

Vision

By 2006, the Environmental Management program intends to complete cleanup at most of its 53 remaining sites. At the 10 remaining sites, including our five largest sites, treatment will continue for the remaining “legacy” waste streams. This vision will drive budget decisions, the sequencing of projects, and the actions needed to meet program objectives. This vision will be implemented in collaboration with stakeholders, regulators, and Tribal Nations.

The Challenge

Cleanup of the radioactive, chemical, and other hazardous waste left after 50 years of U.S. production of nuclear weapons is the largest environmental management program in the world. Only in the last five years has the Department of Energy (DOE) made substantial progress in systematically defining the technical scope, schedules, and life-cycle costs of meeting this challenge, and creating a step-by-step work plan to tackle it.

The Department of Energy, its stakeholders, its regulators, Tribal Nations, the Congress, and the American people want to accelerate and finish the job of cleaning up DOE’s sites. At the same time, we all continue to share the goal of placing the safety of our workers, our communities, and the environment first among all other priorities.

Accelerating Cleanup: Paths to Closure (hereinafter referred to as *Paths to Closure*) provides, for the first time, a site-by-site, project-by-project projection of the technical scope, cost, and schedule required to complete all 353 projects at DOE’s 53 remaining cleanup sites in the United States. These projections are essential for better management—they provide critical information on technical activities, budgets, worker health and safety, and risk to inform regulators, state and local officials, stakeholders, Tribal Nations, and others. Like DOE itself, all these groups need an understanding of the technical requirements for meeting DOE’s obligations and agreements. We can then work together to clean up as many sites as possible, as quickly and safely as possible. Our goal is to clean up more than 90 percent of our sites by 2006. It is important to note that the “closure” of a site does not end DOE’s responsibility. In most cases, DOE will continue long-term surveillance and monitoring activities to ensure that human health and the environment are protected.

Resources are limited. Technical risks are often high, and schedules for meeting compliance agreements are often very ambitious. For the first time, we—DOE officials, stakeholders, regulators, Tribal Nations, and the Congress—have a comprehensive management tool that can inform us of the consequences of our choices. *Paths to Closure* provides:

- An integrated path forward for the management of DOE's Environmental Management (EM) program¹, based on a site-by-site, project-by-project, life-cycle foundation;
- A basis to evaluate EM's annual budgets in the context of long-term cleanup and closure requirements and projections;
- A response to Congressional requests for a supportable management strategy on the EM program; and
- A response to the concerns of stakeholders, regulators, and Tribal Nations.

Paths to Closure reflects the most recent evolution of DOE's ability to accurately project the cost, schedule and scope of its massive cleanup effort. *Paths to Closure* is part of a continuum from the first life-cycle cost estimates and risk analyses contained in the *Baseline Environmental Management Report* (BEMR) that initiated the first national dialogue on these issues. *Paths to Closure* is a critical management tool that reflects project-by-project work plans of each of 353 projects at DOE cleanup sites nationwide. Current life-cycle estimates for cleanup, based on the assumptions described in this report, total \$147 billion.

Paths to Closure also reflects DOE's strengthened and more organized commitment to listen and respond to stakeholder, regulator, Tribal Nation, and internal DOE concerns. The result is a more realistic projection of where we are headed, how we can accelerate cleanup and closure, and what the technical, policy, and other barriers are to the further acceleration of those goals. This report incorporates comments and guidance received from stakeholders, regulators, and Tribal Nations on the draft circulated in February 1998.

A key change to the February draft is the addition of a discussion on the Environmental Management program's decision-making process and *Paths to Closure's* relationship to that process. This report also includes a new chapter summarizing comments received on the draft and describing changes made to the draft. The basic work scope, cost, and schedule data supporting this report are the same as those used to develop the February draft *Paths to Closure*.

Chapter 1 describes in more detail the process by which *Paths to Closure* has been developed and what it hopes to accomplish, its relationship to the Environmental Management decision-making process, and a general background of the Environmental Management mission and program. Chapter 2, "Baseline Scope, Schedule, and Cost," describes how the site-by-site projections were constructed, and summarizes, for each of DOE's 11 Operations/Field Offices, the projected costs and schedules for completing the cleanup mission. Chapter 3 presents summaries of the detailed cleanup projections from three of the 11 Operations/Field Offices: Rocky Flats (Colorado), Richland (Washington), and Savannah River (South Carolina). The remaining eight Operations/Field Office

¹Throughout this document, the phrase "Environmental Management program" or "EM program" refers to operations at both the Headquarters and site level. Section 1.3 explains the relationships of Headquarters and site levels in the EM program.

summaries are in Appendix E. These summaries are built on the projections for the individual projects and sites that these offices oversee.

Chapter 4, “Meeting Programmatic Challenges,” reviews the cost drivers, budgetary constraints, and “performance enhancements” underlying the detailed analysis of the 353 projects that comprise EM’s accelerated cleanup and closure effort. Chapter 5 describes “A Management System To Support the EM Program.” Chapter 6 provides responses to the general comments received on the February draft of this document. Specific comments will be addressed in letters to the organizations providing the comment.

Relationship of *Paths to Closure* to the EM Decision-making Process

Public comments on the 1997 *Accelerating Cleanup: Focus on 2006 Discussion Draft* (hereinafter referred to as the *Discussion Draft*) and the February 1998 draft *Paths to Closure* report requested clarification on the decision-making process for the work described in *Paths to Closure*. Decisions in the EM program are driven by various statutory mandates, most notably the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Resource Conservation and Recovery Act (RCRA). Most decisions are made at the site level (with appropriate Headquarters oversight). Other decisions are made at the Headquarters level because of their complex-wide implications. In many cases, ultimate decision-making authority, in the sense of final approval authority, resides with U.S. Environmental Protection Agency (EPA) or state regulators.

Public participation is an important element of the EM program’s decision-making process. The National Environmental Policy Act (NEPA) requires federal agencies to consider the environmental impacts of their proposed actions. NEPA also requires that the public be informed of, and have an opportunity to comment on, major federal actions significantly affecting the environment. Consistent with its obligations under NEPA, the EM program performs an appropriate level of environmental review in connection with its projects, with opportunities for public involvement. For projects managed under CERCLA, EM relies on the CERCLA process to incorporate NEPA values.

Paths to Closure outlines EM’s current estimate of the scope, schedule, and costs for each site to complete the cleanup program. The estimate includes projects for which key decisions have been made pursuant to CERCLA, RCRA, or other statutes, and projects where such decisions have yet to be made. Where decisions have not yet been made, sites make **assumptions** (e.g., site planning end states) about how those cleanup actions might be carried out so that sites can define work and develop schedule and cost estimates. In those cases where decisions have not yet been made, the Environmental Management program will follow the decision-making processes called for by the relevant statutory authority that governs the activity in question (e.g., CERCLA or RCRA) with appropriate environmental review.

Paths to Closure also includes cost estimates for federal salaries, investments in science and technology, and miscellaneous support functions. EM sites and EM Headquarters make decisions through the budgetary process on the scope and pace of work for these activities. Stakeholders and Tribal Nations will have significant opportunities to participate in all decision-making processes.

Projected Scope, Schedule, and Cost

Paths to Closure contains the Environmental Management program's detailed projections on the scope, schedules, and costs at each site for the cleanup of contaminated soil, groundwater, and facilities; treating, storing, and disposing of waste; and effectively managing nuclear materials and spent nuclear fuel. These projections account for, where possible, future decisions that must be made and define the degree of technical and scope uncertainties.

A key component of *Paths to Closure* is the development of projections—or “baselines” (as estimates of individual projects are called). The projections include descriptions of the work to be accomplished, schedules (including interim milestones), and cost estimates for each project. Chapter 2 of this report provides summary information on the scope, schedule, and cost of the Environmental Management program, as derived from these baselines. The division of all cleanup work into projects and the establishment of formal projections, or baselines, represents a significant shift in DOE's approach to environmental management. The process of establishing specific projects and baselines with defined scope, schedule, and cost projections has resulted in significant reductions in EM life-cycle cost estimates.

Developing cost, schedule, and scope projections also requires identifying either an actual or, more often, a planning-based cleanup “end state” for each site. The cleanup of a site is considered to be complete—to have reached its end state—when it has been cleaned up in accordance with agreed-upon cleanup standards. (Additional elements of this definition are provided in Chapter 1.) To develop a cost, schedule, and scope projection for a project, some assumptions have been made about the desired end state. The projections made for this document are based not only on end states that are consistent with existing agreements and applicable regulations but also on planned end states based on assumptions for the many sites still in the process of working with stakeholders, regulators, and Tribal Nations to finalize agreed-upon end states. Many end states will change for a number of reasons, including the development of new technologies, more economical cleanup approaches, and changes in the interests of stakeholders, regulators, and Tribal Nations.

For the first time, every site has a critical closure path, identifying the key technical and programmatic activities that must occur before closing a site. Also for the first time, each site has waste and materials disposition maps that describe each waste stream, the steps for processing or managing the wastes, and where the wastes are intended to be permanently disposed (if known). And finally, for

the first time, DOE has identified the potential roadblocks on the critical closure path, by identifying technological uncertainty and the degree of intersite dependence, among other factors.

Projections of scope, schedule, and cost contain the data necessary to establish an estimated life-cycle cleanup cost and a completion date for EM work at each site. *Paths to Closure* provides a funding guideline of \$5.75 billion per year for the entire EM program, starting in FY 1999. Site funding needs in excess of the guideline vary from year to year, as is shown in Exhibit 4-2 of this document. No increases are included for future inflation, so in “real” terms (i.e., in terms of constant FY 1998 dollars), the amount of funding decreases every year.

With this funding guideline, the sum of the life-cycle cost estimates for the current 353 projects is about \$147 billion between 1997 and 2070. Of this amount, about \$57 billion would be expended through 2006; about \$90 billion would be expended from 2007-2070. The table below provides a summary of these costs, by Operations/Field Office and time frame.

EM Costs by Operations/Field Office

Operations/ Field Office	Estimated EM Costs (1997-2006)	Estimated EM Costs (2007-2070)	Total Estimated EM Costs (1997-2070)	Number of Sites Completed	
	(All costs in billions of constant 1998 dollars)			1998- 2006	After 2006
Albuquerque	2.1	2.0	4.1	12	1
Carlsbad	1.8	5.9	7.7	0	1
Chicago	0.3	0.0	0.3	5	0
Headquarters/ National Programs	5.7	5.6	11.3	NA	NA
Idaho	5.0	11.3	16.3	0	1
Nevada	0.9	1.3	2.2	8	2
Oakland	0.7	0.3	1.0	8	1
Oak Ridge	5.4	7.7	13.1	3	2
Ohio	4.6	0.2	4.8	5	1 ^a
Richland	13.0	37.3	50.3	0	1
Rocky Flats	5.3	1.0	6.3	0	1 ^b
Savannah River	12.0	17.7	29.7	0	1
TOTAL^c	57.0	90.3	147.3	41^d	12

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^aThe one site after 2006 is the Fernald Environmental Management Project (FEMP). It is expected that cleanup at FEMP also will be completed before 2006, although the baseline currently indicates completion in 2008.

^bThe current baseline for the Rocky Flats Environmental Technology Site reflects a 2010 closure. However, the baseline is being revised to reflect the commitment to complete closure by 2006.

^cIndividual costs may not sum to totals due to rounding.

^dWith the accelerated goal of cleaning up the Rocky Flats Environmental Technology Site and the Fernald Environmental Management Project (by 2006 and 2005 respectively), the number of sites completed by 2006 would be 43.

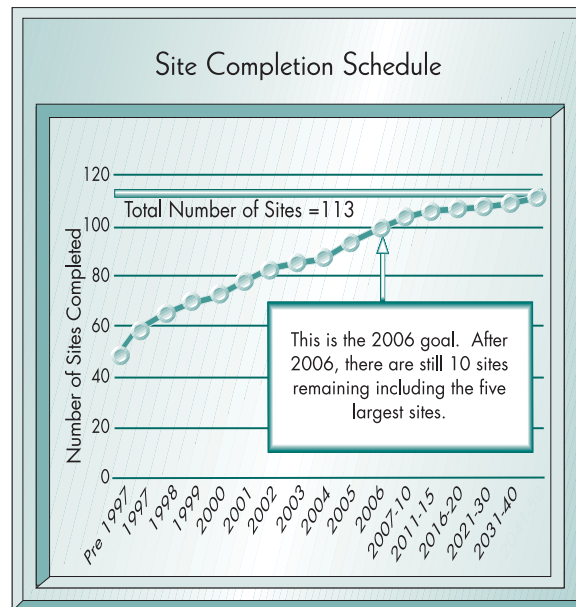
In addition to the \$147 billion *Paths to Closure* life-cycle cost estimate, stakeholders have asked for other costs associated with the EM program, but not included in *Paths to Closure*, to be identified. Two examples of these costs are:

- \$8.1 billion associated with newly-generated waste generated after FY 2000. *Paths to Closure* was developed under the assumption that EM would transfer these costs back to the generators after FY 2000.
- \$8.7 billion associated with deactivation and decommissioning of excess facilities not currently under EM jurisdiction. DOE is considering the transfer of additional surplus facilities to the EM program beginning in FY 2002 with limited exceptions occurring before that date. If and when such transfers occur, EM will develop projects and adjust current assumptions to account for these facilities and to include these costs in future updates to *Paths to Closure*.

Chapter 3 provides more detailed scope, schedule, and cost information for sites under the jurisdiction of three of DOE's Operations/Field Offices. Appendix E provides information on the remaining eight field offices. The more detailed site versions of *Paths to Closure* provide still further details.

Numerous cleanup activities will continue beyond 2006. Projections reveal that at the Hanford Site in Washington, the Idaho National Engineering and Environmental Laboratory, and the Savannah River Site in South Carolina, about half the costs will be incurred after 2006 for treatment and disposal of high-level and transuranic waste. Although some activities will not be completed by 2006, a primary goal of *Paths to Closure* is to reduce outyear costs. At the end of FY 1997, 60 of the 113 contaminated

sites had been cleaned up. An additional 43 sites are estimated to be cleaned up between 1998 and 2006—for a total of 103 cleaned up sites by 2006 (see box). Long-term cleanup activities will continue at the remaining 10 sites. Major cleanup goals for 2006 include:



- Remediation of 80 percent of all release sites, that is, specific locations or areas where contaminants may have been released to the environment;
- Stabilization of all nuclear materials and spent nuclear fuel and completion of all preparations for their ultimate disposition; and

- Completion of all cleanup activities at some major sites, for example, the Rocky Flats Environmental Technology Site, the Fernald Environmental Management Project, the Miamisburg Environmental Management Project, and the Weldon Spring Site.

Meeting Programmatic Challenges

To reduce the costs of this massive cleanup effort, the Environmental Management program continues to seek significant opportunities to accelerate cleanup without jeopardizing the safety of workers, communities, or the environment. *Paths to Closure* addresses the need to continuously seek “performance enhancements,” i.e., productivity improvements that will allow DOE to accelerate cleanup and closure schedules, and lower overall life-cycle cleanup costs. The EM program is focusing on six specific mechanisms to help achieve additional performance efficiencies (see box).

Accelerating cleanup even further than is projected in *Paths to Closure* will certainly happen, although the degree of acceleration is difficult to predict. For example, DOE and its stakeholders and regulators in Colorado have established an accelerated goal of cleaning up and closing the Rocky Flats Environmental Technology Site by 2006—four years earlier than the current baseline indicates. DOE will attempt to set similar acceleration goals at other cleanup sites. Credible acceleration goals will be based on the likelihood of achieving technology deployment, intersite integration, and other productivity improvements. Chapter 4 of this report discusses enhanced performance mechanisms and goals in greater detail.

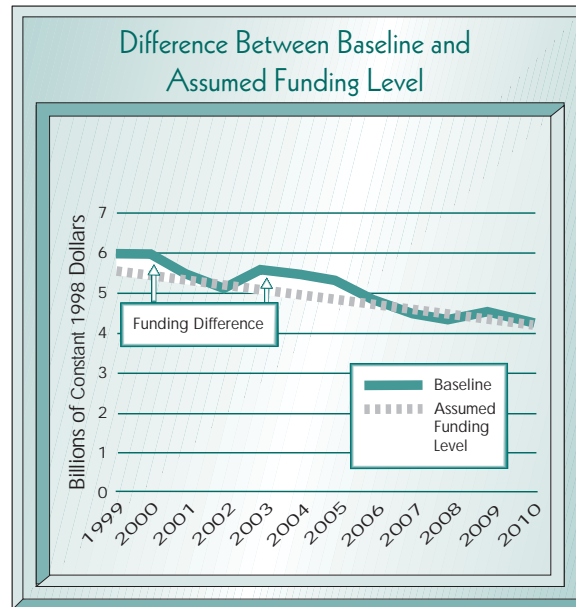
Although *Paths to Closure* is not a budget document, it is designed to be an integral part

of the annual and multi-year DOE budget development process. The projections prepared for each site are the basis upon which future resource allocation decisions can be made. In building future budgets, differences will emerge

Performance Enhancement Mechanisms	
Mechanism	Achieves Efficiency By...
Technology Deployment	Introducing less expensive and/or more effective cleanup technologies.
Integration	Identifying better ways to transfer and manage wastes among sites.
Project Sequencing	Completing projects with high “upkeep” costs.
Pollution Prevention	Reducing waste volumes and associated disposal costs.
Contract Reform	Creating incentives for contractors to work less expensively.
Lessons Learned	Increasing productivity based on lessons learned.

between the cost projections established in this and future *Paths to Closure* reports, and budget allocations to DOE from the President and the Congress. *Paths to Closure* gives EM, its stakeholders, regulators, and Tribal Nations, and the Congress the management tools we need to understand the consequences of our choices—the effects on life-cycle costs and closure date schedules of alternative near-term and outyear budget scenarios.

Paths to Closure provides a funding guideline of \$5.75 billion per year for the entire EM program, starting in FY 1999. This figure was set in October 1997, prior to DOE receiving its FY 1999 and outyear budget targets from the President. It was essential to establish a funding profile at that time in order to produce this report on schedule. In some cases, sites exceeded the \$5.75 funding guideline to meet compliance commitments. One critical budget and resource allocation question is how the EM program will make up the



difference between the funding guideline of \$5.75 billion, and the requirement for more than that in several future years to meet compliance agreements and other commitments. An even more difficult question is what would happen if the funding guideline of \$5.75 billion per year were not met. The chart above converts the \$5.75 billion per year in “current” (or “nominal”) dollars, to “constant” FY 1998 dollars—thus showing how inflation lowers the “real” amount of money available each year. The higher “baseline” level of funding is that which is required based on the projections from each of the 353 projects. The gap between the two is \$3.9 billion (in constant FY 1998 dollars) between 1999 and 2006.

The first step in meeting this challenge is the aggressive application of the productivity improvements—the performance enhancements—described above and in Chapter 4. The performance enhancements are expected to include improvements in the efficiency of day-to-day operations, better application of science, the deployment of new technologies, and streamlined approaches—to be developed with regulators—for managing waste and cleaning up contaminated areas.

If performance enhancements are not sufficient to address funding differences at specific sites, and if additional funding were not obtained, EM would pursue several options. In cases where new work is required immediately to protect safety and health and where related costs exceed available appropriations, the Department will shift funds from lower priority activities to ensure that public health and safety are adequately protected.

In future years where larger funding differences are projected, the Department intends to work with the Office of Management and Budget (OMB) and the Congress to seek additional funds for vitally important missions. Also, DOE will propose shifting outyear funding from completed sites to other sites. No matter how successful these efforts are, however, the discipline of working within binding budget ceilings means that the EM program must engage in an active dialogue with stakeholders, regulators, and Tribal Nations about activities and programs at each of the sites—and collectively make hard choices regarding priorities.

A Management System to Support the EM Program

The Environmental Management program is developing a formal integrated management system to more closely align *Paths to Closure* and the annual budget formulation process. This system will allow the Environmental Management program to use a single framework for all activities linked to planning, the budget formulation and execution process, and performance measurement. For the first time, EM is working toward the implementation of a truly integrated life-cycle database containing most of the data the field provides to Headquarters. Chapter 5 of this report describes the EM management system components of the process in greater detail. Some of the new management tools include:

- Waste/Material Disposition Maps (or flow charts), which are conceptual approaches to the environmental remediation of contaminated soil, groundwater, and buildings; and for the storage, treatment, and disposal of all waste and material at all sites;
- Critical Closure Paths, which are the schedules of activities that must be completed on time in order for cleanup to be accomplished;
- Identification of specific science and technology needs, to help reduce the cost and risk of specific projects by developing improved cleanup technologies; and
- Programmatic Risk Assessments, which provide a measure of the risks associated with accomplishing the work and meeting schedules and cost estimates.

As the cleanup program moves forward, the quality of the data on which the above tools are based continues to improve. *Paths to Closure* represents a significant refinement over the national *Discussion Draft* and the site *Discussion Drafts* published in June 1997. Project baselines, the heart of *Paths*

to Closure, are more technically sound and only include projected performance enhancements (productivity improvements) that can be documented. Management-related data such as disposition maps, critical closure paths, and programmatic risk assignments have been incorporated to enhance the rigor, quality, and realism of the planning process. Such data will continue to be refined.

Stakeholder, Regulator, and Tribal Nation Involvement

EM Headquarters received 39 letters during the draft *Paths to Closure* comment period, which included over 260 comments on a broad range of subjects from stakeholders, regulators, and Tribal Nations. Many of these comments were supportive of the goals and strategies outlined in the draft of *Paths to Closure*. These comments were divided into 13 distinct categories which capture those comments found to be similar in nature from multiple stakeholders: Relationship of *Paths to Closure* to Decision-making, Budget, Compliance, Uncertainties/Contingencies, End States/Stewardship, Safety and Health, Data Quality, Waste and Materials Disposition, Transportation, Enhanced Performance, Privatization, Technology Development, and Public Participation.

Chapter 6 provides responses to comments in each of these categories. In addition, keeping with EM's commitment to respond to the issues of concern expressed in the letters, many of those comments have been addressed in the body of the document (see text box).

The comment process was designed to give stakeholders, regulators, and Tribal Nations the opportunity to continue to participate meaningfully in the process. As these groups engage in helping to develop EM's long-term priorities and objectives, they will continue to help shape the Environmental Management program.

Comment Area	Addressed in Chapter
Relationship of <i>Paths to Closure</i> to Decision-making	1
Budget	2, 4, 5
Compliance	1, 4
Uncertainties/Contingencies	1, 4
End States/Stewardship	1, 3, E
Safety and Health	1, 4
Data Quality	5
Waste and Materials Disposition	1, 3, 5
Transportation	1
Enhanced Performance	4
Privatization	4
Technology Development	1, 4
Public Participation	6