# Applying a Decision Process for Long-Term Stewardship Planning at a US Department of Energy Site

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**Abstract —** *Long-term stewardship (LTS) can be defined as the system of activities needed to protect human health and the environment from hazards left remaining at a site as a result of a cleanup decision. Although the general consensus has been that remediation decisions and LTS decisions should be made conjointly, the general practice has been to separate them. This bifurcation can result in LTS plans that are difficult to implement and enforce and disproportionately costly for the benefit they provide. Worse still, they can be ineffective and result in harmful exposures to humans and the environment.*

*Sites that have not yet made cleanup decisions and that can still integrate LTS planning into that decision making would benefit from a process built on a systematic review of the LTS risks and costs associated with remedial alternatives that include allowing on-site residual contamination. Sites that must develop LTS plans in response to previously determined cleanup decisions are even more in need of a process that involves close scrutiny of the risks and costs of possible LTS plan components. An LTS planning decision process usable by both categories of sites has been developed and is being used at the US Department of Energy (DOE) Mound site. In addition to facilitating LTS planning, the process demonstrated the need to integrate the work of LTS planners, remediation decision makers, and LTS technology developers and deployers.*

## 1. BACKGROUND

The US Department of Energy (DOE)[1] and the National Research Council Committee on the Remediation of Buried and Tank Wastes[2] have affirmed that remediation decisions and long-term stewardship (LTS) decisions should be made conjointly. The prevailing practice, however, has often been to separate the decision processes. Cleanup decisions are made, and, because the cleanup decision involves leaving residual contamination onsite, there is acknowledgment that long-term stewardship of some sort will be implemented. The cleanup proceeds, and, at some point, the LTS plan is developed. The potential problems associated with this practice relate to the implementability and enforceability of the proposed land use controls, failure of the LTS plan (which could result in harmful exposures to humans or the environment), and high costs that could be associated with the eventual LTS plan and its failures.

The DOE Miamisburg Environmental Management Project (MEMP) in Miamisburg, Ohio, is in a remediation decision making mode as well as in an LTS mode. Thus, it is in a position in which it can still integrate LTS planning in its ongoing remediation decision making while it is developing and implementing an LTS plan for land already in stewardship.

## 2. MIAMISBURG ENVIRONMENTAL MANAGEMENT PROJECT

The Miamisburg Environmental Management Project (formerly known as the Mound site) is approximately 10 miles southwest of Dayton, Ohio. The site is surrounded by homes, parks, and business areas. Site operations from 1946 to 1995 included

developing and fabricating nuclear and nonnuclear components, building detonators and cable assemblies, and retrieving and recycling tritium from dismantled nuclear weapons. Site workers produced components containing plutonium-238, polonium-210, and tritium and processed extensive quantities of high explosives.

The site was transferred from the Office of Defense Programs to the Environmental Management Program in 1995.[3] The 306-acre site is slated for closeout in 2006.

The overall cleanup goal at MEMP is remediation to an industrial use standard. When site parcels have been remediated to that standard, they are transferred from DOE to the Miamisburg Mound Community Improvement Corporation (MMCIC), an entity established by the City of Miamisburg for economic development of the former Mound site. Three parcels have been transferred from DOE to MMCIC to date. Remediation is being planned for the remaining parcels.

The remedy for the transferred parcels includes restrictions that the land can be used only for industrial purposes and that prior written approval from regulators is required to use groundwater and remove soil from the site. These restrictions are listed in the Record of Decision and the quitclaim deed developed for each parcel as it is transferred.

The site began its LTS planning in January 2001, when the MMCIC and DOE assembled the Post Closure Stewardship Working Group composed of representatives from the Mound Reuse Committee; the Miamisburg Residents for Environment, Safety, and Health; MMCIC; DOE; the City of Miamisburg; the Ohio Department of Health (ODH); the Ohio Environmental Protection Agency (OEPA); and the site remediation contractor, BWXTO. A small Steering Committee of representatives from ODH, OEPA, MMCIC, DOE, BWXTO, the City of Miamisburg, and the US Environmental Protection Agency (EPA) evolved from the Working Group. The Working Group and the Steering Committee began using the LTS decision process in summer of 2001.

## 3. LTS DECISION PROCESS

The LTS decision process leads planners through several steps in order to develop an LTS plan that provides site stewardship at the lowest possible risk and cost. The process is portrayed in Figure 1. The first step is to describe in detail the proposed components of the site LTS plan. LTS plan components are the (1) contaminant containment system (engineered and/or natural systems used to restrict releases of contaminants

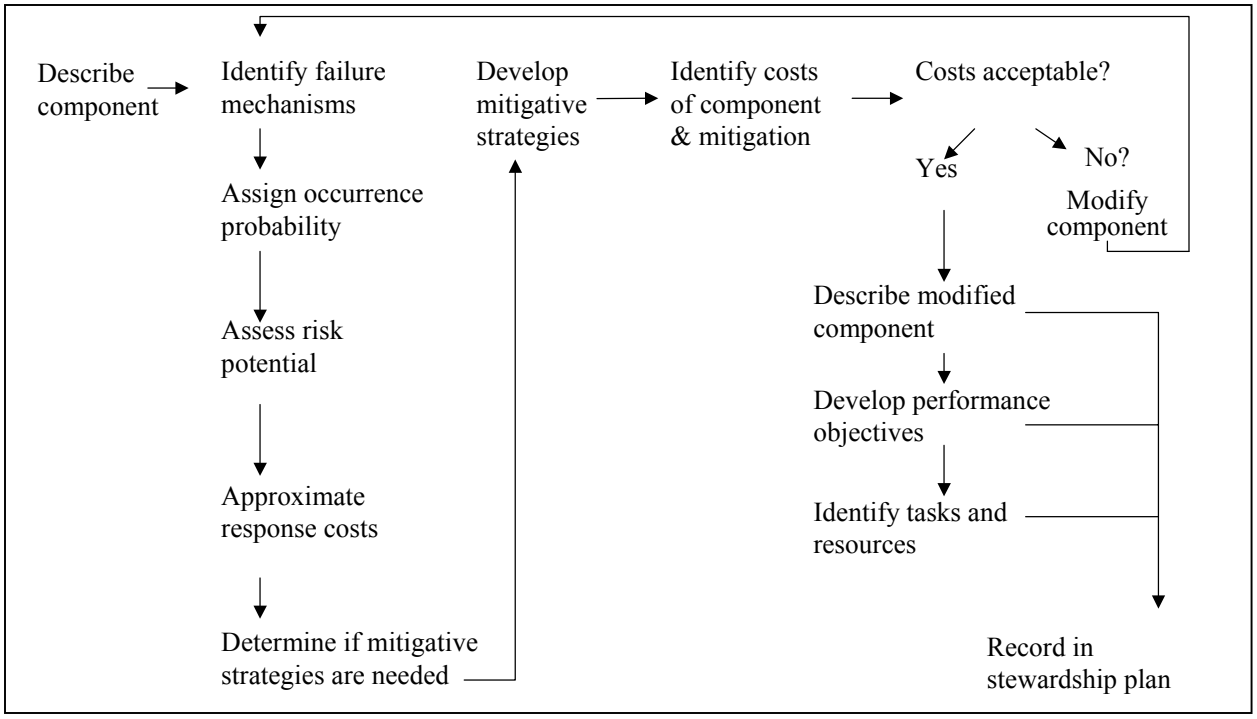


**Figure 1: A Decision Process for Long-Term Stewardship Planning**

to the environment), (2) land use controls (engineered barriers and/or institutional controls used to restrict access to or use of contaminated areas), (3) monitoring system, (4) information management system, and (5) organizational system.[4]

The next steps are to identify all the mechanisms that could cause a component to fail, assign an occurrence probability and a risk potential to each failure mechanism, and approximate the costs of responding to a failure. Site LTS planners then determine which failure mechanisms pose an unacceptable risk or cost and therefore warrant development of mitigative strategies to reduce the likelihood of component failure or the magnitude of its consequences.

The costs of any proposed components and mitigative strategies are then assessed and evaluated with regard to their acceptability. If the costs are determined to be unacceptably high, the appropriate component and/or strategy need to be modified.

Performance objectives for the LTS components are then developed in order to facilitate periodic assessments of component effectiveness. In the final step, planners identify all the tasks and resources needed to implement, enforce, and periodically assess the LTS plan.

## 4. APPLYING THE DECISION MODEL AT MEMP

Two major outcomes resulted when the decision model was tested at MEMP with the Post Closure Stewardship Working Group and the Steering Committee. First, site land use control vulnerabilities were identified. Mitigative strategies are being developed to address them in order to create a more comprehensive LTS plan. Second, the LTS planners began to work more closely with the site remediation core team and the site's LTS technology development and deployment team.

What initially appeared to be a case of developing an LTS plan for cleanup decisions that had already been made evolved into LTS planners working with cleanup and LTS technology decision makers to develop a more integrated approach to long-term stewardship.

### *4.1 LTS Vulnerabilities and Mitigative Strategy Development*

The Post Closure Stewardship Working Group began the decision process by describing the land use component of the LTS system. This component consists of three deed restrictions that ban the (1) movement of soil off the site without prior written approval from the ODH and OEPA, (2) use of groundwater underlying the site without the written prior approval of the EPA and OEPA, and (3) use of the site for any purpose other than industrial.

The Working Group moved into the next steps of the decision process and assessed that there was a medium to high probability that the proposed land use control component would fail and that the risks to human health and the environment from the failure would be in the medium to high range. Because the probability of failure and its consequences were deemed unacceptably high, the Working Group determined that mitigative strategies needed to be developed to minimize the probability and impact of deed restriction failure.

The Steering Committee subsequently identified several strategies that could enhance the effectiveness of the land use controls. The strategies fall into three categories: (1) federal response actions that will be undertaken to enforce the deed restrictions; (2) activities of state and local government agencies that could decrease the likelihood that a deed restriction would fail, and (3) educational and communication approaches that could also forestall a deed restriction violation.

The first category addresses DOE's responsibility to enforce the land use controls and take action against violators. The Records of Decision for the parcels released to date state that DOE "has the responsibility to monitor, maintain, and enforce" the deed restrictions.[5] The federal response process entails DOE or its agent investigating alleged deed restriction violations, requesting voluntary cessation of actual violations, and referring the matter to the US Department of Justice for action if the matter is not resolved voluntarily.

The second category includes existing and possible nonfederal government mechanisms that could be useful adjuncts in reducing the possibility of land use control failure. DOE has no control over these mechanisms because they are based in state and local government authority rather than federal authority. Thus, DOE cannot depend on them to safeguard the land use controls or take action against the state or local government if the mechanisms are unsuccessful. Rather, these state and local systems may enhance the success of the land use controls.

For example, one of the mechanisms in this category is incorporating the three land use restrictions in all site property leases. If a lessee violates one of the use restrictions, the lessor can take action under contract law to stop the violation. Other examples of possible activities in this category include state regulators' using their police power authority to protect human health and the environment or using their authority to enforce the deed restrictions obtained through easements in the quitclaim deeds.

The third category consists of educational and communication activities designed to keep community members and site and city workers aware of the site and its use restrictions. Public knowledge and awareness can also promote adherence to the land use controls. Possible actions in this category include a "call-before-you-dig" program, a museum, and a city worker education program.

Other activities could include platting the Mound site as it existed before the first property transfer and implementing a planned unit development (PUD) designation for the site. These latter activities would institutionalize the original size of the area to which the deed restrictions apply. This information might otherwise be easily forgotten as the site was divided into smaller and smaller parcels.

### *4.2 Integrating LTS into Remediation Decision Making and Technology Development and Deployment*

One of the steps in the decision process is describing the expected performance measures associated with the LTS components. When developing the land use control performance measures, the LTS planners realized that they needed information from the remediation core team regarding earlier cleanup decisions. Specifically, the LTS planners needed to know the basis for the restriction on movement of soil offsite without prior approval.

This information was necessary in order for the LTS planners to determine what volume of removed soil constituted a violation of the soil removal deed restriction. Planners needed to know if the prohibition on soil removal extended to soil adhering to the tires of vehicles leaving the site or if it was intended to ban large-scale unapproved removals such as the removal of loads by pick-up trucks.

One member of the Steering Committee who also served on the remediation core team served as the link between the two groups and helped to resolve the questions by communicating the information on the risk basis for the soil removal ban. Thus, on the basis of their knowledge of site conditions and the reason for cleanup decisions, the remediation core team members were able to assist the LTS planners develop a more comprehensive plan. In turn, the core team became more sensitized to the LTS implications of the decisions it makes on future cleanup at the site.

As the LTS planners moved ahead with their work, their connection to the site LTS technology development and deployment team also strengthened. The soil volume issue was of great importance to the technology team as well as the planners. With the information that emerged from consultations between the LTS planners and the remediation core team, the LTS technology team was better prepared to identify technologies that would be able to be used to detect soil removals that might constitute a deed restriction violation.

## 5. CONCLUSIONS

The decision process helped LTS planners describe their proposed plan, assess its vulnerabilities, and recognize the need for mitigation strategies to minimize the likelihood of LTS component failure. As a result of the process, the LTS planners, the LTS technology development and deployment team, and the remediation core team better realized the interplay of their respective responsibilities and began to work together. Their actions became more integrated than they had been previously.

An additional benefit of the process was greater recognition by the LTS planners of the interrelatedness of the LTS components. Long-term stewardship is defined in this paper as the system of activities needed to protect human health and the environment from hazards left remaining at a site as a result of a cleanup decision.

When they had to describe the land use control component at MEMP, the planners grasped how the activities of one component needed to link to activities of other components in order to form a comprehensive system of LTS activities. Describing the deed restriction performance measures led the planners to realize what monitoring, information management, and organizational system activities need to be in place to best assure safe land use — the goal of long-term stewardship.

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