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Facility Disposition: Principles for Accelerated Project Management

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Facility Disposition: Principles for Accelerated Project Management

This technical support bulletin is intended primarily for project managers responsible for planning, organizing, and implementing facility disposition (deactivation and decommissioning) activities at sites throughout the Department of Energy (DOE) complex. Its goal is to assist in developing more efficient project plans, while concurrently abiding by all requirements and guidance outlined in: 1) DOE O 430.1A, *Life Cycle Asset Management* (LCAM) and its associated guides; 2) appropriate elements of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); and 3) DOE-STD-1120-98, *DOE Technical Standard: Integration of Environment, Safety, and Health into Facility Disposition Activities*. These facility disposition framework documents explicitly include DOE's Integrated Safety Management (ISM) Policy (DOE P 450.4), which provides the overall structure for conducting projects safely, including those related to facility disposition.[1]

With the publication of these three documents, DOE has outlined a general approach to ensure project managers conduct adequate planning and have appropriate mechanisms in place to protect workers, meet environmental requirements, and achieve project objectives. To implement the elements of this approach as practically and cost-effectively as possible, this *Bulletin* presents a detailed planning approach that is based on meeting the same challenges for very similar environmental restoration projects. *Specifically, this bulletin introduces four underlying principles for project managers to apply to facility disposition planning. These principles are the distilled lessons learned from practical field experience implementing facility disposition and environmental restoration projects.* Together with the core activities of ISM, the Orders and guidance, these principles form a complete framework that will foster better communication and enhanced project planning and implementation. **Highlight 1** illustrates the relationship between ISM, the Principles, and the primary facility disposition Orders, Policies, and Standards.

I. Introduction and Policy Background

Facility disposition encompasses three major, often interrelated phases of work:

- *Surveillance and Maintenance (S&M):* Surveillance includes any activity that involves the scheduled periodic inspection of a facility, equipment, or structure as required by federal and state environmental, safety, and health laws and regulations, and DOE Orders. The purpose of surveillance is to demonstrate compliance, identify problems requiring corrective action, and determine the facility's present environmental, radiological, and physical condition. More specifically, surveillance includes activities performed to determine the operability of critical equipment, monitor radiological conditions, check safety-related items, provide for facility-security controls, and assess facility structural integrity.

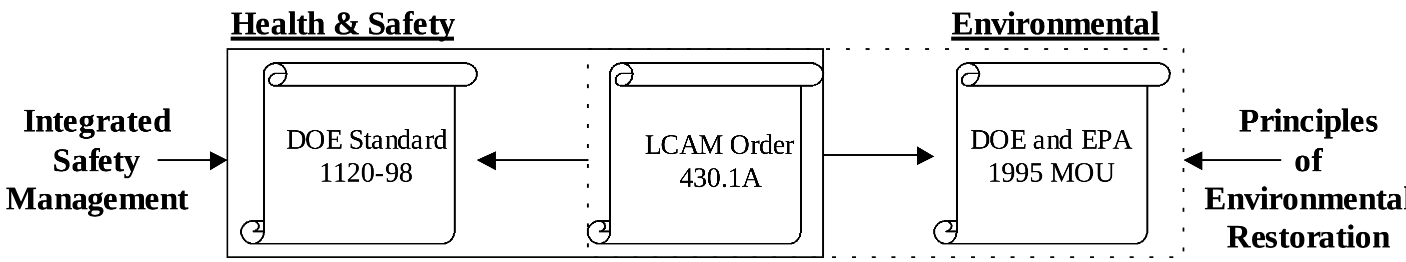
  Maintenance includes any activity that is required to sustain property in a condition suitable for the property to be used for its designated purpose, including preventative, predictive, and corrective maintenance.

- *Deactivation*. Deactivation is the process of placing a facility in a stable condition for the purposes of minimizing existing risks and the

[1] A central component of the ISM Policy is an emphasis on the use of project teams to define the work, analyze hazards, develop and implement hazard controls, and provide feedback and continuous improvement.

Highlight 1.

Integration of Disposition Documents Referenced in this Bulletin



Integrated Safety Management influences the structure of the DOE Standard 1120-98 and the LCAM Order 430.1A. The four Principles of Environmental Restoration establish the framework for LCAM and the 1995 MOU between the EPA and DOE.

life-cycle cost of an S&M program that is still protective of workers, the public, and the environment.

- *Decommissioning*. Decommissioning generally takes place after deactivation, and includes surveillance and maintenance, decontamination, and/or dismantlement. These actions are taken at the end of the life of a facility to retire it from service with adequate regard for the health and safety of workers and the public and protection of the environment. The ultimate goal of decommissioning is generally unrestricted release or restricted use of the facility.

The three major DOE Orders, policies, or environmental laws that determine how project managers conduct these disposition activities are described below.

1. DOE Order 430.1A: *Life Cycle Cost and Asset Management*

The LCAM Order provides the governing policy for DOE facility disposition activities. Sections 6.F and 6.G of the DOE Order 430.1A establish specific requirements for facility disposition activities.[2] Section 6.F addresses <u>deactivation</u> and requires project managers to conduct several activities including (but not limited to):

- Identification, inventory, and assessment of the condition of physical assets under maintenance;
- Establishment of requirements, budgets, and work management systems to maintain physical assets in suitable condition for their intended use, and ensure that maintenance proceeds accordingly;
- Developing a method for prioritization of infrastructure requirements; and
- Taking actions to identify hazards for disposition, such as their identification and characterization, assessment, and adjustment of facility authorization basis, surveillance and maintenance to stabilize hazardous materials.

Section 6.G of the Order requires project managers to take other actions to implement decommissioning, including (but not limited to):

[2] <u>Note</u>: <u>Transition</u> and <u>Surveillance & Maintenance</u> (S&M) are two phases often part of facility disposition, but they will not be addressed extensively in this bulletin.

Further information on LCAM (DOE O 430.1A, and associated Guides) is located on the DOE Directives website: *http://www.explorer.doe.gov:1776/htmls/directives.html*

- Use of CERCLA non-time-critical removal actions to implement decommissioning *(further explained in the next section*);
- Applying DOE-STD-1120-98, the *ES&H Disposition Standard* to these activities (see next sections);
- Detailing the steps in the transfer of contaminated facilities;
- Developing methods to ensure that deactivation, surveillance and maintenance, and decommissioning activities are appropriately planned, conducted, and documented; and
- Developing a final report for each project.

Highlight 2 provides detailed information on implementing the LCAM requirements by summarizing the main steps of the S&M, Deactivation, and Decommissioning Guides.

2. CERCLA Non-Time-Critical Removal Actions under 40 CFR 300.415.

Under a 1995 Memorandum of Understanding (MOU) between DOE and EPA,[3] there are specific, non-time critical removal action requirements under CERCLA, and its implementing regulation, the National Contingency Plan (NCP), that project managers should evaluate during decommissioning project planning. The CERCLA MOU provides project managers with key programmatic guidance within the LCAM framework, and its application has proven particularly well suited to guiding facility disposition activities.

Based on the NCP, the MOU outlines both DOE and EPA responsibilities when decommissioning actions occur:

1) DOE should:

- Exercise lead agency authority for responding to releases or threat of release (i.e., the decommissioning action);
- Implement the removal action determined to be most appropriate;
- Consult with EPA and resolve disagreements with them; and
- Submit sampling and analysis plans for EPA approval if samples are taken and analyzed.

In addition, consistent with the NCP requirements for non-time critical removal actions, DOE is responsible for meeting applicable or relevant and appropriate requirements (ARARs) to the extent practicable, and instituting appropriate public involvement and documentation programs for decisions made regarding decommissioning actions.[4]

2) EPA should:

- Consult with DOE on removal actions;
- Review and approve sampling and analysis plans if samples are taken; and
- Issue a “stop work” instruction under an applicable interagency agreement, if necessary.

[3] *Policy on Decommissioning of Department of Energy Facilities Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA),* May 22, 1995.

[4] Refer to DOE-STD-1120-98, Section 1, Section 3, and Appendix A and D for further information on ARARs. Other references include*: CERCLA Compliance with Other Laws Manual, Part 1, Interim Final* (EPA 540-G-89-006, OSWER 9234.1-01, August 8, 1988); *CERCLA Compliance with Other Laws Manual, Part 2, Clean Air Act and Other Environmental Statutes and State Regulations* (EPA 540-TG-89-009, OSWER 9234.1-02, August 1989); *Community Relations in Superfund: A Handbook* (EPA 540-R-92-009, OSWER 9230.0-03C, January 1992*); Final Guidance on Administrative Records for Selecting CERCLA Response Actions* (OSWER 9833.3A-1, December 1990).

Highlight 2.

Key Steps in the LCAM Guidance Process

BOLD indicates a key step addressed by one or more of the four principles of facility disposition and how to implement the step is discussed more fully in this bulletin

Implementation Guide for Surveillance and Maintenance During Facility Transition and Disposition (DOE G 430.1-2)

The major S&M steps are as follows:
Step 1: Continue Ongoing S&M.
Step 2: Identify Need to Evaluate/Reevaluate S&M Baseline. Execute S&M tasks until conditions change such that the activity is no longer required or must be altered.
***Step 3: Collection of Baseline Data*, to identify hazards and determine the risk posed by the hazards to workers, the public, and the environment. It also involves identification of facility condition, such as characterization and documentation.**
***Step 4: Evaluation of Baseline Data in terms of hazards and activities to be performed*. This will serve as the framework for development of the facility S&M program.**
Step 5: Develop/Revise S&M Plan.
Step 6: Implement the S&M Program. The S&M program will operate over the entire life cycle of the facility, but will need to be monitored and modified constantly to ensure safety.

Deactivation Implementation Guide (DOE G 430.1-3)

The major deactivation steps are as follows:
Step 1: Make Policy and Operational Decisions.
***Step 2: Facility End-State Decision*. The agreed-upon facility condition to be achieved after completion of deactivation. Clearly plan the project to achieve objectives and to effectively communicate the objectives, requirements, and constraints.**
***Step 3: Determine Project Scope*. Establish boundaries for the deactivation project.**
Step 4: Integrate Safety into the Project. Identify hazards, standards and requirements as drivers for data collection.
***Step 5: Develop Detailed End-Points.* Determine when deactivation activities are complete based upon the systematic method for establishing quantifiable goals throughout the project.**
***Step 6: Identify and Evaluate Alternatives*. Compile pertinent information and data, end-points, and requirements to determine appropriate deactivation options.**
Step 7: Prepare Baselines. Establish performance policies or expectations for deactivation projects, as well as cost and schedule baselines.
Step 8: Issue Project Plan Document.
Step 9: Detailed Work Packages. Develop detailed work tasks and schedule.
Step 10: Project Execution. Perform work after the work packages are developed.
Step 11: Feedback. Project personnel must ensure that hazard controls and work practices are monitored for adequacy during deactivation tasks.
***Step 12: End-Point Closeout.* Evaluate procedures and the project to ensure that end points were achieved.**
Step 13: Final Report.
Step 14: Deactivation to Decommissioning. The transfer process to facility decommissioning, per DOE G 430.1-5.

Decommissioning Implementation Guide (DOE G 430.1-4)

The major decommissioning steps are as follows:
Step 1: Conduct On-going Surveillance & Maintenance.
***Step 2: Problem Discovered.* Determine hazardous material involved, and effects of release.**
Step 3: Assess Need for/Desirability of Decommissioning. Evaluate the situation to determine what action, if any, is appropriate, based upon examination of facility factors. Determine whether or not a CERCLA response is appropriate.
Step 4: Conduct Decommissioning? This provides a decision point to evaluate whether or not to go forward with decommissioning, and determine whether a CERCLA or non-CERCLA action would be appropriate.
Step 5: Continue S&M as Appropriate.
Step 6: Prepare Decommissioning Project Scoping Document (Baseline). Prepare project scoping document or preliminary project plan to define objectives/end-points, technical scope, cost, and schedule ranges.
***Step 7: Review Data to Determine Extent of Action.* Begin the process of selecting and evaluating decommissioning alternatives for the facility. All data compiled to this point should be reviewed.**
***Step 8: Develop Characterization Plan, Including Sampling and Analysis and HASP.* Continues the process of characterization of the facility.**
***Step 9: Conduct Characterization/Document Results*. Apply the graded approach to conduct field characterization work, data analysis, and documentation.**
***Step 10: Conduct Risk Assessment.* Prepare risk assessment to support safety analysis and evaluation of decommissioning alternatives.**
Step 11: Conduct Safety Analysis. Analyze hazards and identify mitigating actions associated with each alternative, performed in a graded approach.
***Step 12: Define and Conduct Activities to Inform/Involve Stakeholders.* Develop and implement comprehensive public participation plans.**
Step 13: Evaluate Alternatives, Propose Response and Document Analysis of Decommissioning Alternatives.
***Step 14: Respond to Public Comment.* Provide an opportunity for public review and comment on alternatives. Comments are reviewed.**
Step 15: Document Final Decision.
Step 16: Prepare Decommissioning Project Plan, including HASP. Prepare engineering and planning work required to create decommissioning project plan; work planning activities must include ISM considerations.
Step 17: Conduct and Document Readiness Review. Identify organization that will perform the decommissioning, a detailed work package is prepared, the contracting approach is selected, and a readiness review is completed.
***Step 18: Conduct Action to Decommission Facility*.**
Step 19: Conduct S&M Phase-Out.
Step 20: Close Out Project and Complete Decommissioning Project Final Report.
***Step 21: Further Action Required.* Evaluate whether or not further action is needed, and if so, what it is.**
Step 22: Establish Long-Term Monitoring and/or Transfer to Remedial Action.

The purpose of the CERCLA MOU is to provide managers of facility disposition projects a flexible framework to develop and implement plans that are appropriate for the circumstances presented. It guides project managers in the selection of the most appropriate level of analysis, oversight, and public participation.

3. DOE-STD-1120-98*: DOE Technical Standard: Integration of Environment, Safety, and Health into Facility Disposition*

The *ES&H Disposition Technical Standard* is intended to help facility disposition project teams apply ISM concepts to deactivation, decommissioning, and long-term surveillance and maintenance phases of disposition. The *Standard* also is fully consistent with the LCAM Order.

Specifically, the *Standard* provides guidance for integrating and enhancing worker, public, and environmental protection during facility disposition activities, by providing environment, safety, and health guidance to supplement the project management requirements in LCAM.

The *Standard* also provides specific guidance on incorporating the five-step ISM approach to facility disposition, using the core functions: 1) define scope of work; 2) analyze hazards; 3) develop and implement controls; 4) perform work within controls; and 5) feedback and continuous improvement.[5]

A practical implementation tool emphasized in DOE's ISM Policy and outlined in detail in both the *Standard (*and also the LCAM Guides) is application of the tailored or *graded approach*. This approach permits the consideration of differences between facilities and provides a method of determining the extent to which actions and safety measures are appropriate for a particular facility. When applied in conjunction with the ISM process, the graded approach promotes a work management system that is safe, efficient, and cost effective, by allowing sites to select only those actions most appropriate for a given facility.

Together, the principles of environmental restoration and ISM provide a good framework for performing disposition at DOE sites. The following section will establish how to implement the *Standard*, the LCAM Order, and the CERCLA MOU within this framework to conduct dispositioning in an efficient and compliant manner.

II. Using Four Principles as a Practical Framework to Plan and Implement Effective Disposition Projects

To implement the steps outlined in each of the LCAM Guides (see **Highlight 2**), project managers still must address many practical questions about how to best implement facility disposition projects. These questions, similar to those faced by environmental restoration project managers, include:

- Who should make which decisions during the course of a facility disposition project?
- What work is necessary to meet acceptable standards and how can it be planned consistent with ISM principles?
- What technical approaches and technologies are appropriate to evaluate? and
- How does a project manager manage the many unknown and uncertain conditions that exist in a project?

Highlight 2 showed the significant number of key steps that relate to one or more of these questions. Because of the similarities between facility disposition and environmental restoration, facility disposition projects can

[5] DOE P 450.4, *Safety Management System Policy*, October 15, 1996. An electronic copy of this Policy is available on the DOE Directives website, *http://www.explorer.doe.gov:1776/htmls/directives.html*

benefit from lessons learned within the environmental restoration program that routinely address these same issues. Recent reports[6] suggest that four principles are valuable to use as a framework to plan and implement facility disposition work:

1. Use a multi-disciplined project team to plan and implement more effective disposition activities.

2. Define a safe work scope using the least amount of data necessary to meet appropriate end states and end points.

3. Focus early during planning on available technical alternatives, including innovative approaches, to ensure work scope is implemented as efficiently as possible.

4. Actively identify, manage, and evaluate uncertainties during facility disposition.

The remainder of this bulletin describes the application of these four principles to facility disposition projects, consistent with the framework established by the LCAM Order, CERCLA MOU, and the *Technical Standard*.

Principle 1. Use a multi-disciplined project team to plan and implement more effective disposition activities.

As is evident from **Highlight 2**, nearly every step of a facility disposition project requires decision-making that integrates the views of multiple technical disciplines. One of the initial goals, therefore, when beginning the project planning process should be to establish open communication by creating a project team, consisting of all people with decision-making authority for the project. This approach is a lesson learned from past disposition and environmental restoration projects (see **Highlight 3**, which describes success stories of using a multi-disciplined team at both the Mound site and the PUREX facility at the Hanford site). The project team approach is also fully consistent with the detailed guidance provided in DOE-STD-1120-98 and with the DOE ISM policy that advocates worker involvement in activity planning and implementation. If successfully formed and appropriately implemented, a multi-disciplined project team is the ongoing mechanism to ensure that all critical parties make and are accountable for key project decisions and that the activities planned meet all policy, project, and health and safety objectives.

Ideally, a multi-disciplined project team operates with the decision-making authority to plan and implement projects (rather than simply providing advice to other decision-making staff). For a multi-disciplined team to be successful, therefore, it may need to include project management, technical, and health and safety staff from both DOE and its contractors; regulators and involved stakeholders; and even future landlords if controversial issues about end-state conditions exist that are critical to the direction of the project. In some cases, both DOE and EPA representatives may be appropriate to involve in the multi-disciplined project team.

The role and responsibility of a multi-disciplined project team is to bring together all involved parties to make better decisions about work scope, uncertainties, and health and safety issues, and to ensure eventual regulator/ stakeholder support.

Benefits and Limits of Multi-Disciplined Teams

Benefits of forming a multi-disciplined project team from the early stages of project planning include early identification of disposition alternatives, resolution of disagreements between involved parties, the potential for a reduction in data collection through an integrated and streamlined approach, and implementation of an improved review process.

[6] *A Monograph: Facility Disposition Lessons Learned from the Mound Site*. U.S. Department of Energy, July *1999. http://tis-nt.eh.doe.gov/oepa/*

Experience with such teams has highlighted situations where teams do not work as well. Difficulties may arise when: roles and responsibilities of team members are not well defined; management has a weak commitment to the team decision-making approach; necessary personnel are not available or dedicated to the project; or there are transition or project hand-off issues between contractors or other involved work parties.

Effective Implementation of Multi-Disciplined Teams

To realize the advantages offered by this principle, a multi-disciplined team must have adequate decision-making authority. To implement this decision-making authority effectively, teams in many cases must establish formal and documented decision-making guidelines to allow the decisions made by the team to carry through to actual work activities. Formal and documented guidelines also ensure that outside parties reviewing team decisions can understand why certain approaches were selected and, when staff transitions occur and new team members join, it is easier to explain how key project decisions were made and why certain activities are occurring.

Two types of decision-making guidelines that have proven useful are:

1) Decision rules – An approach to defining project decisions that relies on "if-then" statements to define the conditions under which work or an activity will be taken. For example, decision rules can quantitatively or qualitatively define for all members of the team, how and what type of characterization needs to occur, what the result of characterization will be, and what resulting actions will be taken. An example of a decision rule follows in **Highlight 4**.

Highlight 3.

Lessons Learned From Purex and Mound

A multi-disciplined team approach results in a more efficient planning process, a more comprehensive hazard analysis, and fewer opportunities to overlook safety-critical items**.**

Example 1--

The Purex project team identifies the following lessons learned from its disposition activities:

1. Early in the deactivation planning process, it is necessary to identify the disciplines that should participate on the project team and the team's roles and responsibilities.
2. Team composition and size depend on perceived hazardous conditions and magnitude of the project.
3. Teams depend upon individual worker knowledge and experience to guide decision-making.
4. Roles and responsibilities for each team member should be clearly identified.
5. The team should develop consistent methods of communication, and identification and evaluation of hazards.
6. The team should identify specific standards or procedures applicable to each member's area of responsibility and/or other individuals or groups with whom the team must collaborate.

Source--
DOE/EH-0486. Integrating Safety and Health During Deactivation with Lessons Learned from PUREX

Example 2--

The core team approach at Mound.
By working with regulators as part of the core team, Mound was able to reduce costs and schedule for Building 87.

In the original baseline planning documentation, Mound assumed that decontamination of Building 87 would be required, costing approximately $251,000. After evaluating existing information, the core team determined that any potential contamination was restricted to the building's ducts and surge tanks, which are inaccessible to potential receptors. The core team concluded that because potential contamination is inaccessible, there is no exposure route, and consequently, no risk. Further, decontamination prior to reuse would be inappropriate, because the activities that will be conducted in the building will result in similar contamination. As a result of this evaluation, the core team determined that the building, in its current state, is protective of human health and the environment for industrial use, thereby eliminating the spending of $251,000 for decontamination.

Source---
A Monograph: Facility Disposition Lessons Learned from the Mound Site. U.S. Department of Energy, July 1999

2) Hold points – Alternatively, or in conjunction with decision rules, teams can define predetermined steps, specified in work planning documents, that require specific actions or hazard controls to be established prior to continuing work (e.g., characterization activities or radiological

controls) based on certain conditions that may be found.[7]

An example hold point is the following: *If a facility disposition project has begun and then trace quantities of beryllium are found through initial characterization efforts in an abandoned laboratory within the facility, it is prudent to assume a larger than expected quantity is present (therefore, workers not dressed in level B clothing should cease work) until the actual quantity can be verified*.[8]

Defining both decision rules and hold points as part of workplans serves as a means of promoting effective communication among a multi-disciplined project team. The advantages for either approach is to require the team to make explicit decisions about work scope, technical approaches, and health and safety requirements, consistent with the ISM framework.

Highlight 4.
Establishment of a Decision Rule

During the Building 21 pilot project at Mound, the site used the following decision rule to determine if the building was appropriate for release without decontamination:

***If** all concentrations of Ra-226, Th-232, and U-238 do not exceed concentrations equivalent to a dose rate of 30 mrem/yr, measured using composites or discrete concrete/paint chip samples adjusted for their distribution (i.e., according to the agreed upon model) across the concrete depth,*
***Then** the entire component (e.g., wall, floor, etc.) from which these samples were taken is radiologically clean and can be unconditionally released as debris.*

Because Mound had already conducted extensive destructive sampling for this building, there was sufficient existing information for the site to evaluate the building based on this decision rule.

Source--
A Monograph: Facility Disposition Lessons Learned From the Mound Site. U.S. Department of Energy, July 1999

Principle 2: Define a safe work scope, using the least amount of data necessary, to meet appropriate end states and end points.

As outlined in **Highlight 2**, defining a safe work scope is a critical planning task for facility disposition and traditionally has involved compiling and collecting substantial data. Although some guidance is available on the amount of data needed to make decisions (i.e., how the use of graded approach can allow tailoring of requirements), typically disposition projects have spent large amounts of their budgets on data collection with no clear method to determine when data are sufficient. Systematically implementing the tools introduced as part of this principle throughout a disposition project will help project managers to better establish when data are sufficient to make required decisions.

As shown in **Highlight 2**, many types of decisions to be made during disposition may require data collection and analysis. Specific reasons to collect data may include:

- Define end state – Deciding on the final condition of the facility during both deactivation and decommissioning projects;
- Define end points – Establishing specific conditions to complete throughout the project;
- Identify hazards – Defining chemical property, energy source, or physical conditions that have the potential to cause harm or damage to personnel or the environment (and defining what controls are needed to address them); and
- Assess technologies – Evaluating the benefits of baseline and innovative technical alternatives for performing the work (discussed further in the third principle below).

The following sections provide more details on the types data necessary to make these decisions and to better address data sufficiency issues.

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[7] See DOE-STD-1120-98, Section 3, for more information (*http://tis.eh.doe.gov/techstds/standard/std1120/s1120v1.pdf*).
[8] DOE-STD-1120-98, Section 3.3.3.

End State and End Point Determinations

As outlined in the LCAM Order and its accompanying implementation manuals,[9] project teams should define their work scope initially by establishing a clear end state and required end points for the work. These terms are defined below.

1. **End State**: Agreed-upon facility condition that is to be achieved after completion of deactivation and decommissioning. This is the ultimate goal of disposition.

2. **End Points**: Final states for each of a facility's spaces, systems, and major equipment (used to translate broad mission objectives [end states] into explicit tasks). End points are necessary to address all problems that are keeping the site from achieving the end state. (Refer to section 3.3 of the *Decommissioning Guide* and step 5 of the *Deactivation Guide* for further information).

Specifying the end points is also the key to identifying when the project is complete:

> *Specifying and achieving end points is a systematic engineering method for progressing from an existing condition to a desired final set of conditions in which the facility is safe, shutdown, and can be economically maintained and monitored. An end-point method is a way to translate broad mission statements into explicit goals that are readily understood by engineers and the crafts personnel who perform the work.…The specifications should be quantitative, where possible.*[10]

Highlight 5 shows an example of end state and end point statements. For each end point, project managers must identify the task and then evaluate whether a task can proceed based on current data, or whether additional data collection is necessary. In the example shown in **Highlight 5**, a project manager must determine: 1) whether sampling to locate all asbestos is required prior to work; or 2) sampling during the removal activities is adequate to find and segregate asbestos. This type of data collection decision is central to conducting work in the most cost effective manner.

Highlight 5.
End State and End Point Examples

412-D Heavy Water Facility Dismantlement

Initial State
- Facility contaminated with asbestos
- Facility shut down

End State
- Complete decontamination and dismantlement of facility

Example End Points
- Removal of approximately 330,000 square feet of asbestos
- Removal of all waste and contaminants from sump and auxiliary equipment to levels allowing equipment to no longer be defined as hazardous waste upon removal

Hazard Identification

When evaluating the data available on facility conditions, it is also critical to identify and assess hazards that may pose risks during subsequent disposition activities. The hazards identification process is specified in detail in guidance accompanying Step 4 of the LCAM *Deactivation Guide* and Step 8 of the LCAM *Decommissioning Guide*.

When analyzing hazards, project managers may need to: 1) assess existing facility status by collecting and reviewing available facility operating records and existing hazard baseline documentation; 2) interview past and present employees to supplement incident and operations information; 3) perform a facility walkdown with appropriate personnel, project team representatives and documentation staff; 4)

[9] See DOE O 430.1A (*http://www.explorer.doe.gov:1776/cgi-bin/w3vdkhgw?qryAQA0NQ0.R;doe-415*), and accompanying Guides G 430.1A-3, G 430.1A-4.
[10] DOE G 430.1-3.

review lessons learned reports and occurrence reports; and 5) document the hazards determined to be associated with planned work activities.[11] Specifically, hazards must be evaluated against system operations, materials handling, safety and health, and regulatory requirements. Hazard identification and analysis is one of the important potential data drivers in the disposition process. As the work scope is being established, only the hazards related to the planned work scope need to be characterized. For example, if a facility has a structurally unsound roof, that information may contribute to the decision to raze the building. On the other hand, if the facility is going to be razed, the fact that the roof is already structurally unsound and, therefore, could be dangerous may need to be investigated only with regard to protecting the workers doing the decontamination project.

Achieving Adequate Definition of Work Scope and Necessary Data by Using Decision Rules

Although LCAM Guides describe how to define end points and the *Standard* explains steps in identifying hazards, they do not include explicit descriptions of when adequate work scope planning is achieved and when data are sufficient. *Similar to an investigation conducted as part of an environmental restoration project, determining when data are adequate to make cleanup decisions and proceed with the actual project is almost always a critical decision that project teams must make.*

To address this challenge in facility disposition projects, project teams should rely on defining work through decision rules and hold points that specify the nature and magnitude of conditions that do not meet the defined end points and end state. This approach forces a project team to translate end points to specific work scope that must be implemented to meet that end point and to explicitly define data needs. Once all activities needed to meet end states are defined satisfactorily, project teams can shift their focus from defining work scope to determining what technologies or approaches need to be implemented. The capability to link all end points to the actual work scope required, through decision rules and hold points, is the test to determine whether existing data are adequate or additional data collection is required prior to work commencing.

For example, if an end point condition is:

Removal of all friable asbestos,

Project teams should develop decision rules and hold points to specify the exact work scope necessary to achieve this end point. In the course of this evaluation, project teams will have to specifically determine whether further data collection is needed prior to commencement of actual deactivation or decommissioning (e.g., are more data necessary to determine the exact locations of all friable asbestos in a building, or can the locations be determined and addressed during implementation of the deactivation project). In this case, a decision rule might be specified as follows:

If visual inspection or monitoring equipment detect friable asbestos in any room or portion of facility X during work activities, using monitoring technique Y, then the asbestos will be removed according to site procedure #T, otherwise it will be assumed not to be present unless other evidence of its presence is found.

A corresponding hold point might be:

If visual inspection or monitoring equipment detect friable asbestos in any room or portion of Facility X during work activities, stop work until workers can obtain appropriate personal protective equipment and other equipment to properly manage the waste generated.

This decision rule/hold point example defines only one possible approach that project teams could use to plan work without having to sample each square foot of a room prior to work actually

[11] DOE-STD-1120-98, Section 3.1.3.

commencing. Under different circumstances, a project team might decide that locating all friable asbestos prior to proceeding was a critical element of its project plan (e.g., to determine what rooms would require respiratory protection against asbestos prior to sending work crews into the facility). In this way, the ability to define decision rules and hold points also help to define when data are adequate to ensure planned activities are "safe" (i.e., hazards are sufficiently identified).

There are several key elements project teams will need to consider when defining decision rules and hold points for work scope and making decisions about whether additional data collection is necessary prior to commencing work:

- **"Cost" of obtaining additional data prior to commencing work scope versus the capability and costs of making decisions without the data**. If the cost of obtaining additional data is relatively inexpensive (both in terms of actual costs and the timeframe within which the data will be available), and the data will address a decision critical to the project's implementation, additional data collection may be a good investment for project teams to make. For example, if interviewing a previous employee about the conditions in a facility is easy to do (and the team believes the data reliable), then making such an investment may be very valuable.

- **"Cost" to the project of not collecting the data prior to commencement of work scope**. In some cases, the costs of not obtaining the additional data are too high to proceed with work planning (i.e., the information is critical to developing an effective work plan). For example, in a completely unknown set of conditions (e.g., where no S&M activities have occurred in the past), it may be necessary to determine baseline conditions prior to sending in work teams (e.g., to ensure they are adequately protected) or making a decision whether to use remote control or robotic equipment. In these cases, project teams must identify precisely the information they need and avoid the tendency to spend resources to collect extra information that will not assist in planning future work scope.

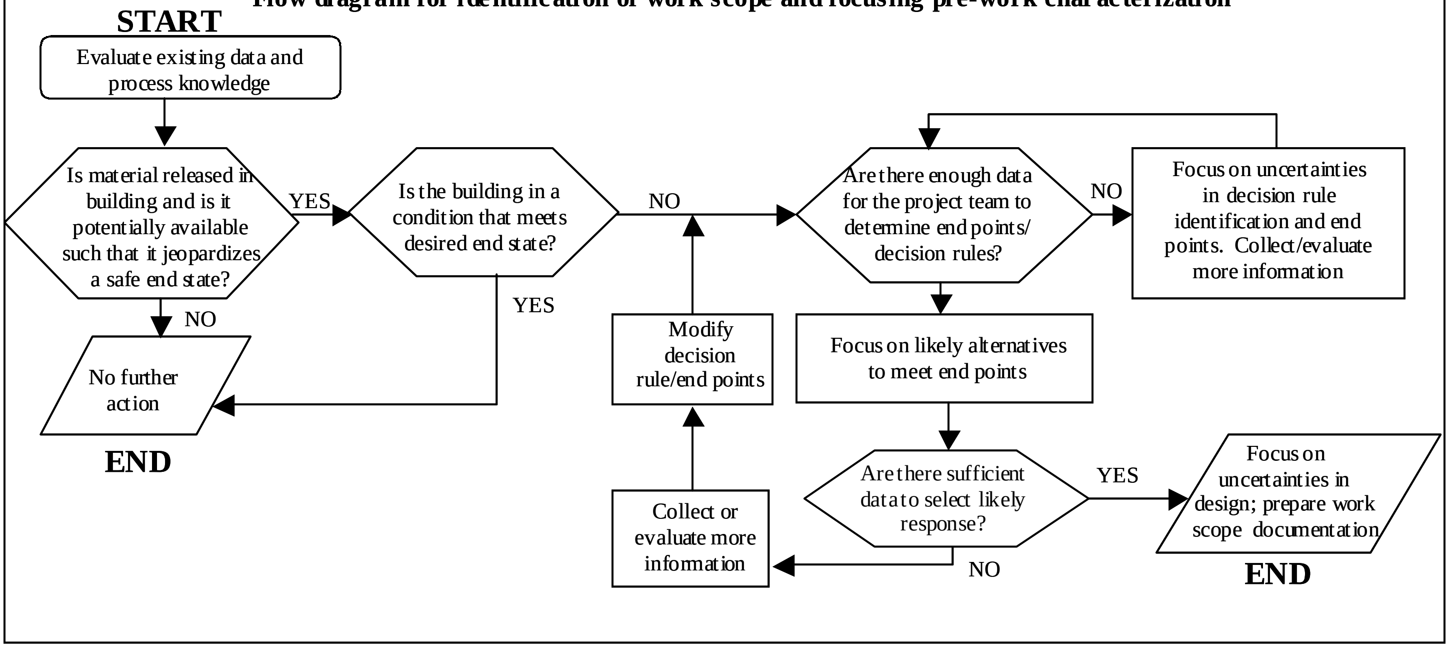
<u>Principle 3</u>: Focus early during planning on available technical alternatives, including innovative approaches, to ensure work scope is implemented as efficiently as possible.

Early identification of technologies and approaches to implement planned work scope can significantly decrease the costs and accelerate the schedules of facility disposition projects. Because most facility disposition projects start with existing data about likely conditions that will be encountered (e.g., defined end states, surveillance and maintenance data), evaluation of alternatives can generally begin simultaneously with the work scope planning conducted under the second principle.

During the process of identifying work scope, the multi-disciplined project team should identify both baseline approaches to meeting end points and end states (i.e., those technologies routinely used for the work scope being planned) and concurrently explore innovative ways to disposition a facility that may offer cost or performance advantages. This early evaluation of technologies can often assist project teams in determining what additional information is needed to distinguish which facility disposition approach will work best (e.g., by focusing only on collecting or evaluating data that will show which one of a limited number of approaches is better than the others). Project teams can avoid, therefore, the need for lengthy engineering evaluations because many approaches can be eliminated early on as possible solutions.

Highlight 6.

Flow diagram for identification of work scope and focusing pre-work characterization



Techniques to Focus Early on Technical Alternatives

Much like in planning work scope, project teams should have the key responsibility for evaluating potential approaches and determining what data are needed to make technology decisions. The challenge for project teams, therefore, is to use definition of work scope, available data, and knowledge of technologies to establish the list of realistic disposition alternatives early in the planning process.

During the process of defining work scope, the multi-disciplined team should begin by identifying appropriate responses to address the facility conditions as end points and decision rules are specified. As a facility hazard analysis is conducted to provide a baseline of anticipated hazards and their potential consequences, project teams will gain additional clarity on the feasibility of certain response alternatives. Further, integrated evaluation of the alternative techniques can then conclude with an evaluation of specific technical issues for implementing the technology. Project management (e.g., cost/schedule) and ES&H concerns or requirements that would be needed to implement the technology (e.g., does a technology pose unacceptable conditions for workers implementing the approach) can then also be evaluated.

Tools to Help Identify Innovative Technology Alternatives

There are numerous sources of information about facility disposition technologies. A central DOE source for such information is located at the Federal Energy Technology Center (FETC) in Morgantown, WV. FETC publishes reports on facility disposition technologies, oversees the implementation of demonstration projects, and maintains databases about what technologies are likely to work in a variety of circumstances.[12] **Highlight 7** summarizes one such resource available from FETC. Other sources of data about selecting likely alternatives for technologies include the Preferred Alternatives Matrices (PAM),[13] which provide information

[12] Specifically, the D&D Focus Area at FETC works to provide solutions to facilitate Environmental Management's efforts to clean up contaminated and aging facilities. It is this focus area manages the Large Scale Disposition Projects that demonstrate the differences between innovative technologies and baseline procedures by implementing both side by side.

[13] Preferred Alternatives Matrices Decommissioning. U.S. Department of Energy, EM-40, June, 1997.

and compare technologies for a wide variety of applications. Tools such as those offered through FETC and the PAM not only provide information on the way a technology works and what site conditions it best addresses, but they also compare the technologies with one another, allowing the project teams to evaluate specific benefits and shortcomings of each.

Highlight 7.
Federal Energy Technology Center Resources

FETC D&D Technologies Assessment Tool, created by the Phoenix Team, allows managers to select appropriate technology based on several categories of information (e.g., material type, decontamination category, process types), and combines some of advantages of other technology selection tools under one interface. The tool is designed to help project teams plan and execute disposition projects more efficiently by identifying, collecting, and organizing necessary data for project planning. It includes information on commercial and innovative technologies, and accurate cost estimates.

(For more information contact FETC at (304) 285-4358)

A Technique To Implement An Early Evaluation of Technologies

Once project teams have initiated the identification of approaches that will best work for the planned work scope, tools defining a hierarchy of preferred alternatives help the teams organize and assess the information needed to make technology selection decisions.

As a first step, project teams should use existing data and knowledge about a technology's past performance to focus on determining the ranking of which technologies are likely to work best. [14] In establishing this initial hierarchy, project teams should focus on potential limitations of the technologies (i.e., conditions that, if encountered, would limit its effectiveness, rule out the technology, or require too extensive a set of controls), as well as potential cost saving opportunities if applied in an innovative manner (e.g., using a technology enhancement such as scabbling a floor robotically if worker hazards are too high). Building this hierarchy allows a narrowing of technical options as well as an identification of the key questions that must be addressed prior to deciding on how to proceed. **Highlight 8** provides a sample technology evaluation for a disposition project that must decide whether to further characterize or remediate a buried pipe that is potentially contaminated.

Highlight 8.
Evaluation of Underground Pipe Disposition

End Point: Remediate a 170 foot, six inch diameter pipe, located underground and used as a drain line that potentially contains residual uranium contamination

Example Hierarchy of Probable Technologies

1) Excavate and dispose of buried pipe without initial characterization
- Most costly remediation alternative, but does not require extensive characterization prior to implementing the technology
- May expose workers and the public to contamination unless excavation controls are established
- May require characterization for waste management purposes after excavation is complete
- Will result in certain attainment of end point

2) Seal/grout pipe in place
- Could require extensive monitoring to ensure integrity of grouted pipe
- Does not address any residual soil contamination that may exist due to leaks or breaks
- May be easy to implement if access to pipe is available
- Lack of pipe integrity information may result in uncertainty whether end point is met

3) Use pipe crawler to survey pipe contents and condition before making a remediation decision
- Costly characterization approach
- Must address whether the approach will collect data that provide sufficient additional information to support a remediation decision

Once the initial hierarchy of technologies is developed based on existing information, project teams can make similar evaluations as they do with work scope and data needs:

- Are data missing that are preventing a project team from deciding which of the technologies are most appropriate to use? and
- Will any of the fatal flaws or implementation issues be best addressed prior to implementing work scope, or will the project

[14] Refer to the fact sheet DOE/EH 413-9902, *Expediting Cleanup Through Early Identification of Likely Response Actions* for more information.

team be able to make acceptable adjustments as the technology is employed?

The final principle, uncertainty management, will provide an additional tool that project teams can use to evaluate more systematically these tradeoffs about whether to undertake additional data collection or proceed with implementation of the planned work scope.

Principle 4: Actively identify, evaluate, and manage uncertainties during facility disposition.

Uncertainty, as the term is used in this *Bulletin* does not mean the amount of risk associated with meeting schedules or budgets (i.e., project contingency), nor does it refer to issues with data variability, data precision, or accuracy. Rather, uncertainty refers to any conditions that may be different from known circumstances in any aspects of planning and implementing a project. Some degree of uncertainty in facility disposition 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 that may apply as new facility conditions are discovered. Although these inherent uncertainties present a significant challenge to effective project management, recognizing and planning for them helps to ensure that projects have a better chance of staying on schedule and within budget.

Lessons learned from applying uncertainty management in facility disposition projects have shown that its application leads to:

- Explicit recognition of uncertainties;
- Project team consensus on their relevance and importance;
- Establishment of contingency plans for proceeding without creating substantial project management and project performance issues;
- Establishment of agreed upon approaches to manage uncertainties;
- Documentation on how the response will progress;
- Focus on uncertainty in problem, end state and end points; and
- Emphasis on the essential role of the multi-disciplined project team in making these decisions.

Other benefits that project teams have realized by active application of uncertainty management include better planning, enhanced communication within the project team, earlier consensus on key issues, better and more efficient use of resources, and increased safety and environmental performance.

Uncertainty Management Techniques

To manage uncertainty most effectively when evaluating alternatives or during disposition activities, the project team must first determine which uncertainties are significant. Significant uncertainties are those a project team believes could impact the implementation of the response action(s) under consideration, either because of a needed change in work scope, a needed change in the planned disposition approach, or the health and safety plan to protect workers and the public may no longer be appropriate.

Once the project team has identified the most significant uncertainties, it must decide whether to reduce uncertainty through data collection, or reach consensus on how best to manage the uncertainty through monitoring or contingency planning approaches. The cost of data collection, cost of contingency planning, and cost/schedule impacts of any future modifications in work scope or controls will all be critical factors that project teams will weigh in making this decision.

The typical process to evaluate and develop strategies to manage uncertainties involves a project team:

1) Identifying expected conditions and determining potential deviations from these conditions. (These uncertainties may be technical, programmatic, regulatory, or health and safety related);

2) Assessing the likelihood that deviations from expected conditions will occur;

3) Evaluating the potential impacts these deviations will have on protection of human health and the environment; and

4) Evaluating the time needed to respond to encountering an unexpected condition.

To better evaluate and manage these uncertainties, the project team may use an uncertainty matrix to document its evaluation process. The matrix allows project teams to document expected conditions and potential deviations. By organizing the information in this manner, the project team can more easily determine what type(s) of management strategies are most appropriate. **Highlight 9** shows an example uncertainty matrix for a sample disposition project.

Completing the remainder of the matrix involves having a project team decide on an uncertainty management strategy(ies). Three possible strategies (or combinations of strategies) are available: 1) Collect additional data prior to commencing the facility disposition project to eliminate or reduce the uncertainty (i.e., determine if the uncertain condition exists and/or will it have a major impact on the project); 2) Establish monitoring approaches during implementation of work scope to determine if the uncertain condition occurs; and/or 3) Develop contingency plans, or alternative disposition plans, that allow the project team to continue with disposition activities in the event that uncertainties become realities.

Highlight 9.
Example Uncertainty Matrix

Conditions		Evaluation					Determination of Action(s)	
Expected Condition	**Reasonable Deviation**	**Probability of Occurrence**	**Time to Respond**	**Technical Impact**	**Programmatic Impact**	**Regulatory Impact**	**Data Collection/ Monitoring Plan**	**Contingency Plan**
Thorium contamination is confined to building walls and floor	Contamination has seeped through floor and has reached soil	Medium	Long	Medium. Increased waste handling, sampling, remediation, transportation, disposal, and excavation delays	Significant. Increased cost and schedule delays	Minor. Health and safety requirements must be transferred/ developed for new scope of work		

Example Using Uncertainty Management Analysis in Planning Facility Disposition Projects

Highlight 10 shows an example of planning with an uncertainty matrix. In this situation a project team doing the planning for a disposition action came upon a report discussing a significant material spill within a large facility many years ago. Rather than remediating the spill at the time, the facility sealed off that portion of the room (approximately six feet by four feet in size). When it came time to disposition the entire facility, records did not indicate (nor could workers find anyone who could recall) where the now-sealed room with the spill was located. This left the project team planning the deactivation project with several strategic choices: 1) collect additional data to try to locate the spill (e.g., drill through walls at specified intervals; carefully use engineering drawings to calculate the most likely location; 2) monitor for conditions that might indicate workers had found the room as deactivation work proceeded; and/or 3) develop a contingency plan about how the deactivation project would change if the room were located.

By creating an uncertainty matrix, the project team can clearly identify all contributing factors to the uncertainties present. The impacts of the uncertainties also can be evaluated, and contingency plans established to address the most likely uncertainties. By utilizing this matrix process, the potential of the uncertainties impacts and methods of addressing them are clearly outlined. Furthermore, this documentation and planning approach ensures that hazards and other health and safety issues have been identified and evaluated.

From Project Planning to Execution and Close-Out

After the project team has identified, evaluated, and documented work scope, likely engineering alternatives, and uncertainties, actual disposition may commence. As uncertainties are encountered during disposition, contingency plans should be enacted. During the disposition process, detailed accounts of activities should be recorded, and further methods of saving time and money should be explored and undertaken, as appropriate. Following completion of disposition, lessons learned – both successes and pitfalls – should be distilled, documented, and disseminated. This not only completes the loop for implementation of the ISM process (continual feedback and improvement) but it provides future project planning teams with valuable information to consult as they plan their disposition projects.

Highlight 10.

Application of an Uncertainty Matrix

Conditions		Evaluation					Determination of Action(s)	
Expected Condition	**Reasonable Deviation**	**Probability of Occurrence**	**Time to Respond**	**Technical Impact**	**Program-matic Impact**	**Regulatory Impact**	**Data Collection/ Monitoring Plan**	**Contin-gency Plan**
Contam-ination / missing room does not exist and/or cannot be detected.	Contamination/ missing room exists and will be located during deactivation activities.	High, Good evidence exists of this situation being present.	Very short given immediate potential exposures and risks to workers and the environ-ment.	Significant. Immediate protection of workers and the environ-ment would likely be necessary, and decontam-ination procedures may need to begin promptly.	Significant. Increased cost and schedule delays if proper planning does not allow contingencies to be available when contaminants are found.	Significant. Appropriate health and safety requirements for a highly contam-inated area would need to be applied.	Bore into walls near the most likely area in an attempt to locate contam-inated space, keeping proper equipment and personnel on hand to handle the situation as soon as the contam-inated space is located.	Proceed with dispo-sition proce-dures, ensuring that person-nel are properly equip-ped and wearing protec-tive clothing.
Contam-inants present are similar to those found throughout the building (e.g., LLW and mixed LLW wastes.	Contaminants differ substantially from those found elsewhere in building.	Low. Evidence suggests building housed similar processes over its operating history.	Medium. PPE planned to be used should be adequate in short-term to respond to conditions.	Medium. May require different technolo-gies and approa-ches to be evaluated.	Medium. Depending on new approaches, could require cost and schedule changes.	Significant. If new contam-inants introduce new regulatory requirements.		Establish alternate manage-ment plans if wastes are TRU-only or hazard-ous-only.
Contam-inants have been removed in room and not leaked.	Contaminants have migrated through ducts or drains.	Low. Would likely have been detected through existing methods and sampling approaches.	Long. Would be able to address through ongoing disposition activities.	Low.	Low.	Low.	None. Additional data collection would not change likely approach to address through ongoing disposition activities.	

Highlight 11.

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2) DOE O 430.1A *Life Cycle Asset Management (LCAM)*, 1998.

3) *Policy on Decommissioning of DOE Facilities Under CERCLA*, May 22, 1995.

5) DOE P 450.4, *Safety Management System Policy*, October 15, 1996

6) *A Monograph: Facility Disposition Lessons Learned from the Mound Site*. U.S. Department of Energy, July 1999..

7) DOE-STD-1120-98, *Integration of Environment, Safety and Health into Facility Disposition Activities*, 1998.

8) DOE-STD-1120-98, *Integration of Environment, Safety and Health into Facility Disposition Activities*, 1998.

9) DOE O 430.1A *Life Cycle Asset Management (LCAM)*, 1998.

10) DOE G 430.1-3, *Life Cycle Asset Management (LCAM), Deactivation Implementation Guide*, September 29, 1999.

11) DOE-STD-1120-98, *Integration of Environment, Safety and Health into Facility Disposition Activities*, 1998.

12) Federal Energy Technology Center (FETC) Technologies Assessment Tool. (For more information contact FETC at (304) 285-4358.)

13) *Preferred Alternatives Matrices Decommissioning*. US DOE, EM-40, June, 1997.

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DOE/EH-0568 (June 1998), *Cost-Effective Facility Disposition Planning with Safety and Health Lessons Learned and Good Practices from the Oak Ridge Decontamination and Decommissioning Program*

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(Numbered references correspond to footnotes within the body of the *Bulletin.)*