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Uncertainty Management: Expediting Cleanup Through Contingency Planning

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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 techniques for managing project uncertainty, including decision rules and contingency planning 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-0256, November 1995).

Introduction

Some degree of uncertainty in environmental restoration projects always exists. This inherent uncertainty may result from incomplete knowledge of the nature and extent of contamination, an inability to predict a technology's performance under site-specific conditions, or new or changing regulatory requirements. Although these inherent uncertainties present a significant challenge to effective project management, recognizing and planning for them helps to ensure that projects stay on schedule and within budget.

In order to effectively reduce and manage uncertainty prior to or during a response action, the project team must first determine which uncertainties are significant (i.e., can impact the implementation of the response action(s) under consideration). Once significant uncertainties are identified, the DOE, EPA and State project managers (i.e., the core team), must decide whether to reduce the uncertainty through data collection, or reach consensus on how best to "manage" the uncertainty through contingency planning. In short, this decision will require a balance between the cost of data collection (and decisional benefits gained) against the cost of planning for a potential deviation (i.e., uncertainty), and the cost / schedule impacts of modifying the design if the deviation occurs.

Outlined below are steps to follow once the core team decides to pursue managing an uncertainty through contingency planning.

Step One: Identify Expected Conditions and Potential Deviations

The core team should use their conceptual model developed for the site (or "problem") being addressed as a basis for identifying and evaluating expected conditions and potential deviations. An expected condition is any physical, chemical, technical, or regulatory condition that is expected to be encountered during implementation of the response action. For example, based on all available information [e.g., process history, preliminary assessment / site investigation (PA/SI)], the core team expects that contamination of Pu-238 greater than 75 pCi/g is confined to the soil and sediment from zero to four feet deep in the bed of an old, abandoned canal. However, given the possible releases of Pu-238 that could have occurred over a twenty year period, the core team identifies the potential presence of Pu-238 greater than 75 pCi/g below four feet, as a deviation that has a realistic probability of occurrence.

Step Two: Evaluate Deviations

Once potential deviations have been identified, the core team should determine what level of "pre-response" planning is appropriate by evaluating each deviation as to its possible impact on the implementation of the likely response(s), and its ability to negate achievement of response objectives.

Typically, a qualitative evaluation of the factors discussed below is sufficient to determine how best to proceed:

- Probability deviation will occur: The core team should rank deviations based on their likelihood of occurrence (e.g., high, medium, low).[1] Using the example from above, the core team may determine there is a low probability that contamination of Pu-238 above 75 pCi/g extends below four feet since the two PA/SI samples taken did not exceed this level.

- Potential impacts of the deviation: The core team should evaluate each deviation in terms of its potential impacts on the response action(s) cost, schedule, and implementation requirements (e.g., site preparation / mobilization, material handling, transportation). Typically, this requires bounding the range of impacts and comparing this range to a tolerable threshold[2] around which the base design is being constructed. For example, should contamination of Pu-238 above 75 pCi/g extend below four feet, soil volumes requiring excavation will increase significantly. If the site's temporary storage facility can only absorb a 25% increase (the threshold) in soil volume before capacity is exceeded, termination of field activities may be necessary until additional temporary storage is made available.

- Time to respond: The core team should estimate the "lead" time to respond between occurrence of the deviation and the impact to the project. As before, this may be done qualitatively or quantitatively, depending on the significance of the potential impact of the deviation. The shorter the lead time to respond, the less time available to implement the contingent response if a deviation is detected. Consequently, a greater level of contingency plan development / design is usually required to modify the base design in a timely manner (e.g., special equipment is procured and brought out to the site in case deviation occurs). Alternatively, if a long lead time is expected, then a less detailed contingency plan may be appropriate.

[1] The core team needs to carefully consider whether a deviation having a high probability of occurrence is better characterized as an expected condition rather than a potential deviation.

[2] This threshold is the maximum change in the expected conditions that the base design (for the response action) can accommodate before a contingent response(s) is required.

Step Three: Develop Appropriate Contingency Plans

Once the core team determines the appropriate level of "pre-response" contingency plan for each specified deviation, development of contingency plans can begin. Based on the required level of detail, a contingency plan should include a strategy for what needs to be accomplished to effectively manage and respond to a deviation. Specifically, the core team should define the necessary design modifications and / or actions required in the field to manage the deviation (e.g., modify excavation approach, provide higher level of personnel protection equipment (PPE), construct short-term storage area). Ultimately, the objective is to ensure the required scope of the contingency plan can be documented for procurement purposes and preplanning is sufficient to allow rapid, effective responses to deviations.

Additional considerations in developing contingency plans are discussed below[3]:

- Implementability: Based on the evaluation in step two, the core team should determine the necessary level of development / design to ensure the contingency plan can be easily implemented and will reliably address the deviation. As the probability that a deviation may occur increases, or as a shorter lead time to respond is required, a more developed contingency plan may be necessary to ensure rapid implementation. [NOTE: In some cases, the design of the contingency plan may need to be integrated into the base design.] Likewise, the greater the potential impacts of the deviation (e.g., occurrence of the deviation will require termination of field activities), the higher degree of confidence required that the contingency plan is implementable.

[3] These same factors are useful to determine the most suitable contingency plan in the case where several contingency options exist.