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Expediting Cleanup through Problem Identification and Definition

Office of Environmental Management
Office of Environment, Safety & Health

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This guide is primarily intended for personnel with line management responsibility for Department of Energy (DOE) environmental restoration projects conducted pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Resource Conservation and Recovery Act (RCRA). It describes how clear, concise and accurate problem definition are critical to streamlining environmental restoration projects as outlined in the DOE/EPA "Principles of Environmental Restoration" workshop. Additional written guidance is available in DOE's *Remedial Investigation/Feasibility Study (RI/FS) Process, Elements, and Techniques Guidance* (DOE/EH-9400, December 1993) and DOE's *Phased Response/Early Action Guidance* (DOE/EH-0506, November 1995).

Introduction

A clear and concise problem definition is essential to environmental restoration projects since it specifies the condition(s) requiring action, bounds the likely response(s) appropriate for consideration, and focuses data collection on reducing key uncertainties to support remedy selection and implementation. Unclear problem definition may result in overly extensive or ineffective investigations, thus extending project schedules and ultimately delaying cleanup. During the execution of a response action, inadequate problem definition can lead to difficulties addressing the problem, addressing the wrong problem (e.g., dealing with a "symptom" rather than the cause), or addressing a problem at significantly greater cost than was technically necessary.

Identifying and Defining Site Problems

Ultimately, it is the core team (DOE, EPA, and State project managers) which is responsible and accountable for identifying site problems and sufficiently defining them to ensure appropriate remedial measures are selected and implemented. As used in this guide, a problem is a site condition posing an actual or perceived risk that the core team determines requires a response. [NOTE: A "response" may range from an institutional control (e.g., creation of a restricted area around a contaminated area) to excavation and treatment, or an engineered containment system; whatever is agreed to by the core team as appropriate and necessary to mitigate potential exposures.]

During initial scoping activities, the core team should develop a site conceptual model (to represent source areas, release mechanisms, exposure pathways, etc.) as a first step in determining whether a threshold, (i.e., condition under which a current or potential exposure pathway poses an unacceptable risk), has been exceeded and a response is necessary. In other words, the core team should attempt to identify any known or potential human health and ecological risks that constitute a "problem" as early as possible to promote / support an early focus on potential actions[1].

Specifically, the core team should, to the extent possible, define site problems in terms of:

- Environmental media impacted (e.g., groundwater, soil);
- Geographic features (e.g., creek bank);
- Types of known or suspected wastes (e.g., radioactive sludge, volatile organic compounds);
- Threshold exceeded (e.g., Federal MCLs, risk-based criteria); and
- Where appropriate, the type of waste unit (e.g., tank, drum).

HIGHLIGHT 1: Example Problem Statements

Concentrations of Cs-137 in surface soils surrounding the T-2 process plant exceed the agreed to action threshold of *x* pCi/g for industrial workers.

Concentrations of chromium in subsurface soils below the S-2 sludge ponds are expected to result in concentrations in ground water exceeding the state drinking water standard.

Concentrations of mercury in the Geneva river between outfall S-7 and highway 311 exceed the State's sediment criteria for protection of aquatic species.

[1] See related fact sheet, *Expediting Cleanup Through Early Identification of Likely Response Actions*, DOE/EH-413-9902, May 1998.

Uncertainties

During problem identification and definition, the core team should focus on those uncertainties which prevent determination of whether a problem exists (e.g., the core team knows contamination is present but cannot determine if action is required since existing information does not indicate that a threshold has been exceeded). As problems are determined to exist, the core team also should identify those uncertainties which prevent selection / implementation of an appropriate response action (e.g., insufficient information is available about the range and / or concentration of contaminants which will determine the effectiveness of likely response technologies).

Uncertainties which prevent determination of whether a problem exists, or the evaluation and selection of an appropriate response action, represent data needs which must be satisfied before the project can proceed. Therefore, the core team needs to specifically define the information required, and as this additional information is obtained, further evaluate site conditions to determine whether:

- No action is appropriate (e.g., core team suspected soil contamination was present above risk-based trigger levels but additional data indicate otherwise);
- A different problem exists (e.g., sampling discovers mixed waste is present rather than low-level waste) and therefore a different response(s) needs to be evaluated; or
- The problem is sufficiently defined to allow selection / implementation of a response.

Use of Decision Rules

Once a preferred response action is identified to address a site problem, a decision rule is an effective tool to formalize what constitutes sufficient information to trigger an agreed to response by linking the problem definition, the response action to be taken and the data required to support the decision (see Highlight 2). Furthermore, decision rules can be useful in articulating to the public the basis for proposing a specific action.

HIGHLIGHT 2: Example Decision Rule

IF cesium-137 is found above *x* pCi/g in an area of soil less than 100 square feet and at depths of no more than 6 inches (measured using standard site protocols), THEN excavate the hot spot, remove to on-site storage area, and manage the material as low level waste.

Problem Definition During Design and Implementation

To a certain extent, the design process begins as soon as the core team identifies a problem and begins to consider likely response actions. Once a preferred response action is selected following public comment, the decision document (e.g., Action Memorandum) and supporting analyses used to define the problem and evaluate potential response actions serves as the basis to more fully design the selected response.

Should the design team determine that additional information is required to resolve remaining technical uncertainties, the core team will need to evaluate proposed information needs and results of any additional data collected, to ensure the problem as originally defined, or assumption regarding performance of the response technology, continues to be adequately supported by the new information. [NOTE: Careful attention to the potential deviations from expected conditions, and the evaluation of appropriate contingency measures can reduce the likelihood that response selection decisions will have to be revisited.[2]]

During implementation of the response action, the problem statement (and associated decision rule) defines the conditions that require action and is therefore, also critical in determining when response objectives have been met (e.g., all soils contaminated with Cs-137 above *x* pCi/g, as determined through standard site protocols, have been removed). Therefore, specifying the core team's consensus on the specific methodology by which measurements will be taken to confirm attainment of response objectives eliminates the potential for subsequent debate on whether additional analyses (or a different analysis) are needed.

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[2] See related fact sheet, *Uncertainty Management: Expediting Cleanup Through Contingency Planning*, DOE/EH/(CERCLA)-002, February 1997.