been determined acceptable by the Project Team:	— UXO Inputs: — Behavioral Inputs: — Other:

What is the Optimal Sampling Approach for Collecting Data?

- Here the Project Team must determine if samples will be collected, evaluate sampling or document search approaches and select the optimal site-specific plan for collecting data to accomplish the objectives of this phase. For the Range Assessment Phase a document search and site visit may be sufficient to gather the necessary information. If the project team decides to collect samples, the project team should refer to Appendix 2 for more information.
- Designs will be developed based on information known about the site, previously completed components of the Range Assessment Planning Worksheet and the following additional considerations:

Will the Project Team collect samples?	— YES: Consider the components under both "Document Search" and "Sampling Approach" below (Appendix 2). — NO: Consider the requirements under "Document Search" below.

Document Search:

When using a document search alone or along with statistically based or judgemental sampling, use the information in the column on the right to define number of sources and types of documents that must be searched to obtain inputs to the decision.	— Review the DQO outputs — Review existing environmental data (e.g. variability of data collected and data gaps) — Historical patterns of chemical and ordnance deposition, estimates of variance — Establish minimum or maximum requirements for an acceptable document search — Other: — Refer to the **Suggested Information Sources** on page 26.

Design and Document the Data Gathering Effort

As a result of the planning process the Project Team has developed an optimal design for the Range Assessment Step. This plan should be well documented in a Range Assessment Plan. While developing the plan, consider including the following:

- The information included on this Range Assessment Planning Worksheet
- The planning, data collection and reporting process
- Key features that must be implemented properly to allow for efficient and valid interpretation of the data.
- Assumptions, that if altered during data collection, may change the objectives of the data collection effort.

☐ GATHER DATA

RANGE ASSESSMENT GATHER DATA WORKSHEETS

For each sector, parcel or unit of the range the Project Team is assessing, complete the following worksheets, with the data collected in Step 2 - Range Assessment. If the Team is unable to fully complete the worksheets, continue building and refining the data in Step 3 - Range Evaluation; Information from these worksheets will enable the Team to complete baseline risk assessments and plan a site-specific response data collection effort for unexploded ordnance and other constituents. The Project Team will need to look at the scales in these assessments to determine the level of data needed to complete them. These worksheets are contained on a disc; complete a worksheet for each sector, parcel or unit of the range. If you do not have the capability to use the accompanying disc, make copies of the worksheets below.

WORKSHEET 2d – UXO DATA

Range Name: _____

Location: _____

Sector Name: _____

Sector Size/Acreage: _____

Sector _____ of _____ (total # of sectors on this range)

RANGE CHARACTERISTICS

Where were the targets located?	Attach sheets
Where were the firing points?	Attach sheets
What is the firing history (years, weapons, types, etc.)?	Attach sheets
Have any EOD activities taken place?	Attach sheets
What type of scrap/fragments have been found?	Attach sheets
Other?	Attach sheets

UXO CHARACTERISTICS	UXO Type 1: _____	UXO Type 2: _____	UXO Type 3: _____	UXO Type 4: _____	UXO Type 5: _____
UXO Density:					
How many UXO of each type exist per acre?					
UXO Hazard:					
What are the type(s) of unexploded ordnance?					
Fuzing:					
Does the UXO have a fuze (Y/N)?					
Scale of Impact:					
How much energetic material is contained in the UXO?					
Unexploded Ordnance Depth:					
How deep would you expect to find each type of UXO including those that may be located under water? (indicate minimum depth or how close UXO is to the surface)					
Migration:					
What is the potential that the unexploded ordnance may move as the result of naturally occurring weather or events?					
Portability:					
What is the potential that the unexploded ordnance may move with the help of humans?					
Other Distinguishable Characteristics:					
Fired/Unfired					
Piled					
Deteriorated					

ACTIVITY CHARACTERISTICS	Activity 1: _____	Activity 2: _____	Activity 3: _____	Activity 4: _____	Activity 5: _____
Frequency of Entry					
How many entries per month by activity?					
Duration					
How long (in hours) does each activity last?					
Intrusion Level					
What depth (in feet BLS) does each activity intrude below land surface?					

RISK METHODOLOGY

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Ecological Risk Assessment Guidance for Superfund:
Several manuals developed by EPA to be used in the remedial investigation/feasibility study process at Superfund sites. They present the analytical framework and methods for evaluating potential adverse effects to the environment at hazardous waste sites.

Risk Assessment Guidance for Superfund:
Several manuals developed by EPA to be used in the remedial investigation/ feasibility study process at Superfund sites. They present analytical framework and methods for evaluating potential adverse human health associated with potential exposures to hazardous substances and materials.

WORKSHEET 2e - OTHER CONSTITUENTS DATA

If the sector has other constituents associated with military activity, complete the following data worksheet. This data worksheet allows the Project Team to collect the necessary data to estimate baseline risk. In order to assess the following information for the Risk Methodology, the Project Team will need to use the Environmental Protection Agency's Guidance for Data Usability in Risk Assessment, ***Ecological Risk Assessment Guidance for Superfund****, and* ***Risk Assessment Guidance for Superfund***[1]*.*

Does background monitoring data for chemicals exist?	
Does environmental data for chemicals exist?	
What chemicals may be present?	List:
What is the distribution of sampling data?	
Estimate certainty for chemical concentrations?	
Exposure Assessment:	
Release rates	
Physical, chemical and biological guidelines for evaluating transport and transportation of range related chemicals	
Estimates of exposure concentrations for all chemicals, environmental media and receptors risk	
Estimates of chemical intake or dose for all exposure pathways and exposure areas	
Toxicity Assessment:	
Toxicity values for all chemicals, exposure pathways and exposure areas of concern	
Uncertainty factors and confidence measures for reference doses and weight-of-evidence classifications for cancer slope factors	
Risk Characterization:	
Hazard quotients and indexes	
Estimate of excess lifetime cancer risk	
Existing regulatory standards	
Uncertainty analysis	
What Else Exists:	
(Examples: land fills, vehicle maintenance areas, storage facilities, treatment facilities, etc.)	List:

[1] Guidance for Data Usability in Risk Assessment (Parts A&B) (EPA 1992b, 1992c)
Ecological Risk Assessment Guidance for Superfund - ERAGS (EPA 1992d, 1997a)
Risk Assessment Guidance for Superfund (EPA 1989a, 1991a, 1991c, 1992a, 1998b)

WORKSHEET 2f - PHYSICAL AND ENVIRONMENTAL DATA

The Project Team will need to identify physical and ecological information for assessment later in the Risk Methodology. This Physical and Environmental Data worksheet is a starting point for much of the necessary information.

Surface Features:	
What man-made features are located in or near the sector?	Distinguish if feature is in or near sector
What natural features are located in or near the sector?	Distinguish if feature is in or near sector
Contaminant Source Information: Do any investigations detail operations that may have used or released contaminants? (Chemical, biological, organic contaminants)	
Meteorological Information:	
What are the climate, temperature extremes, frost depth, and wind rose?	
Surface Water and Sediment Information:	
What is the Surface Water Hydrology? (Lagoons, wetlands, lakes, rivers, etc.)	
What types of soils exist? (Clay, sand, etc.)	
Ground Water Information:	
What are the depth, number of aquifers, aquifer use, recharge areas, infiltration rates, and hydrological conductivity?	
Where are the private and municipal drinking water wells?	
Geological Information:	
What are the soil type, age, formation, and depth to bedrock?	
Human Population Surveys:	
What are the population, income and unemployment rates?	
Other Information:	
What cultural resources exist? (Structures, archaeological sites, etc.)	
What endangered animals or plants exist? (Migratory birds, threatened and endangered species)	
What ecosystem exists?	

Examples of immediate threats:
UXO present on the surface and uncontrolled access to the range

Other constituents present immediate toxicological threats to human health or the environment

☐ DECIDE

WORKSHEET 2g - RANGE IDENTIFICATION DECIDE

Based upon the data gathered, answer the following to decide what action(s) must be taken now:

1. Based on the information gathered in this step, is there reason to consider immediate action under Accelerated Response?
__ **YES**: Safety is threatened because one or more of the following are evident: ___Unexploded ordnance present an immediate threat to human health or the environment. ___Potentially hazardous constituents are present that may cause immediate and dangerous threats to human health or the environment. Proceed to Accelerated Response action (page 127)
__ **NO**: Proceed to Question 2
2. Do any sector(s), parcel(s) or unit(s) on the range need to be further investigated for explosives safety risk?
__ **YES:** Go to Question 3
__ **NO:** Go to Question 3 (Close-out is not an option in the Interim Risk Methodology)
3. Do any sector(s), parcel(s) or unit(s) on the range need to be further considered for other constituents?
__ **YES**: Go to Step 3—Range Evaluation
__ **NO**: Go to Step 3—Range Evaluation for Explosives Safety Only

WRITE THE RANGE ASSESSMENT REPORT

The report will detail the data collected, data assessments concerning the hazards on the ranges, and what additional data should be collected to estimate the location, quantity, and type of hazards. The conclusions may include a "no further action" determination for other constituents and proceeding to the next step in the **Risk Methodology**. Attach reports and all supporting documentation and submit to DoD Information Point of Contact for inclusion in publicly accessible records and release to stakeholders.[8]

[8] Archive Searches at Potential Ordnance Response Sites (EPA 1995b)
Guidance for Performing Preliminary Assessments Under CERCLA (EPA 1991d)
Guidance for Performing Site Inspections: (EPA 1992)

STEP 3 – RANGE EVALUATION

The third step of the Risk Methodology, **Range Evaluation** requires the Project Team to:

- Collect additional data to help complete and refine information concerning the location, amount and type of unexploded ordnance and other constituents.
- Determine the baseline explosives safety and other constituents risk.
- Decide whether sectors, parcels or units need to be further considered for other constituents.

The **Range Evaluation Worksheet** will guide the Project Team through a data collection and thought process necessary for completing **Step 3.**

What Data Must Be Collected

In this step, the Project Team will gather additional archival data and conduct field studies to verify that the information gathered in **Step 2** is accurate and/or to refine this data. This extensive, thorough investigation will allow the Project Team to assess baseline explosives safety risk and, if necessary, **baseline risk** for other constituents. The Project Team's goal, during **Range Evaluation**, is to gather all the data necessary to make informed decisions concerning **Response Actions** in **Step 4.**

Baseline Risk:
The risk that exists before any action is taken.

The Response Actions in Step 4 are focused on risk reduction. The baseline assessments for explosives safety and other constituents help the Project Team distinguish between the risks from unexploded ordnance and risks from other constituents and how those impacts may threaten human health or environmental factors. The Project Team will only be able to assess relative risk and not assign a quantitative value for UXO. A qualitative translation of the quantitative risk outputs of RAGS & ERAGS (Risk Assessment Guidance for Superfund & Ecological Risk Assessment Guidance for Superfund) has been provided in this section. This translation does not change the regulatory requirements for other constituents but assists in the comparison of response alternatives, considering both explosives safety and other constituent risks.

To effectively gather data, the Project Team will need to work with experts in a variety of fields. The Project Team could be supported by individuals with **expertise in key areas** (geology, geophysics, geological engineering, statistics, ordnance and explosives sciences, etc.) to ensure that all data gathering and risk assessment is performed successfully.

Suggested Areas of Expertise: *Geology, Geophysics, Geological Engineering, Statistics, Ordnance and Explosives Sciences, Environmental Sciences, Hydro-geology, Environmental Engineering, Chemistry, Toxicology*

Immediate action should be considered under **Accelerated Response** if at any point the Project Team determines there is an immediate threat to human health or the environment caused by unexploded ordnance or other constituents.

How Data Will Be Evaluated

The data gathered in this section will complete the information needed for the Project Team to adequately characterize the range and any unexploded ordnance or other constituents it may contain. In characterizing the range, the Project Team will use **risk tools** from this document to assess baseline risk to humans and the environment. Baseline risk defines the amount of potential risk from unexploded ordnance or other constituents prior to conducting response actions. The baseline explosives safety risk establishes a level the Project Team will work from to measure risk reduction based on decisions or actions on the range. Baseline risk for other constituents are weighed against regulatory standards identified in the National Contingency Plan and state regulators[9]. The Project Team will be using both risk tools in this step (See Appendix 1—Nature of Risk).

*Throughout the process, the **risk tools** are used to assess:*

- *Baseline risk (Step 3)*
- *Residual risk and risk during response (Step 4)*
- *Residual risk (Step 6)*

Residual Risk: *the risk that remains after the response action is complete.*

What Should Be Communicated With Stakeholders

During **Step 3**, communicating the following information would enhance stakeholder involvement and may be submitted for inclusion in publicly-accessible records:

- Qualifications of the investigating team.
- Processes and procedures for conducting investigations.

*Stakeholders and the public will be given access to information collected throughout the **Range Evaluation Step** in a variety of ways including written notification, informal meetings, public availability sessions, newspaper announcements, and formal reports. Each of these communication tools should provide clear information concerning the work being done in and seek stakeholder input to the **Risk Methodology.***

[9] The National Oil and Hazardous Substances Pollution Contingency Plan (EPA 1992).

- Abilities and limitations of analytical and sampling technologies/techniques.
- Results of the investigation and meaning of the data.
- Immediate threats to human health or the environment (if any)
- Next action in this process and why.
- Stakeholders can be involved in the process
- Stakeholders' main concerns and how they are best addressed.

What Reports Are Required

All documents (Final Report, Decision Documents and supporting information) should be provided to appropriate government agencies, the landowner, and provided for inclusion in publicly accessible records.

DoD is required to provide the following reports and documentation during Step 3:

- Written notice to Federal, Tribal and State agencies of start of Range Evaluation Step
- **Draft Range Evaluation Plan** (EPA, State,Tribal & Land Owner)
- Notice of Availability outlining report contents published in major local paper (45 day comment period)
- Public Availability Session/ Informal meetings with Restoration Advisory Board
- Response Summary of Comments
- Final **Range Evaluation Report** or Letter Report if proceeding to **Response Selection- Step 4**
- Formal Decision Documents as needed

WORKSHEET 3a – RANGE EVALUATION BASIC PROJECT AND CONTACT INFORMATION

This worksheet is intended to help the Project Team collect and analyze information necessary to complete Step 3 - Range Evaluation of the Risk Methodology. Information annotated and decisions made using this worksheet will help the Project Team document and report the information to DoD, provide publicly accessible records, and communicate with stakeholders.

The Project Team will complete the following worksheets for each sector, parcel, or unit of the range. These worksheets are contained on a disc. If the Project Team does not have the capability to use the disc, make copies of the following worksheets for each sector, parcel, or unit evaluated.

RANGE & SECTOR NAME:	
LOCATION: *(City, State, Approximate Acreage)*	
LANDOWNER:	
PROJECT TEAM MEMBERS *(Team members are subject to change and should be reconfirmed at each step to ensure accurate contact information.)*	
DoD Contact: *(Note if Restoration Advisory Board Co-Chair)*	Phone: E-mail:
Environmental Protection Agency Contact:	Phone: E-mail:
State Contact:	Phone: E-mail:
Tribal Contact:	Phone: E-mail:
DoD Information Contact:	Phone: E-mail:
Restoration Advisory Board Co-Chair	Phone: E-mail:
Technical Review Committee	Phone: E-mail:
Other Members:	
INFORMATION REPOSITORY	
Location 1: Address: Phone: E-mail:	Location 2: (if applicable) Address: Phone: E-mail:
Location 3: (if applicable) Address: Phone: E-mail:	

WORKSHEET 3b - RANGE EVALUATION REPORTING

This worksheet will help the Project Team track requirements for reporting to stakeholders, providing information to publicly accessible records, and managing concurrence when required.

Range Evaluation Commencement Notice:	Federal Date Sent:_____ State Date Sent:_____ Tribal Date Sent:_____
Project Work Plan: **Submitted To:**	Date Started:_____ Date Completed:_____ Federal Date Sent:_____ State Date Sent:_____ Tribal Date Sent:_____
Range Evaluation Report ***Or*** **Letter Report (when proceeding to Step 4 – Response Selection)** **Submitted To:**	Date Completed:_____ Federal Date Sent:_____ State Date Sent:_____ Tribal Date Sent:_____ Land Owner Date Sent: _____ Information Repository Date Sent:_____
Notice of Availability *(45 day comment period)*	Name of Newspaper Publication Date(s):
Public Availability Session requested?	Yes No Date held:_____
Response Summary Report	Date Completed:
Decision Document	Date Completed:
All documents mailed to:	Government Agencies (Names & Dates Sent): Land Owner Date Sent:_____ Information Repository Date Sent:_____

DECISION-MAKING PROCESS

Step 3 – Range Evaluation

This process has been organized in a practical manner to help the Project Team approach Range Evaluation in order to Plan, Gather Data, and Decide courses of action. This will ensure that all necessary factors are available at the time needed for consideration.

☐ PLAN

To ensure that the data gathering strategy will result in accurate, appropriate data collection, use the Range Evaluation Planning Worksheet below to help establish Data Quality Objectives[10] for the particular range, sector, parcel or unit. The data quality objectives will assist the Project Team in meeting the underlying goal of the Range Evaluation Step, assess baseline risk to human health or the environment. These worksheets will also aid the Project Team in developing a range-specific geophysical prove-out (Appendix 4). These objectives should be built on the information from Range Assessment Step and will define the more detailed data collection (e.g. the field program) effort for this step.

NOTE: The proposed Range Rule encourages accelerating the response process by delineating areas within the range where immediate response activities are necessary. During Step 3, effort should be spent collecting data to evaluate risks posed by unexploded ordnance and, if applicable, other constituents. This process should be focussed on assisting in selecting a response action in Step 4, Response Selection and any necessary Accelerated Responses.

During this planning process, it is also important to recognize the Interim R3M qualitatively evaluates explosives safety risk and therefore requires the Project Team to obtain enough data about the range to determine the appropriate score for each of the variables of risk. In addition, the Interim R3M does not identify action levels for evaluating explosives safety risk, therefore determining areas that pose no explosives safety risk is not possible. By using the action levels identified by regulatory agencies[11], determining areas that pose minimal risk associated with other constituents is possible. Please keep this concept in mind when completing the Range Evaluation Planning Worksheet and developing DQOs.

[10] The Data Quality Objective process, based on *EPA's Guidance for the Data Quality Objective Process (1994a)* is presented in greater detailed in Appendix 2.
[11] Action levels as defined in the National Oil and Hazardous Substances Pollution Contingency Plan.

Conceptual Site Model: *Functional description of the problem, which often illustrates the relationships between location of waste sources and contamination; types and expected concentrations of contaminants; potentially contaminated media and migration pathways; and, potential human and ecological receptors.*

WORKSHEET 3c - RANGE EVALUATION PLANNING

What Is The Situation?

- The project team may want to enhance the general situation provided based on site-specific conditions (e.g. Conceptual Site Model, resources, time constraints).

General Situation:	The Project Team will determine baseline explosives safety risk as well as the baseline risk associated with other constituents.
— Describe and attach the Conceptual Site Model illustrating the specific situation (e.g., sources, receptors, pathways, etc.).	
— Describe and attach the resources and/or time constraints may affect the situation.	
— Describe and attach any known information about the land owner, geology, hydrogeology, UXO type, UXO depth, range characteristics, topography, soil, wildlife, land use (current/future/next planned) etc. that may affect the situation.	
— Document any other considerations for the situation.	
Provide a site-specific situation (considering the components above), if determined necessary by the Project Team:	

What Decisions Must Be Made?

- The Project Team must build upon the specific objectives identified above and pinpoint both the decisions and how the decisions will be made during this step of the process.
- This information will be used to define which data that will be valuable and which data are required when making these decisions.

1) Is there an immediate threat to human health and the environment caused by unexploded ordnance or other constituents?	Evaluate existing information and information in the Accelerated Response Section to determine if an accelerated response is appropriate. Other:
2) What is the Baseline Explosives Safety Risk (see tool on page 57)?	Determine if the information needed to assess baseline explosives safety risk is available. If the information is not available, complete the data collection required to assess risk and to aid in selecting a risk reduction action in Step 4. Other:

3) Does the Project Team need to continue to consider other constituents during Step 4, Range Evaluation?	Identify sources for standards or criteria against which data will be evaluated. Decisions will result in either: eliminating other constituents from further consideration while continuing to evaluate explosives safety risk; or, selecting a response action to address both risks. Other:

What Data Will Be Used in Making These Decisions?

- The Project Team will need to design a sampling approach to gather data required to estimate baseline explosives safety and other constituent risks and to make the decisions identified above.
- Completing this Range Evaluation Planning worksheet will help the Project Team design the sampling approach (number, location and type of samples). Consider the documents and information below when selecting the data needed to make informed decisions at Step 3.

What information exists and how was that information obtained? *Indicate how the data was obtained (i.e. from estimation or known). If information is not known based on data collected in the previous steps then indicate unknown.* *See Explosives Safety Risk Tool (page 57) for information on the terms to the right.*	Depth below land surface: Migration/erosion: Intrusion level of activity: UXO hazard type: Fuzing: Amount of energetic material: Frequency of exposure: UXO density: Intensity of activity: Portability: Presence of natural resources: Presence of cultural resources: Other:
What information is available to plan the sampling approach and augment the record search conducted in Step 2? *Review the Range Assessment Report, completed in Step 2, as well as any sources suggested in Step 2 that may contain new information. Then check other sources that are applicable to the situation and decisions described previously in this worksheet.*	**Suggested Additional Information Sources for Step 3:** — Hazard ranking system scores — Preliminary Assessment/Site inspection reports — Remedial Investigation/Feasibility Study reports — DoD Technical manuals (to determine fillers, contents and other characteristics of unexploded ordnance) and published engineering evaluations — Specific information/conclusions from Range Assessment Report (e.g. location of Targets and Firing Points on the Ranges, past unexploded ordnance incidents) — Reports and risk assessments from previous steps (Accelerated Response, environmental assessments, National Priority List related site assessments) — Other:

Other information that might be necessary to complete the baseline risk evaluation. Check those that are available.	— Technology availability, capabilities and limitations — Frequency of entries to range — Intensity of activity — Number of unexploded ordnance per acre — Unexploded ordnance type and fuzing — Amount of energetic material in unexploded ordnance — Portability of unexploded ordnance — Depth of unexploded ordnance — Current activities — Migration of unexploded ordnance by natural forces — Background data for all affected media — List of other materials of potential concern — Distribution of sampling data — Confidence limits surrounding data estimates — Release rates — Fate and transport of other materials — Exposure concentration estimates — Chemical intake estimates — Toxicity values for chemicals — Uncertainty factors and confidence measures for reference doses and weight of evidence classifications for cancer slop factors. — Hazard quotients and indices — Estimates of excess lifetime cancer risk — Other:

What Are the Limits to Collecting Data?

- Determining the limits to collecting the data is based on the boundaries of the study area. Setting boundaries will allow resources to be focused on collecting the necessary data to make informed decisions during this step.
- The answers to the questions below will allow the Project Team to identify those factors that may weigh heavily or limit the design of the data collection effort for Step 3, Range Evaluation.

Population of Interest:

Objects: Describe and attach information on:	— How many UXO and what types exist? **AND/OR** — What are the other constituents and their concentrations?
Media: Which environmental media are involved?	— Air — Surface Soil — Subsurface Soil — Surface Water — Groundwater — Sediment — Other:

Current Land Use:
Realistic assumptions about how the former range property is currently being used.

Next Planned Land Use:
Realistic assumptions about how the former range property will be used immediately following the response actions.

Reasonably Anticipated Future Land Use:
Realistic assumptions concerning how the former range property will be used in the future.

People: Will current or future land use play a role the location or focus of data collection?	**Identify and Check** — **Current Land Use** Specify: — **Next Planned Land Use** Specify: — **Reasonably Anticipated Future Land Use** Specify:
Based on available information, are any highly sensitive or exposed sub-populations present?	Specify:
List any other factors that will play into the population of interest of the data collection in Step 2?	

Time-based Boundaries:

Describe and attach information on:

— When decisions will be made.
— Whether site conditions may change before decisions are made.
— Whether data will still be representative of conditions when decisions are made and response actions will be implemented.

Physical Boundaries:

Describe and attach information on:

— Will a phased investigation that will approach be used? If so, how?
A phased approach based on what is found in the previsous step could focus, limit or refine the design of this data collection effort.

— The sectors, parcels or units the Project Team has identified in order to effectively conduct the investigation. How were they defined?
Consider how these sub-areas may focus or refine the design of the data collection effort (e.g. types of munitions, physical features, reuse categories, risk).

— The safety considerations that may focus, limit or refine the design of this data collection effort (e.g. unconventional munitions, other constituent hazards).

— The physical conditions on the sector, parcel or unit that are expected to cause safety concerns and should be factored into the design of the data collection effort (e.g. seasonal, meteorological, terrain, vegetation, geologic or geophysical constraints).

— Any special considerations due to the interaction between or overlapping of other constituents and explosives safety concerns (e.g. will unexploded ordnance impact soil sample collection or well installation).

— Any special consideration due to receptors on or off site which may affect the design of the data collection effort (e.g. quantity distance arcs, current land user or owner).

— The physical conditions on the sector, parcel or unit that are expected to cause logistical constraints that should be factored into the design of the data collection effort (e.g. access, availability of personnel or equipment, funding).

— The environmental considerations which should be considered in designing (location or timing) the data collection effort (e.g. migratory birds, endangered species, wetlands, cultural resources).

— Any other physical or temporal factors that will affect the boundaries of the data collection in Step 3, Range Evaluation.

Scale of Decision-Making:

Describe and attach information on:

— The role of risk-based decision-making on the range (e.g. decisions by land use).

— The role of regulatory requirements in guiding how decisions are made (e.g. Solid Waste Management Unit boundaries). Be sure to list requirements.

— The role of technological limitations in decision-making (e.g. clearance to a specific depth). Describe limitations.

— The role financial considerations will have in decision-making (e.g. funding for characterization vice response). Describe financial considerations.

Check or list any other factors that will play into the scale of the decisions being made in Step 3.	— Availability of Past or Current Information — Personnel for Interviews — Classified Material — Damaged or Ruined files — Other:

Tolerable Limits:
Amount of decision error decision-makers are willing to accept. In some cases the limit may not be quantitative (e.g., explosives safety).

Decision Error:
Consequences of making an incorrect decision based on unavoidable uncertainties in the data. In other words, a different decision would have been made if there was no uncertainty.

Action Level:
Numerical value that causes a decision-maker to choose one of the alternative actions. It may be a regulatory standard, risk-based level, technology limitation, or reference-based standard. In some cases, the level may not be quantified (e.g., explosives safety).

Practical Constraints:

Time of Year:	
Time to complete sampling and clean-up:	
People; surrounding land use:	
Climate and Weather:	
Funding, Personnel, Equipment, Others:	

How Will Decisions be Made?

- To design a data collection effort, it is important to understand how decisions are being made. The DQOs should be focused on providing the necessary information to make the required decisions at this point in the process.

Review the "Decide" part of the Range Evaluation Step.

What are the Tolerable Limits of Decision Error [12]

- The **tolerable limits** of **decision error** will likely be different for explosives safety than for other constituents. For explosives safety, where a parameter of interest can be estimated from data, but there are no **action levels**, the limits of decision error will likely be qualitative. For the purpose of the Range Assessment Phase, it is likely qualitative decision rules will suffice for data collection. Therefore this portion of the planning worksheet is to assist in developing Qualitative tolerable limits. If a Project Team is sampling in an effort to determine the need for the further consideration of other constituents, then quantitative limits on decision error may be necessary. Under that situation the project team should refer to this section of the Range Evaluation Worksheet in Appendix 2 for more information.
- Use the following questions to determine the appropriate confidence level for the data being collected at this stage in the process:

Will a quantitative limit on decision error be developed for either the explosives safety or other constituents component of the study?	— **YES**: Go to "Quantitative Evaluation of Tolerable Decision Error Limits" and develop tolerable decision errors for other constituents and/or explosives safety below. — **NO:** Go to "Qualitative Evaluation of Tolerable Decision Error Limits" to develop tolerable decision errors for explosives safety and other constituents. (Appendix 2)

Quantitative Evaluation of Limits of Decision Error :

This could be a complex statistical process requiring the development of Null Hypotheses, Type I and II error rates, and definition of gray areas. As with the other components of the planning process, the technical details are outlined in Appendix 2 and EPA's DQO guidance manuals[13]. To determine tolerable limits on decision error, consider the questions posed below and consult personnel with experience in statistics. They can assist the Project Team in selecting the appropriate statistical parameter, action level, and decision rules and developing the Project Team's tolerable limits on decision error.

[12] See Appendix 2 for more information on Decision error.
[13] EPA Guidance for the Data Quality Objective Process (1994a)

Complete and attach the following:

— Specify the statistical parameter that characterizes the population of interest (e.g., mean, median, percentile).

— List the action levels and the information that will be used to make the decision during Step 3. Provide basis (e.g. risk, regulation, technology) for Note, confirm that the action levels can be compared with the statistical parameter specified in previous step.

— List the capabilities and limitations of applicable sampling and characterization technologies.

Consider the following possible decision errors and their consequences:

— Determining that the parameter of interest for other constituents has not exceeded risk criteria[14], when it actually does. The Project Team may not have the appropriate information to select a response action that is protective; this could possibly endanger human health and the environment, as well as affect future development of the property. In addition, it could lead to unnecessary future damages and liabilities.

— Determining that the parameter of interest for other constituents have exceeded risk criteria, when it is actually below the criteria. Under this scenario the Project Team, may conduct unnecessary investigations or cleanup. This could take away funding and progress from other more serious projects on site.

— Other Site-Specific possible consequences:

Evaluate, document, and attach the following:

— Given site-specific conditions, which of the decision errors (above) presents more severe consequences?

— Formulate a Null Hypothesis[15].

— Suggest a method for testing the statistical hypothesis and define a sample size[16].

— How likely is the Project Team to make an incorrect decision based on data that inaccurately estimates the conditions at the site?

— Document and attach the site-specific determination of tolerable limits of Decision Error:

What is the Optimal Sampling Approach for Collecting Data?

- The Project Team must determine if samples will be collected, evaluate sampling or document search approaches, and select the optimal site-specific plan for collecting data to accomplish the objectives of this phase. If the project team determines additional document searches are needed, refer Appendix 2 for more information.
- Designs will be developed based upon information known about the site, previously completed components of the Range Evaluation Planning Worksheet, and the following additional considerations:

[14] Criteria identified by regulatory agencies as action levels in the National Contingency Plan and state regulations.
[15] The Null Hypothesis is described in more in Appendix 2.
[16] Methods for testing the statistical hypothesis and defining sample size are described in more detail in Appendix 2.

Will the Project Team collect additional documents as well as samples?	— YES: Consider both the requirements under "Sampling Approach" below and "Document Search" (Appendix 2) — NO: Consider the components under "Sampling Approach" below.
Sampling Approach: *To develop the sampling approach, the Project Team must first identify several sampling, technical and analytical design alternatives, screen these alternatives to eliminate inappropriate alternatives, and then analyze the alternatives to select the best site-specific approach. Use the information below to assist in selecting the best approach:*	
Develop list of general data sampling design alternatives[17]. Consider:	— Factorial design — Sequential random sampling — Simple random sampling — Systematic sampling — Stratified random sampling — Composite sampling — Other:_____
To analyze sampling design alternatives, at a minimum consider;	— DQO outputs — Characteristics of the contaminants, ordnance and media — Cost-effectiveness of alternatives (balancing sample size and measurements of performance). — Total cost of sampling and analysis to total number of samples
Desired Technology Capabilities	— **Probability of Detection (Pd)** — **False-Alarm Rate (FAR)** — Other Statistics
For statistically based sampling programs, select optimal sample size that satisfies DQOs, using information collected and developed above.	

Probability of Detection: *Pd = number of UXO detected/number of UXO buried*

False-Alarm Rate: *Number of **false-positive** and **false-negative** readings/area surveyed.*

False-Positive: *Technology indicates ordnance is present, when it actually is not.*

False-Negative: *Technology indicates ordnance is not present, when it actually is.*

[17] Appendix 2 contains a detailed description of these sampling approaches.

If no design meets the limits on decision errors within the budget or other constraints, consider relaxing one or more constraints.	— Budget — Change limits on decision error — Relax schedule — Change boundaries of sample area — Other:

Design and Document the Data Gathering Effort

As a result of the planning process the Project Team has developed an optimal design for the Range Evaluation Step. This plan should be well documented in a Range Evaluation Plan.

While developing the plan, consider including the following:

- The information included on this Range Assessment Planning Worksheet
- Developing a range-specific geophysical prove-out (Appendix 4).
- The planning, data collection and reporting process
- Key features that must be implemented properly to allow for efficient and valid interpretation of the data.
- Assumptions, that if altered during data collection, may change the objectives of the data collection effort.

☐ GATHER DATA

RANGE EVALUATION GATHER DATA WORKSHEETS

The Project Team will be required to complete and refine the information from the data worksheets started in Step 2 to characterize unexploded ordnance and other constituents.

For each sector, parcel or unit of the range, complete the following worksheets, with the data collected in Step 3--Range Evaluation. In this step, continue to build and refine the data collected in Step 2 - Range Assessment. Information from these worksheets will enable the Project Team to complete baseline risk assessments and plan a site-specific response data collection effort for unexploded ordnance and other constituents. The Team will need to look at the scales in these assessments to determine the level of data needed in order to complete them. Complete a worksheet for each sector, parcel or unit of the range. If you do not have the capability to use the accompanying disc, make copies of the following worksheets for each parcel, sector, or unit.

WORKSHEET 3d – UXO DATA

Range Name: _____
Location: _____
Sector Name: _____
Sector Size/Acreage: _____
Sector _____ of _____ (total # of sectors on this range)

RANGE CHARACTERISTICS

Where were the targets located?	Attach sheets
Where were the firing points?	Attach sheets
What is the firing history (years, weapons, types, etc.)?	Attach sheets
Have any EOD activities taken place?	Attach sheets
What type of scrap/fragments have been found?	Attach sheets
Other?	Attach sheets

UXO CHARACTERISTICS	UXO Type 1:	UXO Type 2:	UXO Type 3:	UXO Type 4:	UXO Type 5:
UXO Density:					
How many UXO of each type exist per acre?					
UXO Hazard:					
What are the type(s) of unexploded ordnance?					
Fuzing:					
Does the UXO have a fuze (Y/N)?					
Scale of Impact:					
How much energetic material is contained in the UXO?					
Unexploded Ordnance Depth:					
How deep would you expect to find each type of UXO including those that may be located under water? (indicate minimum depth or how close UXO is to the surface)					
Migration:					
What is the potential that the unexploded ordnance may move as the result of naturally occurring weather or events?					
Portability:					
What is the potential that the unexploded ordnance may move with the help of humans?					
Other Distinguishable Characteristics:					
Fired/Unfired					
Piled					
Deteriorated					

ACTIVITY CHARACTERISTICS	Activity 1:	Activity 2:	Activity 3:	Activity 4:	Activity 5:
Frequency of Entry					
How many entries per month by activity?					
Duration					
How long (in hours) does each activity last?					
Intrusion Level					
What depth (in feet BLS) does each activity intrude below land surface?					

Ecological Risk Assessment Guidance for Superfund:
Several manuals developed by EPA to be used in the remedial investigation/feasibility study process at Superfund sites. They present the analytical framework and methods for evaluating potential adverse effects to the environment at hazardous waste sites.

Risk Assessment Guidance for Superfund:
Several manuals developed by EPA to be used in the remedial investigation/ feasibility study process at Superfund sites. They present analytical framework and methods for evaluating potential adverse human health associated with potential exposures to hazardous substances and materials.

WORKSHEET 3e - OTHER CONSTITUENTS DATA

If the sector has other constituents associated with military activity, complete the following data worksheet. This data worksheet allows the Project Team to collect the necessary data to estimate baseline risk. In order to assess the following information for the Risk Methodology, the Project Team will need to use the Environmental Protection ***Agency's Ecological Risk Assessment Guidance for Superfund*** *and* ***Risk Assessment Guidance for Superfund***[18].

Does background monitoring data for chemicals exist?	
Does environmental data for chemicals exist?	
What chemicals may be present?	List:
What is the distribution of sampling data?	
Estimate certainty for chemical concentrations?	
Exposure Assessment:	
Release rates	
Physical, chemical and biological guidelines for evaluating transport and transportation of range related chemicals	
Estimates of exposure concentrations for all chemicals, environmental media and receptors risk	
Estimates of chemical intake or dose for all exposure pathways and exposure areas	
Toxicity Assessment:	
Toxicity values for all chemicals, exposure pathways and exposure areas of concern.	
Uncertainty factors and confidence measures for reference doses and weight-of-evidence classifications for cancer slope factors	
Risk Characterization:	
Hazard quotients and indexes	
Estimate of excess lifetime cancer risk	
Existing regulatory standards	
Uncertainty analysis	
What Else Exists:	
(Examples: land fills, vehicle maintenance areas, storage facilities, treatment facilities, etc.)	List:

[18] Guidance for Data Usability in Risk Assessment (Parts A & B) (EPA 1992b, 1992c) Ecological Risk Assessment Guidance for Superfund –ERAGS (EPA 1992d, 1997a) Risk Assessment Guidance for Superfund (EPA 1989a, 1991a, 1991c, 1992a, 1998b)

WORKSHEET 3f - PHYSICAL AND ENVIRONMENTAL DATA

The Project Team will need to identify physical and ecological information for assessment later in the Risk Methodology. This Physical and Environmental Data worksheet is a starting point for much of the necessary information.

Surface Features:	
What man-made features are located in or near the sector?	Distinguish if feature is in or near sector
What natural features are located in or near the sector?	Distinguish if feature is in or near sector
Contaminant Source Information: Do any investigations detail operations that may have used or released contaminants? (Chemical, biological, organic contaminants)	
Meteorological Information:	
What are the climate, temperature extremes, frost depth, and wind rose?	
Surface Water and Sediment Information:	
What is the Surface Water Hydrology? (Lagoons, wetlands, lakes, rivers, etc.)	
What types of soils exist? (Clay, sand, etc.)	
Ground Water Information:	
What are the depth, number of aquifers, aquifer use, recharge areas, infiltration rates, and hydrological conductivity?	
Where are the private and municipal drinking water wells?	
Geological Information:	
What are the soil type, age, formation, and depth to bedrock?	
Human Population Surveys:	
What are the population, income, and unemployment rates?	
Other Information:	
What cultural resources exist? (Structures, archaeological sites, etc.)	
What endangered animals or plants exist? (Migratory birds, threatened and endangered species)	
What ecosystem exists?	

☐ EVALUATE DATA

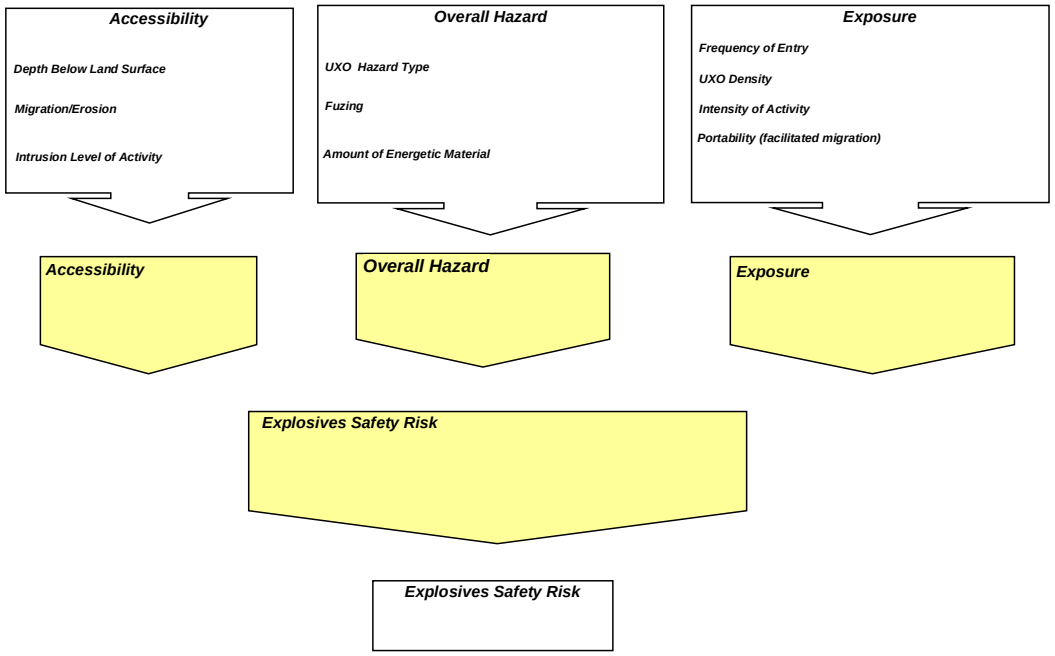
EVALUATE DATA WORKSHEETS

Using the information gathered on the Data Worksheets in Step 2, assess baseline risk for explosives safety and other constituents.

Note: Variables supported by real data should influence decisions more heavily than variables that are estimated by best professional judgment.

Baseline risk is defined as the amount of potential risk prior to conducting response actions. The explosives safety risk establishes a level the Project Team will work from to measure risk reduction based on decisions or actions on the range. Baseline risk for other constituents are weighed against regulatory standards identified in the National Contingency Plan and state regulators[19] (See Appendix 1—Nature of Risk).

The tools for Explosives Safety and Other Constituents Risk are intended to serve as roadmaps to demonstrate how individual factors feed into the overall assessment of baseline risk for each UXO type and each sector, parcel, or unit. The Explosives Safety Risk Tool is also used in Step 4 to assess risks during the implementation of response actions and risks after completing the response (residual risk). This tool is used again to assess residual risk in Step 6. Note, if adjustments are necessary to adapt the tool for site-specific usage, the Explosives Safety Risk Tool in Worksheet 3G must first be used as presented.



EXPLOSIVES SAFETY RISK TOOL

[19] The National Oil and Hazardous Substances Pollution Contingency Plan (EPA 1992).

Actual Data:
Information contained in documents, surveys or researched documentation. Actual Data is based on fact and is weighed higher than Best Professional Judgment

Best Professional Judgment:
Decisions based on reviewing all available information or documentation. This decision is based on expertise and experience to form a conclusion rather than fact.

WORKSHEET 3g - EXPLOSIVES SAFETY RISK TOOL

*Based on information gathered above, the Project Team can now assess baseline explosives safety risk. To use the following worksheet, start at the top of each scale and assign the **first** score that applies. In some cases, the score at the bottom of each scale will encompass all the scores above it.*

ACCESSIBILITY ASSESSMENT

Depth below surface = _____	1) All UXO > 10 feet. 2) All UXO > 4 feet. 3) All UXO > 2 feet. 4) All UXO ≥ 1 foot. 5) Any UXO < 1 foot.	☐ Actual Data ☐ Best Professional Judgment
Migration / Erosion = _____	1) Very Stable: no UXO will migrate 2) Minor Migration: UXO not expected to migrate due to reoccurring natural events (e.g., freeze-thaw processes); extreme natural events (e.g., tornado) may cause migration 3) Moderate migration: UXO may surface over long period of time and/or through recurring natural events 4) Significant Migration: Recurring and extreme natural events will bring UXO to surface 5) Highly dynamic: UXO will surface within first recurring review	☐ Actual Data ☐ Best Professional Judgment
Level of Activity (Intrusion) = _____	1) Non-intrusive: on surface only 2) Minor intrusions: active on surface and w/ hand tool to 1 foot 3) Moderate intrusion: ground disturbance w/ equipment to 2 feet 4) Significant intrusion: ground disturbance w/ equipment to 4 feet 5) Highly intrusive: ground disturbance more than 4 feet	☐ Actual Data ☐ Best Professional Judgment
Use above scores to give an **Accessibility Score:**_____ (Conversion is weighted for depth w/migration and intrusion as modifiers.)	1) Depth =1, Migration ≤2, Intrusion ≤ 2 2) Depth =1, Migration ≤5, Intrusion ≤ 5 or Depth =2, Migration ≤3, Intrusion ≤ 3 3) Depth =2, Migration ≤5, Intrusion ≤ 5 or Depth =3, Migration ≤4, Intrusion ≤ 4 or Depth =4, Migration ≤2, Intrusion ≤ 2 4) Depth ≤ 4, Migration ≤5, Intrusion ≤ 5 5) Depth =5, Migration ≤5, Intrusion ≤ 5	

OVERALL HAZARD ASSESSMENT[20]		
UXO Hazard Type = ____	1) Explosives substance or article, very or extremely insensitive (DOD Class 1 Divisions 1.5 and 1.6)[21] 2) Moderate fire, no blast or fragment (1.4) 3) Mass Fire, minor blast, or fragment (1.3) 4) Non-mass explosion, fragment producing (1.2) 5) Mass explosion (1.1)	☐ Actual Data ☐ Best Professional Judgment
Fuzing = ____	1) Non-fuzed (low sensitivity) 2) Fuzed (high sensitivity)	☐ Actual Data ☐ Best Professional Judgment
Amount of Energetic Material (Impact Scale) = _____	1) <0.5 lbs. 2) 0.5 to 1 lbs. 3) 1 to 10 lbs. 4) 10 to 100 lbs. 5) >100 lbs.	☐ Actual Data ☐ Best Professional Judgment
Use above scores to give an **Overall Hazard Score: _____**	1) Overall UXO Hazard =1, Energetic Material ≤ 3 2) Overall UXO Hazard ≤2, Energetic Material ≤ 4 3) Overall UXO Hazard ≤3, Energetic Material ≤ 5 4) Overall UXO Hazard ≤4, Energetic Material ≤ 5 5) Overall UXO Hazard ≤5, Energetic Material ≤ 5 **(Overall UXO Hazard = UXO Hazard Type + Fuzing Maximum Score = 5, Minimum Score = 1)**	

[20] For ranges where rounds containing chemical warfare material may be present, risks will be calculated for explosives safety separately from risks for other potentially hazardous material. Both analyses will be used as a baseline in **Step 4 – Site-Specific Action.**

[21] DoD Ammunition and Explosives Hazard Classification Procedures: Joint Technical Bulletin, DoD 1998

EXPOSURE ASSESSMENT

Frequency of Entry = _____	1) Rare : ≤ 1 entry /month 2) Occasional: 2 – 8 entries/month 3) Often: 9-15 entries/month 4) Frequent: 16 – 22 entries/month 5) Very Frequent: >22 entries/month *(One entry=one person visiting per day over course of month regardless of how many entries per day)*	☐ Actual Data ☐ Best Professional Judgment
UXO Density = _____	1) <2 per acre 2) 2-10 per acre 3) 11-50 per acre 4) 50-100 per acre 5) >100 per acre	☐ Actual Data ☐ Best Professional Judgment
Intensity of Activity = _____	1) Very low: < 1 hour/day and light activity 2) Low: ≤ 3 hours/day and light activity 3) Moderate: ≤ 6 hours/day and light/moderate activity 4) High: ≤ 9 hours/day or moderate activity 5) Very High: > 9 hours/day or heavy activity *(e.g., Light=walking, hiking & bird watching; Moderate= bicycling, horse back riding, etc.; High=off-roading in motorized vehicles)*	☐ Actual Data ☐ Best Professional Judgment
Portability = _____	1) Not Portable 2) Portable by motorized vehicle/livestock (very low portability) 3) Portable by 2 adults (low portability) 4) Portable by 1 adult (moderately portable) 5) Portable by a child (easily portable)	☐ Actual Data ☐ Best Professional Judgment
Use above scores to give an **Exposure Score:** _____	1) Frequency ≤ 2, Density ≤ 2, Intensity ≤4, Portability ≤ 4 2) Frequency ≤ 3, Density ≤ 3, Intensity ≤5, Portability ≤ 5 3) Frequency ≤ 4, Density ≤ 4, Intensity ≤5, Portability ≤ 5 4) Frequency ≤ 5, Density ≤ 5, Intensity ≤4, Portability ≤ 4 5) Frequency ≤ 5, Density ≤ 5, Intensity ≤5, Portability ≤ 5	

RISK METHODOLOGY

- *RANGE IDENTIFICATION*
- *RANGE ASSESSMENT*
- *RANGE EVALUATION*
  - *PLAN*
  - *GATHER DATA*
  - ➢ *EVALUATE DATA*
  - *DECIDE*
- *RESPONSE SELECTION*
- *SITE-SPECIFIC ACTION*
- *RECURRING REVIEW*
- *CLOSE-OUT*

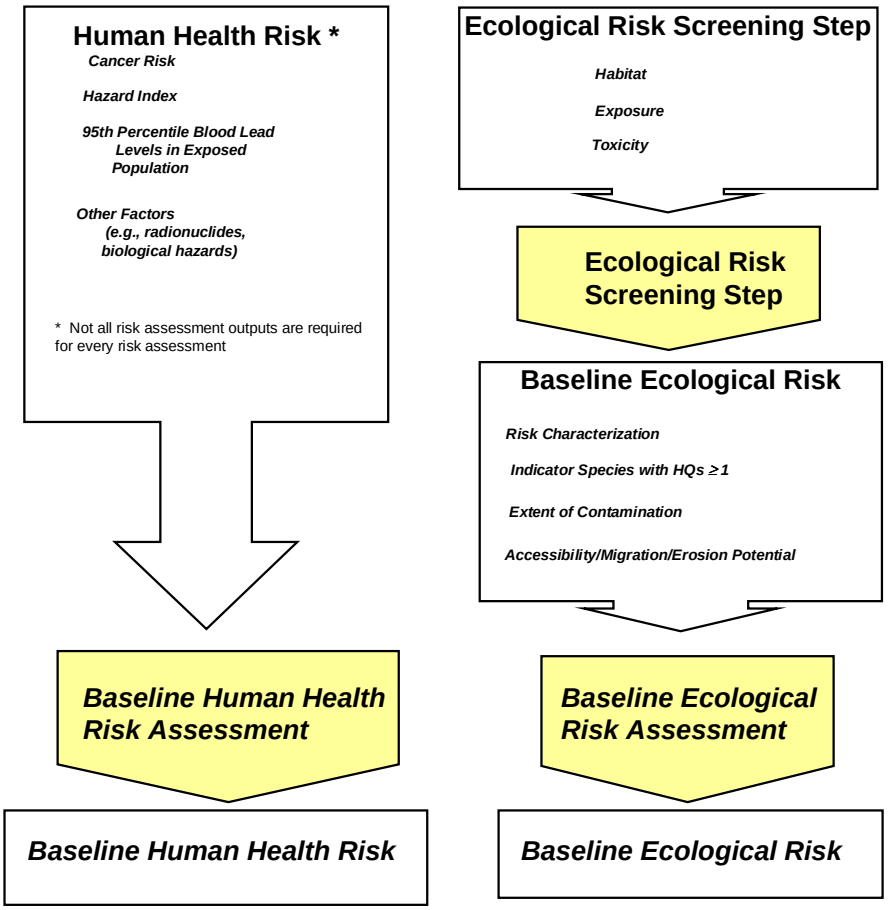
EXPLOSIVES SAFETY RISK ASSESSMENT

Record the Accessibility, Overall Hazard, and Exposure Scores here and use them to give an Explosives Safety Risk score: Accessibility = ____ Overall Hazard = ____ Exposure = ____ **Explosives Safety Risk:** _____	A) Accessibility ≤ 2, Overall Hazard ≤ 3, Exposure ≤ 2 B) Accessibility ≤ 2, Overall Hazard ≤ 5, Exposure ≤ 2 or Accessibility ≤ 3, Overall Hazard ≤ 3, Exposure ≤ 3 C) Accessibility ≤ 4, Overall Hazard ≤ 3, Exposure ≤ 4 or Accessibility ≤ 3, Overall Hazard ≤ 5, Exposure ≤ 3 or Accessibility = 5, Overall Hazard ≤ 3, Exposure ≤ 2 or Accessibility ≤ 2, Overall Hazard ≤ 3, Exposure = 5 D) Accessibility ≤ 4, Overall Hazard ≤ 5, Exposure ≤ 4 or Accessibility ≤ 5, Overall Hazard ≤ 3, Exposure ≤ 5 E) Accessibility ≤ 5, Overall Hazard ≤ 5, Exposure ≤ 5

Baseline Other Constituents Risk Assessment

Based on information gathered in Steps 1, 2, and 3, the Project Team can now assess the baseline risk associated with other constituents. Baseline risk is simply the risk that exists before actions are taken. Baseline risk is assessed and the decisions whether to conduct actions are made before using this worksheet. It provides a basis for comparison against estimated after-action risk, and aligns the outputs for consideration with explosives safety. This worksheet is only needed when evaluating explosives safety and other constituents together. The most conservative quantity that applies is the score.

OTHER CONSTITUENT RISK TOOL



WORKSHEET 3h – BASELINE OTHER CONSTITUENT RISK TOOL FOR HUMAN HEALTH

Values for these assessments are based on input provided from extensive investigations conducted under guidelines from the Environmental Protection Agency's Ecological Risk Assessment Guidance for Superfund and Risk Assessment Guidance for Superfund.

Risks associated with potential exposures to chemical warfare materiel will be assessed using applicable guidance. Recently, guidance has been developed and submitted for concurrence to evaluate chronic human exposures to residual chemical warfare agents in environmental media (DOD 1998b). This document includes health-based environmental screening levels (HBESLs) for soil for vesicant chemical warfare agents sulfur mustard (HD) and Lewisite, and the nerve agents Tabun (GA), Sarin (GB), Soman (GD), and VX.

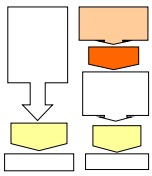
(Not all risk assessment outputs are required for every risk assessment)

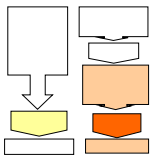
Examples of mitigating circumstances:
Different critical effects and/or target organs, margin-of-exposure analysis supplementing HI, HI is close to 1 but additional analyses indicate "true" exceedance is unlikely

Cancer Risk = _____	1) $< 10^{-6}$ 2) 10^{-6} to 10^{-4} 3) $>10^{-4}$
Hazard Index = _____	1) ≤ 1 2) > 1 with mitigating circumstances 3) >1 without mitigating circumstances
95th Percentile Blood Lead Levels in Exposed Population = _____	1) <1 µg/dL 2) 1 to 10 µg/dL 3) > 10 µg/dL
Other Factors = _____ **List Factors:** **_____Factor** **_____Factor** (e.g. radionuclides, biological hazards)	1) Acceptable 2) Acceptable with mitigating circumstances 3) Unacceptable
Use above scores to give a **Baseline Human Health Risk Assessment:** **____**_____	1) All 1's 2) All 1's and 2's 3) One 3, others <3 4) Two 3's, others < 3 5) All 3's

RISK METHODOLOGY

- *RANGE IDENTIFICATION*
- *RANGE ASSESSMENT*
- *RANGE EVALUATION*
  - *PLAN*
  - *GATHER DATA*
  - ➢ *EVALUATE DATA*
  - *DECIDE*
- *RESPONSE SELECTION*
- *SITE-SPECIFIC ACTION*
- *RECURRING REVIEW*
- *CLOSE-OUT*





WORKSHEET 3i – BASELINE ECOLOGICAL RISK TOOL	
Habitat = _____	1) No significant ecological habitat 2) Habitat available, but limited in quality & quantity 3) Either good quality or good quantity 4) Good quality and good quantity 5) Extensive tracts of good quality habitat
Exposure = ____	1) No complete exposure pathways 2) Complete exposure pathways
Toxicity = ___	1) Other constituents are generally non-toxic 2) Other constituents have limited toxicity and no potential to bioaccumulate 3) Medium potential for toxicity as well as limited potential to bioaccumulate 4) Strong potential for toxicity and potential to bioaccumulate 5) Other constituents highly toxic and greatest potential to bioaccumulate
Use above scores to give an **Ecological Risk Screening Score:** _____	1) Any 1's- No need for further ecological investigation 2) No 1's- Move to baseline Ecological Risk Assessment
BASELINE ECOLOGICAL RISK ASSESSMENT	
Risk Characterization = _____	1) Hazard Quotient <1 (If <1, continue with Extent of Contamination) 2) Hazard Quotient ≥1 (If ≥1, continue with Indicator Species)
Indicator Species with Hazard Quotients ≥ 1 = _____	1) Common species 2) Species sensitive to toxicants 3) Migratory birds 4) Threatened and endangered species 5) Keystone species
Extent of Contamination = _____	1) small area 2) small area w/ hot spots 3) medium area 4) medium area w/ hot spots 5) widespread distribution
Accessibility / Migration / Erosion Potential= _____	1) Very stable 2) Minor migration / erosion potential 3) Moderate migration / erosion potential 4) Significant migration / erosion potential 5) Highly dynamic
Use above scores to give a **Baseline Ecological Risk Assessment:** _____	1) **Lower**: Any combination with hazard quotient < 1 2) Hazard quotient ≥ 1, other factor <3 3) Hazard quotient ≥ 1, at least one 3 4) Hazard quotient ≥ 1, at least one 4 5) **Higher**: Hazard quotient ≥ 1, at least one 5

Examples of immediate threats:
UXO present on the surface and uncontrolled access to the range

Other constituents present immediate toxicological threats to human health or the environment

☐ DECIDE

WORKSHEET 3j - RANGE EVALUATION DECIDE

Based upon the data gathered and baseline risk, answer the following:

1. Based on the information gathered in this step, is there reason to take immediate action under Accelerated Response?

____ **YES**: Safety is threatened because one or more of the following are evident:

____ Unexploded ordnance present an immediate threat to human health or the environment.

____ Potentially hazardous constituents are present that may cause immediate and dangerous threats to human health or the environment.

Proceed to Accelerated Response Action (page 127)

____ **NO:** Proceed to question 2

2. Were you able to complete the Baseline Risk Assessment Worksheets for UXO and other constituents?

____**YES:** Complete the Worksheets, then proceed to Question 3

____ **NO:** Annotate reasons why and return to data gathering stage

3. Do sectors, parcels or units need to be further considered for other constituents?

_____**YES:** Continue to **Step 4—Response Selection**

_____**NO:** Proceed to **Step 4- Response Selection** for Explosives Safety only

WRITE THE RANGE EVALUATION REPORT

Attach reports, information, findings and all supporting documentation, photos, interviews, etc., to this worksheet and submit to DoD Information point of contact for inclusion in publicly accessible records and release to stakeholders. The report will include:

- Objectives established for Step 3–Range Evaluation
- Rationale for those objectives
- How objectives were met

Step 4 - Response Selection

The fourth of seven steps in the Risk Methodology, **Response Selection** requires the Project Team to:

- Address risks from explosives safety and other constituents through the development and screening of response alternatives.
- Collect data to complete a **detailed analysis** of response alternatives.

What Data Must Be Collected

During this step, the Project Team will develop then screen range response alternatives. The development and screening will take into consideration physical and geographical conditions as well as potential future uses for the land. In selecting a response alternative, the Project Team will conduct the following:

1. Develop a list of **Response Alternative Objectives** (RAO's), General Response Actions and alternatives that are most appropriate for the range in question
2. Screen response alternatives
3. Conduct a **detailed analysis** of the response alternatives to include an **individual analysis** and **comparative analysis** of all alternatives to seek best options for the range.
4. Evaluate "No Action" Alternative

There are several technology clearinghouses that can offer information on current technologies to help the Project Team assemble a list of possible alternatives for a specific range. Although the clearinghouses do not recommend technologies or approve vendors, they are an existing resource in which to research options currently available.

Specific details about the hazards and range have great impact on the type of technologies that may be selected for use. In evaluating response alternatives, consider these details and the use of different combinations of **land use controls (LUC's)** to address the problem. Evaluate **institutional controls** alone, **engineering controls** alone, and combinations of both. In other words, when conducting the detailed analysis of alternatives, consider different response actions by themselves with and without **institutional controls**.

RAO: Response Action Objectives *consist of medium-, range-, or operable unit-specific goals for protecting human health and the environment and should address the nature of the hazard, exposure routes and receptors and an acceptable level or range of levels for the hazards.*

Detailed Analysis: *Each alternative is evaluated **individually** against nine criteria and **comparatively** to explore advantages and disadvantages of each alternative relative to one another.*

Individual Analysis: *Each alternative is evaluated independently without consideration of the other potential actions.*

Comparative Analysis: *The performance of each alternative is assessed relative to other alternatives, are noted so the Project Team may balance tradeoffs in choosing the response action for the site*

Land Use Controls: *A combination of **Institutional** and **Engineering** Controls (next page).*

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Ultimately, the Project Team may find the development, screening, and detailed analysis could result in a recommendation of "**Technical Impracticality**." In this case, the response alternative might include imposing institutional controls and monitoring, or it might include a combination of limited, active actions in conjunction with institutional controls and monitoring.

Another option is to re-visit the next planned use of the site and look at other potential uses for the land that may be more compatible than the intended use (e.g. wildlife area versus housing area).

How Data Will Be Evaluated

An individual and comparative analysis of each technology will help the Project Team determine the best available technology. The individual analysis evaluates the technology against nine criteria; this information is later used in the comparative analysis. The analysis will also help the Project Team cross-reference what, if any, repercussions a response action addressing unexploded ordnance will have on other constituents and vise versa.

The nine criteria are broken into weighted areas:

- **Threshold Criteria** – Key criteria that relate directly to legal requirements. All potential response alternatives must meet the two listed below. However, in the absence of thresholds for explosives safety, the primary objective of the response is to reduce risk while meeting Applicable or Relevant and Appropriate Requirements (ARAR's). In the event a response is available that meets ARARs, the goal of the response under the Interim R3M is to reduce risk. The Final R3M will address how to meet the Overall Protection of Human Health and the Environment criterion:
  1. Overall Protection of Human Health and the Environment
  2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)
- **Primary Balancing Criteria** – Distinguish and measure differences between response alternatives:
  3. Long Term Effectiveness and Permanence
  4. Reduction in Toxicity, Mobility and Volume
  5. Short Term Effectiveness
  6. Implementability
  7. Cost

Engineering Controls: *Engineered remedies to contain or reduce contamination or the installation of physical barriers to limit access to the property.*

Institutional Controls:
A legal or institutional mechanism that limits access to or use of property, or warns of a hazard. An Institutional Control can be imposed by the property owner, such as use restrictions contained in a deed or by a government, such as a zoning restriction.

Technical Impracticability: *A decision that may occur when response actions are not acceptable due to technical or safety factors.*

- **Modifying Criteria** - Initially these two criteria will be evaluated prior to public review then considered again during the comment period on the Draft Response Selection Report:
  8. Acceptance by Appropriate Regulatory Agencies or Agencies with Jurisdiction over Affected Resources
  9. Community Acceptance

Once the analyses are completed, the Project Team will have a comparison of all potential technologies and be able to choose the best response action for the range. If an alternative is available, select a response that reduces baseline risk (or reduces the score of one of the input variables) and performs acceptably with respect to other criteria. If one is not available, then technology and site-specific conditions may not be available at this time (i.e., Technical Impracticability). In **Step 5 – Site-Specific Action**, the response will be implemented.

What Should Be Communicated With Stakeholders

*Stakeholders and the public will be given access to information collected throughout the **Response Selection Step** in a variety of ways including written notification, informal meetings and public availability sessions, newspaper announcements and formal reports. Each of these communication tools seeks to provide clear information concerning the work being done and seeks stakeholder input to the **Risk Methodology.***

During **Step 4**, communicating the following information would enhance stakeholder involvement and may be submitted for inclusion in publicly-accessible records:

- Technologies that are being considered for each range/sector
- Reasonably anticipated costs associated with selected response action
- Response action objectives in preparing site for future use
- Anticipated remaining risks from unexploded ordnance or other constituents once action is taken
- Individual analysis and comparative analysis aided the Project Team in evaluating potential alternatives
- Stakeholders' main concerns and how they will be addressed

What Reports Are Required

DoD will provide the following reports and information during Step 4:

- **Site-Specific Response Evaluation** Draft Plan (EPA, State,Tribal, and Landowner)
- Notice of Availability outlining report contents – published in major local paper (45 day comment period)
- Public Availability Session/Informal Meetings with Restoration Advisory Board
- Response Summary of Comments
- Final **Site-Specific Response Evaluation**
- Formal Decision Document as needed

All documents (Final Report, Decision Documents and supporting information) should be provided to appropriate government agencies, the landowner, and for inclusion in publicly accessible records.

WORKSHEET 4a - RESPONSE SELECTION BASIC PROJECT AND CONTACT INFORMATION

*This worksheet is intended to help the Project Team collect and analyze information necessary to complete Step 4 - Response Selection of the **Risk Methodology**. Information annotated and decisions made using this worksheet will help the Project Team document and report the information to DoD, provide publicly accessible records, and communicate with stakeholders.*

The Project Team will complete the following worksheets for each sector, parcel, or unit of the range. These worksheets are contained on a disc. If the Project Team does not have the capability to use the disc, make copies of the following worksheets for each sector, parcel, or unit evaluated.

RANGE & SECTOR NAME:	
LOCATION: *(City, State, Approximate Acreage)*	
LANDOWNER:	
PROJECT TEAM MEMBERS *(Members will make up the core team conducting the Risk Methodology. Team members are subject to change and should be reconfirmed at each step to ensure accurate contact information.)*	
DoD Contact: *(Note if Restoration Advisory Board Co-Chair)*	Phone: E-mail:
Environmental Protection Agency Contact:	Phone: E-mail:
State Contact:	Phone: E-mail:
Tribal Contact:	Phone: E-mail:
DoD Information Contact:	Phone: E-mail:
Restoration Advisory Board Co-Chair:	Phone: E-mail:
Technical Review Committee:	Phone: E-mail:
Other Members:	
INFORMATION REPOSITORY	
Location 1: Address: Phone: E-mail:	Location 2: (if applicable) Address: Phone: E-mail:
Location 3: (if applicable Address: Phone: E-mail:	

WORKSHEET 4b - RESPONSE SELECTION REPORTING

This worksheet will help the Project Team track requirements for reporting to stakeholders, provide information to publicly accessible records, and manage concurrence when required.

Site-Specific Response Evaluation Plan Submitted To:	Date Started:_____ Date Completed:_____ Federal Date Sent:_____ State Date Sent:_____ Tribal Date Sent:_____ Other _____ Date Sent:_____
Site-Specific Response Evaluation Report Submitted To:	Date Started:_____ Date Completed:_____ Federal Date Sent:_____ State Date Sent:_____ Tribal Date Sent:_____ Landowner Date Sent:_____ Information Repository Date:
Notice of Availability *(45 day comment period)*	Name of Newspaper: Publication Date(s):
Public Availability Session requested?	Yes No Date held:_____
Response Summary Report	Date Sent:
Decision Document	Federal Date Sent:_____ State Date Sent:_____ Tribal Date Sent:_____ Landowner Date Sent:_____ Information Repository Date:

DECISION-MAKING PROCESS

Step 4 – Response Selection

This process has been organized in a practical manner to help the Project Team approach Response Selection in order to Plan, Gather Data, and Decide courses of action. This will ensure that all necessary factors are available at the time needed for consideration.

☐ PLAN AND GATHER DATA

To ensure that the data gathering strategy will result in accurate, appropriate data collection, use the Response Selection Planning Worksheet below to help establish Data Quality Objectives[22] for the particular range, sector, parcel or unit. The data quality objectives will assist the Project Team in meeting the underlying goal of the Response Selection Step, roughly evaluate and select appropriate response actions focused at reducing risks and developing Response Action Objectives. Planning should be focused on defining the data collection that will be necessary to augment the data collected in the previous steps to complete the analyses.

NOTE: The proposed Range Rule encourages accelerating the response process by delineating areas within the range where immediate response activities are necessary. During Step 4, effort should be spent collecting data that are needed to evaluate and select the most appropriate risk reduction response and any necessary Accelerated Responses.

During this planning process, it is also important to keep in mind that explosives safety often pose an immediate risk when selecting responses. The Project Team may have a preference for response actions they feel will best suit the range and may include this in the selection process.

DEVELOP RESPONSE ACTION OBJECTIVES AND GENERAL RESPONSE ACTIONS

In this Step the Project Team will first need to develop medium- range or operable unit-specific goals to protect human health and the environment, prior to defining the type, quantity and quality of data to collect. These goals will be used to determine if the response action alternative is effective at reducing risk by meeting these goals. The Project Team, based on the output for Human Health Risk Assessment (page 63) and the Ecological Risk Assessment (page 64), will determine which of the three risk categories listed below applies to the range or site in question and complete the worksheet based on that determination. For more information on developing Response Action Objectives refer to Appendix 5.

[22] The Data Quality Objective process, based on *EPA's Guidance for the Data Quality Objective Process (1994a)* is presented in greater detailed in Appendix 2.

RESPONSE SELECTION PLAN AND GATHER DATA WORKSHEETS

WORKSHEET 4c - DEVELOP RESPONSE ACTION OBJECTIVES AND GENERAL RESPONSE ACTIONS

Consider both Human Health and Ecological Risk, if applicable.

	Human Health	Ecological
1) Identify the nature of the hazard and other constituents of concern		
2) Identify exposure pathways, routes and receptors		
3) Calculate preliminary remediation goals to include contaminant levels or range of levels for each exposure route for other constituents.		
4) Calculate depth and extent of remediation for UXO		

Will these objectives reduce exposure or cleanup to risk-based levels?

- **NO:** Technical Impracticability determination or other risk management decision Proceed to **Recurring Review—Step 6**
- **YES:** Estimate Residual Risk

Human Health Risk, No Ecological Risk

1) Very low residual risk to humans
2) Low residual risk to humans
3) Medium residual risk to humans
4) High residual risk to humans
5) Very high residual risk to humans

Human Health and Ecological Risks

1) Residual risk protective of humans and all ecological receptors
2) Residual risk protective of humans, keystone species and threatened and endangered species
3) Residual risk protective of humans, threatened and endangered species and migratory birds
4) Residual risk not protective of humans, but protective for some ecological receptors
5) Residual risk not protective of either humans or ecological receptors

Ecological Risk, No Human Health Risk

1) Residual risk protective of all ecological receptors
2) Residual risk protective of keystone species, threatened and endangered species and migratory birds
3) Residual risk protective of keystone species and threatened and endangered species
4) Residual risk protective for some ecological receptors
5) Residual risk not protective of ecological receptors

WORKSHEET 4d - SCREEN RESPONSE ALTERNATIVES

After the Project Team has determined the Response Action Objectives and General Response Action, they should eliminate technologies that are ineffective, not implementable or grossly excessive in cost.

The following technology clearinghouse lists of potential technologies can provide key data:	**List potential technologies from the clearinghouses:**
1. Naval School Explosive Ordnance Disposal (NAVSCOLEOD) http://www.eglin.af.mil/navscoleod 2. U.S. Army Engineering and Support Center, Huntsville, Ordnance and Explosives Mandatory Center of Expertise and Design Center (http://www.hnd.usace.army.mil/oew/index.htm) 3. U.S. Army Environmental Center Technology Web Page (http://aec.army.mil/) 4. Defense Information Systems Agency, Defense Technical Information Center (http://www.dtic.mil/technav/) 5. Environmental Security Technology Certification Program (ESTCP) reports (http://www.estcp.org/) 6. EPA Superfund Innovative Technology Evaluation (SITE) Program 7. Federal Remedial Technologies Roundtable (FRTR) *(Remediation Technologies Screening Matrix and Reference Guide*, Version 3, http://www.frtr.gov/matrix2/top_page.html) 8. Joint UXO Coordination Office (JUXOCO) list of available UXO technologies, or other similar DOD repositories (http://www.denix.osd.mil/denix/Public/News/UXOCOE/uxocoe.html) 9. JPG Phase I through IV and Live-Site Advanced Technology Demonstration (ATD) Reports (http://aec-www.apgea.army.mil:8080/prod/files/files.htm) 10. Strategic Environmental Research and Development Program (SERDP) reports (http://www.serdp.com/) 11. Technical conference/symposia proceedings (e.g., UXO Forum, Tri-Services Environmental Technology Workshop, FUDS) 12. Vendor Information System for Innovative Treatment Technologies (VISITT).	

Potential Engineering Controls: Engineered remedies to contain or reduce contamination or the installation of physical barriers to limit access to property. Examples include:	• Posting signs • Building fences • Installing landfill caps • Installing soil covers • Providing potable water • Constructing slurry walls • Installing sheet pile/vertical caps • Pumping and treating ground water • Installing and monitoring wells • Installing vapor extraction systems • Conducting surface sweeps • Excavating and disposing off-site
Potential Institutional Controls: Placing restrictions or legal policy on land to ensure Engineering Controls stay in place. These controls may include:	• Affirmative/negative easements • Affirmative/restrictive covenants • Equitable servitudes • Notices (deeds and newspaper) • Zoning • Educational constituents • Permits (construction, excavation, well drilling, etc.) • Agreements with regulators Reporting
Assemble the selected technologies and response alternatives representing a range of treatment and containment combinations for range response.	
Screen the technologies above and develop a core list of technologies to carry through the detailed analysis of alternatives.	
As an addition to identification and screening, list any preferences for treatment, expectations of beneficial re-use and use of institutional controls	

Conceptual Site Model: *Functional description of the problem, which often illustrates the relationships between location of waste sources and contamination; types and expected concentrations of contaminants; potentially contaminated media and migration pathways; and, potential human and ecological receptors.*

Technical Impracticability: *A decision that may occur when response actions are not acceptable due to technical or safety factors.*

WORKSHEET 4e - RESPONSE SELECTION PLANNING AND GATHERING DATA

What Is The Situation?

- The team may want to alter the general situation provided based on site-specific conditions (e.g. Conceptual Site Model, resources, time constraints).

General Situation:	The Project Team must select appropriate response alternatives to respond to unexploded ordnance and/or other constituents found on the range or sector. If no technology is available based on potential future use and other variables, the Project Team must determine if a "**Technical Impracticability**" finding is appropriate.

— Describe and attach the Conceptual Site Model illustrating the specific situation (e.g., sources, receptors, pathways, etc.).

— Describe and attach the resources and/or time constraints may affect the situation.

— Describe and attach any known information about the land owner, geology, hydrogeology, UXO type, UXO depth, range characteristics, topography, soil, wildlife, land use (current/future/next planned) etc. that may affect the situation.

— Document any other considerations for the situation.

— Document any known data gaps.

Provide a Site-Specific situation (considering the components above), if determined necessary by the Project Team:	

What Decisions Must Be Made?

- The Project Team must build upon the specific objectives identified above and pinpoint both the decisions and how the decisions will be made during this step of the process.
- This information will be used to define data which will be valuable and which data are required data when making these decisions.

1) Which response action is most appropriate in addressing explosives safety and other constituents?	Determine if the information needed to evaluate the response alternatives against the nine criteria is available. If the information is not available, the Project Team must revisit the planning part of the Range Evaluation Step or plan a data collection effort for this step (e.g. treatability study or technology prove-out). Based on the information, consider each of the alternatives independently and comparatively to select the best response action to reduce explosives safety risk. Other:

2) Is there an immediate threat to human health and the environment caused by unexploded ordnance or other constituents?	Evaluate existing information and information in the Accelerated Response Section to determine if an accelerated response is appropriate. Other:

What Data Will Be Used in Making These Decisions?

- The Project Team will need to design a data collection effort to collect the appropriate information to develop Response Action Objectives. The Project Team will also conduct the Detailed Analysis of Alternatives selected in the initial portion of this step to address explosives safety and/or other constituents risks.

What information exists (about the site and potential response actions) and how was that information obtained? *Indicate how the data was obtained (i.e. estimated or known). If information is not known based on data collected in the previous steps or cannot be estimated, then indicate unknown.* *Refer to the Explosives Safety Risk Tool (page 57) for more information on the terms to the right.*	Depth below land surface:
	Migration/erosion:
	Intrusion level of activity:
	UXO type (unique features):
	Fuzing:
	Amount of energetic material:
	Frequency of exposure:
	UXO density:
	Intensity of activity:
	Portability:
	Presence of natural resources:
	Presence of cultural resources:
	ARARs:
	Effectiveness of Engineering & Institutional Controls:
	Maintenance requirements:
	Use of environmental protection controls:
	Site Infrastructure capabilities:
	Project logistics on the Site:
	Presence of unique worker logistics:
	Presence of Natural hazards:
	Socio-economic status and potential impacts to:
	Time to complete:
	Technical & administrative requirements:
	Presence of ecological factors and potential impacts to:
	Community/Regulatory input or concerns:
	Costs:
	Other**:**

What information sources and locations were reviewed during the technology search? *Check sources that are available and applicable to the situation and decisions described previously in this worksheet.*	**Suggested Information Sources and Locations for Step 4:** **Information Sources** — Applicable or Relevant and Appropriate Requirement (ARARs) — Technology performance, specifications and standard operating procedures (e.g. land use controls, requirement for maintenance, residuals after treatment) — Worker, community risks during response action — Presence of ecological, cultural resources — Socioeconomic conditions — Technical and administrative requirements of alternatives — Cost (capital, annual operation and maintenance, and net present value) — Anticipated community and regulatory acceptance of alternatives — Treatability Studies — Volumes/Areas and media to be treated — Response Action Objectives — Technology Prove-Out Tests — Information to support technical impracticability, if applicable — Other:
	Locations — Naval School Explosive Ordnance Disposal (NAVSCOLEOD) — U.S. Army Engineering and Support Center, Huntsville, Ordnance and Explosives Mandatory Center of Expertise and Design Center — Defense Information Systems Agency, Defense Technical Information Center — Environmental Security Technology Certification Program (ESTCP) — EPA Superfund Innovative Technology Evaluation (SITE) — Federal Remedial Technologies Roundtable (FRTR) — Joint UXO Coordination Office — JPG Phase I - IV and Live-Site Advanced Technology Demonstration (ATD) Reports — U.S. Army Environmental Center — Strategic Environmental Research and Development Program (SERDP) — Technical conference/symposia proceeding — Vendor Information System for Innovative Treatment Technologies (VISITT)

What Are the Limits to Collecting Data?

- Determining the limits to collecting the data is based on the boundaries of the study area. Setting boundaries will allow resources to be focused on collecting the necessary data to make informed decisions during Step 4. In order to set the limits to collecting the data, the Project Team must determine and evaluate temporal and physical boundaries, the population of interest, and the scale of decision-making.
- The answers to the questions below will allow the Project Team to identify those factors that may weigh heavily or limit the design of the data collection effort for Step 4.

Population of Interest:

Objects: Describe and attach information on:	— How many UXO and what types exist? — What are the other constituents and their concentrations?
Media: Which environmental media are involved?	— Air — Surface Soil — Subsurface Soil — Surface Water — Groundwater — Sediment — Other:
People: Will current or future land use play a role the location or focus of data collection?	**Identify and Check** — **Current Land Use** Specify: — **Next Planned Land Use** Specify: — **Reasonably Anticipated Future Land Use** Specify:
Based on available information, are any highly sensitive or exposed sub-populations present?	Specifiy:
List any other factors that will play into the population of interest of the data collection in Step 2.	

Current Land Use:
Realistic assumptions about how the former range property is currently being used.

Next Planned Land Use:
Realistic assumptions about how the former range property will be used immediately following the response actions.

Reasonably Anticipated Future Land Use:
Realistic assumptions concerning how the former range property will be used in the future.

Time-based Boundaries:

Describe and attach information on:

— When decisions will be made.
— Whether site conditions may change before decisions are made.
— Whether data will still be representative of conditions when decisions and actions are to be be made.

Physical Boundaries:

Describe and attach information on:

— Will a phased investigation that will approach be used? If so, how? *A phased approach based on what is found in Range Evaluation (e.g. location, depth, or types of munitions) could focus, limit or refine the design of this data collection effort.*

— The sectors, parcels or units the Project Team has identified in order to effectively conduct the investigation. How were they defined? *Consider how these sub-areas may focus or refine the design of the data collection effort (e.g. types of munitions, physical features, reuse categories, risk).*

— The safety considerations that may focus, limit or refine the design of this data collection effort (e.g. unconventional munitions, other constituent hazards).

— The physical conditions on the sector, parcel or unit that are expected to cause safety concerns and should be factored into the design of the data collection effort (e.g. seasonal, meteorological, terrain, vegetation, geologic or geophysical constraints).

— Any special considerations due to the interaction between or overlapping of other constituents and explosives safety concerns (e.g. will unexploded ordnance impact soil sample collection or well installation).

— Any special consideration due to receptors on or off site which may affect the design of the data collection effort (e.g. quantity distance arcs, current land user or owner).

— The physical conditions on the sector, parcel or unit that are expected to cause logistical constraints that should be factored into the design of the data collection effort (e.g. access, availability of personnel or equipment, funding).

— The environmental considerations which should be considered in designing (location or timing) the data collection effort (e.g. migratory birds, endangered species, wetlands, cultural resources).

— Any other physical or temporal factors that will affect the boundaries of the data collection in Step 4, Response Selection.

Scale of Decision-Making:

Describe and attach information on:

— The role of risk-based decision-making on the range (e.g. decisions based on land use).

— The role of regulatory requirements in guiding how decisions are made (e.g. Solid Waste Management Unit boundaries). Be sure to list requirements.

— The role of technological limitations in decision-making (e.g. clearance to a specific depth). Describe limitations.

— The role financial considerations will have in decision-making (e.g., Funding for characterization vice response). Describe financial considerations.

List any other factors that will play into the scale of the decisions being made in step 4.	— Availability of Past or Current Information — Personnel for Interviews — Classified Material — Damaged or Ruined files — Other:

Practical Constraints:

Time of Year:	
Time to complete sampling and clean-up:	
People; surrounding land use:	
Climate and Weather:	
Funding, Personnel, Equipment, Others:	

How Will Decisions be Made?

- To design a data collection effort, it is important to understand how decisions are being made. The DQOs should be focused on providing the necessary information to make the required decisions at this point in the process.

Review the "Decide" part of the Response Selection Step.

What are the Tolerable Limits of Decision Error

*The **tolerable limits** of **decision error** will likely be qualitative for much of the data necessary to complete the Detailed Analysis, but may also be quantitative for other data. The project team should refer to Appendix 2 to develop the quantitative limits if a quantitative **action level** is available.*

Use the following questions to determine the appropriate confidence level for the data being collected at this stage in the process:

Will a quantitative limit on decision error be developed either for the explosives safety or other constituent component of the study?	— **YES:** Go to "Quantitative Evaluation of Tolerable Decision Error Limits" (Appendix 2) and develop tolerable decision errors for other constituents and/or explosives safety. — **NO:** Go to "Qualitative Evaluation of Tolerable Decision Error Limits" (Appendix 2) to develop tolerable decision errors for explosives safety and other constituents.

Qualitative Evaluation of Tolerable Limits of Decision Error:

This process is aimed at laying out the information sources and determining the associated confidence level for the individual sources. Based on this information, the Project Team should identify the sources and associated confidence limits they are willing to accept.

Quantitative Evaluation of Limits of Decision Error :

This could be a complex statistical process that requires the development of Null Hypotheses, Type I and II error rates, and definition of gray areas. As with the other components of the planning process, the technical details of the DQO process are outlined in Appendix 2 and in EPA's DQO guidance manuals[23].

Tolerable Limits:
Amount of decision error decision-makers are willing to accept. In some cases the limit may not be quantitative (e.g., explosives safety).

Decision Error:
Consequences of making an incorrect decision based on unavoidable uncertainties in the data. In other words, a different decision would have been made if there was no uncertainty.

Action Level:
Numerical value that causes a decision-maker to choose one of the alternative actions. It may be a regulatory standard, risk-based level, technology limitation, or reference-based standard. In some cases, the level may not be quantified (e.g., explosives safety).

[23] EPA Guidance for the Data Quality Objective Process (1994a)

What is the Optimal Sampling Approach for Collecting Data?

- The Project Team must determine if prove-outs or treatability studies are necessary and select the optimal site-specific plan for collecting data to accomplish the objectives of this phase.
- Designs will be developed based on information known about the site, previously completed components of the this Planning Worksheet and the following additional considerations:

Will the Project Team conduct Treatability Studies or Prove-outs? (See Appendix 2 – Data Quality Objectives and Appendix 5 -Geophysical Prove-Outs)	— **YES:** Consider the components under both "Document Search" and "Prove-outs or Treatability Studies" — **NO:** Consider the requirements under "Document Search".

Document Search:

When not using statistically based or judgemental sampling, use the information in the column on the right to define number of sources and types of documents that must be searched to obtain inputs to the decision.	— Review the DQO outputs — Review existing environmental data (e.g. variability of data collected and data gaps) — Historical patterns of chemical and ordnance deposition, estimates of variance — Other: — Review list from "What Data Will Be Used…" Section of this Planning Worksheet

Treatability Study and/or Technology Prove-out Tests:

In many cases, it may be appropriate to conduct a treatability study and/or a technology prove-out test. This will allow the Project Team to determine the Site-Specific performance of the alternatives and their associated technology. Use the information below to assist in determining the sampling approach for Step 4.

Develop list of general data sampling design alternatives[24]; consider:	— Treatability Studies — Technology Prove-out Tests — Other:_____

[24] Appendix 2 contains a detailed description of these sampling approaches.

Consider the following while designing a treatability study and/or prove-out:	— DQO outputs — Technical characteristics of the contaminants and media — Necessary information to complete evaluation. — Response Action Objectives. — Total cost of conducting test and accuracy of data collected Other:

Design and Document the Data Gathering Effort

As a result of the planning process the Project Team has developed an optimal design for the Response Selection Step. If data gathering is needed, the Project Team should develop a Response Selection Plan.

If necessary, the plan will detail sampling and analysis protocols, safety requirements, data analysis procedures, or Treatability studies required to complete the Response Selection.

☐ EVALUATE DATA

EVALUATE DATA WORKSHEETS

The Project Team will be using evaluation tools to assess the potential response alternatives. The Team will need to review scores from the baseline risk assessments for unexploded ordnance and other constituents assessed in Step 3. Those scores will be used in this assessment.

NINE CRITERIA EVALUATION TOOLS – EXPLOSIVES SAFETY
These scores correspond to the UXO-UXO or OC-UXO on the **Comparative Analysis** (page 101)**.**

Threshold Criteria *– Key criteria that relate directly to legal requirements. All potential response alternatives must comply with these two criteria. Enter cumulative scores in Comparative Analysis at the end of this section. These scores will be a letter score.*

WORKSHEET 4f - OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT (EXPLOSIVES SAFETY)

How well alternatives protect safety, health, and the environment

OVERALL PROTECTION	
Short-Term Effectiveness = ____ *(Enter score from Step 3 worksheet)*	A) Reduces risk for workers, community, and environment during response B) Reduces risk for workers, community, or environment during response C) No demonstrable risks changes to workers, community, and the environment during response D) Increases (but not severely) risks to workers, community, or the environment during response E) Severely increases risks to workers, community, or the environment during response
Long-Term Effectiveness = ____ *(Enter score from Step 3 worksheet)*	A) Effective and permanent (no maintenance required) B) Effective with low maintenance C) Effective with moderate maintenance D) Effective with high maintenance E) Ineffective in reducing risk
Use above scores to give an **Overall Protection Score:** _____	A) Both characteristics ≤ B B) Both characteristics ≤ C C) Both characteristics ≤ D D) One characteristic≤ C, other characteristic = E OR One characteristic ≤ B, other characteristic ≤ E E) Both characteristics ≤ E

RISK METHODOLOGY

- *RANGE IDENTIFICATION*
- *RANGE ASSESSMENT*
- *RANGE EVALUATION*
- *RESPONSE SELECTION*
  - *PLAN AND GATHER DATA*
  - ➢ *EVALUATE DATA*
  - *DECIDE*
- *SITE-SPECIFIC ACTION*
- *RECURRING REVIEW*
- *CLOSE-OUT*

OVERALL PROTECTION	
Compliance with ARARs = ____ Enter Score from chart 2. Compliance with ARAR's	A) Complies with ARARs B) C) Waivers required D) E) Waivers not available
Use above scores to give an **Overall Protection and Compliance with ARARs Score: _____**	A) 1A, 1B, 2A B) 1C, 2B, 2C C) 1D, 2D, 3A, D) 1E, 3B, 3C E) 2E, 3D, 3E

OVERALL PROTECTION OF HUMAN HEALTH AND ENVIRONMENT SCORE	
Magnitude of Residual Risk = ____ Output from Explosives Safety Risk Tool	A) Lower B) C) D) E) Higher
Use above scores to give an **Overall Protection of Human Health and the Environment Score:** _____	A) Both characteristics ≤ B B) Both characteristics ≤ C C) Both characteristics ≤ D D) One characteristic ≤ C, other characteristic = E OR One characteristic ≤ B, other characteristic ≤ E E) Both characteristics ≤ E

Overall Protection of Human Health and the Environment:
A) Highly protective
B) Moderately protective
C) Slightly protective
D) No change in protectiveness
E) Decreased protectiveness

WORKSHEET 4g - COMPLIANCE WITH ARARs (EXPLOSIVES SAFETY) *Whether alternatives comply with laws and regulations*	
Compliance with ARARs = _____	A) Complies with ARARs B) C) Waivers required D) E) Waivers not available

Compliance with ARARs:
*Reference **Appendix 5** for a list of applicable regulations and instructions on how to assess compliance*

Primary Balancing Criteria – *Distinguish and measure differences between response alternatives. Enter cumulative score for each section in Comparative Analysis at the end of this section. This is a letter score.*

WORKSHEET 4h - LONG-TERM EFFECTIVENESS AND PERMANENCE (EXPLOSIVES SAFETY) *How effective alternatives are after the action*	
EFFECTIVENESS	
Magnitude of Residual Risk = _____	A) Explosives Safety Risk Tool Result = A B) Explosives Safety Risk Tool Result = B C) Explosives Safety Risk Tool Result = C D) Explosives Safety Risk Tool Result = D E) Explosives Safety Risk Tool Result = E
Adequacy of Response = _____	A) UXO removed B) UXO is rendered-safe or exposure is eliminated C) UXO not removed or rendered-safe, but exposure strongly controlled D) UXO not removed or rendered-safe, exposure somewhat controlled E) UXO not removed or rendered-safe, exposure not controlled
Use above scores to give an **Effectiveness Score:** _____	A) Both characteristics ≤ 2 B) Both characteristics ≤ 3 C) Both characteristics ≤ 4 D) One characteristic ≤ 3 and other is 5, OR One characteristic ≤ 2 and other ≤ 5 E) Both characteristics ≤ 5

PERMANENCE	
Engineering Controls = ____	A) No requirement B) Enforceable/active controls C) Enforceable/passive controls D) Unenforceable/active controls E) Unenforceable/passive controls
Institutional Controls = ____	A) No requirement B) Enforceable/active controls C) Enforceable/passive controls D) Unenforceable/active controls E) Unenforceable/passive controls
Maintenance = ____	A) No maintenance B) Low maintenance for maximum of 12 years C) High maintenance for maximum of 12 years D) Low maintenance for more than 12 years E) High maintenance for more than 12 years
Use above scores to give an **Permanence Score: _____**	A) Controls both ≤ 2, maintenance ≤ 4 B) Controls both ≤ 3, maintenance ≤ 4 OR Engineering control ≤ 3, institutional control ≤ 4, maintenance ≤ 2 OR Engineering control ≤ 4, institutional control ≤ 3, maintenance ≤ 2 C) Engineering control ≤ 3, institutional control ≤ 4, maintenance ≤ 5 OR Engineering control ≤ 4, institutional control ≤ 3, maintenance ≤ 5 D) Engineering control ≤ 4, institutional control ≤ 4, maintenance ≤ 5 OR Engineering control ≤ 5, institutional control ≤ 3, maintenance ≤ 5 OR Engineering control ≤ 3, institutional control ≤ 5, maintenance ≤ 5 E) Controls and maintenance ≤ 5

RISK METHODOLOGY

- *RANGE IDENTIFICATION*
- *RANGE ASSESSMENT*
- *RANGE EVALUATION*
- *RESPONSE SELECTION*
  - *PLAN AND GATHER DATA*
  - ➢ *EVALUATE DATA*
  - *DECIDE*
- *SITE-SPECIFIC ACTION*
- *RECURRING REVIEW*
- *CLOSE-OUT*

Long-Term Effectiveness and Permanence:

A) Effective and permanent
B)
C)
D)
E) Ineffective in reducing risk and not permanent

LONG-TERM EFFECTIVENESS AND PERMANENCE OVERALL SCORE	
Use above scores to give a **Long-Term Effectiveness and Permanence Score:** _____	A) Both characteristics ≤ 2 B) Both characteristics ≤ 3 C) Both characteristics ≤ 4 D) One characteristic ≤ 3, other characteristic = 5 OR One characteristic ≤ 2, other characteristic ≤ 5 E) Both characteristics ≤ 5

WORKSHEET 4i - REDUCTION IN TOXICITY, MOBILITY, AND VOLUME (EXPLOSIVES SAFETY) *How effectively the response alternatives reduce risk*	
Does the treatment reduce the toxicity, mobility, and volume? (see Appendix 5 for additional information needed to evaluate this criterion)	A) Environmental Controls B) No Use of Environmental Controls C) Partial Treatment with Environmental Controls, Land Use Controls and storage D) Partial treatment without environmental controls E) Reduction in toxicity, mobility and volume through treatment

WORKSHEET 4j – SHORT-TERM EFFECTIVENESS (EXPLOSIVES SAFETY)

COMMUNITY RISK

Magnitude of Risk During Response = _____	A) Explosives Safety Risk Tool Result = A B) Explosives Safety Risk Tool Result = B C) Explosives Safety Risk Tool Result = C D) Explosives Safety Risk Tool Result = D E) Explosives Safety Risk Tool Result = E
Infrastructure Capabilities = _____	_____ Traffic loads _____ Utilities _____ Emergency service capabilities _____ Other
Project logistics = _____	_____ Quantity/distance overlap _____ Affected population(s) _____ Air quality impacts _____ Transportation of constituents _____ Exposure control _____ Other
Use above scores to give a **Community Risk Score:** _____	A) Risk = A or B and no additional factors affecting community risk B) Risk = B or C and infrastructure factors are manageable; no project logistics that will impact community C) Risk = B or C and project logistics factors are manageable; no infrastructure logistics that will impact community D) Risk = C or D and project logistics and infrastructure factors are manageable E) Risk = E or unmanageable factors exist in either category

WORKER RISK

Logistic Factors = _____	**Scheduling:** _____ _____ Work shifts _____ Hours per week **Seasons:** _____ _____ Extreme temperatures _____ Extreme weather events **Crew control:** _____ _____ Crew size _____ Training/experience _____ Planning **PPE requirements:** _____ _____ Ease of egress _____ Availability/accessibility medical facilities

Site Factors = ____	**Other constituents: ____** **Natural hazards: ____** ____ Vegetation ____ Terrain ____ Rabid or hostile species ____ Disease/virus/pathogens ____ Insects ____ Meteorological
UXO Factors = ____	____ Motion-, light-, and EMF-sensitivity ____ Submunitions ____ Unknowns/exotics ____ Technology limitations
Use above scores to give a **Worker Risk Score:** _____	A) No injuries anticipated B) Minor non-reportable accidents include insect bites or small cuts associated with vegetation, poison ivy, etc. that do not result in time away from work C) Non-reportable accidents include abrasions, sprains, bruises, lacerations, burns, etc. that do not result in time away from work D) Reportable accidents are those that result in time away from work E) A debilitating injury would include loss of limb, eyesight, or life
ENVIRONMENTAL IMPACTS See: "Estimating Impacts Ecological Socio-Economic, and Cultural Resource" in Appendix 5 to determine the following scores.	
Ecological = ____	A) Permanent benefit B) Protects existing resources C) No measurable effect D) Measurable, but not severe effect E) Severe effect
Socio-Economic = ____	A) Enhances value or resource B) Protects value or resource C) Status-quo D) Reduce value or resource E) Eliminates value or resource
Cultural = ____	A) Enhances resources B) Protects resources C) Status-quo D) Damages resources E) Loss of resources
Use above scores to give an **Environmental Impacts Score:** _____	A) All characteristics ≤ 3 B) Two characteristics < 4, one = 4 C) Two characteristics < 3, one = 5 OR Two characteristics = 4, one < 4 D) Two characteristics < 4, one = 5 E) All characteristics ≤ 5

RISK METHODOLOGY

- *RANGE IDENTIFICATION*
- *RANGE ASSESSMENT*
- *RANGE EVALUATION*
- *RESPONSE SELECTION*
  - *PLAN AND GATHER DATA*
  - ➢ *EVALUATE DATA*
  - *DECIDE*
- *SITE-SPECIFIC ACTION*
- *RECURRING REVIEW*
- *CLOSE-OUT*

Short-Term Effectiveness

A) Effective for workers, community, and the environment during response
B)
C)
D)
E) Ineffective to workers, community, or the environment during response

SHORT-TERM EFFECTIVENESS OVERALL SCORE	
Completion Time = ____	A) Less than 6 months B) Six months to 1 year C) One year to 2 years D) Two to 5 years E) Greater than 5 years
Use above scores to give an **Short-Term Effectiveness:** ____	A) Community risk, worker risk, and environmental impact ≤ 3, completion time < 5 B) Community risk, worker risk, and environmental impact ≤ 4, completion time ≤ 3 C) Community risk, worker risk, and environmental impact ≤ 4, completion time ≤ 5 OR Community risk, worker risk, and environmental impact ≤ 5, completion time ≤ 1 D) Community risk, worker risk, and environmental impact ≤ 5, completion time ≤ 3 E) Community risk, worker risk, environmental impact, and completion time ≤ 5

WORKSHEET 4k – IMPLEMENTABILITY (EXPLOSIVES SAFETY)

REQUIREMENTS

Check if there are any **Technical Requirements** for the alternative **=** _____	_____ Feasibility _____ Access due to terrain, vegetation, soils, water _____ Availability of technology _____ Availability of equipment _____ Meteorological/Climatological concerns _____ Proven technology: detection/discrimination _____ Proven technology: recovery or removal _____ Ability to determine effectiveness _____ Interference with subsequent responses or other operable units and potential interference between other constituents and explosives safety _____ Other
Check if there are any **Administrative Requirements** for the alternative **=** _____	_____ Legal considerations _____ Coordination and time requirements _____ Feasibility _____ Access due to ownership _____ Personnel/equipment shortages _____ Funding availability _____ Contracting existing mechanisms and capacities _____ Other
Use above scores to give an **Implementability Score:** _____	A) Meets all requirements B) Meets all technical, some administrative requirements C) Meets all administrative, some technical requirements D) Meets some administrative, some technical requirements E) Meets none or showstopper

WORKSHEET 4l – COST (EXPLOSIVES SAFETY)	
Estimate dollar amount in thousands The cost estimates are based on a comparison of alternatives (Land Use, Engineering and Institutional Controls) and response actions over a 30 year period. Industry standards guide the calculations of cost to determine if long term alternatives are more cost effective than response actions. (Appendix 5)	
Capital Costs	
Net present value costs of criteria	
Annual Operation and Maintenance Costs (O&M)	
Total estimate of response action to the nearest $ amount in thousands	

Modifying Criteria *– Initially, these criteria will be evaluated prior to public review then again during the comment period on the Draft Range Evaluation and Response Selection Report. Enter cumulative score for each section in Comparative Analysis at the end of this section. This is a letter score.*

WORKSHEET 4m - ACCEPTANCE BY APPROPRIATE REGULATORY AGENCIES OR AGENCIES WITH JURISDICTION OVER AFFECTED RESOURCES (EXPLOSIVES SAFETY)	
Use the public review and comment period to give an **Regulatory Acceptance Score:** _____ (see **Appendix 5** for additional information needed to evaluate this criterion)	A) Full Support B) C) Partial or conditional support D) E) No Support

WORKSHEET 4n - COMMUNITY ACCEPTANCE (EXPLOSIVES SAFETY)	
Use the public review and comment period to give an **Community Acceptance Score:** _____ (see **Appendix 5** for additional information needed to evaluate this criterion)	A) Full Support B) Most Support C) D) Few Support E) No Support

NINE CRITERIA EVALUATION TOOLS – OTHER CONSTITUENTS

These scores correspond to the UXO-OC or OC-OC these scores will be entered as number scores in the **Comparative Analysis** at the end of this section.

Threshold Criteria *– Key criteria that relate directly to legal requirements. All potential response alternatives must comply with these two criteria. Enter cumulative scores in Comparative Analysis at the end of this section. These scores will be a numeric score.*

WORKSHEET 4o - OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT (OTHER CONSTITUENTS)	
OVERALL PROTECTION	
Short-Term Effectiveness = ____ *(Enter score from **Short-Term** Effectiveness worksheet)*	1) Reduces risk for workers, community, and environment during response 2) Reduces risk for workers, community, or environment during response 3) No demonstrable risks changes to workers, community, and the environment during response 4) Increases (but not severely) risks to workers, community, or the environment during response 5) Severely increases risks to workers, community, or the environment during response
Long-Term Effectiveness = ____ *(Enter score from **Long-Term Effectiveness** worksheet)*	1) Effective and permanent (no maintenance required) 2) Effective with low maintenance 3) Effective with moderate maintenance 4) Effective with high maintenance 5) Ineffective in reducing risk
Use above scores to give an **Overall Protection Score:** _____	1) Both characteristics ≤ 2 2) Both characteristics ≤ 3 3) Both characteristics ≤ 4 4) One characteristic ≤ 3, other characteristic = 5 OR One characteristic ≤ 2, other characteristic ≤ 5 5) Both characteristics ≤ 5

OVERALL PROTECTION

Compliance with ARARs = ____ (Enter score from ARARs worksheet)	1) Complies with ARARs 2) 3) Waivers required 4) 5) Waivers not available
Use above scores to give an **Overall Protection and Compliance with ARARs Score:** _____	1) Compliance with ARAR=1 and Overall Protection=1 OR Compliance with ARAR=1 and Overall Protection=2 OR Compliance with ARAR=2 and Overall Protection=1 2) Compliance with ARAR=1 and Overall Protection=3 OR Compliance with ARAR=2 and Overall Protection=2 OR Compliance with ARAR=2 and Overall Protection=3 3) Compliance with ARAR=1 and Overall Protection=4 OR Compliance with ARAR=2 and Overall Protection=4 OR Compliance with ARAR=3 and Overall Protection=1 4) Compliance with ARAR=1 and Overall Protection=5 OR Compliance with ARAR=3 and Overall Protection=2 OR Compliance with ARAR=3 and Overall Protection=3 5) Compliance with ARAR=2 and Overall Protection=5 OR Compliance with ARAR=3 and Overall Protection=4 OR Compliance with ARAR=3 and Overall Protection=5

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT SCORE

Magnitude of Residual Risk = ____ Output from Other Constituents Risk Tool	1) Lower 2) 3) 4) 5) Higher
Use above scores to give an **Overall Protection of Human Health and the Environment Score:** _____	1) Both characteristics ≤ 2 2) Both characteristics ≤ 3 3) Both characteristics ≤ 4 4) One characteristic ≤ 3, other characteristic = 5 OR One characteristic ≤ 2, other characteristic ≤ 5 5) Both characteristics ≤ 5

Overall Protection of Human Health and the Environment
1) Highly protective
2) Moderately protective
3) Slightly protective
4) No change in protectiveness
5) Decreased protectiveness

WORKSHEET 4p - COMPLIANCE WITH ARARs (OTHER CONSTITUENTS)

Compliance with ARARs = _____	1) Complies with ARARs 2) 3) Waivers required 4) 5) Waivers not available

Compliance with ARARs: *Reference **Appendix 5** for a list of applicable regulations and instructions on how to assess compliance*

Primary Balancing Criteria – *Distinguish and measure differences between response alternatives. Enter cumulative numeric scores in* ***Comparative Analysis*** *at the end of this section.*

WORKSHEET 4q - LONG-TERM EFFECTIVENESS AND PERMANENCE (OTHER CONSTITUENTS)	
EFFECTIVENESS	
Magnitude of Residual Risk = ____	1) Other Constituents Risk Tool Result = 1 2) Other Constituents Risk Tool Result = 2 3) Other Constituents Risk Tool Result = 3 4) Other Constituents Risk Tool Result = 4 5) Other Constituents Risk Tool Result = 5
Adequacy of Response = ____	1) OCs removed or treated 2) OCs reduced or exposure is eliminated 3) OCs reduced, but exposure strongly controlled 4) OCs reduced, exposure somewhat controlled 5) OCs not removed or treated, exposure not controlled
Use above scores to give an **Effectiveness Score: _____**	1) Both characteristics ≤ 2 2) Both characteristics ≤ 3 3) Both characteristics ≤ 4 4) One characteristic ≤ 3 and other is 5 OR One characteristic ≤ 2 and other ≤ 5 5) Both characteristics ≤ 5

PERMANENCE	
Engineering Controls = ____	1) No requirement 2) Enforceable/active controls 3) Enforceable/passive controls 4) Unenforceable/active controls 5) Unenforceable/passive controls
Institutional Controls = ____	1) No institutional or engineering required 2) Institutional or engineering controls are enforceable and active 3) Institutional or engineering controls are enforceable and passive 4) Institutional or engineering controls are not enforceable but active 5) Institutional or engineering controls are not enforceable or active
Maintenance = ____	1) No maintenance 2) Low maintenance for maximum of 12 years 3) High maintenance for maximum of 12 years 4) Low maintenance for more than 12 years 5) High maintenance for more than 12 years
Use above scores to give an **Permanence Score: _____**	1) Controls both ≤ 2, maintenance ≤ 4 2) Controls both ≤ 3, maintenance ≤ 4 OR Engineering control ≤ 3, institutional control ≤ 4, maintenance ≤ 2 OR Engineering control ≤ 4, institutional control ≤ 3, maintenance ≤ 2 3) Engineering control ≤ 3, institutional control ≤ 4, maintenance ≤ 5 OR Engineering control ≤ 4, institutional control ≤ 3, maintenance ≤ 5 4) Engineering control ≤ 4, institutional control ≤ 4, maintenance ≤ 5 OR Engineering control ≤ 5, institutional control ≤ 3, maintenance ≤ 5 OR Engineering control ≤ 3, institutional control ≤ 5, maintenance ≤ 5 5) Controls and maintenance ≤ 5

Long-Term Effectiveness and Permanence
1) Effective and permanent
2)
3)
4)
5) Ineffective in reducing risk and not permanent

LONG-TERM EFFECTIVENESS AND PERMANENCE OVERALL SCORE	
Use above scores to give an **Long-Term Effectiveness and Permanence Score:** _____	1) Both characteristics ≤ 2 2) Both characteristics ≤ 3 3) Both characteristics ≤ 4 4) One characteristic ≤ 3, other characteristic = 5 OR One characteristic ≤ 2, other characteristic ≤ 5 5) Both characteristics ≤ 5

WORKSHEET 4r - REDUCTION IN TOXICITY, MOBILITY, AND VOLUME (OTHER CONSTITUENTS)	
Does the treatment reduce the toxicity, mobility, and volume? (see Appendix 5 for additional information needed to evaluate this criterion)	1) Environmental Controls 2) No Environmental Controls 3) Partial Treatment with Environmental Controls, Land Use Controls and storage 4) Partial treatment without environmental controls 5) Reduction in toxicity, mobility and volume through treatment

WORKSHEET 4s - SHORT-TERM EFFECTIVENESS (OTHER CONSTITUENTS)	
COMMUNITY RISK	
Community Risk = _____	1) Other Constituents Risk Tool Result = 1 2) Other Constituents Risk Tool Result = 2 3) Other Constituents Risk Tool Result = 3 4) Other Constituents Risk Tool Result = 4 5) Other Constituents Risk Tool Result = 5
WORKER RISK	
Worker Risk Score = _____	1) Other Constituents Risk Tool Result = 1 2) Other Constituents Risk Tool Result = 2 3) Other Constituents Risk Tool Result = 3 4) Other Constituents Risk Tool Result = 4 5) Other Constituents Risk Tool Result = 5
ENVIRONMENTAL IMPACTS	
Environmental Impacts Score = _____	1) Other Constituents Risk Tool Result = 1 2) Other Constituents Risk Tool Result = 2 3) Other Constituents Risk Tool Result = 3 4) Other Constituents Risk Tool Result = 4 5) Other Constituents Risk Tool Result = 5

Short-Term Effectiveness:
1) Effective for workers, community, and the environment during response
2)
3)
4)
5) Ineffective to workers, community, or the environment during response

SHORT-TERM EFFECTIVENESS OVERALL SCORE	
Completion Time = _____	1) Less than 6 months 2) Six months to 1 year 3) One year to 2 years 4) Two to 5 years 5) Greater than 5 years
Use above scores to give a **Short-Term Effectiveness:** _____	1) Community risk, worker risk, and environmental impact ≤ 3; completion time ≤ 5 2) Community risk, worker risk, and environmental impact ≤ 4; completion time ≤ 3 3) Community risk, worker risk, and environmental impact ≤ 5; completion time ≤ 1 4) Community risk, worker risk, and environmental impact ≤ 5; completion time ≤ 3 5) Community risk, worker risk, and environmental impact ≤ 5; completion time ≤ 5

WORKSHEET 4t IMPLEMENTABILITY (OTHER CONSTITUENTS)	
REQUIREMENTS	
Check if there are any **Technical Requirements** for the alternative **=** _____	_____ Feasibility _____ Access due to terrain, vegetation, soils, water _____ Availability of technology _____ Availability of equipment _____ Meteorological/Climatological concerns _____ Proven technology: detection/discrimination _____ Proven technology: recovery or removal _____ Ability to determine effectiveness _____ Interference with subsequent responses or other operable units and potential interference between other constituents and explosives safety
Check if there are any **Administrative Requirements** for the alternative **=** _____	_____ Legal considerations _____ Coordination and time requirements _____ Feasibility _____ Access due to ownership _____ Personnel/equipment shortages _____ Funding availability _____ Contracting existing mechanisms and capacities
Use above scores to give an **Implementability Score:** _____	1) Meets all requirements 2) Meets all technical, some administrative requirements 3) Meets all administrative, some technical requirements 4) Meets some administrative, some technical requirements 5) Meets none or showstopper

WORKSHEET 4u – COST (OTHER CONSTITUENTS)	
Estimate dollar $ amount in thousands The cost estimates are based on a comparison of alternatives (Land Use, Engineering and Institutional Controls) and response actions with a consideration to savings over a 30 year period. Industry standards guide the calculations of cost to determine if long term alternatives are more cost effective than response actions[25]. (See Appendix 5 for additional information regarding the evaluation of the Cost criterion).	
Capital Costs	
Net present value costs of criteria	
Annual Operation and Maintenance Costs (O&M)	
Total estimate of response action to the nearest $ amount in thousands	

Modifying Criteria – *Initially, these criteria will be evaluated prior to public review then again during the comment period on the Draft Range Evaluation and Response Selection Report. Enter cumulative score for each section in Comparative Analysis at the end of this section. This is a numeric score.*

WORKSHEET 4v - ACCEPTANCE BY APPROPRIATE REGULATORY AGENCIES OR AGENCIES WITH JURISDICTION OVER AFFECTED RESOURCES (OTHER CONSTITUENTS)	
Use the public review and comment period to give an **Regulatory Acceptance Score:** _____ (see **Appendix 5** for additional information needed to evaluate this criterion)	1)Full Support 2) 3)Partial or conditional support 4) 5)No Support

WORKSHEET 4w - COMMUNITY ACCEPTANCE (OTHER CONSTITUENTS)	
Use the public review and comment period to give an **Community Acceptance Score:** _____ (see **Appendix 5** for additional information needed to evaluate this criterion)	1) Full Support 2) Most Support 3) 4) Few Support 5) No Support

[25] Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (EPA 1998)

COMPARATIVE ANALYSIS

The performance of each alternative is evaluated. Advantages and disadvantages, relative to other potential actions, are noted so the Project Team may balance tradeoffs in choosing the response action for the site. To accomplish this side-by-side comparison, copy the results from Worksheets 4F through 4N (letter scores for explosives safety) and Worksheets 4O through 4W (numerical scores for other constituents) into Worksheet 4X for each alternative.

UXO_{UXO} + UXO_{OC} = UXO_{COMBO} – *The main hazard is unexploded ordnance. In considering the response action for UXO, other constituents may result and need to be addressed.*

OC_{OC} + OC_{UXO} = OC_{COMBO} – *The main hazard is another constituent. In considering the response action for the other constituent, UXO may be present and need to be addressed.*

No $Action_{COMBO}$ – *Scores when action is implemented.*

WORKSHEET 4x – COMPARATIVE ANALYSIS

Factors	Threshold Criteria		Primary Balancing Criteria					Modifying Criteria	
	1.	2.	3.	4.	5.	6.	7.	8.	9.
Criteria	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction in Toxicity, Mobility, and Volume	Short-Term Effectiveness	Implementability	Cost ($Ks)	Acceptance by Appropriate Regulatory Agencies or Agencies with Jurisdiction Over Affected Resources	Community Acceptance
Response Alternatives to Mitigate UXO									
UXO_{Combo} #1									
UXO_{Combo} #2									
UXO_{Combo} #3									
Response Alternatives to Mitigate Other Constituents									
OC_{Combo} #1									
OC_{Combo} #2									
OC_{Combo} #3									
Response Alternatives to Mitigate Other Constituents									
$No\ Action_{Combo}$									

A = BEST, B = BETTER, C = GOOD, D = NOT GOOD, E = BAD
1 = BEST, 2 = BETTER, 3 = GOOD, 4 = NOT GOOD, 5 = BAD

Examples of immediate threats:

When conducting Treatability Study, discovered UXO type that was not anticipated

UXO present on the surface and uncontrolled access to the range

Other constituents present immediate toxicological threats to human health or the environment

Technical Impracticability: *A decision that may occur when response actions are not acceptable due to technical or safety factors.*

Technical Impracticability: *A decision that may occur when response actions are not acceptable due to technical or safety factors.*

☐ DECIDE

WORKSHEET 4y – RESPONSE SELECTION DECIDE

Based upon the data gathered:

1. Is there an immediate threat to human health or the environment requiring an Accelerated Response to this range?

_____ **YES**: Safety is threatened because one or more of the following are evident:

____ Unexploded ordnance present an immediate threat to human health or the environment.

____ Potentially hazardous constituents are present that may cause immediate and dangerous threats to human health or the environment.

Proceed to Accelerated Response actions (page 127)

_____ **NO:** Proceed to **Step 5 - Site-Specific Action**

2. Which response action is most appropriate in addressing explosives safety?

Using the output from the assessments of the Detailed Analyses, identify the selected response for addressing unexploded ordnance:

If **Technical Impracticability** has been determined, proceed to **Step #5 Recurring Review**

3. Which response action is most appropriate in addressing other constituents?

Using the output from the assessments of the Detailed Analyses, identify the selected response for addressing other constituents:

If **Technical Impracticability** has been determined, proceed to Step #5 Recurring Review

WRITE RESPONSE SELECTION REPORT AND DECISION DOCUMENT

The **Site-Specific Response Evaluation Report** should include evaluation, the chosen response, the goals to reduce risk to human health and the environment as detailed in the Response Action Objectives (RAO's), an explanation of those objectives and how they will be met.

Step 5 - Site-Specific Action

The fifth step of the Risk Methodology, **Site-Specific Action,** requires the Project Team to:

- Implement an action to reduce risk.
- Conduct an initial review of the action once it is complete.
- Determine if the response met the objectives of the action.

The **Site-Specific Action Worksheet** will guide the Project Team through the implementation and assessment process necessary for completing Step 5.

What Data Must Be Collected

The **Site-Specific Action Step** allows the Project Team to implement the response action based on all the information and assessments conducted in the previous steps.

At a minimum, data collection should be sufficient to determine if the response actions met all goals. The Project Team should consider whether to collect and maintain additional data gained through the action to meet long-term goals.

If at any point the Project Team determines that there is an immediate threat to human health or the environment, immediate action should be considered under **Accelerated Response**.

How Will Data Be Evaluated

At this point in the Risk Methodology, the Project Team is implementing the response action selected in the previous step, Response Selection. The Project Team, as early as practical, will determine if the response action is performing as anticipated. The team will assess performance against response action objectives and quality assurance control limits established earlier. These assessments will begin after the initial testing and review of the response action.

The data will be evaluated to determine the effectiveness of the response at reducing risk to human health and the environment and will be used again during Recurring Review. To complete this evaluation, the project team will develop control limits for assessing quality during the response (**process quality assurance**) and after the response (**product quality assurance**).

What Should Be Communicated With Stakeholders

During **Step 5**, communicating the following information would enhance stakeholder involvement and may be submitted for inclusion in publicly-accessible records:

- What response action will be implemented
- What are the design, construction, operation, maintenance, monitoring and decommissioning of the response alternatives
- How well the response action met its goals
- What action will be taken next in this process and why
- How the public will be educated concerning remaining risk
- What are the stakeholders' main concerns and how will they be addressed

What Reports Are Required

DoD will provide the following reports and other documentation during Step 5:

- **Site-Specific Response Implementation Plan** to include all necessary information about the objectives for the response action, rationale for the objectives, and how these objectives will be achieved. The Plan may also include: design, construction, operation, maintenance, monitoring and decommissioning of the response alternative.
- Explosives Safety Submittal addressing explosives safety risk
- Notice of Availability summarizing the Explosives Safety Submittal – will be published in major local paper (45 day comment period)
- Public Availability Session/Informal Meetings may be held if requested

Process Quality Assurance: *Designate qualified individuals to oversee all UXO quality assurance activities during the response.*

Product Quality Assurance: *Independently review the response action to demonstrate the effectiveness for the given site conditions. Independent reviews, specifically government reviews of contractor work, are essential to a successfully demonstrate that the response was completed adequately.*

Stakeholders and the public will be given access to information collected throughout the ***Site-Specific Action Step*** *in a variety of ways including written notification, informal meetings, public availability sessions, newspaper announcements, and formal reports. Each of these communication tools seek to provide information and explanation of the work being done in the* ***Risk Methodology.***

All documents (Final Report, Decision Documents and supporting information) should be provided to appropriate government agencies, the landowner, and provided for inclusion in publicly accessible records.

WORKSHEET 5a - SITE-SPECIFIC ACTION BASIC PROJECT AND CONTACT INFORMATION

This worksheet is intended to help the Project Team collect and analyze information necessary to complete Step 5- Site-Specific Action of the Risk Methodology. Information annotated and decisions made using this worksheet will help the Project Team document and report the information to DoD, provide publicly accessible records, and communicate with stakeholders.

The Project Team will complete the following worksheets for each sector, parcel, or unit of the range. These worksheets are contained on a disc. If the Project Team does not have the capability to use the disc, make copies of the following worksheets for each sector, parcel, or unit evaluated.

RANGE & SECTOR NAME:	
LOCATION: *(City, State, Approximate Acreage)*	
LANDOWNER:	
PROJECT TEAM MEMBERS *(Members will make up the core team conducting the Risk Methodology. Team members are subject to change and should be reconfirmed at each step to ensure accurate contact information.)*	
DoD Contact: *(Note if Restoration Advisory Board Co-Chair)*	Phone: E-mail:
Environmental Protection Agency Contact:	Phone: E-mail:
State Contact:	Phone: E-mail:
Tribal Contact:	Phone: E-mail:
DoD Information Contact:	Phone: E-mail:
Restoration Advisory Board Chair:	Phone: E-mail:
Technical Review Committee:	Phone: E-mail:
Other Members:	
INFORMATION REPOSITORY	
Location 1: Address: Phone: E-mail:	Location 2: (if applicable) Address: Phone: E-mail:
Location 3: (if applicable) Address: Phone: E-mail:	

WORKSHEET 5b - SITE-SPECIFIC ACTION REPORTING

This worksheet will help the Project Team track requirements for reporting to stakeholders, provide information to publicly accessible records, and manage concurrence when required.

Site-Specific Implementation Plan:	Date Written:_____
Explosives Safety Submittal:	Submitted to DoD Explosives Safety Board (or other designee) Date Sent:_____ Approval: Yes No Date:_____
Access Authorization	Federal Land Manager or Property Owner
Field Work Commencement Notification	Federal Date Sent: _____ State Date Sent: _____ Tribal Date Sent: _____
Field Work:	Date Started:_____ Date Completed: _____
Notice of Availability *(45 day comment period)*	Name of Newspaper: Publication Date(s):
Public Availability Session requested?	Yes No Date held:_____
Periodic Updates	Federal Date Sent:_____ State Date Sent:_____ Tribal Date Sent:_____ Other_____ Date Sent:_____
Response Summary Report	Date Sent:
Decision Document	Federal Date Sent:_____ Concurrence_____ State Date Sent:_____ Concurrence_____ Tribal Date Sent:_____ Concurrence_____ Other_____ Date Sent:_____ Concurrence_____
All Documents Mailed To:	Government Agencies (Names & Dates Sent): _____ Landowner Date Sent:_____ Information Repository Date Sent:_____ Other _____ Date Sent: _____

DECISION-MAKING PROCESS

Step 5 - Site-Specific Action

This process has been organized in a practical manner to help the Project Team approach Response Selection in order to Plan, Gather Data, and Decide courses of action. This will ensure that all necessary factors are available at the time needed for consideration.

RISK METHODOLOGY

- *RANGE IDENTIFICATION*
- *RANGE ASSESSMENT*
- *RANGE EVALUATION*
- *RESPONSE SELECTION*
- *SITE-SPECIFIC ACTION*
- ➢ *PLAN*
  - *GATHER DATA*
  - *DECIDE*
- *RECURRING REVIEW*
- *CLOSE-OUT*

☐ PLAN

To ensure that the data gathering strategy will result in accurate, appropriate data collection, use the Site Specific Planning Worksheet that follows to help establish Data Quality Objectives[26] for the particular range, sector, parcel or unit. The data quality objectives will assist the Project Team in meeting the underlying goal of the Site-Specific Action Step - roughly determine whether the response action is meeting predefined Response Action Objectives (RAOs). These objectives should be built on the information from Response Selection Step and will define the quality assurance /quality control (QA/QC)[27] data collection effort for this step.

WORKSHEET 5c - SITE-SPECIFIC ACTION PLANNING

What Is The Situation?

- The Project Team should define the problem and objective of Step 5, Site Specific Action.
- The team may want to enhance the general situation provided based on site-specific conditions (e.g. Conceptual Site Model, resources, time constraints).

General Situation:	The Project Team will determine if the response meets established goals.
— Describe and attach the Conceptual Site Model illustrating the specific situation (e.g., sources, receptors, pathways, etc.).	
— Describe and attach the resources and/or time constraints may affect the situation.	
— Describe and attach any known information about the land owner, geology, hydrogeology, UXO type, UXO depth, range characteristics, topography, soil, wildlife, land use (current/future/next planned) etc. that may affect the situation.	
— Document any other considerations for the situation.	
Provide a site-specific situation (considering the components above), if determined necessary by the Project Team.	

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[26] The Data Quality Objective process, based on *EPA's Guidance for the Data Quality Objective Process (1994a)* is presented in greater detailed in Appendix 2.

[27] Additional information on Quality Assurance and Control is provided in Appendix 5.

What Decisions Must Be Made?

- The Project Team must build upon the specific objectives identified above and pinpoint both the decisions and how the decisions will be made during this step of the process.
- This information will be used to define which data that will be valuable and which data are required when making these decisions.
- Later sections of this worksheet will describe which data will be used and how decisions will be made using the collected data.

1) Did the Response Action meet pre-set goals to reduce risk?	Determine if the information needed to evaluate the response alternatives against the nine criteria and RAOs is available. If the information is not available, the Project Team must revisit the planning part of this Step or plan a data collection effort (e.g. QA/QC effort) for this step. If the information is available, evaluate the response action. Other:
2) Is there an immediate threat to human health and the environment caused by unexploded ordnance or other constituents?	Evaluate existing information and information in the Accelerated Response Section to determine if an accelerated response is appropriate. Other:

What Data Will Be Used in Making These Decisions?

- The Project Team may need to design a sampling approach to make the decisions identified above.
- The sampling approach (number, location and type of samples) will be chosen as a result of the Response Implementation Planning worksheet. Consider the documents and information below when selecting the data needed to make informed decisions at Step 5.

What information is available to develop control limits for QA/QC program and ensure the response action is meeting Response Action Objectives? *Review the Response Selection Report, completed in Step 4. Then check other sources that are applicable to the situation and decisions described previously in this worksheet*.	**Suggested Additional Information Sources for Step 3:** — Response Action Objectives — Response Implementation Plan — QA/QC Sampling — Response Action Report — Other:

Current Land Use:
Realistic assumptions about how the former range property is currently being used.

Next Planned Land Use:
Realistic assumptions about how the former range property will be used immediately following the response actions.

Reasonably Anticipated Future Land Use:
Realistic assumptions concerning how the former range property will be used in the future.

What Are the Limits to Collecting Data?

- Determining the limits to collecting the data is based on the boundaries of the study area. Setting boundaries will allow resources to be focused on collecting the necessary data to make informed decisions during Step 5, Site Specific Action. In order to set the limits to collecting the data, the Project Team must determine and evaluate temporal and physical boundaries, the population of interest, and the scale of decision-making.
- The answers to the questions below will allow the Project Team to identify those factors that may weigh heavily or limit the design of the data collection effort for Step 5, Site Specific Action.

Population of Interest:

Objects: Describe and attach information on:	— How many UXO and what types exist? — What are the other constituents and their concentrations?
Media: Which environmental media are involved?	— Air — Surface Soil — Subsurface Soil — Surface Water — Groundwater — Sediment — Other:
People: Will current or future land use play a role the location or focus of data collection?	**Identify and Check** — Current Land use Specify: — Next Planned Land use Specify: — Reasonably Anticipated Future Land use Specify:
Based on available information, are highly sensitive or exposed populations present?	Specify:
List any other factors that will play into the population of interest of the data collection in Step 5?	

Time-based Boundaries:

Describe and attach information on:

— When decisions will be made.
— Whether site conditions may change before decisions are made.
— Whether data will still be representative of conditions when decisions or responses are to be made.

Physical Boundaries:

Describe and attach information on:

— Will a phased investigation that will approach be used? If so, how? *A phased approach based on what is found in Response Selection (e.g. location, depth, or types of munitions) could focus, limit or refine the design of this data collection effort.*

— The sectors, parcels or units the Project Team has identified in order to effectively conduct the investigation. How were they defined? *Consider how these sub-areas may focus or refine the design of the data collection effort (e.g. types of munitions, physical features, reuse categories, risk).*

— The safety considerations that may focus, limit or refine the design of this data collection effort (e.g. unconventional munitions, other constituent hazards).

— The physical conditions on the sector, parcel or unit that are expected to cause safety concerns and should be factored into the design of the data collection effort (e.g. seasonal, meteorological, terrain, vegetation, geologic or geophysical constraints).

— Any special considerations due to the interaction between or overlapping of other constituents and explosives safety concerns (e.g. will unexploded ordnance impact soil sample collection or well installation).

— Any special consideration due to receptors on or off site which may affect the design of the data collection effort (e.g. quantity distance arcs, current land user or owner).

— The physical conditions on the sector, parcel or unit that are expected to cause logistical constraints that should be factored into the design of the data collection effort (e.g. access, availability of personnel or equipment, funding).

— The environmental considerations which should be considered in designing (location or timing) the data collection effort (e.g. migratory birds, endangered species, wetlands, cultural resources).

— Any other physical or temporal factors that will affect the boundaries of the data collection in Step 5, Site-Specific Action.

Scale of Decision-making:

Describe and attach information on:

— The role of risk-based decision-making on the range (e.g., Decisions based on land use).

— The role of regulatory requirements in guiding how decisions are made (e.g. Solid Waste Management Unit boundaries). Be sure to list requirements.

— The role of technological limitations in decision-making (e.g., clearance to a specific depth). Describe limitations.

— The role financial considerations will have in decision-making (e.g., funding for characterization vice response). Describe financial considerations.

List any other factors that will play into the scale of the decisions being made in Step 5?	

Tolerable Limits:
Amount of decision error decision-makers are willing to accept. In some cases the limit may not be quantitative (e.g., explosives safety).

Decision Error:
Consequences of making an incorrect decision based on unavoidable uncertainties in the data. In other words, a different decision would have been made if there was no uncertainty.

Action Level:
Numerical value that causes a decision-maker to choose one of the alternative actions. It may be a regulatory standard, risk-based level, technology limitation, or reference-based standard. In some cases, the level may not be quantified (e.g., explosives safety).

How Will Decisions be Made?

- To design a data collection effort, it is important to understand how decisions are being made. The DQOs should be focused on providing the necessary information to make the required decisions at this point in the process.

Review the "Decide" part of the Range Evaluation Step.

What are the Tolerable Limits of Decision Error [28]

- *It will likely be necessary to develop both qualitative and quantitative **tolerable limits** of **decision error** depending on the nature of the data collection effort on the site and the availability of quantitative action levels. For specific information on developing qualitative and quantitative limits on decision error see Appendix 2.*
- *Use the following questions to determine the appropriate confidence level for the data being collected at this stage in the process:*

Will a quantitative limit on decision error be developed either for the explosives safety or other constituent component of the study?	— **YES:** Go to "Quantitative Evaluation of Tolerable Decision Error Limits" (Appendix 2) and develop tolerable decision errors for other constituents and/or explosives safety. — **NO:** Go to "Qualitative Evaluation of Tolerable Decision Error Limits" (Appendix 2) to develop tolerable decision errors for explosives safety and other constituents.

Qualitative Evaluation of Tolerable Limits of Decision Error:

This process is aimed at laying out the information sources and determining the associated confidence level for the individual sources. Based on this information, the Project Team should identify the sources and associated confidence limits they are willing to accept.

Quantitative Evaluation of Limits of Decision Error :

This could be a complex statistical process that requires the development of Null Hypotheses, Type I and II error rates, and definition of gray areas. As with the other components of the planning process, the technical details of the DQO process are outlined in Appendix 2 and in EPA's DQO guidance manuals[29].

What is the Optimal Sampling Approach for Collecting Data?

- The Project Team must determine if samples will be collected as part of determining the response met its goals. In order to evaluate sampling or approaches, and select the optimal site-specific plan for collecting data to accomplish the objectives of this phase proceed to either Appendix 2 or this portion of the Range Assessment and Range Evaluation Planning Worksheets.

Will the Project Team collect samples as part of the QA/QC process?	_ **YES:** Consider the components under "Sampling Approach". (Appendix 2) _ **NO:** Consider the requirements under another QA/QC approach. Provide explanation of approach.

[28] Decision error is discussed in more detail in Appendix 2.
[29] EPA Guidance for the Data Quality Objective Process (1994a)

Design and Document the Data Gathering Exercise

As a result of the planning process the Project Team has developed an optimal design for the Quality Assurance/Quality Control (Appendix 4). This design should be well documented in the Plan.

While developing the plan, consider including the following:

- The information included on this Site-Specific Planning Worksheet and information resulting from the Site-Specific Action Step
- The Planning, Data Gathering, and Deciding process
- Key features that must be implemented properly to allow for efficient and valid interpretation of the data.
- Objectives of the data collection effort that should indicate when the Site-Specific Action is considered complete.

☐ GATHER DATA

The Project Team will need to implement the response action and gather data to determine if the response action met previously set goals to reduce risk.

WRITE THE IMPLEMENTATION PLAN

Gather data necessary to write the implementation plan. This may include gathering data before, during and after implementation of the response action.

- Detail Response Action Objectives from Step 4
- State Reasons for the established objectives and how those objectives will be measured (Quality Assurance/ Quality Control- Appendix 4)
- Design the response action
- Detail Operation/Maintenance of the Response Action
- Detail what monitoring of the response action will occur
- Establish schedule dates for Recurring Review (initial review should take place in 3 years, with subsequent reviews at 7 years then every 5 years after)

Examples of immediate threats:

Hazards discovered during the implementation of the Site-Specific Action were not known earlier.

UXO present on the surface and uncontrolled access to the range

Other constituents present immediate toxicological threats to human health or the environment

☐ DECIDE

WORKSHEET 5d – SITE-SPECIFIC ACTION DECIDE

Based upon the data gathered, answer the following to decide what action(s) must be taken:

1. Did the response action meet goals previously set to reduce risk?

_____ **YES:** Go to **Step 6 - Recurring Review**

_____ **NO:** Go to Question 2

2. Based on the information gathered in this step, is there reason to take immediate action under Accelerated Response?

_____ **YES**: Safety is threatened because one or more of the following are evident:

____ Threats to human health and the environment, not previously known, were discovered during the implementation of the response action.

____ Potentially hazardous constituents are present as a result of the response action that may cause immediate and dangerous threats to human health or the environment.

Proceed to Accelerated Response action (page 127)

_____ **NO**: Return to **Step 4 – Response Selection –** to reconsider the response action objectives and selected response

WRITE THE AFTER-ACTION REPORT

The After-Action Report should include details of the Response Action implementation. How well the action performed against pre-set goals, how much risk was reduced, and what are the conclusions based on data collected before, during and after implementation of the response action. The Project Team should detail what the next step in the Risk Methodology will be, and what the scheduled dates for Recurring Review exist.

Attach report, findings based on information gathered, and all supporting documentation, photos, interviews, etc. to this worksheet and submit to DoD Information Point of Contact for inclusion in publicly accessible records and release to stakeholders.

STEP 6 – RECURRING REVIEW

The sixth of seven steps in the Risk Methodology, **Recurring Review** requires the Project Team to:

- Determine if a response action was conducted on the range or if it was technically impracticable to conduct a response.
- Determine if the response action continues to reduce risk from unexploded ordnance or other constituents and continues to meet Remedial Action Objectives.
- Determine if new information has become available to reconsider prior decisions on the range.
- Determine if there is an immediate threat to the public or environment, which requires an Accelerated Response.
- Review decision for **Technical Impracticability** to determine if new technology will address explosives safety risk.

Technical Impracticability: *A decision that may occur when response actions are not acceptable due to technical or safety factors.*

The **Recurring Review Worksheet** will walk decision-makers through a data collection and thought process necessary for completing **Step 6**.

NOTE: Step 6- Recurring Review is being further developed as a part of the Final Risk Methodology

What Data Must Be Collected

In this step, the Project Team will gather data to determine if any changes on the range are relevant and may effect prior decisions. Reviews should take place at previously decided upon time intervals. The Proposed Range Rule suggests the first review at three (3) years with subsequent reviews at seven (7) years and every five (5) years thereafter. Changes to evaluate:

- Physical conditions at range or site
- Public accessibility and land use
- New technology or techniques that have become available and may warrant reconsideration of prior decisions
- Effectiveness of response action to reduce risk and continued ability to meet Remedial Action Objectives

.

How Data Will Be Evaluated

The Project Team will use data gathered from reports and documentation to decide if further action needs to be taken to protect human health and the environment. If any changes occur that alter the effectiveness of previously chosen response actions, the Project Team will need to return to the appropriate step in the Risk Methodology.

If no changes have occurred, the range will continue to be monitored and periodically compared against the Remedial Action Objectives. Although reviews are pre-determined at set intervals, they may be altered in light of changes to physical condition, accessibility, land use or new technology or techniques that change prior decisions concerning the range.

What Should Be Communicated With Stakeholders

During **Step 6**, communicating the following information would enhance stakeholder involvement and may be submitted for inclusion in publicly-accessible records:

- Changes that have occurred, if any, and any impact they have on the range or site
- Changes warranting action or change to decisions
- Actions that will be taken in response to changes
- Risks to human health or the environment remain, if any
- When the next action or review will be taken on the range
- Community concerns that need to be addressed
- Changes that the might concern community about the range

*Stakeholders and the public will be given access to information collected throughout the **Recurring Review Step** in a variety of ways including written notification, informal meetings and public availability sessions, newspaper announcements and formal reports. Each of these communication tools seeks to provide clear information concerning the work being done and seeks stakeholder input to the **Risk Methodology.***

What Reports Required to Be Generated

DoD is required to file the following reports and documentation in Step 6:

- Draft Recurring Review Report
- Public notice in local newspaper concerning continued effectiveness of response action
- Public meeting if requested
- Formal Decision Document referencing any action(s) taken

All documents (Final Report, Decision Documents and supporting information) should be provided to appropriate government agencies, the landowner, and provided for inclusion in publicly accessible records.

WORKSHEET 6A – RECURRING REVIEW BASIC PROJECT AND CONTACT INFORMATION

This worksheet is intended to help the Project Team collect and analyze information necessary to complete Step 6 – Recurring Review of the Risk Methodology. Information collected and decisions made using this worksheet will help the Project Team document and report the information, provide public records, and communicate with stakeholders.

The Project Team will complete the following worksheets for each sector, parcel, or unit of the range. These worksheets are contained on a disc. If the Project Team does not have the capability to use the disc, make copies of the following worksheets for each sector, parcel, or unit evaluated.

RANGE & SECTOR NAME:	
LOCATION: *(City, State, Approximate Acreage)*	
LAND OWNER:	

PROJECT TEAM MEMBERS

Team members are subject to change and should be reconfirmed at each step to ensure accurate contact information.

DoD Contact: *(Note if Restoration Advisory Board Co-Chair)*	Phone: E-mail:
Environmental Protection Agency Contact:	Phone: E-mail:
State Contact:	Phone: E-mail:
Tribal Contact:	Phone: E-mail:
DoD Information Contact:	Phone: E-mail:
Restoration Advisory Board Co-Chair	Phone: E-mail:
Technical Review Committee	Phone: E-mail:
Other Members (if applicable):	

INFORMATION REPOSITORY

Location 1: Address: Phone: E-mail:	Location 2: (if applicable) Address: Phone: E-mail:
Location 3: (if applicable) Address: Phone: E-mail:	

WORKSHEET 6b - RECURRING REVIEW REPORTING

This checklist will help the Project Team track requirements for reporting to stakeholders, provide information to publicly accessible records, and manage concurrence when required.

Recurring Review Draft Report:	Federal Date Sent:_____ Comments: _____ State Date Sent:_____ Comments: _____ Tribal Date Sent:_____ Comments: _____ Other _____ Date Sent:_____ Comments: _____
Notice of Response Action Evaluation Effectiveness	Name of Newspaper Publication Date(s):
Public Availability Session (if requested)	Yes No Date held:_____
Final Recurring Review Report (Decision Document)	Date Completed: _____ Federal Date Sent:_____ Concurrence: State Date Sent:_____ Concurrence: Tribal Date Sent:_____ Concurrence: Other _____ Date Sent:_____ Concurrence:
All documents mailed to:	Government Agencies (Names & Dates Sent): Land Owner Date Sent:_____ Information Repository Date Sent:_____ Other _____ Date Sent:_____

DECISION-MAKING PROCESS

Step 6 – Recurring Review

This process has been organized in a practical manner to help the Project Team Plan, Gather Data and Decide courses of action in Recurring Review.

RISK METHODOLOGY
- *RANGE IDENTIFICATION*
- *RANGE ASSESSMENT*
- *RANGE EVALUATION*
- *RESPONSE SELECTION*
- *SITE-SPECIFIC ACTION*
- *RECURRING REVIEW*
- ➢ *PLAN*
- *GATHER DATA*
- *DECIDE*
- *CLOSE-OUT*

☐ PLAN:

To ensure that the data gathering strategy will result in accurate, appropriate data collection, use the Recurring Review Planning Worksheet below to help establish Data Quality Objectives[30] for the range.

WORKSHEET 6c - RECURRING REVIEW PLANNING

What Is The Situation?

- The Project Team should define the problem and objective of Step 6, Recurring Review. The team may want to enhance the general situation provided based on site-specific conditions (e.g. Conceptual Site Model, resources, time constraints).

General Situation:	The Project Team will determine if the responses taken continue to minimize explosives safety risks, continue to be protective of human health and the environment, and prevent off-range releases of other constituents.

What Decisions must be made?

- The Project Team must build upon the specific objectives identified above and pinpoint both the decisions and how the decisions will be made during this step of the process.
- This information will be used to define which data that will be valuable and which data are required when making these decisions.

1) Is there an immediate threat to human health and the environment caused by unexploded ordnance or other constituents?	Evaluate existing information and information in the Accelerated Response Section to determine if an accelerated response is appropriate. Other:

[30] The Data Quality Objective process, based on *EPA's Guidance for the Data Quality Objective Process (1994a)* is presented in greater detailed in Appendix 2.

2) Have new information or technologies become available that would change a prior decision on the range?	Identify if any new information or technologies and evaluate the information to determine if it would change prior decisions on the site.
3) Does the response still remain protective	Information required to make this decision are not part of this Procedures Manual.
What Data Will Be Used in Making These Decisions? • The Project Team will need to consider what information is necessary to determine if the response is effective in reducing risk to human health and the environment	
Identify which of the sources have provided information to assist in planning the data gathering associated with Recurring Review and those that will part of the data collection effort to evaluate if Response Action Objectives for the range are being met: *(Place a x in front of those sources that have been used and a in front of those items that will be considered in the data collection of the Recurring Review Step)*	– Final reports, Decision Documents – Response Action Objectives – Technical submittals – Statement of work/work plans – Explosives safety submittals – Site-Specific Action Report – Technical clearinghouses – Real estate records, Newspaper records, Accident reports – Operation and maintenance records – Five-year review reports – CERCLA close-out reports &remedial action reports – Community feedback
Are sampling events needed? If yes, list what sampling is necessary to assess performance of response action against goals. If so use Planning Worksheet (Appendix 2) to develop sampling plan.	
Will the Project Team need to go on-site? If yes, explain what actions are to be accomplished during on-site visit.	

Design and Document the Data Gathering Effort

As a result of the planning process the Project Team has developed an optimal design for the Recurring Review. This design should be well documented in the Recurring Review Plan.

While developing this plan, consider including the following:

- The information included on this Recurring Review Worksheets and information resulting from the Site-Specific Action Step
- The Planning, Data Gathering, and Deciding process
- Key features that must be implemented properly to allow for efficient and valid interpretation of the data.
- Response action objectives should indicate when the Site-Specific Action is considered complete or when further action (e.g., Accelerated Response, returning to a prior phase, or conducting additional Recurring Reviews) is needed.
- How to evaluate new information and how to determine if it affects prior decisions.
- When the next Recurring Review is scheduled.

☐ GATHER DATA

All gathered data and information should be documented and attached to this worksheet along with any documents created based on findings.

WORKSHEET 6d - RECURRING REVIEW GATHER DATA	
What changes have occurred that may effect prior decisions concerning the range?	Physical Changes: Technology Changes: Accessibility to Public: Land Use: Other:
How do these changes affect previous decisions for this range?	
Are additional actions needed?	
List documents, resources needed to confirm Response Action Objectives	

Examples of immediate threats:

UXO present on the surface and uncontrolled access to the range

Other constituents present immediate toxicological threats to human health or the environment

☐ DECIDE

WORKSHEET 6e – RECURRING REVIEW DECIDE

Based upon the data gathered:

1. Is there new information?

_____ **YES:** Go to Question 2

_____ **NO:** Proceed to Step 7, Close-Out[31]

Recurring Review _____

Repeat Step 6 – Recurring Review

2. Does response remain effective?

_____ **YES:** Proceed to Step 7, Close-Out[32]

Recurring Review _____

Repeat Step 6 – Recurring Review

_____ **NO:** Note which of the following changes have occurred and go to Question 3:

- — Physical changes to range
- — New technology or techniques applicable to range
- — Accessibility to public
- — Land use
- — Other (specify):

3. Is there an immediate threat to the public or environment, which requires an Accelerated Response?

_____**YES:** Proceed to Accelerated Response actions (page 127) to ensure quickest response to protect human health and the environment.

_____**NO:** Return to appropriate step of the Risk Management. Process to reduce risk.

- — Range Identification
- — Range Assessment
- — Range Evaluation
- — Response Selection
- — Site-Specific Action

[31] In the absence of Close-Out criteria in the Interim Risk Methodology, determine date for next Recurring Review _____ and return to Step 6

[32] In the absence of Close-Out criteria in the Interim Risk Methodology, determine date for next Recurring Review _____ and return to Step 6

WRITE RECURRING REVIEW REPORT

The Recurring Review Draft Report will include:

- What changes have occurred, if any, and what impact they will have on the range or site
- What changes warrant action or a change to prior decisions concerning the range
- Whether the current response action continues meet Remedial Action Objectives
- What actions, if any, will be taken in response to changes
- What, if any, risks to human health or the environment remain
- When the next action or review will be taken on the range
- What the community concerns are that need to be addressed
- What changes the community may be aware of that concern the range

STEP 7 – CLOSE-OUT

The last of the seven steps in the Risk Methodology, **Close-Out** is the administrative process that ends the Risk Methodology. Close-Out criteria are currently under development so Close-Out is not an available option as a part of the **INTERIM R3M RANGE RULE Risk Methodology: A Process for Managing, Assessing, & Communicating Risk on Closed, Transferred, or Transferring U.S. Ranges**.

☐ DECIDE

Is the range ready for Administrative Close-Out?

_____ **NO**: Return to Step 6, Recurring Review

NOTE: There is no Close-Out in the Interim R3M. Close-Out criteria will be developed in the Final R3M.

WRITE THE RANGE CLOSE-OUT REPORT

Following completion of an appropriate number of Recurring Reviews to demonstrate that the range is unlikely to pose an explosives safety risk or a risk to human health or the environment, DOD will administratively close-out and end the range response. The Proposed Range Rule indicates that once the Draft Range Close-Out Report is complete, the responsible DOD component will:

- Send a copy of the Draft Range Close-Out Report to the appropriate Federal, Tribal, and State regulators, seeking their review and comment
- Publish a notice of intent to end response activities in a major, local newspaper announcing a 45-day period for submission of comments
- Hold a public meeting or availability session if requested
- Develop a response summary and prepare a Final Range Close-Out Report
- Prepare a formal Decision Document specifying the action(s) to be taken

The Decision Document and all supporting information will be part of the Administrative Record

- Copies of the Decision Document and Final Range Close-Out Report will be sent to the appropriate Federal, Tribal, state, and local governments; and, current property owner
- The responsible DOD component will seek concurrence on the Decision Document.

If at some future date, a problem is discovered at a CTT range that has been administratively closed out, DOD will conduct an appropriate response to address the problem. This response typically will be handled as an explosives or munitions emergency response; however, if the circumstances indicate a need for a more detailed response, DOD will re-open the range response process and conduct any appropriate actions.

Accelerated Response Action

In each step of the **Risk Methodology**, the Project Team is asked to review gathered data or conduct a limited data gathering effort. This information will be used to make an assessment about possible threats to human health and the environment that may require immediate action. This is a step outside of the Risk Methodology to accurately evaluate possible threats and institute immediate responses to reduce risk. This action requires the Project Team to:

- Estimate the risk from unexploded ordnance or other constituents to human health and the environment.
- Identify appropriate actions to immediately reduce risk.
- Communicate Accelerated Response Action to stakeholders and public.
- Implement the Accelerated Response Action.
- Gather data as the Accelerated Response is implemented.
- Identify the next step in the **Risk Methodology**.
- Communicate and report findings to stakeholders, to the public and for inclusion in permanent land records.

The Accelerated Response Worksheets will walk the Project Team through the assessments necessary for completing Accelerated Response and returning to the **Risk Methodology**.

What Data Must Be Collected

When collecting data in each of the Seven-Steps of the Risk Methodology, the Project Team will identify the need for Accelerated Response. Therefore, there are no requirements for data collection associated with Accelerated Responses. However, if time permits, the Project Team may decide to collect enough data to estimate baseline risk (see **Step 3 – Range Evaluation** for applicable information) and evaluate responses against the nine NCP criteria (see **Step 4 – Response Selection** for applicable information).

The Project Team will be using the data from whichever step of the process they were conducting that warranted immediate action to protect human health and the environment. If during the Accelerated Response action, data has not been collected for certain worksheets, evaluations or assessments, the Project Team will use their best professional judgment based on the information that is available.

How Data Should Be Evaluated

During this portion of the Risk Methodology, the Project Team will need to determine immediate actions to reduce risk to human health and the environment. In any given step, the Project Team will decide if there is a situation that warrants Accelerated Response. Once in Accelerated Response, the Project Team will use a combination of data and best professional judgment to determine what is causing the risk and how to best remedy the situation as well as secure human health and environmental safety

If the time permits to evaluate alternatives, the Project Team should first define the **scope, goals, and objectives** of the Accelerated Response rather than developing an extensive list of remedial technologies. Based on available information and the cleanup objectives, select a limited number (e.g., three or four) alternatives appropriate for addressing the objectives. Focus the evaluation only on the most qualified technologies. Since the goal is to take an early action to reduce risk, the preference for treatment needs to be balanced against the time required to implement the Accelerated Response.

Identify and analyze Accelerated Response alternatives. Existing environmental laws identify a strong preference for remedies that are highly reliable and provide long-term protection. The principal requirements for a selected remedy are that it be both protective of human health and the environment as well as cost-effective. Additional criteria include the following:

- Alternatives in which the principal element consists of treatment to permanently and significantly reduce the volume, toxicity, and mobility of the hazard are preferred
- Alternatives in which treatment technologies or resource recovery technologies are assessed and used to the maximum extent practical
- The least preferred alternatives involve offsite transport and disposal without treatment when practical treatment technologies are available.

Scope, Goals, and Objectives: *The Environmental Protection Agency sets forth a series of standards that agencies must follow when selecting remedies for CERCLA releases in the National Contingency Plan and state regulators. At some sites,* ***engineering controls*** *and/or* ***institutional controls*** *may be the remedy of choice. In general, institutional controls shall not substitute for active response measures as the sole remedy, unless such active measures are determined not to be practicable. Typically,* ***land use controls*** *are chosen where the waste poses a low, long-term threat or where full treatment is impracticable.*

Engineering Controls: *Engineered remedies to contain or reduce contamination or the installation of physical barriers to limit access to the property.*

Institutional Controls:
A legal or institutional mechanism that limits access to or use of property, or warns of a hazard. An Institutional Control can be imposed by the property owner, such as use restrictions contained in a deed or by a government, such as a zoning restriction.

Land Use Controls: *A combination of* ***Institutional*** *controls and* ***Engineering*** *Controls.*

Individual Analysis:
Each alternative is evaluated independently without consideration of the other potential actions.

Although the nine NCP criteria are evaluated **individually**, the criteria are evaluated slightly differently than the evaluation in the Response Selection Step as follows:

Effectiveness - The degree of protection that an accelerated response provides to public health and the environment as evaluated by the following five criteria:

- Overall Protection of Human Health and the Environment
- Compliance with ARAR's
- Long-Term Effectiveness and Permanence
- Reduction in Toxicity, Mobility and Volume
- Short-Term Effectiveness

Implementability - Technical feasibility, resource availability and administrative feasibility of the Accelerated response alternative determine implementability. In addition, the following criteria are evaluated to determine implementability:

- Acceptance by appropriate regulatory agencies or agencies with jurisdiction over affected resources
- Community acceptance

Comparative Analysis:
The performance of each alternative is assessed relative to other alternatives. These are noted so the Project Team may balance tradeoffs in choosing the response action for the range.

*The **"no-action"** alternative is considered as the baseline for comparisons against other alternatives. Baseline risk is used as a component of the no-action alternative.*

Cost - Sum of direct and indirect capital costs of implementing the Accelerated Response alternative.

After evaluating Accelerated Response alternatives individually, conduct a **Comparative Analysis**. A **"no-action" alternative** must be included as a basis for comparison.

Following the Comparative Analysis, the project team should select the preferred Accelerated Response alternative. In determining an appropriate accelerated response, the Project Team should focus on immediate risk reduction. When possible, preference should be given to accelerated actions that contribute or support longer-term project goals.

What Should Be Communicated With Stakeholders

During the Accelerated Response Action, the Project Team will be responsible for providing information to the information point of contact regarding action. The point of contact will notify federal, state, tribal, and local governments as well as disseminate information to the public. The stakeholders will help decide the type of action necessary based on timing, coordination, and the urgency of the situation. The information point of contact will work with the community to determine if there is a need for a public meeting and workshops or other releases of information. Initial information for release:

- What decision has been made concerning Accelerated Response and why
- What suspected threats of unexploded ordnance, munitions or other hazardous materials are there
- What the baseline risks are for human health and the environment
- What precautions are necessary while the action is being coordinated and conducted.
- What concerns of the stakeholder need to be addressed.

WORKSHEET 8a – ACCELERATED RESPONSE BASIC PROJECT AND CONTACT INFORMATION

Accelerated Response is included in the Risk Methodology to address immediate risks. Thus, data gathering efforts or a detailed analysis of alternatives may not be required. If the Project Team determines that time allows, the following worksheets are intended to help the Project Team collect and analyze information necessary to conduct an Accelerated Response. Information collected and decisions made using these worksheets will help the Project Team document and report the information, provide public records, and communicate with stakeholders.

The Project Team will complete the following worksheets for each sector, parcel, or unit of the range. These worksheets are contained on a disc. If the Project Team does not have the capability to use the disc, make copies of the following worksheets for each sector, parcel, or unit evaluated.

RANGE NAME:	
LOCATION: *(City, State, Approximate Acreage)*	
LANDOWNER:	
PROJECT TEAM MEMBERS	
DoD Contact: *(Note if Restoration Advisory Board Co-Chair)*	Phone: E-mail:
Environmental Protection Agency Contact:	Phone: E-mail:
State Contact:	Phone: E-mail:
Tribal Contact:	Phone: E-mail:
DoD Information Contact:	Phone: E-mail:
Restoration Advisory Board Co-Chair	Phone: E-mail:
Technical Review Committee	Phone: E-mail:
Other Members:	
INFORMATION REPOSITORY	
Location 1: Address: Phone: E-mail:	Location 2: (if applicable) Address: Phone: E-mail:
Location 3: (if applicable) Address: Phone: E-mail:	

WORKSHEET 8b - ACCELERATED RESPONSE REPORTING

This worksheet will help the Project Team track requirements for reporting to stakeholders, providing information to publicly accessible records, and managing concurrence when required.

Public Involvement Plan:	Federal Date Sent:_____ State Date Sent:_____ Tribal Date Sent:_____
Project Work Plan: **Submitted To:**	Date Started:_____ Date Completed:_____ Federal Date Sent:_____ State Date Sent:_____ Tribal Date Sent:_____
Accelerated Response Plan **Submitted To:**	Date Completed:_____ Federal Date Sent:_____ State Date Sent:_____ Tribal Date Sent:_____ Land Owner Date Sent: _____ Information Repository Date Sent:_____
Public Availability Session requested?	Yes No Date held:_____
Response Summary Report	Date Completed:
Final Accelerated Response Report	Date Completed:
All documents mailed to:	Government Agencies (Names & Dates Sent): Land Owner Date Sent:_____ Information Repository Date Sent:_____

DECISION-MAKING PROCESS

Accelerated Response

This process has been organized in a practical manner to help the Project Team approach Accelerated Response. The scope, goals, and objectives defined first in the Planning process will determine the extent to which later sections of the Worksheet are needed to Plan, Gather Data, and Decide courses of action. This will ensure that all necessary factors are available at the time needed for consideration.

RISK METHODOLOGY *ACCELERATED RESPONSE* ➢ *PLAN* *GATHER DATA* *EVALUATE DATA* *DECIDE*	☐ **PLAN** Initially, the Project Team should determine if a data collection and/or analysis of alternatives is possible given the immediate nature of the known hazards. In addition, if the Project Team has already identified the Accelerated Response, there is no need to proceed with completing the following worksheets. If the Project Team determines sufficient time is available to Plan, Gather, Evaluate, and Decide, the following worksheets or sections of the following worksheets should be used to guide the Accelerated Response.

WORKSHEET 8c - ACCELERATED RESPONSE PLANNING

Identifying Scope, Goals, and Objectives

Use the information listed below to clearly define the scope, goals and objectives of the Accelerated Response Action. If information is available to identify and select an Accelerated Response, do not proceed completing this worksheet. However, if the appropriate Accelerated Response is not apparent, continue completing the following worksheets.

Identification of Accelerated Response Alternatives

Potential Engineering Controls: Engineered remedies to contain or reduce contamination or the installation of physical barriers to limit access to property. Examples include:	• Posting signs • Building fences • Installing landfill caps • Installing soil covers • Providing potable water • Constructing slurry walls • Installing sheet pile/vertical caps • Pumping and treating ground water • Installing and monitoring wells • Installing vapor extraction systems • Conducting surface sweeps • Excavating and disposing off-site
Potential Institutional Controls: a variety of legal devices imposed to ensure that engineering controls stay in place or, where there are no engineering controls, to ensure the restrictions on land use stay in place Some examples include:	• Affirmative and negative easements • Affirmative and restrictive covenants • Equitable servitude • Notices (e.g., in deeds, newspapers, etc.) • Zoning • Educational materials • Permits (e.g., construction, excavation, well drilling, etc.) • Agreements with regulators • Reporting on land use control maintenance

What Is The Situation?

- The Project Team needs to determine if sufficient data are available and if time permits to collect data to assess baseline risk and evaluate response action alternatives. The following questions should guide the team if a data gathering effort is needed and permitted by time.

General Situation: State the Scope, Goals and Objectives	The Project Team must conduct an Accelerated Response to immediately reduce risks to human health and the environment from unexploded ordnance or other constituents.
What step was being conducted and what information collected compelled the Project Team to consider Accelerated Response?	

What Decisions Must Be Made?

- The Project Team must build upon the specific objectives identified above and pinpoint both the decisions and how the decisions will be made during this step of the process.
- This information will be used to define data which will be valuable and which data are required data when making these decisions. Note that the Interim R3M does not specify data collection requirements; the Project Team will determine which data are required and which are valuable.

1. What are the current risks to human health and the environment?	
2. What is the appropriate Accelerated Response Action?	
3. How will the Project Team implement the appropriate action?	
4. What information, reports and data must be communicated to stakeholders and the public?	
5. How well did the Accelerated Response Action work?	
6. Is an additional Accelerated Response Action necessary or can the Project Team return to the appropriate step of the Risk Management Process?	

What Data Will Be Used in Making These Decisions?

Refer to same question in Step 3 – Range Evaluation and Step 4 – Response Selection Planning Worksheets

What Are the Limits to Collecting the Data?

Refer to same question in Step 3 – Range Evaluation and Step 4 – Response Selection Planning Worksheets

How Will the Decisions Be Made?

Refer to same question in Step 3 – Range Evaluation and Step 4 – Response Selection Planning Worksheets

What Are the Tolerable Limits of Decision Error?

Refer to same question in Step 3 – Range Evaluation and Step 4 – Response Selection Planning Worksheets

What Is the Optimal Sampling Approach for Collecting Data?

Refer to same question in Step 3 – Range Evaluation and Step 4 – Response Selection Planning Worksheets

WRITE THE ACCELERATED RESPONSE PLAN

The Accelerated Response Plan should:

- Detail the Accelerated Response Action scope, objectives, and goals
- State reasons for the established objectives and how those objectives will be met
- If possible, identify which alternatives will be evaluated
- Identify data needs to evaluate alternatives
- Detail the response action design
- Detail operation/maintenance of the Accelerated Response Action
- What monitoring of the Accelerated Response action will occur
- What step of the Risk Methodology will the Project Team return to in resuming the Risk Methodology:
  _____ Range Identification
  _____ Range Assessment
  _____ Range Evaluation
  _____ Response Selection
  _____ Site-Specific Action

☐ GATHER DATA

ACCELERATED RESPONSE GATHER DATA WORKSHEETS

*If the Project Team has determined that a data collection and/or analysis of alternatives is **not** possible given the immediate nature of the known hazards or the Project Team has already identified the Accelerated Response, there is no need to proceed with completing the following worksheets. If the Project Team determines sufficient time is available to Plan, Gather Data, Evaluate Data, and Decide, the following guidance for using worksheets should be used to guide the data gathering of the Accelerated Response.*

*Since the activities needed to collect data here is similar to procedures in other steps, the following bullets summarize the appropriate worksheets that can be used here. All of the references will be made to **Step 3 – Range Evaluation** and **Step 4 – Response Selection** Gather Data Worksheets.*

WORKSHEET 8d – UXO DATA

To record information needed to assess explosives safety risk (i.e., baseline, during response, and residual), use Worksheet 3d.

WORKSHEET 8e – OTHER CONSTITUENT DATA

To record information needed to assess other constituent risk (i.e., baseline, during response, and residual), use Worksheet 3e.

WORKSHEET 8f – PHYSICAL AND ENVIRONMENTAL DATA

To record other information that might be needed to evaluate Accelerated Responses, use Worksheet 3f.

☐ EVALUATE DATA

ACCELERATED RESPONSE EVALUATE DATA WORKSHEETS

*If the Project Team has determined that a data collection and/or analysis of alternatives is **not** possible given the immediate nature of the known hazards or the Project Team has already identified the Accelerated Response, there is no need to proceed with completing the following worksheets. If the Project Team determines sufficient time is available to Plan, Gather Data, Evaluate Data, and Decide, the following guidance for using worksheets should be used to evaluate Accelerated Responses.*

Since the activities needed to evaluate data here is similar to procedures in other steps, the following bullets summarize the appropriate worksheets that can be used here. All of the references will be made to Step 3 – Range Evaluation and Step 4 – Response Selection Gather Data Worksheets.

WORKSHEET 8g – EXPLOSIVES SAFETY RISK

To assess explosives safety risk (i.e., baseline, during response, and residual), use Worksheet 3g.

WORKSHEET 8h – OTHER CONSTITUENT RISK

To assess other constituent risk (i.e., baseline, during response, and residual), use Worksheet 3h for human receptors and Worksheet 3i for ecological receptors.

WORKSHEET 8i – INDIVIDUAL ANALYSIS

To conduct the individual analysis of alternatives for explosives safety impacts, use Worksheets 4f through 4n. To conduct the individual analysis of alternatives for other constituent impacts, use Worksheets 4o through 4w.

COMPARATIVE ANALYSIS

The performance of each Accelerated Response alternative is evaluated. Advantages and disadvantages, relative to other potential actions, are noted so the Project Team may balance tradeoffs in choosing the Accelerated Response for the site. To accomplish this side-by-side comparison, copy the results from the worksheets described in 8i (above) into Worksheet 8j (below) for each alternative.

UXO_{UXO} + UXO_{OC} = UXO_{COMBO} – *The main hazard is unexploded ordnance. In considering the response action for UXO, other constituents may result and need to be addressed.*
OC_{OC} + OC_{UXO} = OC_{COMBO} – *The main hazard is another constituent. In considering the response action for the other constituent, UXO may be present and need to be addressed.*
No $Action_{COMBO}$ – *Scores when action is implemented.*

WORKSHEET 8j – COMPARATIVE ANALYSIS

	Effectiveness					Implementability			Cost
Factors	1.	2.	3.	4.	5.	6.	7.	8.	9.
Criteria	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction in Toxicity, Mobility, and Volume	Short-Term Effectiveness	Implementability	Acceptance by Appropriate Regulatory Agencies or Agencies with Jurisdiction Over Affected Resources	Community Acceptance	Cost ($Ks)
Response Alternatives to Mitigate UXO									
UXO_{Combo} #1									
UXO_{Combo} #2									
UXO_{Combo} #3									
Response Alternatives to Mitigate Other Constituents									
OC_{Combo} #1									
OC_{Combo} #2									
OC_{Combo} #3									
Response Alternatives to Mitigate Other Constituents									
No $Action_{Combo}$									

A = BEST, B = BETTER, C = GOOD, D = NOT GOOD, E = BAD
1 = BEST, 2 = BETTER, 3 = GOOD, 4 = NOT GOOD, 5 = BAD

☐ **DECIDE**

WORKSHEET 8k – ACCELERATED RESPONSE DECIDE

At the conclusion of the Accelerated Response action, the Project Team should re-evaluate range risk to determine whether or not implementing the Accelerated Response was successful in reducing risk. If range risk has effectively been reduced (after implementing the Accelerated Response), the Project Team should return to the phase in which the determination was made to implement an Accelerated Response. If range risk has still not been sufficiently reduced after implementation of an Accelerated Response, the Project Team could either return to the originating step (designated above) or implement another appropriate Accelerated Response. The Project Team will determine if an immediate risk is present or if it is more appropriate to return to the Risk Methodology.

During the implementation of the Accelerated Response, data will be collected that describes the actual field conditions. These data will be used to conduct the Individual Analysis, Comparative Analysis, and select the preferred Accelerated Response Alternative. It is important to consider all sources of data that may be relevant to aid in follow-on decisions. Based upon the data gathered, answer the following to decide what action(s) must be taken:

1. Did the accelerated response action meet goals previously set to immediately reduce risk?

_____ **YES:** Go to Question 2

_____ **NO:** Go back to reconsider objectives and selected response(s)

2. Based on the information gathered in this step, is there reason to consider another action under Accelerated Response?

_____ **YES**: Safety is threatened because one or more of the following are still evident:

____ Threats to human health and the environment, not previously known, were discovered during the implementation of the response action.

____ Potentially hazardous constituents are present as a result of the response action that may cause immediate and dangerous threats to human health or the environment.

_____ **NO**: Return to the step in the Risk Methodology being conducted by the Project Team before the Accelerated Response was warranted.

WRITE THE ACCELERATED RESPONSE COMPLETION REPORT

The report should include the following:

- Findings from the action taken to include site-specific data
- Recommendations for follow-on actions
- Effectiveness of the action taken

Attach report findings based on information gathered, and all supporting documentation, photos, interviews, etc. to this worksheet and submit to DoD Information Point of Contact for inclusion in publicly accessible records and release to stakeholders.

GLOSSARY

Accelerated Response*—Any readily available, proven method of addressing the identified risk posed by military munitions, UXO, or other constituents at military ranges. AcRs may be fully protective in and of themselves. An AcR is similar to a CERCLA removal action, a RCRA interim measure and a Superfund Accelerated Cleanup Model (SACM) short-term action.

Active Range*—A military range that is currently in service and is being regularly used for range activities.

Adverse Event—An event or series of events leading (or which may lead) to a human, biological, or environmental harm or loss.

Buffer Zone—The area on a range extending beyond an impact area to provide a safety zone to contain ricochets, blast, and fragmentation from exploding ordnance.

Closed Range*—A military range that has been taken out of service and either has been put to new uses that are incompatible with range activities or is not considered by the military to be a potential range area. A closed range is still under the control of a DOD component.

Composite Random Sampling—A random sampling scheme conducted in conjunction with another sampling design

Consequence—The effect of an adverse event.

Deflagration—A rapid chemical reaction in which the output of heat is enough to enable the reaction to proceed and be accelerated without input of heat from another source. Deflagration is a surface phenomenon with the reaction products flowing away from the unreacted material along the surface at subsonic velocity. The effect of true deflagration under confinement is an explosion. Confinement of the reaction increases pressure, rate of reaction and temperature, and may cause transition into a detonation.

Detonation—A violent chemical reaction within a chemical compound or mechanical mixture evolving heat and pressure. A detonation is a reaction that proceeds through the reacted material toward the unreacted material at supersonic velocity. The result of the chemical reaction is exertion of extremely high pressure on the surrounding medium, forming a propagating shock wave that originally is of supersonic velocity. A detonation, when the material is located on or near the surface of the ground, is characterized by a crater.

Encounter—An interaction (e.g., contact) that has the potential to transfer energy to military munitions or UXO.

Engineering Controls— a variety of engineered remedies to contain and/or reduce contamination, and/or physical barriers intended to limit access to property. Some

examples of ECs include fences, signs, guards, landfill caps, soil covers, provision of potable water, slurry walls, sheet pile (vertical caps), pumping and treatment of groundwater, monitoring wells, and vapor extraction systems.

Explosive—Any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion (i.e., with substantially instantaneous release of gas and heat).

Exposure—Contact of an organism with a physical agent or chemical. Exposure is quantified as the amount of agent or energy available for transfer at the exchange boundaries of the organism.

Federal Land Manager*—A Federal agency that has received or is clearly anticipated to receive jurisdiction, custody, or control over the property.

Impact Area—The area on a range within the limits of which all ordnance is intended to impact and/or detonate. An impact area includes the area containing the target, plus the immediate area around the target, to contain rounds that miss that target.

Inactive Range*—A military range that is not currently being used, but that is still under military control and is considered by the military to be a potential range area, and that has not been put to a new use that is incompatible with range activities.

Initiating Energy—The energy, that when imposed on an item of UXO, can result in a detonation of that UXO. These forces include, but are not limited to, temperature, shock, friction, magnetism, static or lightning, and electromagnetic radiation.

Institutional Control—a legal or institutional mechanism that limits access to or use of property, or warns of a hazard. An IC can be imposed by the property owner, such as use restrictions contained in a deed or by a government, such as a zoning restriction.

Land Use Controls—combination of engineering and institutional controls intended to protect human health and the environment.

Military Munitions*—All ammunition products and components produced or used by or for DOD or the U.S. Armed Services for national defense and security, including military munitions under the control of DOD, the U.S. Coast Guard, the U.S. Department of Energy (DOE), and National Guard personnel. The term military munitions includes: confined gaseous, liquid, and solid propellants, explosives, pyrotechnics, chemical and riot control agents, smokes and incendiaries used by DOD components, including bulk explosives and chemical warfare agents, chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges, and devices and components thereof. Military munitions do not include wholly inert items, improvised explosive devices, and nuclear weapons, nuclear devices, and nuclear components thereof. However, the term does include non-nuclear components of nuclear devices, managed under DOE's nuclear weapons program, after all required

sanitation operations under the Atomic Energy Act of 1954, as amended, have been completed.

Military Range*—Any land mass or water body that is or was used for the conduct of training, research, development, testing, or evaluation of military munitions or explosives. Ranges include firing lines and positions, maneuver areas, firing lanes, test pads, detonation pads, impact areas, and buffer zones with restricted access and exclusionary areas. The definition of a military range does not include airspace, or water, or land areas underlying airspace used for training, testing, or research and development where military munitions have not been used.

Next Planned Land Use—Realistic assumptions concerning how the former range property will be used immediately following the response actions. The next planned land use is typically developed from information such as reasonably anticipated future land use, current land use, Technical Impracticability determinations, the surrounding area, local land use planning and development, and other relevant information.

Other Constituents—Other constituents are potentially hazardous chemicals that are located on or originate from CTT ranges and are released from military munitions or UXO, or have resulted from other activities on military ranges. Other constituents may be subject to other statutory authorities, including, but not limited to, CERCLA (42 U.S.C. 9601, *et seq*.) and RCRA (42 U.S.C. 6901, *et seq*.).

Operable Unit—A division of a site that addresses discrete aspects of the site (e.g., different geographical portions of a site, specific site problems, or initial phases of an action, or may consist of any set of actions performed over time or any actions that are concurrent but located in different parts of a site).

Parcel—A piece, as of land, usually a specific part of a large acreage or estate.

Range—see Military Range and Figure 12-1.

Range Reconnaissance—An exploratory survey or examination, as in making a preliminary survey of physical and geographical conditions of the range as well as land use at the range. Typically, on-range reconnaissances are conducted after off-range reconnaissances. Off-range reconnaissances are intended to identify potential range hazards through the review of historical records and interviews. On-range reconnaissances include a site visit to obtain visible evidence of hazards. Both of these activities are intended to plan subsequent activities.

Reasonably Anticipated Future Land Use—Realistic assumptions concerning how the former range property will be used in the future, typically based on information such as current use, the surrounding area, local land use planning and development, and other relevant information.

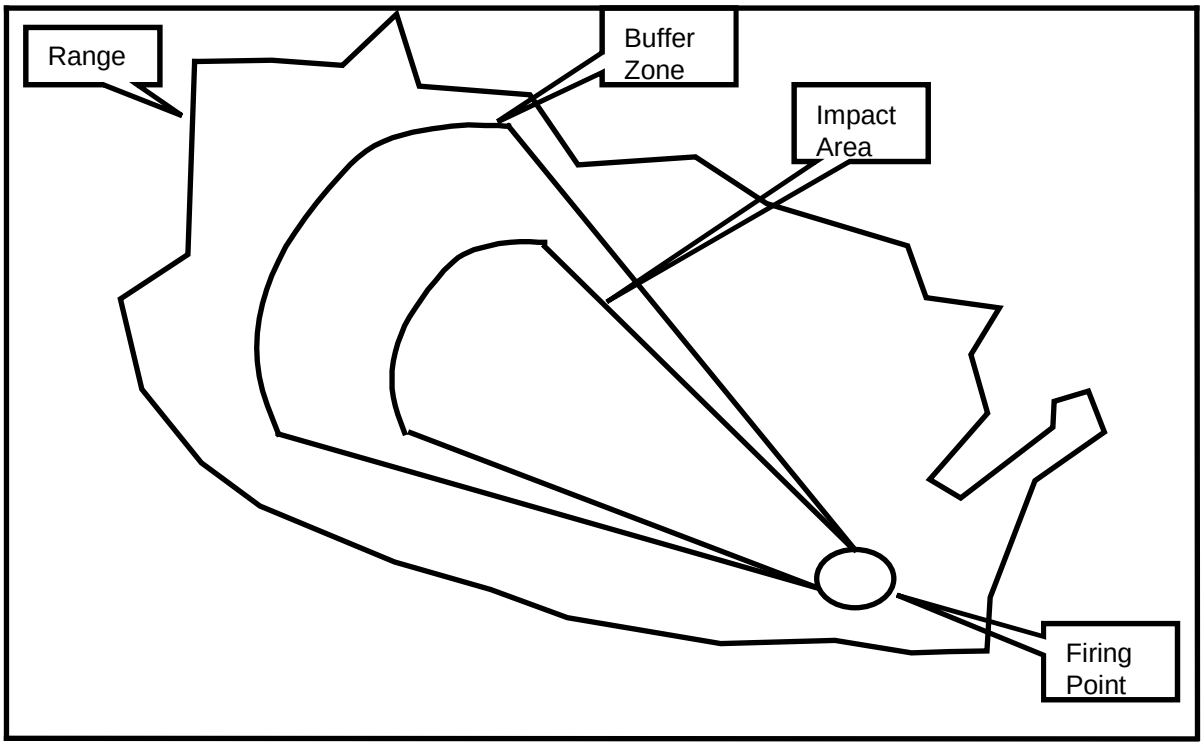

Figure 12-1. Layout of a Generic Range

Risk—The probability that a substance or situation will produce harm under specified conditions. Risk is a consideration of two factors: (1) the probability that an adverse event will occur, and (2) the consequences of an adverse event.

- *UXO Explosives Risk* is a function of two factors: (1) the probability of encounter and munitions functioning, and (2) consequences resulting from exposure.
- *Other Constituents Risk* is a function of two factors: (1) the probability of exposure, and (2) consequences resulting from exposure.

Risk Assessment—An organized process used to describe and estimate the likelihood of adverse outcomes from an exposure.

Risk Communication—A multi-directional information exchange where both technical (e.g., scientific data) and non-technical (e.g., trust, fairness, respect) aspects are considered.

Risk Management—The process of analyzing, selecting, implementing, and evaluating actions to reduce risk to human health and ecosystems.

Sector—A contiguous area located within a range. A sector is a classification of a portion of a range that is homogeneous with respect to terrain, future land use, expected

ordnance density, previous data, need for characterization, topography, geology, or other physical characteristics.

Sequential Random Sampling—Usually, simple random samples have a fixed sample size, but some alternative approaches are available, such as sequential random sampling, where the sample sizes are not fixed a priori. Rather, a statistical test is performed after each specimen's analysis (or after some minimum number have been analyzed). This strategy could be applicable when sampling and/or analysis is quite expensive, when information concerning sampling and/or measurement variability is lacking, when the characteristics of interest are stable over the time frame of the sampling effort, or when the objective of the sampling effort is to test a single specific hypothesis.

Simple Random Sampling—The simplest type of probability sample is the simple random sample where every possible sampling unit in the target population has an equal chance of being selected. Simple random samples, like the other samples, can be either samples in time and/or space and are often appropriate at an early stage of an investigation in which little is known about systematic variation within the site or process. All of the sampling units should have equal volume or mass, and ideally be of the same shape if applicable. With a simple random sample, the term “random” should not be interpreted to mean haphazard; rather, it has the explicit meaning of equiprobable selection. Simple random samples are generally developed through use of a random number table or through computer generation of pseudo-random numbers.

Stratified Random Sampling—Another type of probability sample is the stratified random sample, in which the site or process is divided into two or more nonoverlapping strata, sampling units are defined for each stratum, and separate simple random samples are employed to select the units in each stratum. (If a systematic sample were employed within each stratum, then the design would be referred to as a stratified systematic sample.) Strata should be defined so that physical samples within a stratum are more similar to each other than to samples from other strata. If so, a stratified random sample should result in more precise estimates of the overall population parameter than those that would be obtained from a simple random sample with the same number of sampling units.

Systematic Random Sampling—In the case of spatial sampling, systematic sampling involves establishing a two-dimensional (or in some cases a three-dimensional) spatial grid and selecting a random starting location within one of the cells. Sampling points in the other cells are located in a deterministic way relative to that starting point. In addition, the orientation of the grid is sometimes chosen randomly and various types of systematic samples are possible. For example, points may be arranged in a pattern of squares (rectangular grid sampling) or a pattern of equilateral triangles (triangular grid sampling). The result of either approach is a simple pattern of equally spaced points at which sampling is to be performed.

Technical Impracticability—At a limited number of sites, the Department of Defense foresees that explosives safety concerns and limitations of existing UXO detection and destruction technologies may lead to consideration of site-specific remedies that are

limited to institutional controls and monitoring. Institutional controls, such as fences or barriers to control public access, would be implemented to restrict access to unsafe areas and thereby limit the explosives safety risks and constituent threats to human health. Monitoring would be implemented to ensure that constituent releases do not migrate to where they pose unacceptable risks to human health and the environment. At other sites, safety and technical considerations may allow a limited, active response in conjunction with institutional controls and monitoring.

Training and Maneuver Areas—Other range areas historically used for training and/or maneuvers, but not designated as impact areas, buffer zones, safety fans, or firing and release positions.

Transferred Range*—A military range that has been released from military control. The transfer may have been by deed or lease, or by return under the terms of a withdrawal, special-use permit or authorization, right-of-way, public land order, or other instrument under which DOD used the property.

Transferring Range*—A military range that is proposed to be leased, transferred, or returned from the DOD to another entity, including Federal entities. Transfer may be by deed or lease, or by return under the terms of a withdrawal, special-use permit or authorization, right-of-way, public land order, or other instrument under which DOD used the property. An active range will not be considered to be a "transferring range" until the transfer is imminent.

Unexploded Ordnance*—Military munitions that have been primed, fused, armed, or otherwise prepared for action, and have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installation, personnel, or material and remain unexploded either by malfunction, design, or any other cause.

*Definitions taken directly from Munitions Rule (EPA 1997b) and/or Proposed Range Rule (DOD 1997).

APPENDIX 1 - NATURE OF RISK IN THE INTERIM R3M

1. INTRODUCTION

Because the Interim Range Rule Risk Methodology (R3M) requires the estimation of risks from military munitions, unexploded ordnance (UXO), and other constituents at various points in the range response process, a thorough understanding of risk is essential. The R3M Partnering Initiative agreed in September 1998 to adopt the following definition of risk from the *Presidential/Congressional Commission on Risk Assessment and Risk Management*, 1997:

> Risk is the probability that a substance or situation will produce harm under specified conditions. Risk is a combination of two factors: (1) the probability that an adverse event will occur, and (2) the consequences of an adverse event.

This is similar to the following definition adopted by the National Academy of Sciences (NAS)(1983): risk is the potential for adverse effects to an exposed population.

The U.S. Environmental Protection Agency (EPA) has developed general risk assessment methods for evaluating human health and environmental risks at hazardous and toxic waste sites that follow the basic relationship established by NAS. These general risk assessment methods are conducted through the four basic steps (NAS 1983, EPA 1989a) listed in the text inset on the right. These methods typically are used to quantify risk from long-term, chronic exposure to low levels of contamination.

(1) hazard identification
(2) exposure assessment
(3) dose response modeling
(4) risk characterization

The explosives safety threat from military munitions and UXO, however, typically results from a single exposure and may result in either no effect, injury, or death. Therefore, the established methods for characterizing risk associated with chemical exposures are not directly applicable to explosives safety risks. Consequently, an analytical tool has been developed to assess explosives safety risks and has been incorporated into the Interim R3M.

This tool, unlike the other constituent counterpart, is not designed to assess absolute risk. Current capabilities of technology do not yet fully support an in-depth understanding of all the components of explosives safety risk. Therefore, the qualitative tool presented in the Interim R3M simply provides a mechanism for measuring risk reduction as a result of a response action at a range. It is not a mechanism for comparing ranges or determining no action.

Since the Risk Management Strategy for the Interim R3M focuses on risk reduction (vice risk elimination), the concept of residual risk is an integral component in understanding the nature of risk in the Interim R3M. Residual risk is risk that remains following completion of the Accelerated Response or Site-Specific Action. The Project Team

should consider this concept when developing a strategy to manage residual risk following implementation of Accelerated Responses or Site-Specific Actions. This strategy is the basis for the informed risk management decisionmaking process.

Applying risk management requires a clear understanding of what constitutes "unnecessary risk", when benefits actually outweigh costs, and knowledge of the appropriate risk decision level. Accepting risk is a function of both risk assessment and risk management. Risk acceptance is not as simple a matter as it may first appear. Several points must be kept in mind:

- Some risk is a fundamental reality.
- Risk management is a process of tradeoffs.
- Quantifying risk does not ensure safety.

General guidelines for the Project Team are:

1. Many activities involving a technical device or complex process entails some risk during their execution.

2. Weigh risks and make judgments according to knowledge, experience, and mission requirements.

3. Hazard analysis and risk assessment does not free the Project Team from reliance on good judgment.

4. It is more important to establish clear objectives and parameters for those providing risk assessments than to employ a "cookbook" approach and procedure.

5. There may be no "best solution". There are a variety of directions to go. Each of these directions may produce some degree of risk reduction.

6. Complete risk control is not the goal; total risk elimination is seldom achieved in a practical manner.

The following sections discuss the nature of explosives safety and other constituent risks.

1.1 Nature of Explosives Safety Risk

The potential for risk depends on the presence of three critical items: a source of contamination, a pathway, and a receptor. For example, a person could sustain injuries when they are near a UXO that detonates or functions. The likelihood that this occurs is considered the explosives safety risk. Without a source (such as the presence of military munitions or UXO), a pathway (such as range access), or a receptor (such as someone in close proximity to military munitions or UXO), no potential for risk exists. Exposure to military munitions and UXO can occur if a receptor enters a range with military munitions or UXO. Exposure could also occur if military munitions or UXO are removed from a range.

Risk is determined through the characterization of the source, reasonableness of the potential pathway, and ease or frequency that a receptor has for exposure to military munitions or UXO. These are critical concepts that the project team must understand in order to evaluate the potential risks posed by military munitions and UXO at a range.

The Proposed Range Rule (DOD 1997) requires the Project Team to address the special risks posed by military munitions and UXO on CTT ranges. Due to the complex design of military munitions and the large number of military munitions employed, some are almost certain to become UXO. Thus, during any response activity, the presence or suspected presence of military munitions, UXO, or both creates unique challenges due to explosives safety concerns.

The safety risks associated with military munitions may be significantly different than UXO. For example, UXO (such as a military munition that has been fuzed and employed but failed to function) may be more dangerous than military munitions that are either unfuzed or not armed. Normally, it is very difficult to distinguish between military munitions and UXO even when using state-of-the-art techniques. This difficulty increases when the military munitions or UXO are identified below land surface (BLS) using geophysical techniques. Within the Interim R3M the only distinction between military munitions and UXO is whether or not the items are fuzed. When the information needed to determine fuzing is not available or certain, the Interim R3M conservatively assumes that the items are fuzed.

Throughout the Procedures Manual, the term “UXO” is used to collectively address both military munitions and UXO. This has been done to make the Procedures Manual a little bit easier to read and understand. While the proposed Range Rule and the Interim R3M focus on both military munitions and UXO, the Interim R3M relies more upon the actual conditions of the munitions in managing and assessing risks. Whenever a distinction between military munitions and UXO is necessary the text will clearly reflect that need.

The explosives safety risk is of great concern when addressing UXO in response actions. One of DOD’s greatest concerns is occupational risk to workers during response actions. DOD must consider the inherent explosives safety risks involved in locating, investigating, evaluating, responding, and removing UXO and/or military munitions from known or suspect CTT ranges. In many cases, there will be a mix of different types of UXO on CTT ranges. Response personnel, even those specially trained to deal with the explosives safety hazards associated with UXO, must not be exposed to an unreasonable explosives safety risk in order to address less compelling environmental concerns. Generally, the risk to response personnel increases as the density of UXO increases and in areas of rough terrain and thick vegetation, which restrict visibility and mobility. Response activities often are difficult and dangerous because of technology limitations with respect to positively detecting, identifying, and removing all military munitions and UXO in any given area.

1.2 Nature of Other Constituent Risk

Other constituents incidentally released to the environment during range activities can result in human health or ecological risks. Exposure to other constituents can occur after a release of toxic chemicals or other hazardous material. When a release occurs, human and ecological populations could be exposed through direct contact (i.e., dermal, ingestion, inhalation, or external) or indirect contact (e.g., eating contaminated plants and/or vegetables or contaminated soil).

The existing EPA guidance for estimating human health and ecological risk is being used in the Interim R3M for estimating risk for other constituents. The guidance includes Risk Assessment Guidance for Superfund (RAGS) (EPA 1989a, 1991a, 1991c, 1992a, and 1998b) and Ecological Risk Assessment Guidance for Superfund (ERAGS) (EPA 1992d and 1997a). The Interim R3M includes guidance for translating the results of the quantitative risk assessment performed using RAGS and ERAGS into qualitative terms so that the risk for other constituents can be evaluated more easily using the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) criteria.

Risks associated with potential exposures to chemical warfare materiel will be assessed using applicable guidance (EPA 1989a, 1991a, 1991c, 1992a, and 1998b). Recently, guidance has been developed and submitted for concurrence to evaluate chronic human exposures to residual chemical warfare agents in environmental media (DOD 1998b). This document includes health-based environmental screening levels (HBESLs) for soil for vesicant chemical warfare agents sulfur mustard (HD) and Lewisite, and the nerve agents Tabun (GA), Sarin (GB), Soman (GD), and VX.

1.3 Project Management Strategies for Estimating Range Risk

The project management strategy for a range should be driven by the physical and geographical conditions of the range as well as land use. This strategy should be decided early in the process and used to implement the risk-based decisionmaking process contained within the Interim R3M, however, this does not preclude making a change in strategy if new information is found later in the process. In addition, the strategy should focus on collecting appropriate data to conduct risk reduction actions rather than protracted studies.

Since several options for estimating risk on a range exist, it is important to develop a project management strategy for estimating risk early in the process. The Project Team could evaluate risk for all hazards within the range simultaneously (i.e., military munitions, UXO, and other constituents), for smaller portions of the range (e.g., parcels, operable units, or sectors), or based on specific attributes (e.g., UXO type).

In most cases, the Project Team will choose to divide the range and estimate risk for the smaller portions. If, for example, the Project Team chooses to divide the range by UXO type, risk can be evaluated independently for each type of UXO or risk can be evaluated assuming the worst UXO type. If risks are evaluated independently for different UXO types, consideration also should be given to other types of UXO and their estimated

relative density. Similar steps might be needed to combine risks if other characteristics or factors have been used to divide the range.

2. BASELINE RISK

The Project Team will estimate the pre-response or baseline explosives safety and other constituent risks. Since it is not possible to interpret these risks on a common scale, the risk management decisionmaking process is complicated by the differences in metrics used to represent explosives safety and other constituent risks. The following bullets summarize several of the key differences:

- Explosives safety risks are presented in qualitative terms using a scale that ranges from A (lower) to E (higher). At this time, methods have been developed primarily to characterize risks to individual human receptors. With slight modification, the methods can be adapted to characterize risks to ecological receptors or groups of humans or ecological receptors. The modifications needed to assess ecological risk are described below**.**
- The endpoints for health risk assessments usually are quantitative and based on protection of individual humans or groups of humans. Normally, risks for chemical contaminants are portrayed as probabilities of cancer for carcinogens or as hazard quotients (HQ) (for individual contaminants) or hazard indexes (HI) (for groups of contaminants) for noncarcinogens. Other endpoints are sometimes included in human health risk assessments. For example, biokinetic modeling is needed to evaluate blood lead levels (EPA 1994b) if blood samples were not collected from receptors living in the vicinity of or visiting the range.
- Ecological risk assessments, which are statements of the actual ecological resources that are to be protected (EPA 1992d), are concerned with protecting multiple populations, communities, and ecosystems, as well as various properties of those entities. Hence, ecological risk assessments must begin by defining a limited number of assessment endpoints. A single contaminated range usually will have multiple ecological assessment endpoints that are likely to have different metrics (e.g., density, and number of species).

The qualitative results of the explosives safety risks should not be combined with multiple, potentially quantitative, outputs from human and ecological risk assessments. However, the Project Team must consider both risks in selecting response actions. In light of the complexities associated with considering explosives safety and other constituent risks, similar scales have been developed to aid in understanding the risks posed by other constituents and UXO as well as facilitate decisionmaking. Explosives safety risks will be presented using letters and other constituent risks will be presented by using small numbers (i.e., 1 through 5). Scales for each representation will be relative. For example, an explosives safety risk of “B” is worse than an explosives safety risk of “A.” Since the scale is relative and not absolute, the difference between risks of “A” and “B” is not readily discernible. As such, under the Interim R3M, these scores do not provide sufficient information to determine when no additional action is needed to address explosives

safety risks. These scores provide a scale that forms the basis of future comparisons against response actions.

Tools have been developed that can be used to estimate range risks for explosives safety and to portray risks to human and ecological receptors. The risk tools are presented in the following sections and will be used to estimate both current range risk and range risk for the next planned and reasonably anticipated future land uses. The Explosives Safety Risk Tool provides a qualitative approach for estimating baseline risks for UXO. The baseline explosives safety risk will be used during the Response Selection step to evaluate response alternatives. The Other Constituents Risk Tool provides a mechanism to qualitatively portray the quantitative outputs from traditional other constituent-style human health and ecological baseline risk assessments (BRAs). Based on the results of the human health and ecological BRA, constituents of concern (COCs) may be carried into the Response Selection step and become the basis for derivation of remediation goals.

For ranges where rounds containing chemical warfare materiel (CWM) may be present, risks will be calculated for explosives safety separately from risks for other constituents. Both analyses will be used as a baseline in the Response Selection step. When assessing other constituent risks for the CWM filler material, careful consideration should be given to the mechanism of release (e.g., leak from UXO, dispersion from munition functioning).

2.1 Baseline Explosives Safety Risks

The following sections describe the methods and define the terms needed to assess explosives safety risk for human and ecological receptors. The discussion for human receptors appears to be more detailed because the same approach, with minor differences, is used for ecological receptors. The differences between the two approaches are presented in Section 2.1.2.

A qualitative tool has been developed to estimate baseline explosives safety risk. All of the Interim R3M phases require the estimation of explosives safety risk to determine if an Accelerated Response is appropriate. In addition, estimation of the pre-response or baseline risk is required for the Response Selection step. During the Detailed Analysis of Response Alternatives, three of the NCP criteria require output from the Explosives Safety Risk Tool, which is presented in Figure 1. The following critical items form the basis for assessing explosives safety risks:

- Potential accessibility of receptors to UXO
- Overall UXO hazard
- Relative exposure potential

2.1.1 Baseline Explosives Safety Risk Assessment for Human Health

The range data should be used in conjunction Figure 1 to estimate baseline explosives safety risk. In order to use the Explosives Safety Risk Tool, definitions are needed for the terms provided with the numerical scores. These definitions should enable the Project Team to answer questions such as what is the difference between "moderate" and "low" intensities of activities. Definitions needed to use the Explosives Safety Risk Tool follow Figure 1. In addition, definitions for terms provided with the numerical scales, definitions of terms within Figure 1, suggested modifying factors, and suggested information sources are provided to facilitate applying scores to the range data.

Definitions are not needed for terms describing numerical scores for several variables. In many cases, if additional information is sought, the cited reference is the appropriate source for that information. Definitions are provided below for several input variables:

- ***UXO Depth:*** Minimum depth of UXO with respect to land surface, this includes ground surface in cases where ranges may be underwater (i.e., on a water range or stream bed, ground surface is considered the solid ground surface below the surface of the water). In risk assessment for water ranges, the defining characteristic will be the description of exposures (e.g., who will encounter the UXO, what exposure pathways exist).
- ***UXO Hazard Type:*** Description of explosives safety hazard (DOD 1998c).
- ***Fuzing:*** Presence or absence of a fuze (DOD 1998c).
- ***Scale of Impact:*** Amount of energetic material in the UXO (DOD 1998c).
- ***UXO Density:*** Number of UXO per acre.
- ***Portability:*** Ability for UXO to be moved.

The following example describes the process by which the Project Team might score Overall UXO Hazard based on the presence of 40-millimeter (mm) projected grenades with high-explosive (HE) filler. The overall hazard for a 40-mm projected grenade with HE filler would receive the following scores for the Input Variables: UXO Hazard Type = "5" (mass explosion), Fuzing = "1" (fuzed, high sensitivity), and Amount of Energetic Material = "1" (<0.5 pounds). Using information provided in the Process Arrow labeled "Overall Hazard," the Project Team would first add the UXO Hazard Type and Fuzing. Since the sum must not exceed "5," the Overall UXO Hazard receives a score of "5." The score for the Overall UXO Hazard offsets the low score for the Amount of Energetic Material. Using the information provided in the Process Arrow labeled "Explosives Safety Risk," the Overall UXO Hazard is "5."

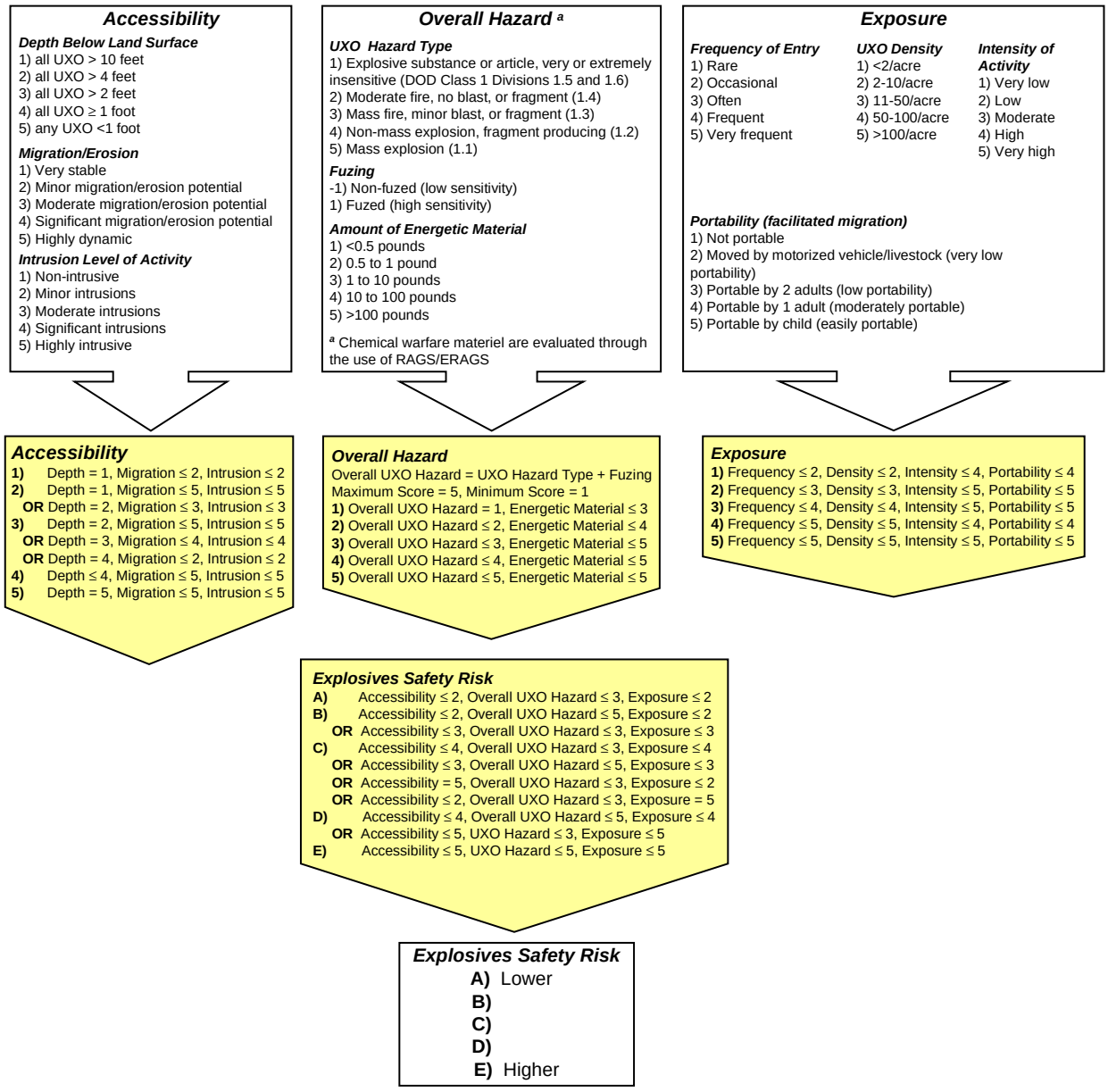

Figure 1. Explosives Safety Risk Tool

In order for the Project Team to assign scores for variables in the Explosives Safety Risk Tool, several of the terms used to describe the numerical scores first must be defined. Definitions will be provided on tables that follow, but the Project Team may need to exercise professional judgment in developing scores for range data. In cases where professional judgment is used, the Project Team should clearly state any assumptions used. Tables 1 through 4 define criteria and terms for several of the Input Variables of the Explosives Safety Risk Tool.

2.1.2 Baseline Explosives Safety Risk Assessment for Ecological Receptors

For ecological receptors, the evaluation is very similar to that for humans and relies on the same Explosives Safety Risk Tool. The following bullets identify the similarities and differences that need to be considered in the assessment of explosives safety risk for ecological receptors.

- Accessibility is essentially the same, except Intrusion Level of Activity is based on animal (e.g., digging, climbing) and human activities (i.e., collateral damage or indirect impacts). In referring to definitions listed on Table 2, the only consideration for ecological receptors is the depth of ground disturbance.
- Overall UXO Hazard is evaluated in the same manner for both human and ecological receptors.
- Of the three broad variables, exposure differs the most as many receptors might be permanent residents of a range rather than visitors such as humans. This is not to imply that ecological receptors may not move into and out of a range during foraging. However, ecological exposures may be greater based on permanent residency. In a similar manner to Accessibility, the Project Team should consider human activities when evaluating exposure for ecological receptors.
    - "Frequency of Entry" should be considered "Frequency of Occurrence", which is defined as how often certain receptors are expected at the range. Some receptors may live on-range, while others such as migratory fowl may visit the range on rare occasions.
    - UXO Density is evaluated in the same manner for both human and ecological receptors.
    - Intensity of Activity is based on a combination of animal activity and size. For example, digging would be considered a "highly intrusive" activity by itself, but digging by small animal, such a woodchuck, is not as likely to cause an explosion as digging by a large animal, such as a bear. In addition, animals that weigh less are less likely to cause a detonation due to pressure.
    - Portability is assumed to be negligible for animals.

2.2 Baseline Other Constituent Risks

Existing guidance from EPA for conducting human health and ecological risk assessment will be used to quantify other constituent risks. Examples of guidance includes RAGS (EPA 1989a, 1991a, 1991c, 1992a, and 1998b) and ERAGS (EPA 1992d and 1997a). The purpose of the Other Constituents Risk Tool is to translate the quantitative risk assessment results performed using RAGS and ERAGS into qualitative terms, thereby aligning the outputs with the outputs of the Explosives Safety Risk Tool. It serves primarily as an aid to the Project Team and has been developed with consideration of action levels presented in EPA guidance documents.

Table 1. Definition of Terms for Migration/Erosion

Score	Term	Definition
1	Very stable	No UXO will migrate
2	Minor migration/ erosion potential	UXO not expected to migrate due to reoccurring natural events (e.g., freeze-thaw processes), extreme natural events (e.g., tornado) may cause migration
3	Moderate migration/ erosion potential	Only reoccurring natural events will bring UXO to surface (longer time period)
4	Significant migration/ erosion potential	Reoccurring and extreme natural events will bring UXO to surface
5	Highly dynamic	UXO will surface within first Recurring Review

Table 2. Definition of Terms for Intrusion Level of Activity

Score	Term	Definitions for Human Receptors	Definitions for Ecological Receptors
1	Non-intrusive	Activity on ground surface, none below surface	Activity on ground surface, none below surface
2	Minor intrusions	Activity only on ground surface, ground disturbances to a depth of 1 foot BLS, and hand tools only	Activity only on ground surface, ground disturbances to a depth of 1 foot BLS
3	Moderate intrusions	Ground disturbances to a depth of 2 feet BLS and intrusions by mechanized equipment (e.g., plows and backhoes)	Ground disturbances to a depth of 2 feet BLS
4	Significant intrusions	Ground disturbances to a depth of 4 feet BLS and intrusions by mechanized equipment (e.g., post-hole augers and backhoes)	Ground disturbances to a depth of 4 feet BLS
5	Highly intrusive	Ground disturbance greater than 4 feet	Ground disturbance greater than 4 feet

The Interim R3M requires the estimation of risks associated with potential exposures to other constituents at various points in the range response process. All of the Interim R3M steps require the estimation of risk to determine if an Accelerated Response is appropriate. However, acute risks to human health or the environment may not be the only motivation for conducting an Accelerated Response. In addition, estimation of the baseline risk is required for the Range Evaluation step. The tool presented in Figure 2 will be used in each situation.

Table 3. Definition of Terms for Frequency of Entry

Score	Term	Definition [a, b, c, d]
1	Rare	One or fewer range entries per month
2	Occasional	Two to 8 range entries per month
3	Often	Nine to 15 range entries per month
4	Frequent	Sixteen to 22 range entries per month
5	Very frequent	More than 22 range entries per month

[a] Entries are considered for a single individual visiting a range per day over the course of a month, regardless of how many times the individual entered the range during that day. It should be noted that the "Intensity of Activity" variable (Table 4) accounts for the total duration of the visit.

[b] The following bullets include examples of resources the Project Team could use to determine numbers of entries:

- Range access logs (Range control office)
- Visitor centers
- Local property owner

[c] Access controls (e.g., land use restrictions or engineering controls) can be considered in modifying the frequency of entry. The consideration of access controls might be particularly important to running the Explosives Safety Risk Tool during the Site-Specific Response Evaluation Phase. Access controls that should be considered include:

- Fences and gates
- Permits
- Educational programs
- Access control programs

[d] An example of access controls might include limiting the number of permits that are available to drivers of off-road vehicles. This action might restrict access, particularly if it is used in conjunction with some form of enforcement (e.g., security patrols). In this case, the Project Team would run the risk tool to estimate baseline risks and run the risk tool with the expected change in frequency of entry to estimate the post-response risk. The comparison of these risks is needed during the Site-Specific Response Evaluation Phase.

The Process Arrows and Rectangles at the bottom of Figure 2 illustrate the output of the Other Constituents Risk Tool. The outputs are based on action levels EPA has adopted for interpreting the results of BRAs and all outputs are not required for every risk assessment (e.g., cancer risks would not be estimated if carcinogens were not detected in environmental monitoring samples). These action levels are used in determining the need for site remediation. The following paragraphs present the guidance that was used to develop the output scales.

Table 4. Definition of Terms for Intensity of Activity

Score	Term	Definition
1	Very low	Less than 1 hour per day and light activity [a, d, e]
2	Low	Up to 3 hours per day and light activity [a, d, e]
3	Moderate	Up to 6 hours per day and moderate [b, d, e] or light activity [a, d, e]
4	High	Up to 9 hours per day and moderate activity [b, d, e]
5	Very high	Greater than 9 hours per day or heavy activity [c, d, e]

[a] Light activity includes activities such as walking, hiking, and bird watching

[b] Moderate activity includes activities such as bicycling, horseback riding, etc.

[c] Heavy activity includes activities such as off-roading in motorized vehicles

[d] The following bullets include examples of resources the Project Team could use to determine durations and types of activities:

Range access logs (Range control office)
Visitor centers
Local property owner

[e] Modifying factors for intensity of activity include steps to modify behavior. For example, if off-road drivers are required to participate in an educational program, the overall intensity of the activity may be reduced.

2.2.1 Baseline Human Health Risk Assessment

The NCP (EPA 1991b) and *Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children* (EPA 1994b) identify action levels for interpreting results of human health BRAs. For noncancer effects, EPA sets the target at 1. If an HQ or the HI is greater than 1, the potential for adverse health effects is of concern. The Project Team might conclude that HQs greater than 1 are not a concern in light of site-specific, mitigating circumstances (e.g., different critical effects and/or target organs, margin-of-exposure analysis supplements HI, HI is close to 1 but additional analyses indicate "true" exceedance is unlikely). For cancer effects, the target cancer risk range has been set at 1×10^{-6} to 1×10^{-4}. Cancer risks less than 1×10^{-6} are not typically considered a concern. If individual other constituents or a group of other constituents contribute to an exposure pathway that exceeds an HI of 1 or a cancer risk of 1×10^{-4}, response actions should be evaluated in the Response Selection step. For cancer risks falling between 1×10^{-6} and 1×10^{-4}, the Project Team determine the need for Site-Specific Actions on a case-by-case basis.

In the special case of lead exposures, the current EPA guideline for young children is based upon the proposed benchmark concentration developed by the Centers for Prevention and Disease Control (CDC). Under this guideline, there must be a 95 percent probability that blood lead levels do not exceed 10 µg/dL (EPA 1994a) in the exposed population. As an alternative to obtaining blood lead samples from receptors living in the immediate proximity or visiting the range, EPA has developed biokinetic models to predict blood lead levels in residential children (EPA 1994a) and fetal blood lead levels in female workers of child-bearing age (EPA 1996).

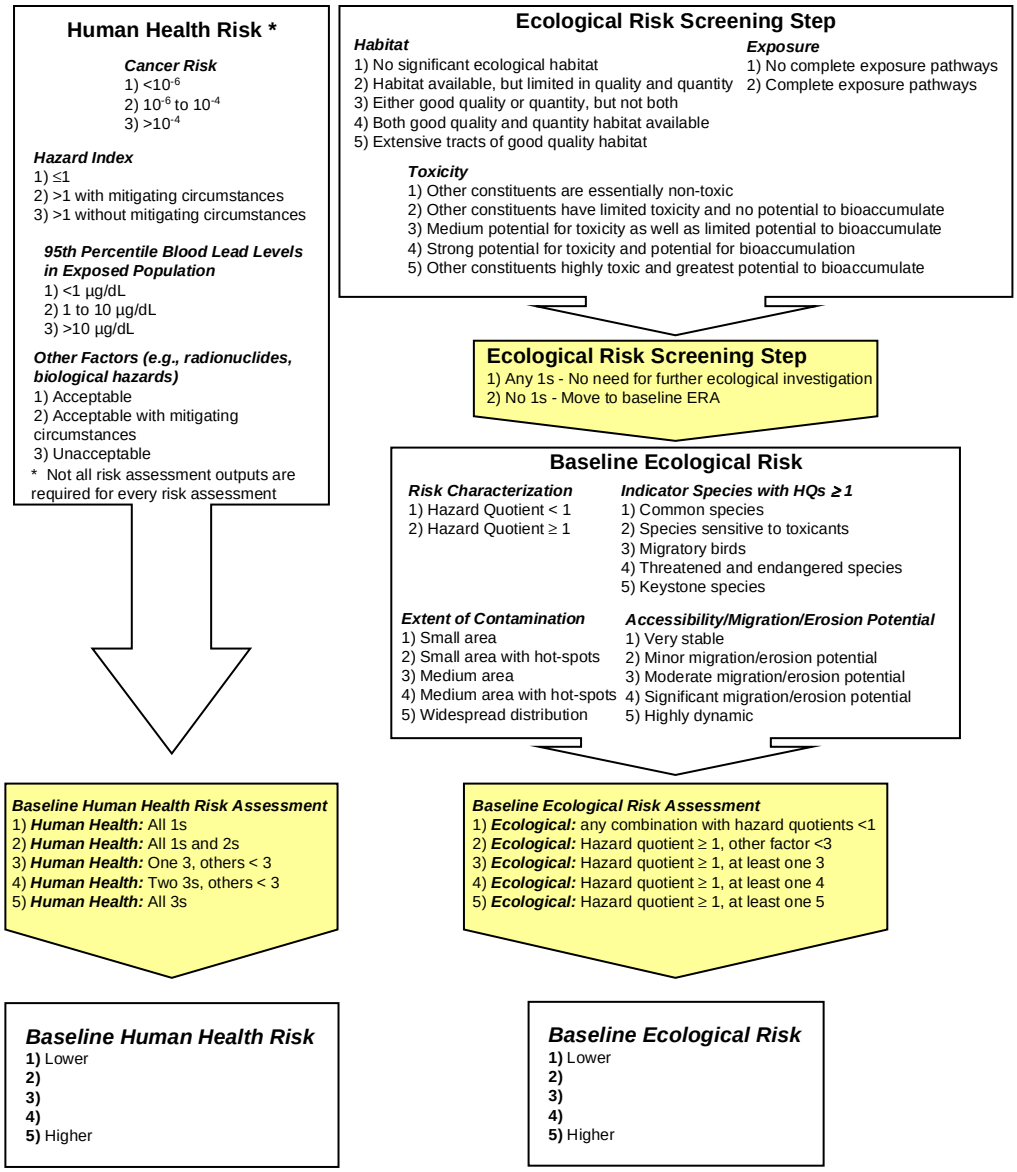

Figure 2. Other Constituents Risk Tool

Other potential hazards may be evaluated in human health risk assessments conducted during the Range Evaluation Phase. Hazards from potential radiological (e.g., depleted uranium rounds) or chemical warfare materiel must be addressed. EPA advocates the assessment of risk (i.e., estimate of excess lifetime cancer risk) rather than estimating radiological dose equivalents (EPA 1989a). If the Project Team choose to assess risk associated with potential exposures to ionizing radiation sources, the scale entitled "Cancer Risk" in the "Human Health Risk" callout box should be used. However, if radiological doses are estimated, the Project Team should develop a scale using the guidelines presented with the scale entitled "Other Factors" in the "Human Health Risk" callout box.

2.2.2 Baseline Ecological Risk Assessment

Although a number of guidance documents exist (ERAGs, EPA 1992d and 1997a), action levels for ecological risk assessment are not nearly as standardized as in human health risk assessment, with one exception. In a similar manner to noncancer effects in humans, if an HQ or HI is greater than or equal to 1, the potential for adverse effects to ecological receptors is of concern. However, unlike human health risk assessment, response actions are not always the next step if the HQ or HI is equal to or greater than 1. Instead, the risk assessor and risk manager evaluate all risks based on a weight-of-evidence approach that may include information from site-specific toxicity tests, tissue residue studies, and biological surveys, as well as HQs.

In some cases, an HQ may be greater than 1, yet no response actions need to be evaluated. In some cases, the other information available in the weight-of-evidence suggests the potential for risk is lower that that reflected in the HQ. In other cases, additional information may bolster the evidence, indicating that adverse effects are likely and response actions should be evaluated. As EPA indicates in ERAGS, "balancing and interpreting the different types of data can be a major task and require professional judgment." Thus, the results of the ecological risk assessment for other constituent risks will be evaluated on a site-specific basis as they currently are under CERCLA.

3. RESPONSE AND RESIDUAL RISK ASSESSMENT TOOLS

Risk assessment tools have been developed to support the Individual Analysis. The Explosives Safety Risk Tool is used not only to estimate baseline risk, but also to estimate risk during and after the implementation of the Site-Specific Action. For other constituents, a tool has been developed to portray the quantitative results of human health and ecological risk assessments using a relative scale.

3.1 Response and Residual Explosives Safety Risk

During the Individual Analysis, three of the criteria require the use of risk-based techniques (i.e., Short-Term Effectiveness, Long-Term Effectiveness and Permanence, and Overall Protection of Human Health and the Environment). The Explosives Safety Risk Tool can be used to support the Individual Analysis for the different criteria presented in the bullets below:

- The Short-Term Effectiveness criterion is used to evaluate the risks associated with the implementation of response on workers as well as to the surrounding community and environment.
- The Long-Term Effectiveness and Permanence criterion evaluates the results of the remedial action in terms of the risk remaining at the range after response actions have been completed. A simple analysis intended to determine if remedial technologies meet risk-based cleanup goals often completes this task.

- Evaluation of the Overall Protection of Human Health and the Environment criterion serves as a final check that the alternatives are protective of human health and the environment.

3.2 Response and Residual Other Constituent Risk

The outputs of the human health and ecological risk assessments must first be interpreted with respect to the alternatives developed by the Project Team for the Individual Analysis. Residual risk is evaluated under the Long-Term Effectiveness and Permanence criterion as well as under Overall Protection of Human Health and the Environment criterion. Although the residual risk (i.e., risk remaining after the response has been implemented) is needed to conduct the Individual Analysis for these criteria, PRGs are often used for this purpose. In addition, human and ecological risks are sometimes weighed against one another. Figure 3 illustrates this process and provides the single score that is needed for the Comparative Analysis.

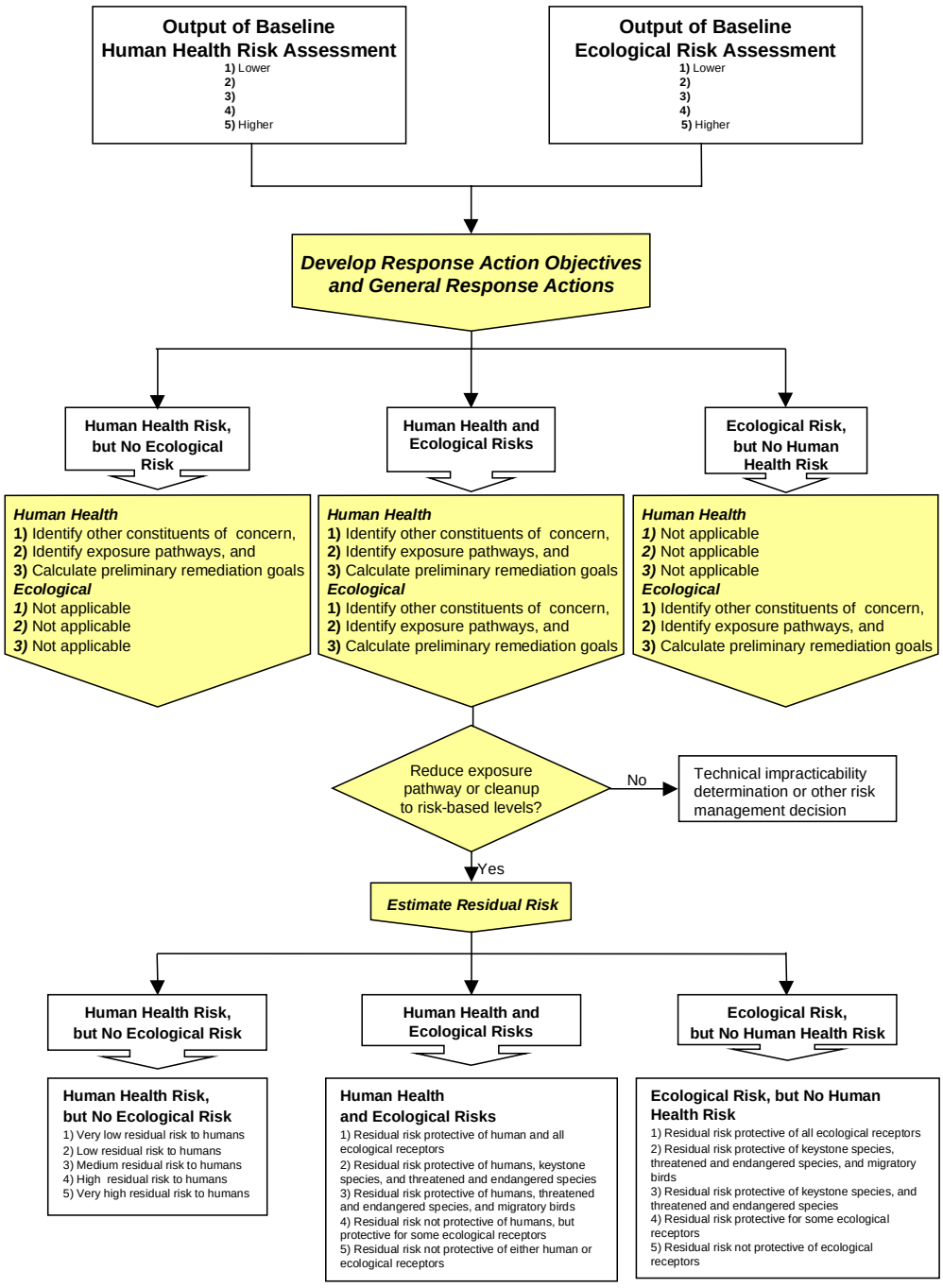

Figure 3. Risk Assessment for Evaluating Residual Other Constituent Risks

APPENDIX 2 - DATA QUALITY OBJECTIVES IN THE INTERIM R3M

Each R3M step requires the collection of data to support the decisionmaking process. This appendix describes the approach to establishing objectives for gathering appropriate data needed to support these decisions. This process for developing objectives and collecting data is the planning process. The planning process in each step of the Risk Methodology is the based on the total quality management tool developed by EPA (EPA 1994a). The EPA DQO process was developed to facilitate efficient planning design. The original goal was to identify the type, quantity, and quality of data required to support decisions being made by EPA managers with a desired level of confidence. The procedures and methodology included in the DQO process are outlined in EPA's *Guidance for the Data Quality Objectives Process* (EPA 1994a). The planning process in this Procedures Manual is mandatory for both UXO and other constituents, although it is based on guidance.

The planning process in the Risk Methodology is the method for obtaining appropriate data to support and defend risk management decisions. This process is:

1. An efficient, coordinated, logical, and systematic approach

2. A method to address physical, chemical, and biological data requirements necessary to support the range response process

3. Refined at each project step, dependent on range conditions, to document and select appropriate response actions that address safety, public health, and the environment

4. Technically feasible

5. Fiscally responsible (i.e., cost-effective, integrated action that takes into account social, cultural, ethical, and legal considerations)

6. Consistent with the current, next planned, or reasonably anticipated future land and the nine NCP criteria.

In short, the EPA's seven step DQO process has been translated into a planning process that walks project teams through how to obtain appropriate data needed to make informed risk management decisions under the Risk Methodology.

The planning process will be used in the Risk Methodology to demonstrate the completion of step objectives and to provide an approach to address data collection requirements. Site-specific DQOs will be developed during the project scoping stage of each step and will serve as standards against which project objectives are measured at the completion of the step. This process will be used when implementing each step of the Risk Methodology to serve as a measure of ensuring successful completion of each step.

Each step of the planning process includes minimum data reporting requirements, which will be used to develop site-specific data needs. The planning process for each step of the Risk Methodology can be conducted once or repeated in an iterative manner, to ensure that the final decision (e.g., proceed to the next step or conduct an Accelerated

Response) is actually the result of the planning process. Inputs to the planning process are step dependent and come from requirements, previous work (e.g., outputs of previous steps or technical results), or other sources (e.g., decision requirements or specifications). The outputs are step dependent and include technical outputs (e.g., analyses and data), management outputs (e.g., plans and schedules), and recommended actions (e.g., proceed to next step).

The planning process is used to develop site-specific data collection programs for addressing risk associated with UXO and other constituents. It establishes objectives for collecting data needed to support informed risk management decisionmaking. The planning process is a logically sequenced set of steps that identifies the type, quantity, and quality of site-specific data required to make informed and confident decisions. Each step of the Risk Methodology has distinct decisions that need to be made. Thus, in order to make these decisions, site-specific data requirements need to be developed for each step.

During the first six major questions of the planning process the approach for collecting data will be identified. This will include determination of the type, quantity, and quality of data needed. This information is used during the seventh (i.e., "What is the optimal sampling approach for data collection?") to formulate a plan for collecting the data. The planning process also identifies opportunities to change or optimize the data collection activities as new information becomes available. The site-specific data needs, which are developed during the project scoping stage, also serve as the standard against which project objectives are measured at the completion of the step. Table 1 shows the seven steps of the EPA's DQO process as they relate to the questions in the R3M Planning Worksheets and provides an example of the outcome from one of the steps of the Risk Methodology.

Table 1. R3M Planning Process vs. EPA's Data Quality Objective Process

EPA's DQO Process	R3M Planning Worksheet	Definition
State the Problem	What is the Situation?	The first question in the planning process involves defining the problem. ➢ Range Identification, the problem is to verify that the property is a CTT range.
Identify the Decision	What Decisions are Being Made?	The second question involves identifying the decisions (including any alternatives) that need to be made. ➢ Range Assessment, one decision to be made is whether or not an Accelerated Response is appropriate.

Table 1. R3M Planning Process vs. EPA's Data Quality Objective Process (cont)

EPA's DQO Process	R3M Planning Worksheet	Definition
Identify Inputs to the Decision	What Data Will be Used in Making the Decisions?	The third question involves identifying the information that is needed to make the decisions. ➢ Range Evaluation, information is needed to estimate baseline risk; baseline risk is needed to make the decision whether or not a response to address other constituents is needed.
Define the Study Boundaries	What are the Limits to Collecting Data?	The fourth question involves defining the boundaries of the problem. It includes defining the spatial boundary (geographic area) and temporal boundary (timeframe). ➢ Response Selection, a specific area of a range may be defined as the spatial boundary and the timeframe may include reasonably anticipated future land use or next planned use.
Develop a Decision Rule	How Will Decisions Be Made?	The fifth question involves defining the Decision Rules. ➢ Continuing with the example from What decisions are to be made, one decision to be made is whether or not an Accelerated Resonse is appropriate. If an immediate threat to the public exists then this may require an Accelerated Response to be implemented
Specify Tolerable Limits on Decision Errors	What are the Tolerable Limits of Decision Error?	The sixth question involves specifying the tolerable limits on decision errors. Decision error is the probability of making an incorrect decision based on inaccurate data estimates. The tolerable limit is the upper boundary of the decision error and is based on the consequences of making an incorrect decision. These are used to establish performance goals for the data collection effort. ➢ Site-Specific Response Evaluation Step, one tolerable limit may be based on technology capabilities.
Optimize the Design for Obtaining Data	What is the Optimal Sampling Approach for Collecting Data?	The final question involves designing a data collection plan to collect data needed to satisfy the data needs. ➢ Range Evaluation, the design of range sampling methodologies should consider variables that address physical and geographical conditions as well as land use.

The table above contains the basic questions included in the planning process below are more detailed/technical descriptions of the step by step planning process to be used in developing site-specific data needs. The more detailed discussion is to provide additional guidance and assist in the completion of the planning worksheets for each of the Risk Methodology steps. For each of the steps the basic worksheet presented in the body of

the procedures manual is provided along with further explanations and general discussion of the role each plays in the overall Risk Methodology.

To ensure that your data gathering strategy will result in accurate, appropriate data collection, the Project Team will use the Planning Worksheet to help establish Data Quality Objectives[1] for the particular range, sector, parcel or unit. The data quality objectives will assist the Project Team in meeting the underlying goal of each specific step. While completing these planning worksheets it is important to recognize the following key items:

- The proposed Range Rule encourages accelerating the response process by delineating areas within the range where immediate response activities are necessary.
- During this planning process it is also important to recognize the Interim R3M does not identify action levels for evaluating explosives safety risk, therefore distinguishing areas that pose minimal explosives safety risk is not possible. By using the action levels identified by regulatory agencies[2], determining areas that pose little or no risk associated with other constituents is possible.
- The purpose of the data collection in each step is different. The type, quantity and quality of data is therefore likely to be different in each step as well. In situations where the data is to support decision to determine if a site can be closed out the data type, quality and quantity will likely be much higher than when collecting data to simply plan additional data collection efforts. The generic goals of the data collection effort for the Risk Methodologies are:
    - **Step 1, Range Identification -** effort should be spent collecting data to ensure the Range Rule is applicable to the site and to take any necessary immediate action.
    - **Step 2, Range Assessment -** effort should be spent collecting data that are needed to plan both the more comprehensive data collection effort of Step 3, Range Evaluation and any necessary Accelerated Responses. Other constituent data could be collected to determine the need to further consider other constituents in the Range Evaluation Step.
    - **Step 3, Range Evaluation -** effort should be spent to gather data that are needed to assess baseline risk to human health or the environment. The Risk Methodology qualitatively evaluates explosives safety risk and therefore requires the Project Team to obtain enough data about the range to determine the appropriate score for each of the variables of risk. The Risk Methodology

[1] The Data Quality Objective process is based on *EPA's Guidance for the Data Quality Objective Process (1994a)*.

[2] Action levels as determined by regulatory standards, risk based levels, technology limitations or reference based standards.

also uses the EPA's established risk assessment protocols[3] for other constituents and therefore requires the Project Team to obtain sufficient data to complete those protocols. The data collection objectives should be built on the information from Range Assessment Step and will define the more detailed data collection (e.g. the field program) effort for this step. In addition, the Risk Methodology does not identify action levels for evaluating explosives safety risk, therefore determining areas that pose no explosives safety risk is not possible. By using the action levels identified by regulatory agencies[4], determining areas that pose little or no risk associated with other constituents is possible.

- **Step 4, Response Selection -** effort should be spent to gather data that are needed to evaluate and select appropriate response actions focused at reducing risks and developing Response Action Objectives. Planning should be focused on defining the data collection that will be necessary to augment the data collected in the previous steps to complete the Nine Criteria analyses. During this planning process, it is also important to keep in mind explosives safety weighs heavier in response selection than other constituents. The Project Team may have a preference for response actions they feel will best suit the range and may include this in the selection process.
- **Step 5, Site-Specific Action -** effort should be spent to gather data that are needed to determine whether the response actions are meeting predefined Response Action Objectives (RAOs). These objectives should be built on the information from Response Selection Step and will define the quality assurance /quality control (QA/QC)[5] data collection effort for this step.
- **Step 6, Recurring Review -** effort should be spent to gather data that are needed to determine whether the response remains protective, or in the absence of a risk threshold level for explosives safety to determine whether new information is available that may change previous decisions that have been made concerning the site (e.g. technical impracticability, land use).
- **Step 7, Close-Out -** this step has not been fully developed in the absence of close out criteria, which will developed in the Final R3M; therefore, at this point, there is not a defined data collection component of this step.

The generic goals for each step should be kept in mind as the Project Team completes the Planning Worksheets. The remainder of this appendix acts as a resource to augment the information contained in the planning worksheets.

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[3] *Guidance for Data Usability in Risk Assessment (Parts A and B)* (EPA 1992b and EPA 1992c, respectively), RAGS (EPA 1989a, 1991a, 1991c, 1992a, and 1998b) and ERAGS (EPA 1992d and 1997a).

[4] Action levels as defined in the National Oil and Hazardous Substances Pollution Contingency Plan.

[5] Additional information on Quality Assurance and Control is provided in Appendix 4.

What is the Situation?

The Project Team should define the problem and objective of the Step. This should be a simple statement declaring what the Project Team intends to accomplish at this point in the process.

The Team may want to enhance the general situation provided based on site-specific conditions (e.g. Conceptual Site Model, resources, time constraints). When developing a conceptual site model consider all known information about the source, pathway, fate and transport and receptors of concern.

What Is The Situation?	
General Situation:	
– Describe (and attach if space does not permit) the Conceptual Site Model illustrating the specific situation (e.g., sources, receptors, pathways, etc.).	
– Describe (and attach if space does not permit) the resources and/or time constraints may affect your situation.	
– Describe (and attach if space does not permit) any known information about the land owner, geology, hydrogeology, UXO type, UXO depth, range characteristics, topography, soil, wildlife, land use (current/future/next planned) etc. that may affect your situation.	
– Document any other considerations for the situation.	
– Provide a Site-Specific situation (considering the components above), if determined necessary by the Project Team:	

The generic situations for each of the Steps are:

- **Step 1, Range Identification -** Collect data to verify the property is considered a closed, transferred or transferring range and subject to the Range Rule.
- **Step 2, Range Assessment -** The Project Team will distinguish between areas that pose minimal risk to human health or the environment to those that pose greater risk.
- **Step 3, Range Evaluation -** The Project Team will determine baseline explosives safety risk as well as the baseline risk associated with other constituents. The site-specific situation should include a statement of the purpose of the risk assessment and a conceptual model of the current understanding of the problems to be addressed during the Step. Initially, the conceptual model should be developed using historical information collected in Step 2 and should be used to estimate the types of UXO and other constituents

potentially present as well as concentrations of other constituents given the history of the range and the surrounding area.

- **Step 4, Response Selection -** The Project Team must select appropriate response alternatives to respond to unexploded ordnance and/or other constituents found on the range or sector. If no technology is available based on potential future use and other variables, the Project Team must determine if a "Technical Impracticability" finding is appropriate.
- **Step 5, Site-Specific Action -** The Project Team will determine if the response meets established goals.
- **Step 6, Recurring Review -** The Project Team will determine if the responses taken continue to minimize explosives safety risks, continue to be protective of human health and the environment, and prevent off-range releases of other constituents.

What Decisions Must Be Made?

The Project Team must build upon the specific objectives identified above and pinpoint both the decisions and how the decisions will be made during this step of the process. The risk management decision questions for the each of the steps are presented here. The following sections summarize these decisions. Often due to the absence of threshold criteria for explosives safety there will be separate decisions for explosives safety and other constituents.

This information will be used to define data which will be valuable and which data are required when making these decisions. Later sections of this worksheet will describe which data will be used and how decisions will be made using the collected data.

What Decisions Must Be Made?	
Is there an immediate threat to human health and the environment caused by unexploded ordnance or other constituents?	Evaluate existing information and information in the Accelerated Response Section to determine if an accelerated response is appropriate. Other:
Each Step has additional decision questions addressing both actions for other constituents and explosives safety risks.	Determine if … then.

Basic decision for each of the steps are:

- **Step 1, Range Identification -** The Project Team will determine if an accelerated response is appropriate based on the existing information. The team will also verify the Range Rule applies.

- **Step 2, Range Assessment -** Again the Project Team will determine if an accelerated response is appropriate based on any new information obtained in this step. The team will also determine if other constituents should continue to be considered in Step 3, this will be based on existing regulatory requirements and standards. In most cases the team will not make true decisions concerning explosives safety at this point, but will use the data collected in this phase to plan the data collection of Step 3.
- **Step 3, Range Evaluation -** Again the Project Team will determine if an accelerated response is appropriate based on any new information obtained in this step. The team will also determine if other constituents should continue to be considered in Step 4, this will be based on the baseline risk assessment, existing regulatory requirements and standards. The team will not make true decisions concerning explosives safety at this point, but will use the data collected in this phase to establish a baseline explosives safety risk and use the information gathered to assist in the Response Selection process of Step 4.
- **Step 4, Response Selection -** Again the Project Team will determine if an accelerated response is appropriate based on any new information obtained in this step. The team will also determine the appropriate site specific response action(s) and the response action objectives for the response(s).
- **Step 5, Site-Specific Action -** As in the previous steps the Project Team will determine if an accelerated response is appropriate based on any new information obtained in this step. The team will also make determinations if the response action is meeting the previously established Response Action Objectives and quality standards.
- **Step 6, Recurring Review -** Again the Project Team will determine if an accelerated response is appropriate based on any new information obtained in this step. The project team will also evaluate if the response action protects human health and the environment. In the absence of close-out criteria, the Project Team will evaluate if new information has become available that changes any previously made decisions, revisit those decisions and schedule the next recurring review.

What Data Will Be Used in Making These Decisions?

The Project Team will need to determine what information exists and what data sources and locations for data will be most appropriate given the site specific situation and decisions that will be made during the given step.

Determining what information exists and how that information was obtained will help the Project Team recognize what information is available to help plan the data collection effort of the step. It will also assist the Project Team in identifying where to focus the data collection effort (e.g. those unknown items or verifying estimated items).

Completing this Planning worksheet will help the Project Team choose locations and data sources for the record search. At this point in the planning process consider the appropriate documents and sources[6] for this information.

What Data Will Be Used in Making These Decisions?	
What information exists and how was that information obtained? *Indicate how the data was obtained (i.e. from estimation or known). If information is not known based on data collected in the previous steps then indicate unknown. Use the Explosives Safety Risk Tool to obtain more information about the terms/categories to the right.*	— Various inputs to the decisions that apply to each Step.
What information sources and locations are most applicable to the record search? *Check sources that are available and applicable to the situation and decisions described previously in this worksheet.*	Suggested Information Sources for Step:

The data used to make decisions in each step builds on that data which was gathered in previous steps. The data collection for other constituents is geared toward determining the need for a site-specific action and then determining the appropriate action. The data collection for explosives safety is geared toward determining the presence of UXO and then determining the appropriate action to address/reduce the explosives safety risks:

- **Step 1, Range Identification -** Planning data collection effort in this step is very limited. Only one piece of information to verify that the Range Rule applies is necessary, if additional data is collected it should support the subsequent data collection efforts of the next step.
- **Step 2, Range Assessment -** Planning the data collection effort should be focused around designing a record search to locate documents necessary for gathering data to make the decisions during this step. A site reconnaissance or limited sampling may also be part of this effort but are not required. When determining valuable data the Project Team should consider the elements required to estimate explosives safety and other constituent risks. Inputs to the tools are provided below.
- **Step 3, Range Evaluation -** Planning the data collection effort should be focused around designing an investigation that will provide data for the inputs to the decision, this includes the elements required to estimate baseline explosives safety and other constituent risks. To characterize the nature and extent of risks posed by UXO and other constituents, the data collection effort should consider they type quality and quantity of data necessary estimate other constituent and

explosives safety risks. Detailed descriptions of the inputs to the tools are provided below. In addition, in the development of site-specific DQOs for the Range Evaluation Step the Project Team should also consider information needed to support the Response Selection Step.

- **Step 4, Response Selection -** Planning the data collection effort should be focused around determining if information to conduct an individual and comparative analysis of alternatives is already available or if additional data is necessary to complete the response selection process. Those elements necessary to complete the evaluation at this step are the elements that make up the nine criteria tools presented in Step 4.
- **Step 5, Site-Specific Action -** Planning the data collection effort should be focused around determining if information to evaluate the actions to ensure they were implemented to meet response action objectives and the quality standards set earlier the Risk Methodology is available. If this information is not available the Project Team should evaluate the existing information and identify information to be collected to answer the risk management decisions of this Step.
- **Step 6, Recurring Review -** Planning the data collection effort should be focused around determining if information to evaluate the actions previously taken to determine if they are protective or human health and the environment or if new information chances and previous decisions. If this information is not available the Project Team should evaluate the existing information and identify information to be collected to answer the risk management decisions of this Step.

Key Data Elements for Estimating Baseline Explosives Safety Risk

The following bullets list the key data elements that support the use of the Explosives Safety Risk Tool. Data collected under the Range Evaluation Step should coincide with the guidelines for using the Explosives Safety Risk Tool, which is presented in Step 3 of the Risk Methodology. In addition, data should be collected for all UXO types for variables that differ by UXO (e.g., UXO hazard type).

- **Frequency of Range Entry:** Entries per month with a maximum of one entry per individual per day.
- **Intensity of Activity:** Type and duration of activity per day.
- **UXO Density:** Number of UXO per acre.
- **UXO Hazard Type:** Description of explosives safety hazard of the UXO (DOD 1998c).
- **Fuzing:** Presence or absence of a fuze (DOD 1998c).
- **Scale of Impact:** Amount of energetic material in the UXO (DOD 1998c).
- **Portability:** Ability for UXO to be moved.

- **UXO Depth:** Minimum depth of UXO with respect to land surface, this includes ground surface in cases where ranges may be underwater (i.e., on a water range or stream bed, ground surface is considered the solid ground surface below the surface of the water). In risk assessment for water ranges, the defining characteristic will be the description of exposures (e.g., who will encounter the UXO, what exposure pathways exist).
- **Intrusion Level of Activity:** The nature of the activities with respect to the depth of intrusion.
- **Natural Migration:** Potential for movement of UXO by natural forces.

Key Data Elements for Estimating Baseline Other Constituent Risk

Guidance for Data Usability in Risk Assessment (Parts A and B) (EPA 1992b and EPA 1992c, respectively) present data elements needed to estimate baseline human health and ecological risk. Existing guidance from EPA for conducting human health and ecological risk assessment will be used to quantify risks. This guidance includes, but is not limited to, RAGS (EPA 1989a, 1991a, 1991c, 1992a, and 1998b) and ERAGS (EPA 1992d and 1997a). Outputs from the BRAs are needed to support the use of the Other Constituents Risk Tool, which is presented in Step 3.

- Data collection and evaluation, including consideration of the following:
  - Background monitoring data for all affected media
  - Environmental data for all relevant media
  - List of chemicals of potential concern
  - Distribution of sampling data
  - Confidence limits surrounding estimates of representative values.

- Exposure assessment, including consideration of the following:
  - Release rates
  - Physical, chemical, and biological parameters, for evaluating transport and transformation of range-related chemicals
  - Estimates of exposure concentrations for all chemicals, environmental media, and receptors at risk
  - Estimates of chemical intake or dose for all exposure pathways and exposure areas.
  - Toxicity assessment, including consideration of the following:
  - Toxicity values for all chemicals, exposure pathways, and exposure areas of concern
  - Uncertainty factors and confidence measures for reference doses (RfD) and weight-of-evidence classifications for cancer slope factors (CSFs).

- Risk characterization, including consideration of the following:
  - Hazard quotients and indices
  - Estimates of excess lifetime cancer risk
  - Uncertainty analysis.

The final data elements that support the use of the Other Constituents Risk Tool are the action levels EPA has adopted for interpreting the parameters of interest or results of human health and ecological BRAs. These action levels are used to interpret the results of the BRAs and determine the need for site remediation. Page 19 of this appendix identifies these action levels for each parameter of interest considered in the Other Constituents Risk Tool.

Key Data Elements for Conducting the Individual and Detailed Analysis of Response Alternatives

There are a multitude of key data elements needed to conduct the Individual and Detailed Analysis of Response Alternatives. These key data elements are discussed in greater detail in Step 4 of the Risk Methodology. The following bullets provide an overview of the data needs for the Detailed Analysis of Response Alternatives.

- **Baseline, Response, and Residual Risk:** Baseline explosives safety risk to gauge risk reduction of different responses is needed to support the Detailed Analysis of several criteria. If addressing other constituent risks, human health and ecological risk during the implementation of the Response Selection Step as well as residual human health and ecological risk following the implementation of the Site-Specific Action also is needed. The key data elements for baseline explosives safety risk were discussed in Step 3 and above.
- **Overall Protection of Human Health and the Environment:** The individual and detailed analysis of this alternative involves the use of result from the detailed analysis of Short-Term Effectiveness, Long-Term Effectiveness, and Compliance with ARARs. In addition, Magnitude of Residual Risk is also needed. Each of these elements is discussed in other bullets.
- **Compliance with ARARs:** The Project Team needs to determine which requirements are applicable or relevant and appropriate to an alternative and which alternative meets these requirements. When an ARAR is not met, the six waivers allowed under Section 121(d)(4) of CERCLA serve as key data elements. The following classes of ARARs should be addressed for each alternative and serve as key data elements: chemical-specific (e.g., maximum contaminant levels identified under the Safe Drinking Water Act), location-specific (e.g., preservation of historic sites), and action-specific (e.g., RCRA minimum technology standards). Examples of ARARs and guidance “to be considered” (TBC) are presented in Appendix 5.

- **Long-Term Effectiveness and Permanence:** The Individual and Detailed Analysis of this criterion is completed through an evaluation of Magnitude of Residual Risk, Adequacy of the Response, ECs, ICs, and Maintenance. These key data elements are discussed in Step 4 of the Risk Methodology.
- **Reduction in Toxicity, Mobility, and Volume:** The key data elements for this criterion include determining whether the treatment is full or partial; employs environmental controls, LUCs, or storage; and, if the alternative reduces the toxicity, mobility, and volume of the hazard.
- **Short-Term Effectiveness:** The key data elements for conducting the Individual and Detailed Analysis of this criterion include the following items with respect to the timeframe of the Site-Specific Response: community risk, worker risk, ecological impacts, socio-economic impacts, cultural impacts, and completion time.
- **Implementability:** The key data elements for this criterion include technical and administrative feasibility as well as the availability of goods and services.
- **Cost:** The key data elements are the capital costs, annual operation and maintenance (O&M) costs, and net present value costs associated with each criterion.
- **Acceptance by Appropriate Regulatory Agencies or Agencies with Jurisdiction Over Affected Resources:** The key data elements for this criterion are a function of determining the level of support of the appropriate regulatory agencies or agencies with jurisdiction over affected resources.
- **Community Acceptance:** The key data elements for this criterion are a function of determining the level of support of the surrounding community.

What Are the Limits to Collecting Data?

Determining the limits to collecting the data is based on the boundaries of the study area. Setting boundaries will allow resources to be focused on collecting the necessary data to make informed decisions during the Step. The answers to the questions in the portion of the planning worksheet below will allow the Project Team to identify those factors that may weigh heavily or limit the design of the data collection effort for the Step. In order to set the limits to collecting the data the Project Team must determine and evaluate the population of interest, temporal and physical boundaries, the scale of decision making, and practical constraints. When evaluating how these items may limit data collection consider the following:

Specify the Population of Interest: The objects (e.g. UXO, chemicals), contaminated media, or people to be studied. The data being collected during the field effort will represent this "population". Based on available information, use the questions below to select the population of interest or the primary characteristic the data collected during this step will represent.

Temporal Boundary: The temporal boundary considers both the timeframe to which the decision and data apply as well as data collection sequencing. When defining the timeframes for both the data collection effort and decisions the Project Team should: 1) Predict which data might change from the time the data are collected relative to the time decisions will be made (e.g., frost-heave has the potential to alter the depth to UXO). 2) Consider current and future land use scenarios. In planning data collection efforts, the future land use will be based on the "next planned land use"; however, the Project Team also may consider "reasonably anticipated future land use" in establishing temporal boundaries. 3) Consider explosives safety and other constituent risks related to field activities required to meet the DQOs of this step. For example, in sampling subsurface soil to understand potential groundwater impacts, sampling activities may require ordnance avoidance support.

Spatial Boundary: In defining the geographic area to which the decision applies, preliminary spatial boundaries would be determined by the project team based on available site-specific data and the boundaries of the problem defined earlier in the planning worksheet. Determine if the boundaries should be sub-divided. The basis for sub-dividing the boundaries should be specified (e.g. land use regulatory boundaries, technological, financial constraints etc.).

This determination may be the results of estimates of the physical extent of UXO and other constituents. Project teams may refine these boundaries during data collection efforts through the use of management techniques such as dividing the range into parcels, sectors, or operable units, or through the use of phased investigative approaches. "Sector" is a term commonly associated with characterization of ranges and is defined as a contiguous area located within a range with uniform UXO density geophysical characteristics. In addition, the area within the sector would have similar current and/or future use.

Sectorization: One of the first steps in achieving the overall objective for UXO characterization is to adequately define sectors through effective literature searches, supplemental sampling (e.g., geophysical) as needed, and reviews of all pertinent aerial photographs. The background research should be completed during the Range Identification and Range Assessment Steps, but the Project Team should consider reviewing this information or expanding this effort during Range Evaluation. Ideally, the background research will include visual observations and survey data to support the sectorization process such as locations of true and false craters, existence of ordnance items or fragments (including preliminary estimates of ordnance type and physical distribution), and potential presence of soil stains.

Although sectorization for characterization activities will have the same general approach as that for response activities, the sectors for response activities might differ from the sectors identified during the Range Evaluation Step. The possibility exists that additional geophysical sampling, mapping, and/or interrogation might be needed to refine the sectors. In addition, evidence of true and false craters, ordnance items or fragments, and soil stains could be useful information in guiding the general approaches summarized below. The process of sectorization yields information that

serves as the basis for Technology Identification and Screening as well as Technology Selection. In addition, sectorization yields information that is used to establish the boundaries of the study. Sectorization could be completed through one or a combination of the following general types of geophysical investigations:

- Geophysical sampling is performed at representative portions of a range in order to characterize a larger area. The objective of geophysical sampling is to cost-effectively characterize the distribution, type, and condition of UXO across a range.
- Geophysical mapping is performed across an entire area suspected of containing UXO. The objective of geophysical mapping is to locate suspected and verified UXO meeting pre-selected criteria such as UXO type, size, composition, depth, or other similar parameters.
- Geophysical interrogation can be performed at specific locations or small ranges in order to obtain additional target information beyond that gathered by initial investigations. Techniques used for geophysical interrogation are generally too slow and expensive to be used over broad areas, but can yield important information about size, depth, composition and configuration of individual targets or target clusters.

Scale of Decisionmaking: In defining appropriate subsets of populations to which decisions apply based on temporal and spatial boundaries, the Project Team will establish a study area where receptors derive the majority of their exposures. The scale of decision-making is the smallest unit (area, volume, or timeframe) that Project Team is concerned about. It is a combination of the population of interest and the study boundaries, both physical and time-based. For example, if a risk-based approach is being used, and the future use of the property is ½-acre residential lots, then the decision-making is likely ½-acre for the future residential scenario. Many other considerations can define the scale of decision making, to include regulatory requirements, technology, funding. Another example could be, in evaluating risks to children from the presence of UXO in an area near a community, the study area would be set to the specific area where children may play. By focusing on this area, the study evaluates risk within the area of exposure to the most potentially sensitive or highly exposed sub-population.

Identify Practical Constraints on Data Collection: In identifying practical constraints, the Project Team will consider constraints or obstacles that might interfere with implementation of data collection. These constraints or obstacles include safety concerns (e.g., presence of UXO or other constituents), physical conditions (e.g., seasonal, meteorological, terrain, vegetation, geologic, geophysical conditions), and logistical constraints (e.g., site access, availability of personnel or equipment).

What Are the Limits to Collecting Data?	
Population of Interest:	
Objects: Describe (and attach if space does not permit) information on:	How many UXO and what types exist? What are the other constituents and their concentrations?
Media: Which environmental media are involved?	— Air — Surface Soil — Subsurface Soil — Surface Water — Groundwater — Sediment — Other:
People: Will current or future land use play a role in the location or focus of data collection?	**Identify and Check** — Current Land use Specify: — Next Planned Land use Specify: — Reasonably Anticipated Future Land use Specify:
Based on available information, are any highly sensitive or exposed sub-populations present?	Specify:
List any other factors that will play into the population of interest of the data collection in Step 2?	
Time-based Boundaries:	
— Describe (and attach if space does not permit) information on: — When decisions will be made. — Whether site conditions may change before decisions are made. — Whether data will still be representative of conditions when decisions are made or response action is to be taken.	

Physical Boundaries:

Describe (and attach if space does not permit) information on:

- Will a phased investigation that will approach be used? If so, how?
  A phased approach based on what is found in Range Identification (e.g. location, depth, or types of munitions) could focus, limit or refine the design of this data collection effort.
- The sectors, parcels or units the Project Team has identified in order to effectively conduct the investigation. How were they defined?
  Consider how these sub-areas may focus or refine the design of the data collection effort (e.g. types of munitions, physical features, reuse categories, risk).
- The safety considerations that may focus, limit or refine the design of this data collection effort (e.g. unconventional munitions, other constituent hazards).
- The physical conditions on the sector, parcel or unit that are expected to cause safety concerns and should be factored into the design of the data collection effort (e.g. seasonal, meteorological, terrain, vegetation, geologic or geophysical constraints).
- Any special considerations due to the interaction between or overlapping of other constituents and explosives safety concerns (e.g. will unexploded ordnance impact soil sample collection or well installation).

Describe (and attach if space does not permit) information on:

- Any special consideration due to receptors on or off site which may affect the design of the data collection effort (e.g. quantity distance arcs, current land user or owner).
- The physical conditions on the sector, parcel or unit that are expected to cause logistical constraints that should be factored into the design of the data collection effort (e.g. access, availability of personnel or equipment, funding).
- The environmental considerations which should be considered in designing (location or timing) the data collection effort (e.g. migratory birds, endangered species, wetlands, cultural resources).
- Any other physical or temporal factors that will affect the boundaries of the data collection in Step 2, Range Assessment.

Scale of Decision-Making:

- Describe (and attach if space does not permit) information on:
- The role of risk-based decision-making on the site.
- The role of regulatory requirements in guiding how decisions are made (e.g. Solid Waste Management Unit boundaries). Be sure to list requirements.
- The role of technological limitations in decision making (e.g. clearance to a specific depth). Describe limitations.
- The role financial considerations will have in decision making (e.g. funding for characterization vice response). Describe financial considerations.

— Check or list any other factors that will play into the scale of the decisions being made in step 2.	— Availability of Past or Current Information — Personnel for Interviews — Classified Material — Damaged or Ruined files — Other:

Practical Constraints:	
— Time of Year:	
— Time to complete sampling and clean-up:	
— People; surrounding land use:	
— Climate and Weather:	
— Funding, Personnel equipment, other:	

The limits to collecting data will be site specific and based on the conditions surrounding the data collection effort at the site. The limits may change from step to step based on the problem and objective, decisions and type of data being collected. Below are guides as to how the boundaries may be focused for each of the steps:

- **Step 1, Range Identification -** data collection effort at this step may be limited to identifying one piece of supporting information to support the information on the National Inventory. The limits to data collection will likely be wider if the Project Team is going to determine the property should be evaluated under another regulation than they will be to support the inventory and begin an Accelerated Response or continue on to Range Assessment.
- **Step 2, Range Assessment -** limits to the data collection effort at this step will be focused on the amount and type of records that will support the planning effort in the Range Evaluation Step. The data collection could include sampling or an on-site visit, which will also be bound by the population of interest (i.e., object, media and people), physical, time-based and practical constraints, and the scale of decision making.
- **Step 3, Range Evaluation -** limits to the data collection effort at this step will be based on the information gathered during the Range Assessment and focused on the extent and location of the field effort. Constraints could include sectorization, financial, technology, when response can be implemented, characteristics of other constituents and UXO, etc..
- **Step 4, Response Selection -** data collected during this step may be limited by similar constraints of previous steps but also may be the amount of information necessary to conduct the individual analysis of alternatives.
- **Step 5, Site-Specific Action -** data collection effort during this step may be bound by similar constraints of previous steps or may have unique constraints that apply to the implementation of the response action. Unique constraints may include items such as worker or community safety, interaction of other constituents and UXO, environment or technology that are specific to the response action.

- **Step 6, Recurring Review -** limits to data collection in Recurring Review will be influenced by the data that was collected during the Site-Specific Action as well as any changes that have occurred since the action was implemented.

How Will Decisions be Made?

To design a data collection effort, it is important to understand how decisions are being made. The DQOs should be focused on providing the necessary information to make the required decisions at this point in the process. The criteria for making decisions or the decision rules will assist the Project Team in planning the data collection effort. How the decisions will be made will directly influence the tolerable limits on decision error that the team is willing to live with.

The four main elements to developing a decision rule are parameter of interest, scale of decisionmaking (established previously), action level, and alternative actions.

Specify the Statistical Parameter that Characterizes the Population: The Project Team should specify the parameter of interest (e.g., mean, median, or percentile) whose "true" value they would like to know and that the data will be used to estimate.

Specify the Action Level for the Study: The Project Team should specify the numerical values that serves as the basis for choosing between actions and alternative actions.

Develop Decision Rules: In establishing decision rules, the Project Team will first specify the most important parameters of the population that represent the concerns with respect to explosives safety and other constituent risks. For example, explosives safety risk is a function of the scale of impact of the UXO, accessibility, and extent of exposure. The Project Team then need to develop decision rules and alternative actions based on appropriate action levels, parameters of interest, and the scale of decisionmaking.

The collection and analysis of additional information about the conditions at the range will lead to the primary purpose of this step, which is a detailed qualitative assessment of risk posed by UXO and a detailed quantitative assessment of risks posed by other constituents at the range.

Decision Rules for Explosives Safety Only

No action levels exist in the Interim R3M for evaluating explosives safety risk. Therefore, the parameter of interest for evaluating explosives safety risks is not known. Since action levels have not been developed to evaluate explosives safety risk, decision rules have been created independent of the baseline explosives safety risk. Regardless of the baseline explosives safety and other constituent risk, the Project Team must proceed to the Site- Response Selection Step, which could follow an Accelerated Response. However, since action levels are available for evaluating other constituent risks, the Response Selection might only address explosives safety.

Decision rules combine the outputs of previous steps of this DQO process, action levels, and parameters of interest into a series of "if…then…" statements. The following bullets present decision rules for evaluating explosives safety.

Decision Rules for Explosives Safety and Other Constituents

Decisions regarding other constituent risks are based on action levels and parameters of interest established through guidance developed by EPA and other agencies such as the *National Oil and Hazardous Substances Pollution Contingency Plan* (EPA 1991b). The following sentence was excerpted directly from the NCP and provides an example of an action level and a parameter of interest for making decisions concerning other constituent risks:

For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6} using information on the relationship between dose and response.

Note, however, that "concentration levels" are not directly comparable to "excess upper bound lifetime cancer risks to an individual." The Project Team either must conduct a human health BRA or compare concentration levels to criteria developed with consideration of the action level. For example, risk-based screening levels developed by EPA Region 3 (EPA 1998c) could be used for this purpose. Other action levels for human health and ecological risk assessment are presented Step 3, Range Evaluation, of the Risk Methodology.

Decision rules for situations where the Project Team are considering other constituents and explosives safety risks combine the outputs of the previous steps of this DQO process, action levels (e.g., "an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6}"), and parameter of interest (e.g., "concentration levels") into a series of "if…then…" statements. The following sections present decision rules for evaluating explosives safety and other constituents together.

How Will Decisions be Made?
Review the "Decide" part of the Step.

Under standing how decisions are made at each step will assist the Project Team in understanding the progression through the steps of the risk methodology. The decide sections of each of the Steps provides detailed worksheets to walk the Project Team through the decision rules. Below are the simplified decision rules (if then) for each step[7].

[7] The Decide sections of each step provide both the if/then and the if not/then statements.

- **Step 1, Range Identification -** If an immediate threat to the public exists, then an Accelerated Response should be considered. If not, proceed to the next decision rule. An immediate threat should be considered site specifically. By using existing information and best professional judgement to complete the Explosives Safety Risk Tool if an overall risk score of "D" or "E" is received or if the site scores the worst score in any one of the variables the Project Team should consider an Accelerated Response. If not then continue through the process.

  Another decision to be made at this step is if the Range Rule applies, if the property is on the National Inventory, the team can find one piece of supporting information, and there is not a preexisting agreement that will be followed then the Range Rule applies.

- **Step 2, Range Assessment -** If an immediate threat to the public exists, then an Accelerated Response should be considered. If not continue to the next decision rule.

  Other decisions to be made at this step is if other constituents and explosives safety should continue to be considered in Step 3, Range Evaluation. Under this procedures manual in the absence of close-out criteria explosives safety will continue to be considered in Range Evaluation. The Project Team will decide on the action levle by which other constituents will continue to be considered.

- **Step 3, Range Evaluation -** If an immediate threat to the public exists, then an Accelerated Response should be considered. If not, proceed to the next decision rule.

  Other decisions to be made in this step are the next actions to address other constituents and explosives safety risks. If sufficient data have been collected to apply scores to each of the data elements in the Explosives Safety Risk Tool, then estimate baseline explosives safety risk and proceed to the Site-Specific Response Evaluation Step (for explosives safety risk). If not, additional data will need to be collected or DQOs will need to be refined.

  If sufficient data have been collected to apply scores to each of the data elements in the Explosives Safety Risk Tool, then estimate baseline risk and proceed to next decision rule. If not, collect additional data or refine DQOs.

  If a parameter of interest within the scale of decisionmaking for other constituents exceeds the action level, then proceed to the Response Selection Step for explosives safety and other constituents. If not, proceed to the Response Selection Step for explosives safety risk only.

- **Step 4, Response Selection -** If an immediate threat to the public exists, then an Accelerated Response should be considered. If not, proceed to the next decision rule.

  Other decisions to be made at this step is which response action(s) to take in order to reduce risks on the range, sector, parcel or unit. The Project Team will evaluate the response alternatives with the NCP nine criteria chart and select the

response which scores best against the criteria for both other constituents and explosives safety.

- **Step 5, Site-Specific Action -** If an immediate threat to the public exists, then an Accelerated Response should be considered. If not, proceed to the next decision rule.

  Another decision to be made at this step is whether or not the response action is performing as designed and meeting Response Action Objectives. If the response is meeting Response Action Objectives then the team will proceed to the next step, however if it is not, then the team will need to either reevaluate the response or the response action objectives.

- **Step 6, Recurring Review -** If an immediate threat to the public exists, then an Accelerated Response should be considered. If not, proceed to the next decision rule.

  Other decisions are, is new information available that would change a previous decision and does the response remain protective. If new information is available that may change a previous decision then the Project Team should revisit the phase in which that decision was made. If the response remains protective, then the Project Team could proceed to close-out, however, in the absence of close-out criteria for explosives safety risk the team should schedule the next recurring review.

What are the Tolerable Limits of Decision Error?

The tolerable limits of decision error will likely be different for explosives safety and for other constituents. For explosives safety, where a parameter of interest can be estimated from data, but there are no action levels, the limits of decision error will likely be qualitative. It is likely for some of the steps, qualitative decision rules will suffice for data collection. Therefore a portion of the planning worksheet is to assist in developing Qualitative tolerable limits. If a Project Team is sampling in an effort to determine the need for the further consideration of other constituents, then quantitative limits on decision error may be necessary, a portion of the planning worksheet addresses quantitative limits on decision error.

Decision error is the chance of making an incorrect decision based on inaccurate data estimates. It could be the result of sampling design error, measurement error, or both. Sampling design error is related to how the data will be collected to represent the population of interest. Measurement error is a function of the technology used to collect the data. Tolerable limits are how much decision error the Project Teams are willing to live with. The consequences of the decision errors (e.g., human health, ecological, social, legal, economic) are balanced against one another to establish tolerable limits. These limits are then used to establish the appropriate quantity, type, and quality of data to be collected.

The tolerable limits on decision error for explosives safety are a function of the accuracy of the data used to estimate baseline explosives safety risk. In the absence of action levels for evaluating explosives safety risk in the Interim R3M, tolerable limits on decision

error will be developed with consideration of site-specific conditions, technology limitations, boundaries of the study (established previously), and inputs to the Explosives Safety Risk Tool. Consequently, tolerable limits on decision error might be expressed in qualitative terms. In addition, professional judgment may be required by analysts or the Project Team in establishing levels of accuracy for data collection activities.

The accuracy of the data collection effort will be established to yield data to determine the appropriate score on the relative scales for each of the variables in the Explosives Safety Risk Tool (see Step 3 Analyze Data). For example, the data collection effort must report the depth to the lowest UXO to support the use of the Explosives Safety Risk Tool. The Explosives Safety Risk Tool includes the following scale for depth to UXO: (1) <1 foot BLS, (2) <2 feet BLS, (3) <4 feet BLS, (4) ≤10 feet BLS, and (5) >10 feet BLS. To use the Explosives Safety Risk Tool, Project Team may require knowledge of depth to UXO in the following increments: 1 foot BLS, 2 feet BLS, 4 feet BLS, and 10 feet BLS. In relation to depth, if our study boundaries (established previously) only consider depths from the surface to 2 feet BLS within the decision rule (established previously), data collection efforts must identify UXO to depths of at least 2 feet BLS. In absence of these data, the Project Team would assume UXO is present at <1 foot BLS (i.e., the highest level bounded by the study area).

In making these determinations, the Project Team should consider all of the variables in the Explosives Safety Risk Tool collectively. These data should be supported with at least one piece of information to verify each factor. When data cannot be collected to generate a score for a particular variable, the Project Team will assume the score based on the highest level bounded by the study area as established previously in this planning process.

Tolerable Limits on Decision Error for Other Constituents

This step of the DQO process identifies tolerable limits on decision errors for the parameters of interest identified previously. Tolerable limits are represented as statistical terms in relation to the potential consequences of decision errors. These limits are defined as the probability of making an incorrect decision based on data that inaccurately estimate the “true” condition of the site. As such, tolerable limits should be developed with consideration of sampling design error, measurement error, action level, and the statistical parameter that characterizes the population of interest in the decisionmaking process. The goal of this step is to develop a limit for use in developing data collection efforts that reduce the chance of making decision errors to a level that is acceptable to the Project Team.

Qualitative Evaluation of Tolerable Limits of Decision Error:

This process is aimed at laying out the information sources and determining the desired confidence level for each source. Based on this information the Project Team should determine if they are willing to live with the listed confidence limits. In the table below some of the inputs to the decision have been identified, the Project Team needs to

identify any other inputs to the decision, the possible sources of information and their associated (relative) confidence levels.

After identifying the inputs, sources, and confidence levels, this information will be used to weigh the pros and cons of each type of decision error with respect to Human Health, Ecological, Economic, Social, Legal and the Overall Combined consequences.

Quantitative Evaluation of Limits of Decision Error :

This could be a complex statistical process requiring the development of Null Hypotheses[8], Type I and II error rates, and definition of gray areas. As with the other components of the planning process, the technical details are outlined below and more thoroughly in EPA's DQO guidance manuals[9]. To determine tolerable limits on decision error, consider the questions posed below and consult personnel with experience in statistics. They can assist the Project Team in selecting the appropriate statistical parameter, action level, and decision rules and developing the Project Team's tolerable limits on decision error.

Use the following questions to determine the appropriate confidence level for the data being collected at this stage in the process:

What are the Tolerable Limits of Decision Error?	
Will a quantitative limit on decision error be developed either for the explosives safety or other constituent component of the study?	Yes: Go to "Quantitative Evaluation of Tolerable Decision Error Limits" and develop tolerable decision errors for other constituents and/or explosives safety No: Go to "Qualitative Evaluation of Tolerable Decision Error Limits" to develop tolerable decision errors for explosives safety and other constituents below.

Qualitative Evaluation of Tolerable Limits of Decision Error:		
Input to the Decisions	**Sources** (Location/Type/Approach)	**Confidence** (High-Low)
UXO Inputs (UXO depth, hazard type, fuzing, amount of energetic material, UXO density, and Portability)		

[8] Detailed discussion of Null Hypothesis is provided below.
[9] EPA Guidance for the Data Quality Objective Process (1994a)

Exposure and Access Inputs (Intrusion level of activity, frequency of exposure, intensity of activity, portability)		
Additional Inputs (Migration/erosion, natural resources, cultural resources)		
Other:		

Pros and Cons of each type of decision error:

Justification of Confidence Levels: This analysis will be used to support the selected confidence limits the Project Team members are willing to live with for each of the identified sources.	**Human Health:** The amounts of research or investigation results in certain direct risks and may influence your understanding of risks to humans. Careful consideration must be given to balancing these risks against the need for obtaining data to make sound, risk management decisions.
	Ecological: The amount of research or investigation results in certain direct and indirect risks to the environment. Careful consideration must be given to balancing the direct risks potentially damaging the environment during characterization against the need for attaining data to make sound, risk management decisions.
	Economic: The costs associated with the amount of research or investigation varies greatly across the sources of sampling and geophysical analysis listed above. Careful consideration must be given to balance the costs against the need for obtaining data to make sound, risk management decisions.
	Social: The amount of research or investigation results in certain risks to cultural resources. Careful consideration must be given to balancing these risks against the need for attaining data to make sound, risk management decisions.
	Policies: The amount of research or investigation results in certain policy benefits and risks. Careful consideration must be given to balancing these risks against the need for attaining data to make sound, risk management decisions.

Pros and Cons of each type of decision error (continued):	
	Legal: The data collection must comply with existing laws governing protection of human health and the environment. In addition, the characterization must comply with existing laws and regulations for the safe handling of explosives material.
Overall Combined Consequences — Based on consideration of the tolerable limits for each of the consequences listed above, determine the appropriate tolerable level of confidence.	— Consider the consequences discussed above. — Evaluate the table under the "Qualitative Tolerable Limits on Decision Error" - the table illustrates the confidence levels associated with the sources
— From the table above list the sources and associated confidence levels that have been determined acceptable by the Project Team:	— UXO Inputs: — Behavioral Inputs: — Other:
— Quantitative Evaluation of Limits of Decision Error :	
Complete (and attach if space does not permit) the following: — Specify the statistical parameter that characterizes the population of interest (e.g., mean, median, percentile). — List the action levels and the information that will be used to make the decision during Step 3. Provide basis (e.g. Risk, regulation, technology) for Note, confirm that the action levels can be compared with the statistical parameter specified in previous step. — List the capabilities and limitations of applicable sampling and characterization technologies.	
Consider the following possible decision errors and their consequences: — Determining that the parameter of interest for other constituents has not exceeded risk criteria10, when it actually does. The Project Team may not have the appropriate information to select a response action that is protective; this could possibly endanger human health and the environment, as well as affect future development of the property. In addition, it could lead to unnecessary future damages and liabilities. — Determining that the parameter of interest for other constituents have exceeded risk criteria, when it is actually below the criteria. Under this scenario the Project Team, may conduct unnecessary investigations or cleanup. This could take away funding and progress from other more serious projects on site. — Other Site-Specific possible consequences:	

[10] Criteria identified by regulatory agencies as action levels in the National Contingency Plan and state regulations.

Evaluate, document, and attach (if space does not permit) the following: — Given site-specific conditions, which of the decision errors (above) presents more severe consequences? — Formulate a Null Hypothesis11. — Suggest a method for testing the statistical hypothesis and define a sample size12. — How likely is the Project Team to make an incorrect decision based on data that inaccurately estimates the conditions at the site?
— Document (and attach if space does not permit) the site-specific determination of tolerable limits of Decision Error:

Identify the Decision Errors and Choose the Null Hypothesis—The four steps to defining where each decision error occurs relative to the action level and establishing which decision error should be defined as the null hypothesis (baseline condition) are described below:

Two types of decision errors—The two decision errors are: (1) determining if concentration levels of other constituents detected in various environmental media do not exceed action levels when they really do, and (2) determining if concentration levels of other constituents detected in various environmental media exceed action levels when they truly do not.

Potential consequences of each decision error—The consequence of deciding that suspected other constituents detected in various environmental media do not exceed action levels when they truly do possibly could endanger human health or the environment as well as affect the future development of the property. The consequence of deciding that suspected other constituents detected in various environmental media exceed screening criteria when they truly do not, might trigger additional investigations or recommend cleanup unnecessarily.

Which decision error has more severe consequences when near the action level—Since the risk of jeopardizing human health and the environment outweighs the consequences of having to pay additional costs for additional investigations or cleanup, decision error (1) has more severe consequences near the action level.

The null hypothesis (baseline condition) and the alternative hypothesis—The baseline condition or null hypothesis (H_o) for the range is "other constituents were detected in various environmental media at concentration levels that warrant additional investigation or cleanup activities." The alternate hypothesis (H_a) is "other constituents were detected in various environmental media at concentration levels that do not warrant additional

[11] The Null Hypothesis is described in more below.
[12] Methods for testing the statistical hypothesis and defining sample size are also described in more detail below.

investigation or cleanup activities." These hypotheses could be tested in a number of different ways. For example, the hypothesis test could be used to indicate whether other constituents detected in soil samples are site-related.

A false positive decision error occurs when the null hypothesis is rejected when it is true. This is commonly referred to in statistical terms as Type I error. For the Range Evaluation Step, false positive error will occur if the decision is taken that the "true" concentration levels of the other constituents at the range are less than the action levels when they actually exceed the action level.

A false negative decision error occurs when the null hypothesis is accepted when it is false. This is commonly known in statistical terms as Type II error. For the Range Evaluation Step, false negative error will occur if the decision is taken that the "true" concentration levels of the other constituents at the range is greater than the screening criteria when it is actually below the screening criteria.

Define the Range of Possible Parameter Values Where the Consequences of Decision Errors are Relatively Minor (Gray Region)—The gray region is an area represented by the concentration levels of a given other constituent that approach the action level (i.e., the consequences of a Type I decision error are minimal). The intent of defining the gray region is to define an upper limit on errors committed either above (excessive risk) or below (excessive investigative or cleanup costs) the action levels for other constituents. The actual value of the action level is not required, since the focus is on a proportion of the action level. Errors committed within the gray region are considered to be tolerable, since they are likely to err on the side of health and environmental protection, with a tolerable degree of negative consequence incurred in additional investigative or cleanup costs.

Assign Probability Limits to Points Above and Below the Gray Region that Reflect the Tolerable Probability for the Occurrence of Decision Errors—The Type I error rate applies to points above the gray region, meaning that there is a probability of rejecting the hypothesis if the "true" concentration levels lie above the upper limits of the gray area. The Type II error rate applies to points below the gray region, meaning that there is a probability of accepting the hypothesis if the "true" concentration levels lie below the lower limits of the gray region.

What is the Optimal Sampling Approach for Collecting Data?

The Project Team must determine if samples will be collected, evaluate sampling or document search approaches, and select the optimal site-specific plan for collecting data to accomplish the objectives of this step.

Designs will be developed based upon information known about the site, previously completed components of the Planning Worksheet, and the following additional considerations:

What is the Optimal Sampling Approach for Collecting Data?	
— Are you going to collect additional documents as well as samples?	— YES: Consider both the requirements under "Sampling Approach" below and "Document Search". — NO: Consider the components under "Sampling Approach" below.
Document Search:	
When using a document search alone or along with statistically based or judgmental sampling, use the information in the column on the right to define number of sources and types of documents that must be searched to obtain inputs to the decision.	— Review the DQO outputs — Review existing environmental data (e.g. variability of data collected and data gaps) — Historical patterns of chemical and ordnance deposition, estimates of variance — Establish minimum or maximum requirements for an acceptable document search — Other: — Reference list of Suggested Information Sources for this step
Sampling Approach: To develop the sampling approach, the Project Team must first identify several sampling, technical and analytical design alternatives, screen these alternatives to eliminate inappropriate alternatives, and then analyze the alternatives to select the best site-specific approach. Use the information below to assist in selecting the best approach:	
Develop list of general data sampling design alternatives. Consider:	— Factorial design — Sequential random sampling — Simple random sampling — Systematic sampling — Stratified random sampling — Composite sampling — Other:_____
To analyze sampling design alternatives, at a minimum consider;	— DQO outputs — Characteristics of the contaminants, ordnance and media — Cost-effectiveness of alternatives (balancing sample size and measurements of performance). — Total cost of sampling and analysis to total number of samples
Desired Technology Capabilities	— Probability of Detection — False Alarm Rate — Other Statistics
— For statistically based sampling programs, select optimal sample size that satisfies DQOs, using information collected and developed above.	

— If no design meets the limits on decision errors within the budget or other constraints, consider relaxing one or more constraints.	— Budget — Change limits on decision error — Relax schedule — Change boundaries of sample area — Other:

What is the Optimal Sampling Approach for Gathering Data

Some aspects of optimizing the design apply mathematical and statistical methods and terminology. These aspects may not apply fully to the qualitative nature of the explosives safety data collection and decisionmaking processes. However, these aspects would apply for evaluations of other constituents.

The design of range sampling methodologies should consider a number of variables to include physical and geographical conditions as well as current and future land use. The physical factors include estimated amounts, distribution, and types of UXO and other constituents. The geographic factors include slope and topography; vegetation; soil-type; sensitive ecosystems; and geologic, hydrogeologic, and hydrologic conditions.

Regardless of the approach or guidance selected for optimizing the design of the study, the underlying goals will not change. Activities for optimizing the design include the following bullets excerpted from EPA 1994a with minor modifications to address both explosives safety and other constituents:

Review the DQO outputs and existing environmental data. Review the DQO outputs generated in the preceding six steps to ensure that they are internally consistent. The DQOs should provide a succinct collection of information on the context of, requirements for, and constraints on the data collection design. Review existing data in more detail if it appears that they can be used to support the data collection design (e.g., analyze the variability in existing data if they appear to provide good information about the variance for the new data). If existing data are going to be combined with new data to support the decision, determine if any existing gaps can be filled or deficiencies that might be mitigated by including appropriate features in the new data collection design.

Develop general data collection design alternatives. Develop alternative data collection and analysis designs based on the DQO outputs and other relevant information, such as historical patterns of contaminant deposition, estimates of variance, and technical characteristics of the contaminants and media. Generally, the goal is to find cost-effective alternatives that balance sample size and measurement performance, given the feasible choices for sample collection techniques and analytical methods. In some cases where there is a relatively high spatial or temporal variability, it may be more cost-effective to use less expensive yet less precise analytical methods so that a relatively large number of samples can be taken, thereby controlling the sampling design error component of total study error. In other cases where the contaminant distribution is relatively homogeneous, or the action level is very near the method detection limit, it may be more cost-effective to use more expensive yet more precise and/or more sensitive

analytical methods and collect fewer samples, thereby controlling the analytical measurement error component of total study error. General data collection design alternatives include the following examples:

- **Sequential random sampling -** Usually, simple random samples have a fixed sample size, but some alternative approaches are available, such as sequential random sampling, where the sample sizes are not fixed a priori. Rather, a statistical test is performed after each specimen's analysis (or after some minimum number have been analyzed). This strategy could be applicable when sampling and/or analysis is quite expensive, when information concerning sampling and/or measurement variability is lacking, when the characteristics of interest are stable over the time frame of the sampling effort, or when the objective of the sampling effort is to test a single specific hypothesis.
- **Simple random sampling -** The simplest type of probability sample is the simple random sample where every possible sampling unit in the target population has an equal chance of being selected. Simple random samples, like the other samples, can be either samples in time and/or space and are often appropriate at an early stage of an investigation in which little is known about systematic variation within the site or process. All of the sampling units should have equal volume or mass, and ideally be of the same shape if applicable. With a simple random sample, the term “random” should not be interpreted to mean haphazard; rather, it has the explicit meaning of equiprobable selection. Simple random samples are generally developed through use of a random number table or through computer generation of pseudo-random numbers.
- **Systematic sampling -** In the case of spatial sampling, systematic sampling involves establishing a two-dimensional (or in some cases a three-dimensional) spatial grid and selecting a random starting location within one of the cells. Sampling points in the other cells are located in a deterministic way relative to that starting point. In addition, the orientation of the grid is sometimes chosen randomly and various types of systematic samples are possible. For example, points may be arranged in a pattern of squares (rectangular grid sampling) or a pattern of equilateral triangles (triangular grid sampling). The result of either approach is a simple pattern of equally spaced points at which sampling is to be performed.
- **Stratified random sampling -** Another type of probability sample is the stratified random sample, in which the site or process is divided into two or more non-overlapping strata, sampling units are defined for each stratum, and separate simple random samples are employed to select the units in each stratum. (If a systematic sample were employed within each stratum, then the design would be referred to as a stratified systematic sample.) Strata should be defined so that physical samples within a stratum are more similar to each other than to samples from other strata. If so, a stratified random sample should result in more precise estimates of the overall population parameter than those that would be obtained from a simple random sample with the same number of sampling units.

- **Composite sampling -** A random sampling scheme conducted in conjunction with another sampling design

Formulate the mathematical expressions needed to solve the design problem for each data collection design alternative. Develop the following three mathematical expressions needed to optimize the data collection design as follows: (1) Define a suggested method for testing the statistical hypothesis and define a sample size formula that corresponds to the method if one exists (e.g., a Student's t-test). (2) Develop a statistical model that describes the relationship of the measured value to the "true" value. Often, the model will describe the components of error or bias that are believed to exist in the measured value. (3) Develop a cost function that relates the number of samples to the total cost of sampling and analysis.

Select the optimal sample size that satisfies the DQOs for each data collection design alternative. Using the mathematical expressions from the previous bullet, solve for the optimal sample size that satisfies the DQOs, including the Project Team limits on decision errors. If no design will meet the limits on decision errors within the budget or other constraints, the planning team will need to relax one or more constraints.

- Increase the budget for sampling and analysis
- Increase the width of the gray region
- Increase the tolerable decision error rates
- Relax other project constraints, such as the schedule
- Change the boundaries (it may be possible to reduce sampling and analysis costs by changing or eliminating subgroups that will require separate decisions).

Select the most resource-effective data collection design that satisfies all of the DQOs. Evaluate the design options based on cost and ability to meet the DQO constraints. Choose the one that provides the best balance between cost (or expected cost) and ability to meet the DQOs.

Document the operational details and theoretical assumptions of the selected design. Document the selected design's key features that must be implemented properly to allow for efficient and valid statistical interpretation of the data. It is particularly important to document the statistical assumptions that could be violated through errors in or practical constraints on field sample collection procedures or analytical methods.

After all of the activities have been completed it may be helpful to enlist the advice and review of statisticians, UXO specialists, and geophysical experts with expertise in data collection designs. This will be particularly useful if inexperienced personnel developed the initial data collection designs. The experienced personnel may be able to offer innovative alternative data collection designs that may be more cost-effective or simpler to implement.

APPENDIX 3 – RISK COMMUNICATION TOOLS FOR THE INTERIM R3M

Example of Fact Sheet for Identifying Key Documents under R3M

The Department of Defense (DoD) has committed to involving the public and government agencies throughout the range response process. The process uses widely accepted mechanisms to involve stakeholders in decisions and inform them about conditions and actions at closed, transferred and transferring ranges. These common and accepted mechanisms include: public meetings, restoration advisory boards, information repositories, notice of availabilities in local papers, review and comment periods, and formal responses to comments. DoD has found these mechanisms beneficial under current programs, however, the use of these involvement mechanisms and the mutual benefit increases when stakeholders understand the process and when they can most effectively involve themselves and influence decisions up front. This fact sheet outlines the planned schedule for distribution and review periods of key documents under the R3M. By understanding the schedule for document review and when comment periods will occur. This schedule is part of the effort to create a situation for stakeholders to have meaningful involvement and opportunities to influence decisions.

Key Documents	Planned Date of Release for Review	Date Comments are due in to [XX]
Range Assessment Report	[INSERT DATE HERE]	XX days after report issued (including weekends)
Range Evaluation Report	[INSERT DATE HERE]	XX days after report issued (including weekends)
Site Specific Range Evaluation Report	[INSERT DATE HERE]	XX days after report issued (including weekends)
Accelerated Response Report	[INSERT DATE HERE]	XX days after report issued (including weekends)
Other key reports used to make decisions on the site		

As the data collection and the compilation of these key documents occurs the dates may change and this document may be revised.

Please contact [Your Range] Environmental Office or Public Affairs Office at (XXX) XXX-XXXX.

RANGE RULE RISK METHODOLOGY:

10 Common Questions

This document was developed by the Department of Defense to answer 10 of the more common questions associated with the proposed U.S. Department of Defense (DoD) Range Rule Risk Methodology (R3M).

1. WHAT IS THE RANGE RULE?

The proposed Range Rule outlines a process for evaluating appropriate response actions on closed, transferred, and transferring (CTT) military ranges. According to the Range Rule, response actions will be taken at CTT ranges to address safety and protect human health and the environment. These response actions will be implemented using the following five-part process: (1) range identification, (2) range assessment and accelerated response, (3) range evaluation and response, (4) recurring reviews, and (5) range close-out. This process is based on the Superfund Accelerated Cleanup Model developed by the U.S. Environmental Protection Agency (EPA) to speedup cleanups under the Superfund program.

2. WHY IS DoD DEVELOPING A RISK METHODOLOGY?

The Range Rule states that DoD will develop a methodology to assess potential risk posed by military munitions at CTT ranges. Specifically, the R3M will be used to address (1) explosives safety risk from unexploded ordnance (UXO) and (2) human health or ecological risks resulting from exposure to other constituents related to military munitions

3. WHAT IS THE RANGE RULE RISK METHODOLOGY?

The R3M will provide risk information and guidance on how the decisionmakers, identified in the Range Rule, can use this information to determine appropriate response actions. The R3M will include the following:

- A strategy and framework for managing risks
- Methods to assess explosives safety risks from UXO and chemical risks resulting from exposure to constituents related to military munitions
- Tools to communicate risks

When complete, these components will be used to help select appropriate responses at CTT ranges.

4. WHAT IS THE R3M PARTNERING INITIATIVE?

The R3M Partnering Initiative is an ongoing initiative between DoD, EPA, state regulators, Native American Tribal groups, and a public interest group to develop a R3M. To date, two partnering meetings (Las Vegas in May 1998 and Baltimore in September 1998) and several conference calls have been held.

As a result of these discussions, the initiative adopted a two step process for developing the R3M. The first step was to develop an Interim R3M to address the first three steps of the Range Rule process (range identification, range assessment and accelerated response, and range evaluation and response). The second step, which was identified as a long-term goal following Range Rule promulgation, will be to develop a Final

R3M. The Final R3M will provide risk information and guidance on processing this information to decisionmakers identified in the Range Rule during the recurring review and administrative close-out phases.

5. WHAT IS RISK?

The National Research Council (NRC) has defined risk to be "the probability that a substance or situation will produce harm under specified conditions." It is a combination of two factors: the likelihood that an event will occur and the consequence from that event.

As stated in the answer to Question #2, the special risks at military ranges can be grouped into two general categories: (1) explosives safety risks associated with physical forces generated by detonating UXO, and (2) human health or ecological risks associated with exposures to other constituents.

Explosives safety risks exist because people or animals can come into contact with UXO present on ranges. If UXO detonates when it is encountered, one of three outcomes can occur: no injury, injury or death.

Human health and ecological risks associated with exposure to chemical constituents also exist on ranges, primarily from a release or potential release hazardous materials. When releases occur, human and ecological populations could be exposed to hazardous materials through contact with soil, inhalation of airborne constituents, or ingestion of groundwater or other affected environmental media.

6. WHAT IS RISK ASSESSMENT?

The NRC defined risk assessment as "an organized process used to describe and estimate risk." The EPA has developed a process for estimating human health and ecological risks from chemicals under its Superfund Program. These tools are proposed for use within the R3M. However, there are no accepted tools for estimating and describing safety risk from UXO. The R3M Partnering initiative assigned this task to a subgroup for completion (Risk Assessment Subgroup).

7. WHAT IS RISK MANAGEMENT?

The Presidential Commission on Risk Assessment and Risk Management has defined risk management as the "process of analyzing, selecting, implementing, and evaluating actions to reduce risk to human health and ecosystems." The risk management process serves as the framework of the R3M because it allows decisionmakers to systematically address UXO and other constituent risks, make informed decisions, and select appropriate risk reduction actions at CTT ranges.

The R3M is developing a process to identify potential alternatives for responding to risks on ranges. To evaluate these alternative actions, the rule has required that the nine criteria in the EPA's National Contingency Plan be used. The nine criteria are:

- Overall Protectiveness of Human Health and the Environment
- Compliance with Applicable or Relevant and Appropriate Regulations
- Long-term effectiveness
- Short-term effectiveness
- Reduction of toxicity, mobility, and volume
- Implementability
- Cost
- Regulatory Acceptance

- Public Acceptance

After evaluating the nine criteria for each alternative, the alternatives will be compared against a no action alternative to determine which alternative best satisfies the nine criteria.

8. WHAT DOES "RESPONSE" MEAN?

A response is the action taken to reduce risk. DoD has proposed the following goal for range response actions:

> *To conduct response actions on CTT ranges that address safety, public health, and the environment, and are technically feasible, fiscally responsible, and consistent with the reasonably anticipated future land use. In addressing public health, the goal for closing out response actions is to eliminate public contact with UXO under reasonably anticipated future land use.*

Generally, the preferred response at CTT ranges would be to remove UXO. However, due to site conditions, technology limitations, cost, or other factors other alternatives such as access restrictions (fencing, covering with soil, etc.), land use controls (deed restrictions, restricting digging, etc.), or educational programs may be the most efficient response to reduce risk.

9. WHAT IS RISK COMMUNICATION?

Technical information obtained from the risk assessors is passed on using risk communication. This risk information is communicated to a wide audience, including people making the risk management decisions, workers conducting the response, and the public who need to review the proposed actions. In addition, risk communication is being used to educate the surrounding community not to touch UXO. DoD will develop more tools for risk communication including an educational program on UXO detection and removal technologies.

10. HOW WILL THE R3M INCORPORATE PUBLIC INVOLVEMENT?

DoD recognizes the importance of public involvement. The public needs to both understand the issues and provide input to help influence the R3M process.

Additionally, the Range Rule provides for public involvement throughout the CTT range response process, including the establishment of Restoration Advisory Boards, which have DoD and citizen co-chairs. The R3M will provide tools to help decisionmakers effectively meet public participation requirements of the rule.

The draft Interim R3M will be available for a 30-day public review in the summer of 1999. A notice of its availability will be published in the Federal Register.

FOR MORE INFORMATION…

For more information on the Range Rule or the R3M, please contact the Army Environmental Center at (410) 436-7085 or send a request by e-mail to rangerule@aec.apgea.army.mil.

How Can I Best Be Involved & Influence Decisions under the R3M

The Department of Defense (DoD) is committed to involving the public and other government agencies throughout the range response process. The process uses widely accepted mechanisms to involve stakeholders in decisions and inform them about conditions and actions at closed, transferred and transferring ranges. These common and accepted mechanisms include: public meetings, restoration advisory boards, information repositories, notice of availability in local papers, review and comment periods, and formal responses to comments. DoD has found these mechanisms beneficial under current programs, however, the use of these involvement mechanisms and the mutual benefit increases when stakeholders understand the structured process and how they can most effectively involve themselves and influence decisions up front. This fact sheet outlines the best opportunities for stakeholders to be involved and influence decisions.

Identification of Closed, Transferred and Transferring (CTT) Ranges

- Please provide any information you may have or know of about property you believe may be a CTT range in writing to Office of Deputy Secretary of Defense.

Comment on Range Assessment and Range Evaluation Reports

- Provide any information you have concerning the property of concern.
- Actively Participate in Restoration Advisory Board (RAB) or Extended Project Team (EPT).
  - Follow schedules and encourage the group to discuss upcoming actions in which you have interest
  - Identify concerns early (e.g. before the range evaluation data collection begins, identify areas of concern to ensure they are addressed appropriately.)
- Identify concerns and questions you would like answered up front.
- A Notice of Availability and a brief description of the report will be placed in a major local paper. Call the range environmental office or Corps of Engineer District to identify the local paper.
- Visit Information repository to review the report or request a copy of the report.
- Review and comment on the findings and recommendations in the report within the 45-day comment period.
- Request a public meeting or availability session to receive more information.

Comment on Accelerated Response Report

- Identify concerns about specific alternatives that may be evaluated.
- Comment on the Public Involvement Plan (PIP) (completed for actions over 120 days)
- Offer to be involved in interviews for development of PIP.
- When reviewing the Accelerated Response Report be sure to consider the following:
  - Is an Accelerated Response warranted?
  - Did we miss a possible response alternative? If so, what is the alternative and why do you believe it is appropriate?
  - Did we inaccurately evaluate an alternative? Are there site-specific conditions that we failed to consider?
  - Are there factors that you feel we should consider with more importance?

Comment on Site Specific Response Evaluation Report and the evaluation of response alternatives

- Identify concerns about specific alternatives that may be evaluated.
- A Notice of Availability and a brief description of report will be placed in a major local paper. Call range environmental office or Corps of Engineer District to identify local paper.
- Visit Information repository to review the report or request a copy the report.
- Review and comment on the findings and recommendations in the report within the 45-day comment period.
- When reviewing the Site Specific Evaluation Report, be sure to consider the following:
  - Did we miss a possible response alternative? If so, what is the alternative and why do you believe it is appropriate?
  - Did we inaccurately evaluate an alternative? Are there site-specific conditions that we failed to consider?
  - Are there factors that you feel we should consider with more importance?
  - Do you have a better idea?
- Request a public meeting or availability session to receive more information.

Public Participation Requirements w/in the Proposed Range Rule

Preamble IV (D)(3) Programmatic Concepts (50808)

a. ***Public and government agency involvement:***

The Department of Defense has committed to involving the public and government agencies throughout the range response process. This process provides for this involvement through widely accepted mechanisms.

The Requirements in General:

(1) Make information on response activities publicly available.
(2) Keep the public and appropriate agencies aware of planned and completed actions.
(3) Solicit written comments from the public and government agencies on proposed actions, and provide a responsive summary for public comments before proceeding.
(4) Hold public meetings, if requested.
(5) Provide an opportunity for concurrence by the appropriate Federal, State regulatory agencies, American Indian tribe, and Federal Land Manager.
(6) Operate an information repository where the public will have access to range response information.

Other Requirements

(1) DoD will provide a technology education to assist stakeholders in understanding UXO detection and removal technology.
(2) DoD will identify a POC for each range subject to the Range Rule.

Restoration Advisory Boards (RAB) & Extended Project Teams (EPT)

- Where RABs exist or can be established, they will be utilized to involve the stakeholders in this rule's proposed process. If a RAB does not exist and sufficient interest to establish a RAB is not obtainable, DoD will consider the use of EPTs.
- DoD will identify interested members and seek support to establish a RAB/ EPT which should provide opportunities to: (1) Communicate the initial understanding of the range and initial approach for planning and conducting a response; (2) identify issues or concern; and (3) solicit viewpoints.
- DoD will also consider other forums for public involvement as the specifics of the site and interest of the community dictate.

Phase-by-Phase Requirements

Range Assessment

- Written notice to identify RA/AR activities will be starting and need for POC.
  - DoD will send to Federal, State, and local governments, American Indian tribes and the current property owner
- All validated information will be included in information repository.
- Use of RABs or EPTs
- Technology education program
- Draft RA report:
  - Publish NOA and brief description of report in major local newspaper
  - 45-day public comment period & develop written responses
  - Hold public meeting or availability session if requested
- DoD component will prepare final decision document

Accelerated Response

- Prepare a formal PIP when on-site action is more than 120 days
  - Solicit stakeholder concerns, information needs and how or when they would like to be involved in the range response process.
  - Base on the community interviews or other relevant information.
- Review and comment period prior to AR, unless completed within 120 days & review/comment during or when the AR implemented.
- Use of RABs or EPTs

Range Evaluation

- Written notice to identify activities will be starting and need for POC.
  - DoD will send to Federal, State, and local governments, American Indian tribes and the current property owner.
- Information repository will have RE plan, all validated information, decision document and any documented risks posed by the site.
- As appropriate a public availability session will be held to discuss status of the RE.
- Draft RE report:
  - Publish NOA and brief description of report in major local newspaper
  - 45-day public comment period & develop written responses
  - Hold public meeting or availability session if requested

Site-specific Response Evaluation

- The RE and SSRE Plans, all validated information, any documented risks posed by the site, and any validated information generated during the SSRE shall be included in the Information Repository.
- Draft RE/SSRE Report is complete, DoD shall:
  - Publish NOA and brief description of report in major local newspaper
  - 45-day public comment period & develop written responses
  - Hold public meeting or availability session if requested

Site-specific Response Implementation

- All validated information, any documented risks posed by the site, and any validated information generated during the SSRE shall be included in the Information Repository.
- Public availability sessions will be held if requested.
- A periodic status update about the response to the current Property Owner and If requested, to the appropriate federal, state, and local governments and American Indian Tribe.

Recurring Reviews

- The responsible DoD component shall:
    - Publish a notice of whether the response remains effective
    - Hold a public availability session or meeting, if requested.
- A formal decision document specifying the actions(s) to be taken. This decision document and all supporting information are part of the Information Repository.

Ending the Range Response Process (Close-Out)

- Draft Range Close-Out Report :
    - Publish NOA and brief description of report in major local newspaper
    - 45-day public comment period & develop written responses
    - Hold public meeting or availability session if requested
- A formal decision document specifying the action(s) to be taken. This decision document and all supporting information are part of the Information Repository.

Public Meeting Checklist

1) Who will show up?
   - ❑ Size
   - ❑ Can you handle an extra large group
   - ❑ Media
   - ❑ Special interest groups

2) Greeting and escorting?
   - ❑ Parking
   - ❑ At door
   - ❑ Escorts to meeting rooms
   - ❑ Sign-in sheet
   - ❑ Fact Sheets and/or Handouts (such as acronym list)

3) What Information have they received before hand?
   - ❑ Maps
   - ❑ Time
   - ❑ Meeting purpose
   - ❑ Who will be available
   - ❑ Open question sessions

4) Comfort/facilities
   - ❑ Transportation
   - ❑ Chair comfort
   - ❑ Visuals
   - ❑ Lighting
   - ❑ Microphones
   - ❑ Avoid standing room
   - ❑ Clock they can see
   - ❑ Stenographer availability

5) Audience facilitation
   - ❑ Microphones in audience
   - ❑ Handouts
   - ❑ Discussion/comment cards with pencils
   - ❑ Follow-up information cards
   - ❑ Other languages
   - ❑ Fire/emergency exits
   - ❑ Special accommodations for people with special needs (hearing, disabled, elderly)

6) Non-verbal messages
   - ❑ Your dress style
   - ❑ Avoid barriers
   - ❑ Your seating plan

7) Presentation type
   - Informal/formal
   - Questions during or after
   - After each speaker
   - Breaks

8) Anticipate questions
   - Any data/info
   - Problems
   - Other sites
   - Determine through:
     - Surveys
     - Press coverage
     - Leading citizen input
     - Advisory panels
     - Employees

9) Opener
   - Make the meeting the audiences' or everyone's meeting/agenda
   - Not "we are hear to tell you about."
   - "In response to your…" would be more appropriate
   - Keep opener short

10) Key messages
   - State at beginning and end
   - No more than 3
   - Briefing charts should pictorially describe key messages
   - Messages should surround topics of interest

11) After the meeting
   - Remain available
   - Non-verbal messages are critical while one on one
   - Dates for follow-up meetings

Preparing for Your Public Meeting

Community involvement efforts should reach out to the most diverse range of stakeholders possible and should seek their input through a variety of innovative and effective methods appropriate to the community at hand. In an effort to meet this goal the following fact sheet, in addition to the "Public Meeting Checklist", has been prepared to assist you in holding effective public meetings at your site.

1) Selecting a Time & Place
   - Hold the meeting at a time when the most people will be able to attend.
     - Avoid scheduling the meeting during work hours; instead opt for an evening meeting.
     - Avoid scheduling conflicts. If you know there are other major activities occurring in the area that would limit public attendance hold the meeting on a different evening.
     - Choose a location that residents can readily locate (e.g., a school or the city hall). Also make sure the building is handicap accessible.

2) Coordination with other Area Organizations
   - You may not be familiar with the needs of the community surrounding your site. To ensure that your public meeting meets the needs of the entire community coordination with existing organizations is essential.
   - Area groups that you should coordinate with include:
     - Range's Restoration Advisory Board (RAB)
     - Tribal representatives
     - Area environmental organizations
     - Local Media
     - Church or Civic groups

3) Through Coordination – Identify Public Stakeholders and Decide:
   - How you can best involve the broadest diversity of public stakeholders in the process? (i.e., develop effective approaches for informing communities of color, low-income communities, and local governments).
   - What languages do announcements need to be in?
     - Do announcements to be distributed on Tribal lands need to be in the Tribal language?
     - What other non-English languages are prominent in the community (e.g., Spanish, Asian dialects, etc)?
   - Are there individuals in the community with special needs?
     - Are there deaf or hearing-impaired individuals who would benefit from a sign language interpreter?
     - Are visually impaired individuals who would benefit from escorts or the availability of documents in Braille?

4) Advertising the Meeting
   - Utilize ALL available local media outlets
     - Newspapers
     - Local cable TV access & government channels
     - Broadly distributed flyers and/or mailings
     - Radio
     - Local internet providers
   - Ensure that all materials you prepare for the public meeting are:
     - Culturally sensitive
     - Relevant to the specific area
     - In appropriate languages
     - At a variety of scientific levels

5) For additional information on establishing effective community involvement programs the following resources are available:

   - Final Report of the Federal Facilities Environmental Restoration Dialogue Committee, "Consensus Principles and Recommendations for Improving Federal Facilities Cleanup", http://www.epa.gove/swerffrr/ferdcrpt/toc.html
     - Provides an introduction to the Federal Facilities Environmental Restoration Dialogue Committee
     - Discusses Community Involvement, including:
       - Fundamentals of Community Involvement,
       - Assessing community needs,
       - Identifying public stakeholders,
       - Methods to provide information to stakeholders, and
       - Addressing future use planning and institutional controls
     - Addresses Advisory Boards, including:
       - When advisory boards should be established,
       - Existing advisory boards,
       - Scope, mission statement, membership selection, and operating procedures for advisory boards,
       - Federal Advisory Committee Act Charter,
       - Role of advisory board members and support teams
   - National Environmental Justice Advisory Council, Public Participation and Accountability Subcommittee Report, http://es.inel.gov/oeca/oej.html
     - Provides a model plan for public participation
     - Identifies core values for the practice of public participation
     - Provides an environmental justice public participation checklist for government agencies.

ENVIRONMENTAL INFORMATION

PAGE

What is UXO?

XX training ranges have been used for XX training. During training, troops learn to use their ammunitions accurately and safely by shooting at designated targets and into designated impact areas. When troops practice using their weapons, some munitions do not explode as they are designed to do. These unexploded munitions – or dud rounds – are called unexploded ordnance (UXO).

What Does UXO Look Like?

Unexploded ordnance comes in all shapes and sizes from small grenades to bombs. It can be found on the surface or under the ground at depths of up to 30 feet. Some of the most common UXO found on the ranges include: (may be different per site)

- Small arms munitions
- Hand grenades
- Rifle grenades
- Rockets
- Mortars
- Bombs

60mm Mortar UXO

Is UXO Dangerous?

If UXO is stepped on, driven over, struck by excavation equipment, or otherwise disturbed, it can explode and cause injury or death to whoever is in the immediate vicinity. That is why the Department of Defense takes strict safety precautions to ensure that personnel are not harmed by unexploded ordnance. For example, any munitions that create UXO are only fired into designated impact areas, and these areas are posted with large signs to warn against trespassing.

Impact areas, which make up only a small percentage of total rangeland, are posted with large signs to warn against trespassing.

If disturbed, UXO can be dangerous but U.S. troops have trained safely on the ranges in Panama for decades. With proper precaution and care, these areas can continue to be a safe, valuable place.

For More Information
Contact XX Public Affairs Office at
(XXX) XXX-XXXX

ENVIRONMENTAL INFORMATION PAGE

UXO Safety and Risk Reduction

It is important to control the hazards posed by unexploded ordnance (UXO). To prevent people who enter the ranges from being seriously injured or killed by UXO, there are a variety of measures that can be taken.

The following options are methods of reducing risk in areas where UXO detection and excavation can not be conducted in an effective, safe, and environmentally sound manner.

Restricting Access

Access into areas can be restricted by blocking roads and placing warning signs to deter trespassing. This reduces the chance that people entering the ranges will come into contact with potentially explosive dud rounds. This method is effective for remote property or for property with extremely rugged terrain and dense vegetation.

Limiting Activity

Limiting activity can reduce the chance that people could be injured by UXO resting beneath the surface. Prohibiting property development, excavation, or earthmoving activities and only allowing few activities that do not involve excavation – such as wildlife preserves – greatly reduces risk from UXO.

Risk can not be eliminated but it can be reduced tremendously by avoiding possible contact with UXO.

Educating the Public

One of the best ways to control UXO risks is through education. A person's ability to recognize and stay away from unexploded ordnance can vastly reduce the chance of injury. Anyone entering the ranges should be educated on safety procedures such as those that follow:

1. Do not enter areas of known or suspected UXO.
2. If you see UXO, stop. Do not move or disturb it.
3. Do not transmit radio frequencies in the vicinity of a suspected UXO.
4. Do not remove any object on, attached to, or near a UXO.
5. Report the location of any UXO to the proper authorities.

For More Information
Contact XX Public Affairs Office at
(XXX)XXX-XXXX

Sample Agenda
Range Rule Application to [your Range]
July XX, 2000
Local School Auditorium, 7:30 – 9:00 pm

7:30 Introductions

8:00 Purpose of Meeting

- Provide information on actions occurring at [your Range]
- Discuss the Department of Defense Range Rule and the Range Rule Risk Methodology
- Receive input from stakeholders on application of Rule
- Develop relationships between personnel working on the Range and those surrounding the Range, provide information on where to get information as studies are completed

8:15 Broad overview of the Range Rule

- What is it?
- How does it apply to [your Range]?
- What are the plans for [your Range]?
- What is the status at [your Range]?
- How can you be involved with and receive information about actions at [your Range]?

8:45 Questions and Answers

RANGE RULE RISK METHODOLOGY:

Protecting Public Safety & the Environment
on Former Military Ranges

A CITIZEN'S GUIDE

March 2000

RANGE RULE RISK METHODOLOGY:

Protecting Public Safety & the Environment on Former Military Ranges

A CITIZEN'S GUIDE

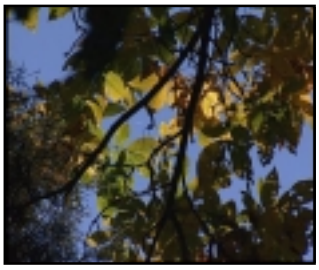
As the military has restructured and downsized, thousands of acres of former military training lands are being turned over to the public for new uses. So that these areas are used in a way that is safe for the public as well as the environment, wise, balanced decisions must be made. The Range Rule Risk Methodology (R3M) provides a logical procedure for making these important decisions.

Contents

RANGE RULE RISK METHODOLOGY:

Protecting Public Safety & the Environment on Former Military Ranges

A BRIEF BACKGROUND



Former ranges are some of the best-preserved lands in the United States.

Ranges across the United States have been used, throughout the 20th century, to train personnel to protect the United States of America. In these areas, soldiers learned to fire their weapons, use and other equipment, communicate and strategize, maneuver difficult terrain, and perform other skills necessary for effective defense.

In addition to keeping our country safe, this military training had two consequences:

First, it created areas with unexploded ordnance or **UXO**. These rounds, which did not explode upon impact, can cause injury or death if someone steps on, drives over, pounds on, or otherwise disturbs them. The military carefully secured these areas (especially impact areas) to keep people away from UXO and UXO away from people.

Because these lands were kept off limits to people and development, military training had a second consequence: **environmental preservation**. In fact, DoD ranges across the United States represent some of the best-preserved land in the country. Many former ranges harbor an abundance of endangered wildlife and imperiled plant species and represent important environmental oases in the midst of increasing sprawl.

To uniformly address the human health, environmental, and explosives safety concerns associated with these lands, Department of Defense (DoD) is developing the Range Rule, which spells out the requirements for studying and taking action on former range areas.

WHAT IS THE R3M?

Under the Range Rule, the Range Rule Risk Methodology (R3M) provides the tools to assist in making logical, systematic decisions concerning former range lands.

Developed by representatives from the military, the Environmental Protection Agency, state and tribal regulatory authorities, and the public, the R3M ensures that actions taken on the former range are:

- ⇒ Effective in protecting human health and the environment
- ⇒ Technically feasible
- ⇒ Fiscally responsible
- ⇒ Consistent with the intended land use

The R3M provides decision-makers the tools necessary to:

- ⇒ Gather sufficient, accurate data
- ⇒ Weigh factors to make informed decisions concerning response actions
- ⇒ Keep interested parties involved in the process
- ⇒ Take proactive action to reduce risk associated with unexploded ordnance and other materials

As former range lands transition to new uses, decision-makers must find environmentally sensitive ways to protect public safety through wise, UXO response actions.

WHO ARE THE DECISION-MAKERS?

The R3M is designed to be highly inclusive. In addition to involving Federal, state, and tribal regulatory authorities, this process involves key local representatives and the public.

Although the military as the primary decision-maker, the R3M process also includes representatives from the Environmental Protection Agency as well as state and tribal regulatory authorities. Throughout the R3M process, the Project Team (those responsible for applying the R3M) must keep the public informed and involved in this inclusive decision-making process.

To ensure that the Team has the necessary knowledge, it may include experts in such fields as:

- ⇒ Geology and Hydrogeology
- ⇒ Geophysics
- ⇒ Engineering
- ⇒ Statistics
- ⇒ Ordnance and Explosive Sciences
- ⇒ Environmental Sciences
- ⇒ Hydro-geology
- ⇒ Chemistry
- ⇒ Toxicology and Health Sciences

HOW DOES THE R3M WORK?

The Project Team uses seven steps when applying R3M:

1. Range Identification
2. Range Assessment
3. Range Evaluation
4. Response Selection
5. Site-Specific Action
6. Recurring Review
7. Close-Out

During any of these steps, the Project Team may decide to implement an **accelerated response** if they discover that there is an immediate threat. Accelerated response allows the Project Team to take immediate action to protect human health and the environment.

During all steps, the Project Team must keep interested parties informed about information they've found. The Team must also keep the public involved throughout the process.

Each step of the R3M is described briefly below:

STEP 1 *RANGE IDENTIFICATION*

In this first step, the Project Team collects data to verify that the property is indeed a range (either a closed, transferred, or transferring range). If it is classified as a range, it moves forward in the R3M process. If it is not a range, it may be subject to other laws and regulations.

STEP 2 *ASSESSMENT*

In step 2, the Project Team estimates how much UXO (or other materials) may be on the former range, where it is located, and what type it is. This data helps the Team identify areas that pose little or no risk and those areas that may pose greater risk.

STEP 3
RANGE EVALUATION

The team continues to collect data to make sure that the estimates they've made are accurate. These data give the Team the information they need to make informed choices concerning response actions.

STEP 4
RESPONSE SELECTION

Now the Team examines possible actions to protect public safety and the environment. They compare these actions using the following factors:

- ⇒ How well they protect safety, health, and the environment
- ⇒ Whether they comply with regulations
- ⇒ How effective they are during the action
- ⇒ How effective they are after the action
- ⇒ How practical they are to implement
- ⇒ How effectively they reduce the risk
- ⇒ How acceptable they will be to the community
- ⇒ Whether they will be acceptable to regulatory agencies
- ⇒ How cost effective they are

The Project Team examines and compares possible response actions. They choose the one(s) that best meet the needs of the specific site and its intended use, while protecting public safety and the environment.

After comparing possible actions, the Team chooses the one(s) that best meet the needs of the specific site and its intended use.

Each former range may be made up of many different parcels, each unique in topography, UXO amount and type, etc. Therefore, the Project Team must examine each parcel separately to choose the most appropriate action to take, given the parcel's uniqueness.

Depending upon the intended land use, actions may include one or more of the following on each parcel:

- ⇒ UXO clearance to various depths
- ⇒ UXO surface clearance
- ⇒ Signs, barricades, and fences
- ⇒ Educational campaigns to educate people about how to use former range areas safely

STEP 5
SITE-SPECIFIC ACTION

Once the Team has chosen the most appropriate action(s), they implement the chosen action on each parcel. During this important step, the Team ensures that the action does indeed adequately protect public safety, given the intended land use of the parcel.

STEP 6
RECURRING REVIEW

Once actions have been taken, the Team continues to review the site(s) to make sure the actions continue to protect public safety. If a decision was previously made that response actions were technically impracticable, the Team also considers new technologies to see if they may offer a better way to protect public safety and/or the environment at this site.

STEP 7
CLOSE-OUT

Once the Project Team has found that the chosen actions effectively protect public safety in the long term, they may close-out the R3M process.

(Note: The current version of the R3M does not set criteria for close-out, so ranges continue in the Recurring Review step until criteria for close-out have been developed).

WHY DO LAND USE DECISIONS MATTER?

The deeper the UXO clearance, the more environmental impact there will be.

Current and intended land use (how the land is and will be used) is a critical factor in taking appropriate response actions. Different land uses require different levels of UXO clearance.

For instance, if the land will be used for a housing development, UXO must be cleared to allow construction personnel to dig deeply into the earth. If the land will be used for agriculture, much less UXO clearance may be required since agriculture does not disturb the land as deeply. If the land will be used as a nature preserve, less extensive actions may be needed – decision-makers can choose to keep people safely away from UXO, much as the military has done, by erecting signs and fences and educating the public about how to use this land safely.

The deeper the UXO clearance procedures, the more environmental impact there will be (e.g. erosion and loss of important wildlife habitat). So decision-makers must clearly understand the effect that land use decisions will have on the environment.

More importantly, R3M decision-makers will examine the impact that land use decisions will have on public safety – because of the limitations of today's technology, some areas within the range (especially impact areas) may be difficult, even impossible, to make safe for housing developments or similar land uses. These limitations may also limit re-use options, so stakeholders need to work together to achieve resolution.

HOW CAN YOU BE INVOLVED?

Through wise, balanced decision-making, both public safety and the environment can be protected on former ranges.

We encourage you to be involved in this important process. Here are several ways that you can learn more and contribute your insight:

⇒ Visit your local information repositories – As the Project Team works through the R3M, findings will be placed in local information repositories. This information is always available to the public.

⇒ Take a tour of the former range – Visiting the area will give you the opportunity to see, first hand, the challenges faced by the Project Team and the valuable property transitioning to new uses.

⇒ Request a public meeting – At any stage of the R3M, you may request a public meeting. These meetings give you the opportunity to ask questions of experts, learn more about the process, and contribute your insight.

⇒ Join the local Restoration Advisory Board (RAB) or Extended Project Team (EPT) – Joining one of these teams will allow you to have input into decision making concerning the former range in your area.

⇒ Work with the Project Team – Interested citizens can work with the Project Team to understand the factors surrounding key decisions and provide their input into the decision-making process.

WHO CAN YOU CONTACT FOR INFORMATION?

Former Range _____

Land Owner

Name _____
Address _____
City _____ State _____
Phone Number _____ Fax _____
E-mail _____

Department of Defense Point of Contact (Public Affairs)

Name _____
Address _____
City _____ State _____
Phone Number _____ Fax _____
E-mail _____

Environmental Protection Agency Point of Contact

Name _____
Address _____
City _____ State _____
Phone Number _____ Fax _____
E-mail _____

State or Tribal Point of Contact

Name _____
Address _____
City _____ State _____
Phone Number _____ Fax _____
E-mail _____

For Copies of R3M Procedures Manual

_____
_____
_____

Local Information Repository (list all in the area)

_____
_____
_____

Helpful Web Sites

_____
_____

APPENDIX 4. GEOPHYSICAL PROVE-OUT AND QA/QC

Range conditions and limitations in technology pose challenges that may not detect 100 percent of the unexploded ordnance (UXO) present. These challenges do not change the overall goal of obtaining data to define the nature and extent of UXO or select appropriate response actions. Instead, the challenges create the need to define the effectiveness of applied search methodologies and geophysical detection technologies to the amount of undetected UXO that may remain.

In developing plans for UXO investigations and removal actions, the U.S. Environmental Protection Agency (EPA) has suggested a goal of 100 percent for surface and subsurface UXO removal. Although DOD agrees with this goal, evidence suggests it is currently not achievable for most ranges and conditions. Even under controlled testing conditions, such as those under which the testing was conducted during the Advanced Technology Demonstration (ATD) Program at Jefferson Proving Ground (JPG), average probabilities of detection ranged from 62 to 77 percent. While this Technology Demonstration Program found several technologies that are able to detect buried UXO with probabilities greater than 90 percent, many were less efficient and are achieved with significantly higher false alarm rates (FARs) than others.

The Project Team should consider all of the anticipated planning, performance, and reporting activities related to data collection efforts for the Range Evaluation and Response Selection steps when designing a geophysical prove-out. Before beginning, the Project Team should resolve five basic issues listed in the bullets below that will influence the development of the site-specific geophysical prove-out. All of the issues should be considered collectively prior to the development of the site-specific geophysical prove-out.

- ***Personnel:*** Personnel from different areas of expertise are needed to plan, collect, interpret, and report the data. Personnel experienced with the theoretical and practical aspects of detecting relatively small UXO and discriminating UXO from multiple non-UXO items that are also likely to be present should be consulted during the planning, performance, and reporting activities. The selection and utilization of geophysical equipment is complex and requires qualified, experienced individuals. A "qualified, experienced individual" is a person with a degree in geophysics, geology, geological engineering, or closely related field and who has a minimum of five years of directly related experience. Personnel with explosives ordnance disposal (EOD) training possess unique expertise in addressing and understanding the hazards present on military ranges. Geophysicists and EOD personnel will form the core group conducting the site-specific geophysical prove-out and should be involved in addressing issues discussed below.
- ***Technology Identification and Screening***—In addition to the physical and geographic conditions of the range, the effectiveness of searching and locating buried UXO is a function of the following elements: instrument type, instrument height, instrument orientation and direction of travel, measurement interval, search strategy, land width, UXO type, condition, and orientation. Consequently, these

factors, in conjunction with evaluations of different technologies, are crucial to the success of the data collection effort and removal actions. Technology demonstrations (e.g., JPG Technology Demonstration Phases I through IV) may only be useful to initially identify and screen potentially applicable technologies. Detection and location of UXO primarily depends on the ability of geophysical instruments to distinguish the physical characteristics of UXO from those of the surrounding environment. The best currently available detection systems all detect the metallic content of the UXO, not the explosive filler. Consequently, site-specific information is needed to make the most informed decisions regarding the selection and usage of geophysical instruments.

- Geophysical instruments do not have ordnance-specific detection rates. Detection rates are always site-specific and are highly dependent upon the type of ordnance at the site, how the ordnance was used, how deeply it is buried, environmental conditions, geologic conditions, and cultural influences. During tests of prototype technologies at JPG, the best munition detection rates of both ground-based conductivity meters and magnetometers were approximately 95%. In comparison, other systems tested at JPG that did not utilize either magnetometry or electromagnetics had extremely poor detection rates for buried ordnance.
- The general rule is, the larger the UXO, the deeper it can be detected. Based upon the work at JPG and at other sites, the typical maximum detection depth for various UXO can be estimated as a function of diameter of the object. The maximum possible depth of UXO is an important consideration in the selection of an appropriate detection system. If UXO is intentionally buried, factors such as type of soil, mechanical vs. hand-excavation, depth of water table affect burial depth. The depth of penetration can be estimated by considering soil type, munition type and weight, and impact velocity if the munition was fired or dropped. There are many cases where UXO can penetrate deeper than geophysical instruments can currently reliably detect. On such sites, it is possible that UXO remains deeper than it can be detected.
- Since detection and removal of buried UXO is a multi-stage process, it is important that positional information gathered at one phase be useable during subsequent phases. This means that all data collected must be tied to a common positional system. The positional system can be either temporary (e.g., temporary monuments, landmarks) or permanent (e.g., standard reference survey grid, tied to permanent monuments). This information should be obtained and entered into electronic format that is compatible with geographic information systems (GIS).

- ***Technology Selection***—Before initiating data collection activities, the Project Team will conduct demonstrations of potentially applicable geophysical detection technologies to identify the most appropriate technology for range conditions. EPA has indicated a preference for the use of follow-on site-specific demonstrations (i.e., geophysical prove-out tests or quality assurance [QA] test ranges), as they will more accurately represent actual site or range conditions. The results of these

tests should be independently reviewed to ensure reliability. The independent review is discussed in greater detail under the bullets labeled “Process QA” and “Product QA” below:

- The true UXO detection rate at an actual field site can be hard to determine. Several factors can significantly reduce the effectiveness of a geophysical survey, including vegetation, terrain, geologic noise/gradients, cultural noise (e.g., utilities, fences), UXO fragments, and UXO penetration beyond detection. These factors will reduce the actual achieved detection rate. However, since the true amount of UXO at a site is unknown, the detection rate, based upon items recovered, is also unknown. Actual detection rates are typically between 70 to 90 percent of UXO present, even when the best available technology is applied.
- All geophysical approaches have inherent strengths and weaknesses. Very seldom will one instrument or approach have the best absolute detection rate, the lowest FAR, the highest production rate, and the lowest cost. Test plots provide information used to select an optimum geophysical approach. Information obtained from the test plots will be used to develop false negative (UXO was present and not detected) and false positive rates (geophysics identifies anomalies that are found to be neither UXO nor UXO scrap). These rates can be used in specifying the tolerable limits on decision error in the Data Quality Objectives process.
- Team members and stakeholders often need site-specific data demonstrating detection depth. When a removal action is performed without a test plot, there may be little information to support the true depth of detection. A test plot, with target items buried at multiple depths, provides important information regarding depth and quality of clearance.
- Test plots provide a safe area for the geophysical investigation team to develop site-specific field and evaluation procedures necessary to demonstrate compliance with project requirements. However, often test plots provide a greater detection capability than will actually be achieved. This occurs for several reasons including the equipment often detecting the disturbances of the soil resulting from burying items in the test plot. In addition, the areas where test plots are set up are normally less heavily vegetated and away from areas containing buried debris. This is important to realize during Data Quality Objective development as well.
- Selection of the most appropriate geophysical approach will be based on best management practice. In determining which approach, which includes a single technology or group of technologies, is the “best value” for use at the subject range, the Project Team will balance the cost of operating the equipment versus the additional efficiency afforded by using that particular piece of equipment. For example, the geophysical prove-out might indicate one approach is 5% better than another, but might cost 50% more. In this case, the less expensive technology would probably be selected.

- ***Process Quality Assurance***—For characterization, the Project Team should consider designating qualified individuals to oversee all UXO quality assurance/quality control (QA/QC) activities. These individuals will be responsible for participating in the development of range-specific geophysical prove-outs, planning documents, and standard operating procedures (SOPs). Planning documents should include the either a Quality Assurance Project Plan (QAPP) or the elements of the QAPP. These elements are contained in EPA's *Requirements for Quality Assurance Project Plans for Environmental Data Operations, EPA QA/R-51*, which is an external policy document that establishes the requirements and specifications for QAPPs. Although many SOPs have been developed by different DOD agencies, guidance such as *Guidance for the Preparation of SOPs for Quality-Related Documents, EPA QA/G-62* provides non-mandatory guidance to help organizations develop and document SOPs.
- ***Product Quality Assurance***—The Project Team should independently review geophysical analyses following site characterization to demonstrate the effectiveness for the given site conditions. Many other aspects of the data collection effort should be independently reviewed. For example, assumptions regarding the UXO and fuzing made in earlier phases to support the assessment of risk should be verified. Independent reviews, specifically government reviews of contractor work, and demonstration that DQOs have been achieved are essential to a successful investigation.

1 *Requirements for Quality Assurance Project Plans for Environmental Data Operations, EPA QA/R-5*. October.
2 *Guidance for the Preparation of SOPs for Quality-Related Documents, EPA QA/G-6*. EPA/600/R-96/027. November.

APPENDIX 5. NCP EVALUATION CRITERIA

Criterion 1. Overall Protection of Human Health and the Environment

The worksheet presented in the Procedures Manual describes how to evaluate alternatives individually for this criterion.

Criterion 2. Compliance with Applicable and Relevant or Appropriate Requirements

This is a Threshold Criterion that considers how each alternative compares with ARARs. Sections 178.7(c)(2) and 178.9(d) of the Proposed Range Rule (DOD 1997) specify that the nine criteria have the same meanings as set forth in the NCP.

Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than Federal requirements may be applicable (40 Code of Federal Regulations [CFR] 300.5).

Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than Federal requirements may be relevant and appropriate (40 CFR 300. 5).

In addition to ARARs, other advisories, criteria, or guidance TBC also are evaluated to determine their appropriateness in evaluating the potential success of an alternative.

ARAR analysis must be tailored to site-specific conditions. For example, maximum contaminant levels (MCLs) under the Safe Drinking Water Act (SDWA) may be "relevant and appropriate" only if potential drinking water exists at the site. In future guidance implementing the Range Rule, DOD expects to provide a site-specific example of an ARAR analysis at a CTT range. In the meantime, EPA has provided examples of potential Federal and state ARARs and to be considered (TBCs) in the NCP (EPA 1990).

The scale presented below considers comparisons with ARARs and the acquisition of waivers. The same scale and related descriptions would apply to the Individual Analysis for other constituents. The only difference would be that the scale for other constituents would range from "1" to "3" rather than "A" through "C". The following scale is proposed

for this criterion to represent the score for the Individual Analysis, which later can be used for the Comparative Analysis:

A. Complies with ARARs
B.
C. Waivers required
D.
E. Waivers not available.

Although ARARs and waivers will be site-specific, potential regulations, policy, and guidance to be evaluated are presented below. Examples of potential Federal and state ARARs and TBCs include, but are not limited to, the items listed in Table 1, which was excerpted directly from the original NCP citation in the Federal Register (EPA 1990).

Table 1. Examples of Potential Federal and State ARARs and TBCs

1. Federal requirements which may be potential applicable or relevant and appropriate requirements

i. EPA's Office of Solid Waste administers inter alia. the Resource Conservation and Recovery Act (RCRA) of 1976, as amended (42 USC 6901). Potentially applicable or relevant and appropriate requirements pursuant to that act are:

a. Open Dump Criteria-Pursuant to RCRA subtitle D criteria for classifications of solid waste disposal facilities (40 CFR part 257) (Note: Only relevant to nonhazardous wastes)

b. RCRA subtitle C requirements governing standards for owners and operators of hazardous waste treatment, storage, and disposal facilities (40 CFR part 264, for permitted facilities, and 40 CFR par 265, for interim status facilities):

(1) Ground-Water Protection and Monitoring (40 CRF 264.90-264.109)

(2) Closure and Post Closure (40 CRF 264.110-264.120)

(3) Containers (40 CRF 264.170-264.178)

(4) Tanks (40 CRF 264.190-264.199)

(5) Surface Impoundments (40 CRF 264.220-264.249)

(6) Waste Piles (40 CRF 264.250-264.269)

(7) Land Treatment (40 CRF 264.270-264.299)

(8) Landfills (40 CRF 264.300-264.339)

(9) Incinerators (40 CRF 264.340-264.999)

(10) Land Disposal Restrictions (40 CRF 268.1-268.50)

(11) Dioxin-Containing Wastes (50 FR 1978)

(12) Standards for storage vessels for petroleum liquids (40 CRF part 60, subparts K and K(e))

(13) Codification rule for 1984 RCRA amendments (50 FR 28702, July 15, 1985; 52 FR 45788, December 1, 1987)

ii. EPA's Office of Water administers several potentially applicable or relevant and appropriate statutes and regulations issued thereunder:

a. Section 14.2 of the Public Health Service Act as amended by the Safe Drinking Water Act, as amended, (42 USC 300 (f)),

(1) Maximum Contaminant Levels (for all source of drinking water exposures) (40 CFR 141.11-141.18)

Table 1. Examples of Potential Federal and State ARARs and TBCs (continued)

(2) Maximum Contaminant Level Goals (40 CFR 141.50-141.52. 50 FR 46936)

(3) Underground Injection Control Regulations (40 CFR parts 144, 145, 146, 147)

b. Clean Water Act, as amended, (33 USC 1251)

(1) Requirements established pursuant to sections 301, 302, 303 (including state water quality/ standards), 304, 306, 307 (including federal pretreatment requirements for discharge into a publicly owned treatment works), 308, 402, 403, and 404 of the Clean Water Act (33 CRF parts 320-330, 40CFR parts 122, 123, 125, 131, 230, 231, 233, 400-469)

(2) Available federal water quality criteria documents are listed at 45 FR 79318, November 28, 1980; 49 FR 5831, February 15, 1984; 50 FR 30784, July 29, 1985; 51 FR 8012, March 7, 1986; 51 FR 22978, June 28, 1986; 51 FR 43665, December 3, 1986; 52 FR 6213, March 2, 1987; 53 FR 177, January 5, 1986; 53 FR 19028, May 26, 1986; 53 FR 33177, August 30 1988; 54 FR 19277, May 4, 1989.

(3) Clean Water Act section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material (40 CFR part 230)

(4) Procedures for Denial or Restriction of Disposal Sites for Dredged Material (Clean Water Act section 404(c) Procedures, 33 CFR parts 320-330, 40 CFR part 231)

c. Marine Protection, Research, and Sanctuaries Act (33 USC 1401) (1) Incineration at sea requirements (40 CFR part 220-225, 227-229. See also 40 CFR 125.120-125.124)

iii. EPA's Office of Pesticides and Toxic Substances administers the Toxic Substances Control Act (15 USC 2601). Potentially applicable or relevant and appropriate requirements pursuant to the Act are:

PCB requirements generally: 40 CFR part 761: Manufacturing, Processing, Distribution in Commerce, and Use of PCBs and PCB Items (40 CFR 761.20-761.30); Markings of PCBs and PCB Items (40 CFR 761.40-761.45); Storage and Disposal (40 CFR 761.60-761.79); Records and Reports (40 CFR 761.180-761.185, 761.187, and 761.193). See also 40 CFR 129.105.750.

iv. EPA's Office of External Affairs administers potentially applicable or relevant and appropriate requirements regarding requirements for floodplains and wetlands (40 CFR part 6, Appendix A).

v. EPA's Office of Air and Radiation administers several potentially applicable or relevant and appropriate statutes and regulations issued thereunder:

a. The Uranium Mill Tailings Radiation Control Act of 1978 (42 USC 2022) and Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings (40 CFR part 192).

b. Clean Air Act (42 USC 7401). (1) National Primary and Secondary Ambient Air Quality Standards (40 CFR part 50)

(1) Standards for Protection Against Radiation (10 CFR part 20). See also 10 CFR parts 10, 40, 60, 61, 72, 960, 961

(2) National Emission Standards for Hazardous Air Pollutants (40 CFR part 61). See also 40 CFR 427.110-427.116, 763

(3) New source performance standards (40 CFR part 60)

vi. Other Federal Requirements:

a. National Historic Preservation Act (16 USC 470). Compliance with NHPA required pursuant to 7 CFR part 650. Protection of Archeological Resources; Uniform Regulations—Department of Defense (82 CFR part 229), Department of the Interior (48 CFR part 7)

b. DOT Rules for the Transportation of Hazardous Materials , 49 CFR parts 67, 171, 172

c. The following requirements are also potentially ARAR:

(1) Endangered Species Act of 1973 (16 USC 1531). Generally, 50 CFR parts 81.25, 402

(2) Wild and Scenic Rivers Act (16 USC 1271)

(3) Fish and Wildlife Coordination Act (16 USC 681)

Table 1. Examples of Potential Federal and State ARARs and TBCs (continued)

(4) Federal Insecticide, Fungicide, and Rodenticide Act (7 USC 136), 40 CFR part 165

(5) Wilderness Act (10 USC 1131)Coastal Barriers Resources Act (16 USC 3901)

(6) Surface Mining Control and Reclamation Act (30 USC 1261)

(7) Coastal Zone Management Act of 1972 (16 USC 1451). Generally, 15 CFR part 990 and 15 CFR 923.46 for Air and Water Pollution Control Requirements

(8) Magnoson Fishery Conservation and Management Act (10 USC 1801 et seq.)

(9) Marine Mammal Protection Act (10 USC 1961 et seq.)

2. Examples of potential state ARARs:

i. State requirements for disposal and transport of radioactive wastes

ii. State approval of water supply system additions or developments

iii. State ground-water withdrawal approvals

iv. Requirements of authorized (subtitle C of RCRA) state hazardous waste programs

v. State implementation plans (SIPs) and delegated programs under the Clean Air Act

vi. Approved state NPDES program under the Clean Water Act

vii. Approved state underground injection control (UIC) programs under the Safe Drinking Water Act

viii. Approved state wellhead protection programs

ix. State water quality standards

x. State air toxics regulations

3. Other federal criteria, advisories, and guidance to be considered

i. Federal Criteria, Advisories, and Procedures

a. Health Effects Assessments (HEAs) and Proposed HEAs ("Health Effects Assessment Summary Tables," updated quarterly)

b. RfDs (RfDs) ("Health Effects Assessment Summary Tables," updated quarterly, or "Integrated Risk Information System (IRIS)," updated monthly)

c. Slope Factors for Carcinogens ("Health Effects Assessment Summary Tables," updated quarterly or "Integrated Risk Information System (IRIS)," updated monthly)

d. Pesticides registrations and registration data

e. Pesticides and food additive tolerances and action levels

Note: Germane portions of tolerances and action levels may be pertinent and therefore are to be considered in certain situations

f. PCB Spill Cleanup Policy (52 FR 10688, April 2, 1987)

g. Waste load allocation procedures (40 CFR parts 125, 130)

h. Federal sole source aquifer requirements (52 FR 8873, March 5, 1987)

i. Public health basis for the decision to list pollutants as hazardous under section 112 of the Clean Air Act

j. EPA's Ground-Water Protection Strategy

k. Guidance on Remedial Actions for Contaminated Ground-Water at Superfund Sites (Draft, October 1986) established criteria for the use of background concentrations and ACLs

l. Superfund Public Health Evaluation Manual

m. TSCA health data

n. TSCA chemical advisories

Table 1. Examples of Potential Federal and State ARARs and TBCs (continued)

- o. ATSDR Toxicological Profiles
- p. Advisories issued by the FWS and NWFS under the Fish and Wildlife Coordination Act
- q. TSCA Compliance Program Policy ("TSCA Enforcement Guidance Manual Policy Compendium," EPA, OECM, OPTS, March 1985)
- r. Health Advisories, EPA Office of Water

ii. EPA/DOT Guidance Manual on Hazardous Waste TransportationEPA RCRA Guidance Documents

- a. Alternate Concentration Limits (ACL) Guidance (Draft)
- b. EPA's RCRA Design Guidelines
  - (1) Surface Impoundments—Liner Systems, Final Cover, and Freeboard Controls
  - (2) Waste Pile Design—Liner Systems
  - (3) Land Treatment Units
  - (4) Landfill Design—Liner Systems and Final Cover
- c. Permitting Guidance Manuals
  - (1) Permit Applicant's Guidance Manual for Hazardous Waste Land Treatment, Storage, and Disposal Facilities
  - (2) Permit Applicant's Guidance Manual for the General Facility Standards of 40 CFR 264
  - (3) Permit Writer's Guidance Manual for Hazardous Waste Land Treatment, Storage, and Disposal Facilities
  - (4) Permit Writer's Guidance Manual for the Location of Hazardous Waste Land Storage and Disposal Facilities: Phase I, Criteria for Location Acceptability and Existing Regulations for Evaluating Locations
  - (5) Permit Writer's Guidance Manual for Subpart F
  - (6) Permit Applicant's Guidance Manual for the General Facility Standards
  - (7) Waste Analysis Plan Guidance Manual
  - (8) Permit Writer's Guidance Manual for Hazardous Waste Tanks
  - (9) Model Permit Application for Existing Incinerators
  - (10) Guidance Manual for Evaluating Permit Applications for the Operation of Hazardous Waste Incinerator Units
  - (11) A Guide for Preparing RCRA Permit Applications for Existing Storage Facilities
  - (12) Guidance Manual on Closure and Post-Closure Interim Status Standards
- d. Technical Resource Documents (TRDs)
  - (1) RCRA Ground-Water Monitoring Technical Enforcement Guidance Document
  - (2) Evaluating Cover Systems for Solid and Hazardous Waste
  - (3) Hydrologic Simulation of Solid Waste Disposal Sites
  - (4) Landfill and Surface Impoundment Performance Evaluation
  - (5) Lining of Water Impoundment and Disposal Facilities
  - (6) Management of Hazardous Waste Leachate
  - (7) Guide to the Disposal of Chemically Stabilized and Solidified Waste
  - (8) Closure of Hazardous Waste Surface Impoundments
  - (9) Hazardous Waste Land Treatment

Table 1. Examples of Potential Federal and State ARARs and TBCs (continued)

(10) Soil Properties Classification and Hydraulic Conductivity Testing

e. Test Methods for Evaluating Solid Waste

(1) Solid Waste Leaching Procedure Manual

(2) Methods for the Prediction of Leachate Plume Migration and Mixing Hydrologic Evaluation of Landfill Performance (HELP) Model Hydrologic Simulation and Solid Waste Disposal Sites

(3) Procedures for Modeling Flow Through Clay Liners to Determine Required Liner Thickness

(4) Test Methods for Evaluating Solid Wastes

(5) A Method for Determining the Compatibility of Hazardous Wastes

(6) Guidance Manual on Hazardous Waste Compatibility

iii. EPA Office of Water Guidance Documents

a. Pretreatment Guidance Documents. (1) 304(g) Guidance Document on Revised Pretreatment Guidelines (3 volumes)

b. Water Quality Guidance Documents.

(1) Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters (1977)

(2) Technical Support Manual: Waterbody Surveys and Assessments for Conducting Use Attainability Analyses (1983)

(3) Water-Related Environmental Fate of 129 Priority Pollutants (1979)

(4) Water Quality Standards Handbook (1983)

(5) Technical Support Document for Water Quality-Based Toxics Control

(6) Developing Requirements for Direct and Indirect Discharges of CERCLA Wastewater (1987)

c. NPDES Guidance Documents

(1) NPDES Best Management Practices Guidance Manual (June 1981)

(2) Case studies on toxicity reduction evaluation (May 1983)

d. Ground-Water/UIC Guidance Documents

(1) Designation of USDW

(2) Elements of Aquifer Identification

(3) Definition of major facilities

f. Corrective action requirements

(4) Requirements applicable to wells injecting into, through, or above an aquifer that has been exempted pursuant to 40 CFR 146.104(b)(4)

(5) Guidance for UIC implementation on Indian lands

e. Clean Water Act Guidance Documents

f. Guidance for Applicants for State Well Head Protection Program Assistance Funds under the Safe Drinking Water Act (Office of Ground-Water Protection, June 1987)

iv. EPA Manuals from the Office of Research and Development

a. SW 846 methods—laboratory analytic methods

(1) Lab protocols pursuant to Clean Water Act section 304(h)

Table 1. Examples of Potential Federal and State ARARs and TBCs (continued)

b. Other,
c. Data Quality Objectives. Volumes I and II
d. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (Draft)
e. Guidance on Preparing Superfund Decision Documents: The Proposed Plan and Record of Decision (Draft)
f. Standard Operating Safety Guides

Criterion 3. Long-Term Effectiveness and Permanence

The worksheet presented in the Procedures Manual describes how to evaluate alternatives individually for this criterion.

Criterion 4. Reduction in Toxicity, Mobility, and Volume

This is a Primary Balancing Criterion and assesses the degree to which response alternatives employ recycling or treatment that reduce toxicity, mobility, and volume. Response alternatives that, at a minimum, address the principal threats posed by the range to the local environment through treatment will be identified when conducting the Individual Analysis. Considerations for the evaluation of this criterion are as follows:

- Treatment or recycling processes and the materials to be treated
- Amount of hazardous substances, pollutants, or contaminants to be destroyed, treated, or recycled
- Degree of expected reduction in toxicity, mobility, and volume, including the means by which the principal threat is addressed through treatment or recycling
- Degree to which the treatment is irreversible
- Type, quantity, or volume of residuals that will remain following treatment, considering the persistence, toxicity, mobility, and propensity to bioaccumulate such hazardous substances and constituents
- The degree to which the treatment reduces the inherent hazards posed by the principal threat at the range.

The primary reason for the treatment of UXO is to remove the characteristics of reactivity and ignitability. A secondary concern is the degree of residual contamination remaining after treatment. For the purposes of this evaluation, reactivity and ignitability will be evaluated as a function of the Individual Analysis for explosives safety and the residual contamination will be addressed as a function of the Individual Analysis for other constituents.

When conducting these analyses, decisionmakers need to consider the multiple sources that may generate waste during clearance operations on ranges and prioritize the associated concerns (i.e., explosives safety and other constituents) for: (1) UXO

(explosives safety), (2) UXO filler material (explosives safety and other constituents), (3) UXO related debris and target materials (other constituents), and (4) contaminated environmental media (other constituents). When evaluating response alternatives against the Reduction in Toxicity, Mobility, and Volume criterion, consider the degree to which the response alternative will render the hazards non-reactive and non-ignitable, while also determining the presence of residual contamination of environmental media.

The same scale and related descriptions for explosives safety would apply to the Detailed Analyses for other constituents. The only difference would be that the scale for other constituents would range from "1" to "5" rather than "A" through "E." The following scale is proposed for this criterion to represent the score for the Individual Analysis, which later can be used for the Comparative Analysis:

A. Treatment with environmental controls
B. Treatment without environmental controls
C. Partial treatment with environmental controls, LUCs, and storage
D. Partial treatment without environmental controls
E. Reduction in toxicity, mobility, and volume through treatment.

The following bullets include examples of how response alternatives intended to address UXO concerns (i.e., UXO_{UXO} and UXO_{OC}) would be scored using this scale. Similar examples would apply to alternatives intended to address other constituents, except these designations would be OC_{OC} or OC_{UXO}.

- Demilitarization (recycling, recovery, and reuse) of UXO and thermal treatment of UXO related debris and target materials (flashing, flaming, hot gas decontamination) would score as "A" for UXO_{UXO} and "1" for UXO_{OC}.
- Thermal treatment (open burning/open detonation [OB/OD], flashing or flaming, hot gas decontamination) of UXO (including bulk explosives) and UXO-related debris and target material would score a "B" for UXO_{UXO} and "2" for UXO_{OC}.
- Use of a Bang-box device that captures off-gases for the treatment of UXO and thermal treatment of UXO-related debris and target materials would score as "A" for UXO_{UXO} and "1" for UXO_{OC}.
- Assuming that UXO is sent off-site for treatment because environmental controls are not available for on-site treatment, the alternative would score an "A" for UXO_{UXO} and a "1" or "3" for UXO_{OC}. The actual selection for UXO_{OC} would be based upon whether the treatment facility operated with or without environmental treatment controls.

Criterion 5. Short-Term Effectiveness

The worksheet presented in the Procedures Manual describes how to evaluate alternatives individually for this criterion. However, Scores for the Input Variables (i.e., Ecological Impacts, Socio-Economic Impacts, and Cultural Impacts) first must be obtained to evaluate Environmental Impacts. The following paragraphs explain how to evaluate Environmental Impacts for the Short-Term Effectiveness Worksheets.

In some cases, decisionmakers might believe that an alternative should automatically be scored as a "severe effect" because a permanent and severe negative impact should not be offset by other factors (e.g., permanent destruction of a nesting area for a threatened or endangered species). If a severe negative impact is not relevant, a preliminary analysis is required that relies on a matrix to generate scores for each Input Variable. Table 2 illustrates an example matrix with the basic structure and elements needed for evaluating Ecological Impacts. This matrix includes examples of site-specific natural resources. Natural resources can be added or deleted from this example matrix as warranted by site-specific conditions.

Table 2. Example Matrix for Evaluating Ecological Impacts

Site-Specific Natural Resource Scale		Ecological Impact Scale					
		Severe Effect	Measurable Effect	No Measurable Effect	Protects Existing Resources	Permanent Benefit	
		5	4	3	2	1	
Threatened or Endangered Species	5	X					25
Wetlands	4				X		8
Wild and Scenic River	3					X	3
Coastal Resources	3			X			9
Migratory Birds	3				X		6
High Soil Erosivity	2				X		4
High Soil Permeability	1		X				4
Sum of Natural Resource Scale	21	Sum of Natural Resource x Ecological Impact					59
Overall Score = Ecological Environmental Impact: 59/21 ~3							

To use this matrix, decisionmakers will develop a list of and relative scores for each natural resource characteristic of the range. Then, for each response alternative, decisionmakers will determine the ecological impact of the alternative on each resource (i.e., by placing an "X" in the appropriate cell). Table 3 includes definitions for the ecological impacts listed across the top of Table 2. The cross-product of the relative score and the ecological impact then should be calculated for each ecological resource. For example, in Table 2, "threatened and endangered species" are ranked highest among natural resources (i.e., score = 5). It receives a relative score of "5" because of the temporary stresses on a threatened species indigenous to the range. Thus, the cross-product is "25;" which is displayed in the far right column of Table 2. The sum of each cross-product divided by the sum of the relative scores for all of the listed natural

resources equals the numerical score for that particular Input Variable (e.g., “3” on the bottom row of Table 2).

This procedure is repeated to evaluate Socio-Economic and Cultural Impacts of each alternative. Tables 3 through 7 provide additional information for the inputs needed to complete these analyses.

Table 3. Definition of Terms for Ecological Impacts

Score	Term	Definition
1	Permanent benefit	Overall impact that results in increase and protection in the productivity or biodiversity of the ecosystem or species
2	Protects existing resources	Overall impact that results in the protection of the viability of existing ecosystems or species
3	No measurable effect	Overall impact that results in no loss in viability of an existing ecosystem or species
4	Measurable, but not severe effect	Overall impact that results in a loss or decrease in the viability of a renewable ecosystem or species
5	Measurable, severe effect	Injury that results in a net or permanent loss in viability of an ecosystem or species

Viability–the capacity of the species or ecosystem to sustain the population through self-renewal or reproduction.

Data to support the analysis of ecological impacts may be obtained through any of the following activities:

Qualitative comparison of ecological surveys and the scope of the subject response actions

Ecological surveys may include: population studies, threatened and endangered species determinations, and habitat evaluation profiles

At a minimum, review the threatened and endangered species list for the range

Table 4. Example Matrix for Evaluating Socio-Economic Impacts

Site-Specific Socio-Economic Considerations		Socio-Economic Impact Scale					
		Eliminates Value or Resource	Reduces Value or Resource	Status-quo	Protects Value or Resource	Enhances Value or Resource	
		5	4	3	2	1	
Health	5	X					25
Happiness	4				X		8
Well Being	4					X	4
Unemployment Rate	3			X			9
Low Income *	3			X			9
Minority Population *	3			X			9
Cost	2				X		4
Earning Capacity	2				X		4
Property Value	1		X				4
Sum of Socio-Economic Consideration Scale	27	Sum of Socio-Economic Considerations x Socio-Economic Impact					76

Overall Score = Socio-Economic Environmental Impact: 76/27 ~3

* Considerations for low income and minority populations are included to evaluate potential environmental justice issues related to response alternatives

Table 5. Definition of Terms for Socio-Economic Impacts

Score	Term	Definition
1	Enhances value or resource	Overall impact that results in increase and protection of the welfare and economic status of the surrounding community
2	Protects value or resource	Overall impact that results in the protection of welfare and economic status of the surrounding community
3	Status-quo	Overall impact that results in no measurable gains or losses of welfare or economic status of the surrounding community
4	Reduce value or resource	Overall impact that results in a temporary decrease in the welfare and economic status of the surrounding community
5	Eliminates value or resource	Injury that results in a net or permanent decrease in welfare and economic status of the surrounding community

Welfare–includes the health, happiness, and well-being of all members of the community

Economic status–includes the average income level, property value, earning capacity, unemployment rate.

Data to support the analysis of socio-economic impacts may be obtained through any of the following activities:

Qualitative comparison of socio-economic measures and the scope of the subject response actions

Socio-economic measures are: welfare (see above) and economic status (see above)

Table 6. Example Matrix for Evaluating Cultural Impacts

Cultural Resource		Cultural Impact Scale					
		Loss of Resource	Damages Resource	Status-quo	Protects Resource	Enhances Resource	
		5	4	3	2	1	
Archaeological Site Addressed Under Archaeological Resources Protection Act (ARPA) or National Register of Historic Places (NRHP)	4	**X**					20
Native American Human Remains/Objects Addressed by Native American Graves Protection and Repatriation Act (NAGP&RA)	4				**X**		8
Native American Sacred Site	4				**X**		8
Significant Historic Building	1		**X**				4
Sum of Cultural Resource Scale	13	Sum of Cultural Resource x Cultural Impact					40

Overall Score = Cultural Environmental Impact: 40/13 ~3

5 = Archaeological sites or sacred site with Native American human remains and/or burial sites

4 = Native American sacred sites without Native American human remains

2 or 3 = Significant* archaeological sites without Native American human remains or significant* historic buildings

* Significant cultural resources are listed or are eligible for listing on the NRHP.

Table 7. Definition of Terms for Cultural Impacts

Score	Term	Definition
1	Enhances resources	Overall impact that results in an increase and protection in the value of cultural resources on the range
2	Protects resources	Overall impact that results in the protection but not increase in the value of cultural resources on the range
3	Status-quo	Overall impact that results in no measurable gains or losses in the value of cultural resources on the range
4	Damages resources	Overall impact that results in a loss of protection but not value of cultural resources on the range
5	Loss of resources	Overall impact that results in a loss of protection and value of cultural resources on the range

Cultural resources–include anthropologic, archaeological, ethnographic, ethnologic, linguistic, social, and psychological elements

Cultural resources–sometimes renewable (e.g., renew an arts program)

Qualitative comparison–of cultural resource elements and measures versus the scope of the subject response actions

The evaluation of Socio-Economic impacts requires decisionmakers to conduct an analysis to determine if environmental justice is a concern or potential concern. To conduct this analysis, decisionmakers should evaluate impacts or potential impacts of each alternative on minority and low-income communities living on and/or surrounding the range. Examples include how response alternative would impact minority or low-income communities versus non-minority, affluent communities, or how subsistence farming or fishing patterns relate to the response alternatives.

Criterion 6. Implementability

The worksheet presented in the Procedures Manual describes how to evaluate alternatives individually for this criterion.

Criterion 7. Cost

This is a Primary Balancing Criterion that is used to evaluate the capital cost, annual O&M cost, and net present value costs associated with implementing each alternative with consideration of discount rates over a 30-year period. The 30-year period adopted in this document is consistent with the NCP (EPA 1991b) and does not represent a limitation on the length of response implementation. It is used in this context for subsequent use during the Comparative Analysis to evaluate the differences in costs between alternatives. As such, the cost estimates will need to be revised prior to the end of the original O&M period.

When conducting the Individual Analysis of Response Alternatives, decisionmakers should compare net present value costs associated with implementing each alternative. In addition, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA 1988) indicates that “order-of-magnitude” costs estimates having a desired accuracy of -30 and +50 percent should suffice for the Detailed Analysis of Response Alternatives for this criterion.

Criterion 8. Acceptance by Appropriate Regulatory Agencies or Agencies with Jurisdiction Over Affected Resources

This is a Modifying Criterion and considers apparent preferences or concerns about alternatives among regulatory agencies involved in the decisionmaking process. Dialogue between members of the project team should be maintained throughout the process. However, formal evaluation of this criterion should precede remedy selection, which is the final step in the Detailed Analysis of Response Alternatives. As presented in this document, this criterion differs slightly from the NCP to account for ranges where a primary governing body is not a Federal or state agency, such as an Indian Tribe.

The scale proposed for decisionmakers to use in evaluating alternatives for this criterion does not require the development of detailed tools or definitions. Decisionmakers at individual ranges will determine where the alternatives fall, with respect to the proposed scale. The same scale and related descriptions would apply to the Detailed Analyses of Response Alternatives for explosives safety and other constituents. The only difference

would be that the scale for other constituents would range from “1” to “3” rather than “A” through “C”. The following scale is proposed for this criterion to represent the score for the Individual Analysis of Response Alternatives that later can be used for the Comparative Analysis of Response Alternatives:

A. Full support
B.
C. Partial or conditional support
D.
E. No support.

Criterion 9. Community Acceptance

This is a Modifying Criterion and considers preferences of the surrounding community among alternatives. This criterion only may be fully evaluated following the close of the comment period on the Draft Site-Specific Response Evaluation Report for the range response action.

Community acceptance may be estimated based on community outreach efforts, but full evaluation of this criterion should be the last phase of the process prior to remedy selection. These community outreach efforts include, but are not limited to, the development of the PIP, RAB meetings, public meetings, and other widely accepted mechanisms. The following scale is proposed for this criterion to represent the score for the Individual Analysis that later can be used for the Comparative Analysis:

A. Full support
B. Most support
C.
D. Few support
E. No support.

The scale proposed for decisionmakers to use in evaluating alternatives for this criterion does not require the development of detailed tools or definitions. In addition, the same scale and related descriptions would apply to the Detailed Analyses of Response Alternatives for explosives safety and other constituents. The only difference would be that the scale for other constituents would range from “1” to “3” rather than “A” through “C.”

Decisionmakers at individual ranges will determine where the alternatives fall with respect to the proposed scale and should consider the following: whether or not the community would prefer a different alternative and how many community members provided input. For example, if a community supported a source removal alternative, but preferred the selection of a pump-and-treat alternative, the Community Acceptance would result in a score of “B.”