Chapter 2

Baseline Scope, Schedule, and Cost

Chapter 2 presents the scope, schedule, and cost for *Paths to Closure*. This chapter begins with a discussion of the approach taken by sites to the development of baselines and the relationship of those baselines to the Project Baseline Summaries (PBSs) used to aggregate the data in *Paths to Closure*. Following the discussion on baselines, the chapter provides a summary of the baselines for each Operations/Field Office, a profile for the completion of Environmental Management (EM) work at each site, a discussion of what will be completed by 2006, a discussion of how the EM program is managing its cleanup schedule, and a comparison between *Paths to Closure* and *Discussion Draft* estimates.

2.1 The Development Of Site Baselines

One of the fundamental improvements to the management of the EM program is the aggregation of units of work essential to EM's cleanup mission into projects. The creation of projects enables Field managers to develop detailed projections of scope, schedule, and cost (that is, a baseline) for each site, based upon the aggregation of logical, discrete units of work. Historically, during the nuclear weapons production phase, sites used mostly level-of-effort methodologies to develop estimates. In contrast, site baselines, built from individual project baselines, are the foundation for *Paths to Closure*. The direct link of scope, schedule, and cost estimates in site baselines to estimates in *Paths to Closure* means that the quality of data in the document is linked directly to the quality of site baselines.

One key determinant of quality is the definition of scope. It is more difficult to develop a baseline for a technically challenging, first-of-its-kind project than for a clearly-defined project that is based on an established approach. The EM program is responsible for a massive environmental cleanup effort, much of which is the first of its kind. A good example of the type of challenge that the Environmental Management program faces is the cleanup of high-level waste tanks at the Hanford Site, a project which is estimated to cost $30 billion (constant 1998 dollars) over the life cycle. The Hanford high-level waste project has been characterized as one of the most challenging engineering projects ever undertaken. Given the technological challenges and the uncertainties involved with the characterization of tank waste, the chemical interactivity of the constituents, the method of removal of waste from the bottom of the tanks, and the processing method that will be applied once the material has been removed from the tanks, the overall baseline for this project encompasses a great deal of uncertainty.

Despite uncertainties, EM's knowledge has increased substantially over the past several years, supporting the development of better baselines. The development of conceptual approaches to the storage, treatment, and disposal of all waste types at all sites is an example of the progress that the EM program has made. Such conceptual approaches, reflected in schematic diagrams called **disposition maps**, provide a picture of the scope of the EM program's environmental restoration and waste management activities. In addition, the maps simultaneously identify uncertainty related to overall scope and disposition. Each site also has improved its understanding of its **critical closure path**, that is, the universe and schedule of activities that must be completed on time in order for EM activities to be completed as scheduled. Both disposition maps and critical closure paths at each site are works in progress that help document the scope, schedule, and cost of the EM program. A short-term priority for the EM program is to continue to improve its understanding of the scope of the cleanup program through the refinement of baselines and related tools, including disposition maps and critical closure paths.

As part of the overall guidance for developing the draft cleanup strategy, sites were asked to develop baselines within a funding assumption of $5.75 billion per year (current year dollars) for the entire EM program. In response to concerns expressed by stakeholders, regulators, and Tribal Nations, the EM program requested that the sites include assumptions of enhanced performance (reductions in cost achieved through increased efficiency), integration assumptions, and other cost-saving assumptions only in cases in which sites were confident that such performance could be demonstrated or where stakeholders, regulators, and Tribal Nations have approved them. Some site baselines currently exceed their share of the $5.75 billion per year funding assumption to show compliance requirements.

Key Elements of a Project Baseline Summary

- Scope
- Schedule
- Cost
- Risk
- Technical Approach
- End state
- Regulatory Drivers
- Safety and Health
- Performance Metrics

Sites provided information from their baselines to support *Paths to Closure*, primarily in the form of PBSs. Appendix A presents a complete list of PBSs. A **PBS** is not the project baseline, but rather a management tool that summarizes information about each project (see text box). PBSs are used for planning, budgeting, and evaluation. Appendix B provides a sample PBS.

2.2 Operations/Field Office Estimates of Cost and Closure

The PBS for each project includes information about scope, schedule, and cost from 1997 through 2070. While all EM cleanup activities are scheduled for completion before 2070, some long-term surveillance and monitoring and stewardship activities will continue beyond 2070. *Paths to Closure*, however, includes only costs through 2070. In each PBS, Operations / Field Offices reported costs in current year dollars; therefore, the cost estimates have already been adjusted for inflation (assumed to be 2.7 percent per year) and indicate the cost at the expected time of the outlay. Inflation lowers the "buying power" of each dollar over time, so a project

Exhibit 2-1
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[a]	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[b]
Richland	13.0	37.3	50.3	0	1
Rocky Flats	5.3	1.0	6.3	0	1[c]
Savannah River	12.0	17.7	29.7	0	1
TOTAL[d]	57.0	90.3	147.3	41	12[e]
				53	

[a] Costs for the Carlsbad Area Office include the costs associated with operating the Waste Isolation Pilot Plant as the national repository for the disposal of transuranic waste and the costs of decommissioning the site after disposal operations have ended.

[b] The 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.

[c] Although the current baseline reflects a 2010 closure, it is the goal of the Rocky Flats Environmental Technology Site to achieve closure by 2006.

[d] Individual costs may not sum to totals due to rounding.

[e] When the Rocky Flats Environmental Technology Site and the Fernald Site are accelerated, there are only ten sites remaining after 2006.

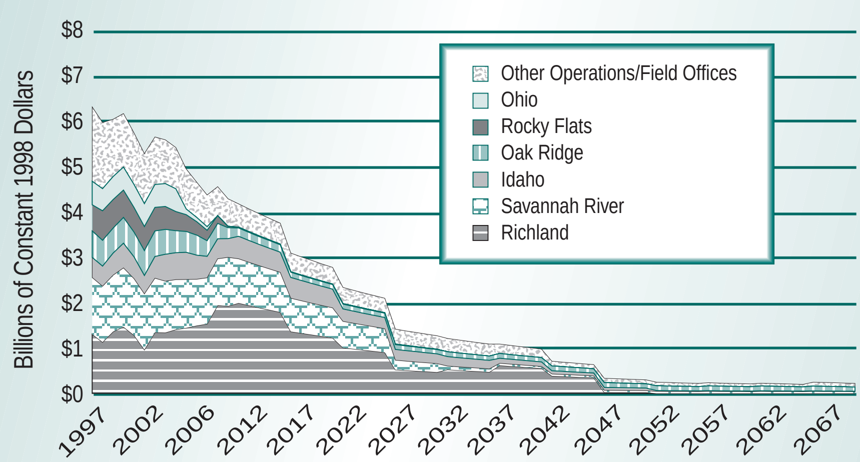
that costs $5 million current year dollars in 1998 is more expensive, in relative terms, than a project that costs $5 million in current year dollars in 2006. The use of constant 1998 dollars in discussions of cost estimates in *Paths to Closure* ensures the comparability of costs over time, eliminating those variations that are the result solely of inflation.

The EM program baseline is based on 353 projects, each with a corresponding PBS. The cost estimate (1997 through 2070) for the EM program—$147.3 billion in constant FY 1998 dollars—aggregates costs for all 353 projects. Exhibit 2-1 shows the overall estimate by Operations / Field Office. The 53 sites in the "Number of Sites Completed" columns includes sites planned for completion in 1998 and beyond. Hisorically, 60 sites were completed through 1997. Appendix C provides a complete list of geographic sites with their actual or planned completion dates.

Exhibit 2-1 shows that the current site baselines support the 2006 vision of completing cleanup at most sites by 2006. However, it also shows that by 2006, completion of EM activities occurs primarily at the Department's smaller sites. After 2006, EM's greatest challenge will be to complete cleanup at some of the largest and most technically complex sites. In fact, 77 percent of the estimated costs after 2006 are accounted for by the Savannah River Site, the Hanford Site (managed by Richland), and the Idaho National Engineering and Environmental Laboratory.

Exhibit 2-2 displays the life-cycle cleanup costs of the EM program, over time, by Operations / Field Office. "Other Operations / Field Offices" in Exhibit 2-2 includes Albuquerque, Carlsbad, Chicago, Headquarters / National Programs, Nevada, and Oakland.

Exhibit 2-2
Environmental Management Cleanup Costs by Operations/Field Office Over Time



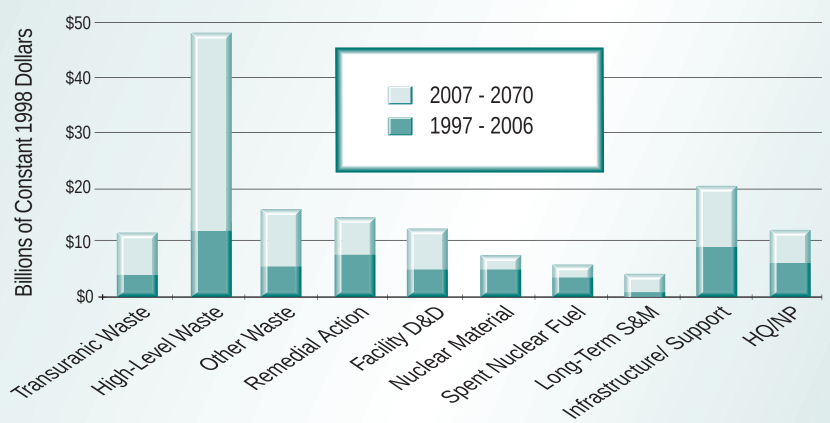
2.3 Details of Life-Cycle Costs

This section presents details of the life-cycle cleanup costs for the EM program. First, the section relates costs to the types of work EM performs, thereby illuminating major cost drivers for the program. Second, the section explains other scope and costs that, while not the focus of *Paths to Closure*, are nevertheless important to put this strategy in context. Finally, the section displays costs by a system of categories that parallels EM's current budget structure, shows the benefits of aggregating units of work into projects, and illustrates the EM program's focus on the completion of specific projects by 2006.

2.3.1 Cost by Category of the EM Work Scope

The $147.3 billion life-cycle cost estimate includes the costs of completing all known EM work scope. To provide additional insights on cost, each Operations/Field Office estimated the distribution of costs by scope category. This supplementary data by category are presented in Exhibit 2-3. Brief explanations of the categories follow the exhibit.

Exhibit 2-3
Life-Cycle Costs by Category



High-Level Waste. Currently, the EM program is responsible for the storage, treatment, and stabilization of hundreds of thousands of cubic meters of highly radioactive waste generated from decades of nuclear weapons production, mostly at the Savannah River Site, the Hanford Site, and the Idaho National Engineering and Environmental Laboratory. High-level waste also is found at the West Valley site in New York. High-level waste management is by far the largest cost driver for EM; it is estimated to account for 32 percent of the total cost of the EM program over the life cycle. Approximately 74 percent of these costs will remain after 2006.

Transuranic Waste. The EM program is responsible for the storage, treatment, and disposal of approximately 130,000 cubic meters of contact- and remote-handled transuranic waste from known defense-related testing and experimental projects. This estimate includes volumes of transuranic waste that is currently stored and that which is expected to be generated. The EM program expects to dispose of an additional 40,000 cubic meters of such waste generated from continuing and future missions as well as decommissioning and other defense-related projects of DOE. Before it can be shipped, transuranic waste requires safe storage and sometimes requires treatment. Currently, transuranic waste activities are estimated to be 7 percent of the total cost of the EM program over the life cycle. Sixty-six percent of the cost for transuranic waste will be incurred after 2006.

Other Waste. The EM program must manage millions of cubic meters of other types of waste including low-level radioactive waste, hazardous waste, and mixed low-level waste (containing both radioactive and hazardous constituents). Some of that waste is in storage awaiting treatment and disposal; more such waste will be generated during the cleanup process. Virtually all sites manage one or more of these types of waste. The EM program currently is estimating that 11 percent of its total cost will go toward addressing these types of waste over the life cycle.

Remedial Action. The EM program is responsible for characterization and cleanup of approximately 9,000 "release sites." A release site is a specific area, within a larger geographic site, at which contaminants or contaminated materials might have been spilled, dumped, disposed of, or abandoned. The cleanup of release sites involves the remediation of soil, surface water, and/or groundwater. Some release sites require no further action while others require remediation or monitoring. Release sites range in size from very small spills to large dumping areas. Characterization and remediation of release sites are estimated to account for 10 percent of the total cost of the EM program over the life cycle. Most of these costs are likely to be incurred before 2006.

Facilities. EM's facilities range from small guardhouses to massive excess production facilities and nuclear reactors. Combined, the area of these facilities currently assigned to EM is more than 65 million square feet. This total square footage exceeds the area of 1,300 football fields. Most of the large buildings contain contaminated equipment, machinery, and pipes. Others store waste and nuclear materials. Most of the buildings require deactivation, decontamination, and decommissioning. These facilities are projected to account for 8 percent of the total cost of the EM program over the life cycle.

Nuclear Materials. Nuclear materials include plutonium, uranium, and other materials in various forms (for example, metals, oxides, solutions, residues). The EM program anticipates that 4 percent of the total life-cycle cost of the EM program will be incurred by the stabilization, packaging, and management of nuclear materials. Most of these costs are likely to be incurred before 2006.

Spent Nuclear Fuel. Spent nuclear fuel includes fuel, targets (excluding medical isotope targets), slugs, and sludge. The Idaho National Engineering and Environmental Laboratory, the Savannah River Site, and the Hanford Site generated most of the existing spent nuclear fuel. The EM program also manages foreign research reactor spent fuel. The EM program estimates that 3 percent of the total Environmental Management cost over the life cycle will go toward spent nuclear fuel management. Most of these costs are likely to be incurred before 2006.

Long-Term Surveillance and Monitoring. The Environmental Management program is responsible for the long-term surveillance and monitoring of up to 81 sites, Surveillance and monitoring activities currently account for 3 percent of the life-cycle estimate. However, some sites need to further refine estimates in this area. A site is considered to be complete before long-term surveillance and monitoring activities end; at some sites these activities will continue well beyond 2070.

Infrastructure and Support. The Environmental Management program maintains site infrastructure, conducts program management and oversight activities, and manages other efforts to ensure the safety and health of workers and the public and to protect the environment while conducting cleanup activities. At some sites, the EM program provides such services as utilities, security, road maintenance, facilities upgrades, and similar activities. The EM program estimates that 14 percent of its total life-cycle costs will be allocated to these activities. At some sites, these costs are allocated to specific waste management or remedial action activities. Therefore, some infrastructure/support costs are captured in other categories.

National Programs and Headquarters. This category includes program direction, which funds federal salaries and related costs for the entire EM complex (both Headquarters and the Field). National programs include such crosscutting projects as the National Transportation program, the National Pollution Prevention program, and the National Science and Technology program. The EM program expects that 8 percent of its life-cycle costs will be expended on these activities.

2.3.2 Other Scope and Costs

In addition to the baseline costs outlined in Section 2.2 and Section 2.3, PBSs include other costs that require explanation. *Paths to Closure* was developed under the assumption that the EM program will not accept any newly-generated, non-EM waste after FY 2000. For the Operations/Field Offices that manage those wastes, especially those that manage waste at operating national laboratories (for example, Albuquerque, Chicago, Oakland, and Oak Ridge), responsibility is expected to be transferred to the generator after FY 2000, which is usually another program of the Department, such as the Defense Programs or Energy Research. Exhibit 2-4 shows these costs in the column labeled “Costs Transferred to Other Programs.” The EM program expects to transfer EM budget target dollars associated with newly-generated, non-EM waste to the generators as well. Should this assumption change, the affected project baselines (and PBSs) will require revision.

In other cases, costs may be paid by other DOE programs or entities other than DOE to support the cleanup at EM sites. Some examples include state contributions to the Uranium Mill Tailings Remedial Action Project and the co-funding of some EM activities with the Department's Office of Defense Programs. The EM program anticipates such funding will continue. The discussion in Section 2.2 excluded funds contributed by these other entities to cover such costs; however, such costs are shown in Exhibit 2-4 in the column labeled "Baseline Costs Paid by Other Entities." Exhibit 2-4 also displays the EM baseline cost (from Section 2.2).

Finally, the current baseline assumes that the EM program will not accept additional surplus facilities for deactivation and decommissioning. However, the Department is considering transferring additional surplus facilities to the EM program beginning in 2002 with limited exceptions occurring before that date. If and when such transfers occur, the EM program will develop projects and adjust current assumptions to account for the cleanup of these facilities and include these costs in future updates to *Paths to Closure*.

Exhibit 2-4
EM Baseline Costs and other Costs

Operations/ Field Office	EM Baseline Cost	Costs Transferred to Other Programs	Baseline Costs Paid by Other Entities
	(billions of constant 1998 dollars)		
Albuquerque	4.1	4.5	<0.1
Carlsbad	7.7	0	0
Chicago	0.3	1.1	0
Headquarters/ National Programs	11.3	0	<0.1
Idaho	16.3	0	0
Nevada	2.2	0	0
Oakland	1.0	1.1	0
Oak Ridge	13.1	1.4	0.1
Ohio	4.8	0	0
Richland	50.3	0	0.5
Rocky Flats	6.3	0	<0.1
Savannah River	29.7	0	0.1

Currently, *Paths to Closure* does not include the costs associated with decommissioning the Portsmouth Gaseous Diffusion Plant in Ohio and the Paducah Gaseous Diffusion Plant in Kentucky. Furthermore, the current assumptions do not include the decommissioning costs for some facilities, such as the spent fuel pools and canyons at the Savannah River Site in South Carolina. As assumptions change, future updates to *Paths to Closure* will be adjusted accordingly.

The effect of the adjustment to meet such needs could be significant. The 1996 *Baseline Environmental Management Report* estimated the cost of decommissioning such facilities at more than $10 billion.

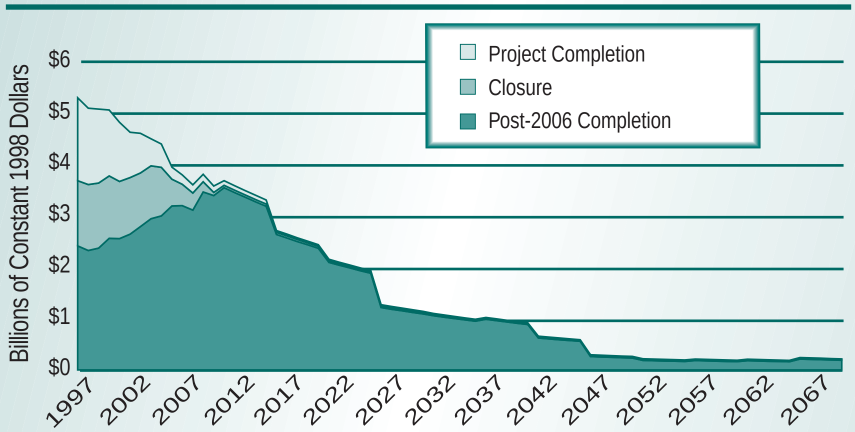
2.3.3 Cost by Category of Project Completion Date

For the FY 1999 budget request, the EM program developed a new categorization structure based upon the projects included in *Paths to Closure*. The new structure includes three program budget accounts:

- **Closure** includes all projects at sites closed by 2006 without a continuing DOE mission.
- **Project Completion** includes sites completed by 2006 with an ongoing DOE mission, and projects completed by 2006 at sites with cleanup work continuing after 2006.
- **Post-2006 Completion** includes projects that are expected to require work beyond FY 2006.

The new structure also identifies three additional accounts: Technology Development, Program Direction (i.e., federal salaries), and Privatization projects. Exhibit 2-5 shows the **baseline cost** of the EM program broken out over time into the Closure, Project Completion, and Post-2006 Completion accounts. Most of the projects in the Closure and the Project Completion accounts are scheduled for completion by 2006. Other projects and/or sites could move into project completion or closure as they achieve additional enhanced performance.

Exhibit 2-5
Baseline Cost by Closure, Project Completion, and Post-2006 Completion*



* Does not include technology development, program direction, or privatization.
Funding beyond 2006 for projects in the Closure and Project Completion accounts is for long-term surveillance and monitoring and for the baseline (non-accelerated) closure strategy for Rocky Flats (closed 2010) and Fernald (closed 2008).

2.4 Completion Schedule for the EM Program

Each Operations / Field Office estimated a completion date for major EM activities at each site and for each of its projects. The definition of "complete" as outlined in Chapter 1 does not assume that the EM program or DOE will leave a site when cleanup activities at that site are considered complete. Instead, sites describe planning assumptions and cost estimates for long-term care in light of the anticipated end state of the site. Chapter 6 presents a discussion of stewardship in the context of the time frame of *Paths to Closure*. The EM program will prepare a separate Stewardship Report that will discuss post-EM closure activities in more detail. Exhibit 2-6 presents the cumulative annual completion schedule for the EM sites. As shown in Exhibit 2-6, EM completed cleanup at 50 sites before 1997.

Exhibit 2-6
Site Completion Schedule

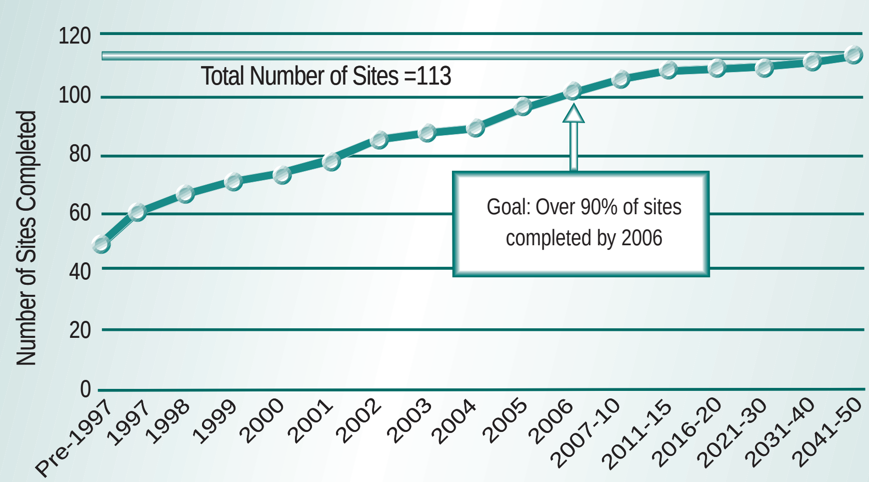


Exhibit 2-7 shows the planned completion date for each site at which cleanup activities remained underway at the beginning of FY 1997[1]. The exhibit is organized by state.

Including sites completed prior to 1997, the EM program is estimating, given the assumed level of funding, completion of 103 of 113, or over 90%, of the sites by 2006 for which the Environmental Management program had or has cleanup responsibility. This goal assumes that EM meets the commitment to complete the Rocky Flats Environmental Technology Site and the Fernald Environmental Management Project by 2006 and 2005, respectively. If these goals are realized, only ten sites will not complete their EM missions by 2006. Appendix C presents a complete list of all geographic sites.

Exhibit 2-7
Baseline Completion Date for Each Site

State	Operations/ Field Office	Site	Completion Date
Alaska	Nevada	Amchitka Island	2001
California	Oakland	Geothermal Test Facility	1997
California	Albuquerque	Sandia National Laboratories - California	1999
California	Oakland	General Atomics Site	2000
California	Oakland	General Electric Vallecitos Nuclear Center	2005
California	Oakland	Laboratory for Energy-Related Health Research	2002
California	Oakland	Lawrence Berkeley National Laboratory	2003
California	Oakland	Lawrence Livermore National Laboratory Main Site	2006
California	Oakland	Lawrence Livermore National Laboratory Site 300	2006
California	Oakland	Energy Technology Engineering Center	2006
California	Oakland	Stanford Linear Accelerator Center	2000
Colorado	Albuquerque	Grand Junction Office Site	2002
Colorado	Albuquerque	Maybell UMTRA Site	1998
Colorado	Albuquerque	Naturita UMTRA Site	1998
Colorado	Albuquerque	New Rifle UMTRA Site	1997
Colorado	Albuquerque	Old Rifle UMTRA Site	1997
Colorado	Albuquerque	Slick Rock Old North Continent UMTRA Site	1997
Colorado	Albuquerque	Slick Rock Union Carbide UMTRA Site	1997
Colorado	Nevada	Rio Blanco	2005
Colorado	Nevada	Rulison	1998
Colorado	Rocky Flats	Rocky Flats Environmental Technology Site	2010[a]
Florida	Albuquerque	Pinellas Plant	1997
Idaho	Chicago	Argonne National Laboratory - West	2000
Idaho	Idaho	Idaho National Engineering and Environmental Laboratory	2050
Illinois	Chicago	Argonne National Laboratory - East	2002
Illinois	Chicago	Fermi National Accelerator Laboratory	1997
Illinois	Chicago	Site A	1997
Iowa	Chicago	Ames Laboratory	1999
Kentucky	Albuquerque	Maxey Flats Disposal Site	2002
Kentucky	Oak Ridge	Paducah Gaseous Diffusion Plant	2010
Massachusetts	Oak Ridge	Ventron (FUSRAP Site)	1997
Mississippi	Nevada	Salmon Site	1999
Missouri	Albuquerque	Kansas City Plant	1999
Missouri	Oak Ridge	Weldon Spring Site	2002
Nevada	Nevada	Central Nevada Test Site	2006
Nevada	Nevada	Nevada Test Site	2014
Nevada	Nevada	Shoal Site	2004
Nevada	Nevada	Tonopah Test Range Area	2007
New Jersey	Oak Ridge	New Brunswick Site (FUSRAP Site)	1997
New Jersey	Chicago	Princeton Plasma Physics Laboratory	1999
New Mexico	Nevada	Gasbuggy	2005
New Mexico	Nevada	Gnome-Coach	2004

Exhibit 2-7 (Cont'd.)
Baseline Completion Date for Each Site

State	Operations/ Field Office	Site	Completion Date
New Mexico	Albuquerque	Los Alamos National Laboratory	2017
New Mexico	Albuquerque	Lovelace Respiratory Research Institute (formerly ITRI)	2000
New Mexico	Albuquerque	Sandia National Laboratories - NM	2001
New Mexico	Carlsbad	Waste Isolation Pilot Plant	2038
New York	Chicago	Brookhaven National Laboratory	2006
New York	Oakland	Separations Process Research Unit (SPRU)	2014
New York	Ohio	West Valley Demonstration Project	2005
North Dakota	Albuquerque	Belfield UMTRA Site	1998
North Dakota	Albuquerque	Bowman UMTRA Site	1998
Ohio	Ohio	Columbus Environmental Management Project - King Avenue	1998
Ohio	Ohio	Columbus Environmental Management Project - West Jefferson	2005
Ohio	Ohio	Fernald Environmental Management Project	2008[b]
Ohio	Ohio	Miamisburg Environmental Management Project	2005[c]
Ohio	Ohio	Ashtabula Environmental Management Project	2003
Ohio	Oak Ridge	Portsmouth Gaseous Diffusion Plant	2005
Puerto Rico	Oak Ridge	Center for Energy and Environmental Research	1998
South Carolina	Savannah River	Savannah River Site	2038
Tennessee	Oak Ridge	Oak Ridge Reservation (including Y-12, ORNL, ETTP)	2013
Texas	Albuquerque	Pantex Plant	2002
Utah	Albuquerque	Monticello Remedial Action Project	2001
Washington	Richland	Hanford Site	2046

[a] The Rocky Flats Environmental Technology Site is committed to accelerate activities to complete the site in 2006.
[b] The Ohio Field Office and the Fernald Environmental Management Project are committed to accomplishing completion scheduled for 2008 by the end of 2005.
[c] Pending validation of the current baseline, it is the goal of the Miamisburg Environmental Management Project and the Ohio Field Office to clean up the site by the end of 2003.

2.5 Maintaining Schedules

The EM program developed schedule estimates, making certain assumptions about the availability of funding. While the availability of funding is a critical influence on schedule, funding alone is not sufficient to ensure the successful completion of the objectives outlined in this document, which is based on numerous assumptions about scope and the achievement of key interim milestones. To elevate key issues and focus management attention, sites have identified those activities and events (key interim milestones) that must occur if the EM program is to remain on schedule and correspondingly within cost. For these activities and events, sites have assigned a programmatic "risk" score in each of three areas: technology (do we have the

[1] Exhibit 2-7 does not include sites managed under the Formerly Utilized Sites Remedial Action Program, (FUSRAP). FUSRAP was transferred to the United States Army Corps of Engineers at the beginning of FY 1998.

Programmatic Risk

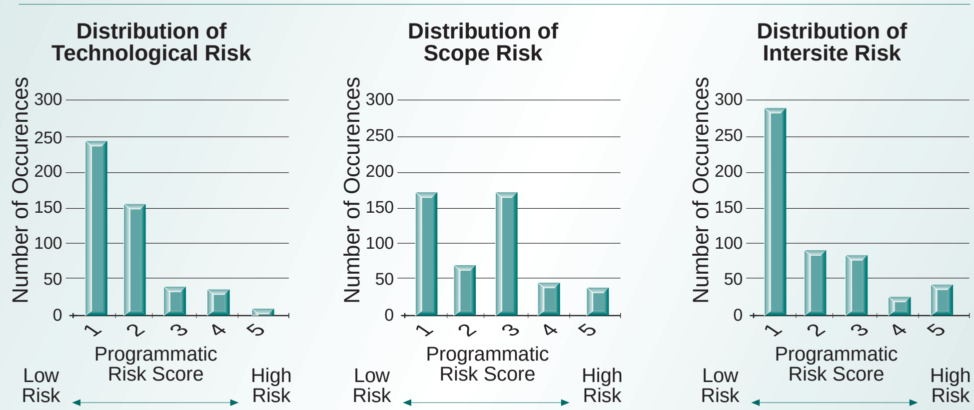
Programmatic risk is defined as the risk to cost, schedule, and technical performance posed when an activity is not completed as scheduled. Sites document programmatic risk for activities on the critical closure path and on disposition maps. There are three categories of programmatic risk:

- Technology (do we have the technology to do our work?)
- Scope (do we know how much work there is to do?)
- Intersite (do we know how and where we plan to store, treat, and dispose of material and waste?)

technology to do our work?), scope (do we know how much work there is to do?), and intersite (do we know how and where we plan to store, treat, and dispose of material and waste?). One example of such an activity is the signing of a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Record of Decision (ROD), through a process that must conform to regulatory requirements. In addition, some activities, such as the vitrification of high-level waste at the Hanford Site, can be completed only as quickly as capacity allows. In total, 504 such critical events and activities were reported for all sites. Exhibit 2-8 shows the distribution of programmatic risk scores among the three areas. Appendix D presents a detailed discussion of programmatic risk.

Sites identified more than 131 activities and events that had high programmatic risk scores (four or five on a scale of one to five) in any one of the three programmatic risk areas. Many of the activities that present a high programmatic risk are crucial to the mission of the EM program. A high programmatic risk score means that the EM program must work diligently to ensure that those activities and events do not

Exhibit 2-8
Distribution of Programmatic Risk Scores



cause disruptions in schedule and subsequent increases in cost. The text box lists a few of the high programmatic risk activities that must take place over the next three years. Critical activities and events that have high programmatic risk are discussed in the Operations / Field Office summaries in Chapter 3 and Appendix E.

Sample Critical Events and Activities

FY 1998, FY 1999, and FY 2000

- The Waste Isolation Pilot Plant opens for acceptance of transuranic waste by May 1998.
- Nuclear material at the Fernald Environmental Management Project is packaged and shipped off site by September 1999.
- Fuel removal starts at the K-Basin at Hanford by July 1999.
- Records of Decision are signed at Oak Ridge for the East Tennessee Technology Park, Bethel Valley, Melton Valley, and Upper East Fork Poplar Creek between now and April 2000.
- West Valley selects a high-level waste receiving site by September 1998.
- The Savannah River Site is available to receive fluoride residues from the Rocky Flats Environmental Technology Site by April 1999 for stabilization.

2.6 Comparison With Estimates In The Discussion Draft

The *Discussion Draft* was based on two scenarios submitted by sites, one at $5.5 billion per year and one at $6.0 billion per year, that represented a low funding and a high funding scenario. *Paths to Closure* is based on one scenario that represents baselines constructed within a funding assumption of $5.75 billion per year. The $5.75 billion funding assumption was selected as a midpoint between the two scenarios set forth in the *Discussion Draft*. It also reflects recent appropriations levels of the EM program. Exhibit 2-10 outlines the overall differences in cost and schedule between the $6.0-billion-per-year scenario in the *Discussion Draft* and the scenario set forth in *Paths to Closure*.

There are numerous reasons for the changes since the *Discussion Draft*. In many cases, the changes are simply due to improvements in the quality of estimates and the maturity of the site baselines. In other cases, demonstrated enhanced performances have been incorporated into baseline assumptions. Finally, new scope or scope growth has, in some cases, offset the effects of enhanced performance or has caused estimates to increase.

Exhibit 2-10
Differences Between the Costs and Schedules in the
Discussion Draft and *Paths to Closure*

Operations/ Field Office	*Discussion Draft* ($6.0 billion per year as submitted)		*Paths to Closure* ($5.75 billion per year)	
	Cost (in billions of constant 1998 dollars)	Completion Date	Cost (in billions of constant 1998 dollars)	Completion Date
Albuquerque	3.0	2006	4.1	2017
Carlsbad[a]	7.1	NA	7.7	2038
Chicago	0.3	2004	0.3	2006
Headquarters/ National Programs	13.3	NA	11.3	NA
Idaho	15.8	2050	16.3	2050
Nevada	1.2	2011	2.2	2014
Oakland	0.7	2006	1.0	2014
Oak Ridge	9.1	2012	13.1	2013
Ohio	4.7	2005	4.8	2008
Richland	54.3	2048	50.3	2046
Rocky Flats	7.2	2015	6.3	2010
Savannah River	29.6	2070	29.7	2038
TOTAL	146.3		147.3	

[a] Costs for the Carlsbad Area Office include the costs associated with operating the Waste Isolation Pilot Plant as the national repository for the disposal of transuranic waste and the costs of decommissioning the site after disposal operations have ended.

Chapter 3 presents detailed scope, cost, and schedule information for the Rocky Flats Field Office, the Richland Operations Office, and the Savannah River Operations Office. Appendix E provides additional detail for the remaining Operations/Field Offices. For a full discussion of each Operations/Field Office, refer to appropriate site Paths to Closure. Chapter 4 discusses the management challenges facing the EM program and relationship between the overall strategy and the budget.