

**ENGINEERING EVALUATION/COST ANALYSIS  
ANNOTATED OUTLINE  
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## ACRONYMS

ARAR	applicable or relevant and appropriate requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	U.S. Department of Energy
EE/CA	Engineering Evaluation/Cost Analysis
EM	Environmental Management
FS	Feasibility Study
NEPA	National Environmental Policy Act
NPL	National Priorities List
O&M	operating and maintenance
ORO	Oak Ridge Operations
RI	Remedial Investigation
RmAO	removal action objective
TBC	to be considered (guidance)

This annotated outline was written to be used as a guide for preparation of Engineering Evaluation/Cost Analysis (EE/CA) reports under the U.S. Department of Energy (DOE) Oak Ridge Operations (ORO) Environmental Management (EM) program. This document addresses preparation of an EE/CA report for a particular project, study area, or operable unit, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) area, or release site, hereinafter referred to as the “site.” (Typically the scope of an EE/CA is more focused than a feasibility study.)

## **EXECUTIVE SUMMARY**

Include an executive summary in all EE/CA reports. The executive summary appears on a separate page or pages in the front matter of the document and briefly summarizes the overall EE/CA report, results, and the recommended removal action alternative. The executive summary should be on blue paper. The summary includes one or two sentences on each of the following items:

- site description (background, previous investigations);
- removal action objectives (RmAOs) (scope, regulatory requirements, justification);
- removal action technologies/alternatives;
- evaluation of alternatives for removal action [effectiveness, implementability, cost, compliance with applicable or relevant and appropriate requirements (ARARs)];
- recommended removal action; and
- anticipated project schedule.

## **1. INTRODUCTION**

In accordance with the guidance on non-time-critical removal actions under CERCLA, this section summarizes available data used to characterize the subject site and surrounding areas, including current and historical information. Sufficient detail should be provided to allow the reviewer to analyze and understand the proposed alternatives. Site characterization data should be divided into the following sections for organizational purposes.

### **1.1 SITE DESCRIPTION**

The site description provides a physical description of the site. Include a map showing the site’s general location and surrounding features. Briefly explain the location of the site with respect to other features in the area. Include a general description of the topographic features of the surrounding area, and adjacent land use (including potential off-site receptors). Include population and commercial centers, parks, schools, and agricultural areas within a 5-mile radius (or other radius, as appropriate), as well as major water bodies. Discuss the vegetation and wildlife found in the surrounding area.

Provide descriptions of the physical condition of the site, including climate, air quality, ecology, topography, surface water hydrology and wetlands, geology and soils, and groundwater (including groundwater flow direction). Describe the relationship of the site within the watershed.

## **1.2 SITE HISTORY**

Discuss the background (history) of the site operations, including any ownership changes; the types and volume of waste(s) produced, disposed of, or handled; and regulatory background. Present the historical operational and management practices of the site.

## **1.3 PREVIOUS INVESTIGATIONS AND REMOVAL ACTIONS**

In this section, discuss any previous remedial investigations and removal/cleanup actions that have taken place, with reference to the regulatory drivers. Include the scope and objectives of previous removal actions, amount of time and money spent, nature and extent of contaminated material treated or controlled by the previous removal action, and technologies and treatment levels used for previous removal actions.

Where appropriate, include the analytical results of previous site investigations and removal actions in tabular form with sample locations shown on site figures. Discuss the regulatory status of the site relative to any following decisions.

## **1.4 SOURCES, NATURE, AND EXTENT OF CONTAMINATION**

Discuss contaminants and their sources detected at the site, including their location; quantity; volume, size, or magnitude; and physical and chemical characteristics of the hazardous substance(s), pollutant(s), or contaminant(s). Compare contaminant concentrations to background values for all media. Also, discuss the approximate extent (boundaries) of the contaminant plumes, if it can be determined. Present any information pertinent to soils and vadose zone characteristics, groundwater, surface water, and sediments that affect the nature and extent of the contamination.

Note: The detail of this section may be significant if the site investigation information is not documented elsewhere. However, if the removal is part of a larger project and site information is presented elsewhere, summary information may be contained in this section with references to the existing detailed information.

## **1.5 STREAMLINED RISK EVALUATION**

The streamlined risk evaluation is intermediate in scope between the limited risk evaluation performed for emergency removal actions and the conventional baseline risk assessment conducted during a CERCLA Remedial Investigation (RI)/Feasibility Study (FS). A streamlined risk assessment should focus on the specific problem the removal action is intended to address (e.g., contaminants from a source, groundwater plume). The streamlined risk assessment must, at a minimum, identify contaminants of concern in the affected media, contaminant concentrations, and toxicity associated with the contaminant and should be of sufficient detail to justify the cleanup action. In addition, identify exposure pathways that indicate an obvious threat to human health or the environment through comparison with potential chemical-specific ARARs (e.g., maximum contaminant levels, maximum contaminant level goals). Section 2.3 presents a detailed discussion of ARARs.

Include a brief description of contaminant sources and receiving media, fate and transport of contaminants of concern in release media, a summary of exposure pathways, reasonable maximum exposure, and potentially exposed populations. As with Sect. 1.4, there is flexibility in the amount of detail that may be necessary. A more complete risk assessment, including human health and environmental risks, may be appropriate for removal action sites that may require comprehensive actions to be performed at the site. Likewise, a very focused risk assessment may be most appropriate for phased removal action projects.

## **2. REMOVAL ACTION OBJECTIVES**

This chapter identifies the scope, goals, and objectives for a non-time-critical removal action. Defining the scope of the removal action is critical because the removal measure may be only an interim measure to abate, prevent, minimize, stabilize, mitigate, or eliminate a release or potential release, and a following ROD will fully address the concerns at the site.

Authority for responding to releases from a hazardous waste site is addressed in Sect. 104 of CERCLA. Executive Order 12580 delegates to DOE the authority for removal actions at DOE sites whether or not the sites are on the National Priorities List (NPL). Under CERCLA 104(b), DOE is authorized to undertake such investigations, surveys, testing, or other data gathering deemed necessary to identify the existence, extent, and nature of the contaminants, including the extent of threats to human health and the environment. In addition, DOE is authorized to undertake planning, engineering, and other studies or investigations appropriate to directing response actions to prevent, limit, or mitigate the risk to human health and the environment.

### **2.1 SCOPE AND PURPOSE**

Define the specific objectives of the removal action here (e.g., total site cleanup, site stabilization, or surface cleanup of hazardous substances). Describe how the removal action for the site is related to other decisions within the watershed and to the ORR remediation strategy.

### **2.2 JUSTIFICATION FOR THE PROPOSED ACTION**

Present a summary of the relevant factors pertaining to the site that necessitate a removal action. This includes identifying that a threat or potential threat to the public or the environment exists. Also, discuss the rationale for conducting the project as a removal action.

### **2.3 IDENTIFICATION OF ARARS**

In accordance with the National Contingency Plan [40 CFR 300.415(j)] and DOE-Headquarters guidance, on-site removal actions conducted under CERCLA are required to meet ARARs “to the extent practicable, considering the exigencies of the situation.” ARARs include only federal and state environmental or facility siting laws or regulations. They do not include occupational safety or worker radiation protection requirements. Additionally, per 40 CFR 300.405(g)(3), other advisories, criteria, or guidance may be considered in determining remedies [so called to-be considered (TBC) guidance category]

ARARs are typically divided into three groups: (1) chemical-specific; (2) location-specific; and (3) action-specific. Chemical-specific ARARs establish an acceptable amount or concentration that may remain in or be discharged to the ambient environment. Location-specific ARARs include restrictions placed on the conduct of activities solely because they occur in special locations such as wetlands, floodplains, historic properties, or critical habitat. Action-specific ARARs are usually technology or activity based requirements or limitations on actions taken with respect to hazardous substances, or other particular circumstances at a site.

Compile a comprehensive list of site-specific ARARs/TBC pertaining to the scope of the removal action alternatives. The complete listing is usually presented in tabular form in an appendix. Also, include a brief discussion of the ARARs/TBC related to the action including anticipated wastestreams, waste storage, treatment or disposal requirements, or any other particular requirements that may be of special consideration.

### **3. REMOVAL ACTION TECHNOLOGIES AND DEVELOPMENT OF ALTERNATIVES**

#### **3.1 TECHNOLOGY IDENTIFICATION AND SCREENING**

This section identifies the applicable technologies based on site-specific conditions and the contaminants. If appropriate, an additional technology screening step can be conducted to limit the number of technologies on the basis of effectiveness, implementability, and cost evaluation. However, the typical EE/CA technology screening process is focused and evaluates only those technologies that have proven to be effective at similar sites.

#### **3.2 DEVELOPMENT OF ALTERNATIVES**

In this section, technologies from Sect. 3.1 are combined (if applicable) to form alternatives to meet the RMAO. Present a detailed description of each alternative. The use of presumptive remedy guidance can, in many cases, provide an immediate focus for the selection of alternatives. Develop a limited number of alternatives (two to four), including no action, for detailed analyses. The descriptions, at a minimum, cover overall implementation of the alternative, technologies or processes to be used (including schematics or flow charts), wastes generated (site and process), waste disposal, and regulatory requirements (National Pollutant Discharge Elimination System or air quality permits required, etc.). The description of the selected alternative (Chap. 5) will provide greater detail on the attributes of the selected alternative.

Insert the following or similar text as a common component of all action alternatives:

The DOE and its contractors will systematically integrate safety into management and work practices at all levels so that the implementation of the removal action is accomplished while protecting the public, the worker, and the environment. This will be accomplished through effective integration of safety management into all facets of work planning and execution.

## 4. ANALYSIS OF ALTERNATIVES

### 4.1 INDIVIDUAL ANALYSIS OF ALTERNATIVES

This section presents an individual analysis of the alternatives based on effectiveness, implementability, and cost.

#### 4.1.1 Effectiveness

Discuss the effectiveness of each alternative to meet the objectives of the removal action. Evaluate effectiveness in terms of the following criteria (all subcriteria need not be addressed):

- Overall protection of human health and the environment (i.e., soil and water resources, air quality, vegetation and wildlife, cultural resources);
- Compliance with ARARs;

Each alternative must be evaluated against any ARARs/TBC that have been identified [see Section 2.3] to determine if it meets them. Alternatives that do not meet an ARAR(s) must either utilize a waiver under CERCLA 121(d)(4) or are eliminated from further consideration.

On-site response actions must comply, to the extent practicable, with the substantive requirements which may be ARAR. In general, compliance with most federal and state ARARs will be practical during removal actions. As noted in the NCP, however, in some rare situations (e.g., emergency or time-critical removal actions), complying with an ARAR may not be practicable. In determining whether compliance with ARARs is practicable, DOE must consider the urgency or degree of threat posed by the site and the appropriate scope of response (i.e. removal) action.

- Long-term effectiveness and permanence;
  - magnitude of residual risk;
  - adequacy and reliability of controls (including any institutional controls);
  - reduction of toxicity, mobility, or volume through treatment;
  - treatment process used and materials tested;
  - amount of hazardous material destroyed or treated;
  - degree of reduction expected in toxicity, mobility, or volume;
  - degree to which treatment is irreversible;
  - type and quantity of residuals remaining after treatment;
  - assessment of whether the alternative will satisfy the preference for treatment;
- Short-term effectiveness;
  - protection of the community during the action;
  - protection of workers during the action;
  - environmental impacts;
  - time until removal objectives are achieved.

#### 4.1.2 Implementability

Address the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during implementation. Consider the following subcriteria under implementability:

- Ability to construct and operate the technology,
- Reliability of the technology,
- Ease of implementing additional response technologies (if necessary),
- Ability to monitor effectiveness,
- Ability to obtain approval from other agencies,
- Ease of coordination with other agencies,
- Availability of off-site treatment, storage, and disposal services and capacity,
- Availability of necessary equipment and specialists,
- Availability of prospective technologies, and
- Likelihood of treatability studies being required to define operational characteristics.

#### **4.1.3 Cost**

Evaluate each alternative to determine the projected costs. Consider the following costs:

- Capital costs,
- Operating and maintenance (O&M) costs (annual), and
- Periodic costs (replacement or abandonment)

Estimate the capital cost in dollars (adjusting for the effects of inflation between the time when the EE/CA is prepared and the time of implementation, if this is a significant period). Estimate the annual O&M costs and indicate the period of time during which the removal action system will be operating prior to being addressed in a ROD. Estimate the cost of replacing or abandoning the removal action system(s) using a similar approach.

Perform a sensitivity analysis of the cost calculations to evaluate the effects of changing assumptions. Other types of contingencies that may be applicable in evaluating costs include an increase in the volume of soil or waste that must be handled or disposed; an increase in flow rate from recovery wells, volume of water required for treatment, or the need for iron-removal or other additional treatment measures; and an increase in the number of recovery wells required to achieve containment and recovery of a groundwater plume. Each of these factors may have an enormous impact on the life cycle cost and the resulting cost-effectiveness of a given alternative. The sensitivity analysis evaluates the worst-case scenario for each approach and then estimates the resulting effect on capital and O&M costs and implementability.

#### **4.1.4 National Environmental Policy Act (NEPA) Considerations**

The DOE Secretarial Policy Statement on NEPA (DOE 1994) requires that CERCLA actions address and incorporate NEPA values such as socioeconomic, ecological, off-site, and cumulative impacts in CERCLA documents to the extent practicable.

As part of the alternative description, include information about how the alternative impacts the environment, local economy, and various resources. Then as part of the alternative evaluation, each alternative is assessed against its impact on these resources and other values. The evaluation against NEPA values should be in a separate section, even if it duplicates information that can be found under CERCLA criteria.

NEPA values that should be addressed in most alternative evaluations include:

- Socioeconomic impacts,

- Threatened and Endangered Species impacts,
- Natural Resources/Wetlands/Ecological impacts,
- Archaeological/Cultural impacts,
- Geological/Soils/Groundwater Resources impacts,
- Transportation,
- Climate/Meteorology/Air Resources impacts,
- Land Use,
- Cumulative Impacts,
- Surface Water/Water Quality,
- Environmental Justice,
- Unavoidable Adverse Impacts, and
- Irreversible/Irretrievable Commitment of Resources.

In some circumstances, other NEPA values may need to be evaluated. The regulations should be reviewed to determine applicability of other values.

#### **4.2 COMPARATIVE ANALYSIS OF ALTERNATIVES**

Evaluate the relative performance of each alternative in relation to each of the criteria presented in Sect. 4.1. Present the criteria as individual subsections of Sect. 4.2 for organizational consistency. Consider preparing a summary matrix for each of the evaluation factors.

### **5. RECOMMENDED REMOVAL ACTION ALTERNATIVE**

Identify the removal action alternative that best satisfies the evaluation criteria based on the comparative analysis described in Chap. 4. Include a detailed description of the evaluation process used to choose the recommended action. Also, explain how the removal action is consistent with the final action (if any).

### **6. REFERENCES**

Include a list of references used to develop the EE/CA in the format shown here. The following are general references for inclusion in an EE/CA.

40 *CFR* Part. 300, National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

42 U.S.C. § 7401 et seq., Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986.

U.S. Environmental Protection Agency (EPA) 1993. *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA*, Publication 9360.0-32, Washington, D.C., August.