Chapter 3

Environmental Management Cleanup Strategy Summaries

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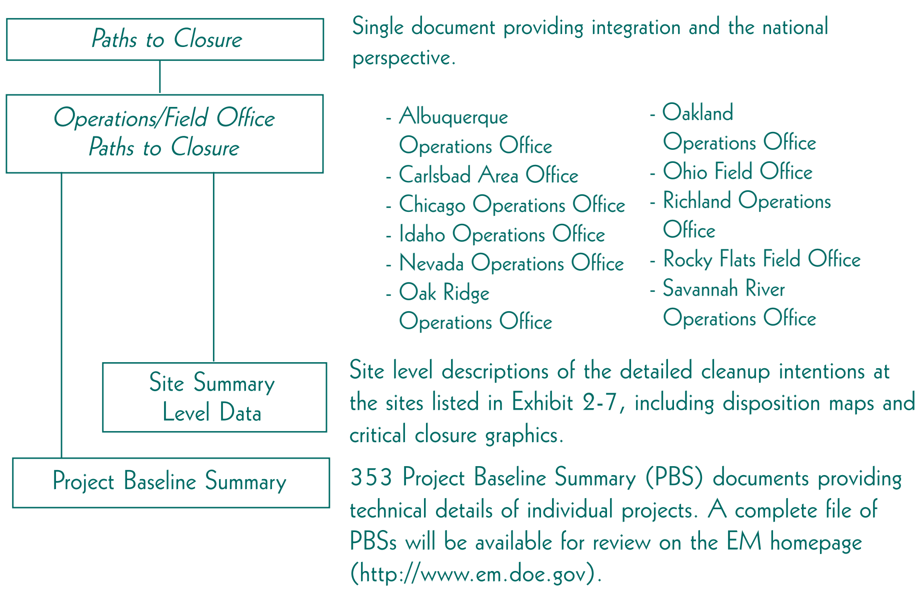
The current scope of the Environmental Management (EM) cleanup mission is described in many documents and management tools. Each product provides a different degree of detail and integration ranging from this document, *Paths to Closure*, that presents a national perspective of the cost, scope, and schedule challenges associated with the EM cleanup mission, to the 353 individual Project Baseline Summaries (PBSs) that present the cost, scope, and schedule elements of each project. Exhibit 3-1 illustrates the relationship between these and other products.

Exhibit 3-1. *Paths to Closure* Documentation



All of the strategy documents and PBSs are further supported by site baselines and other detailed information maintained by the sites. This chapter and Appendix E present summaries of each Operations / Field Office's environmental management strategy. This chapter presents summaries of the Rocky Flats Field Office, the Richland Operations Office, and the Savannah River Operations Office. The summary of the Rocky Flats Field Office is described here because it illustrates a near-term closure effort with a challenging critical closure path. Rocky Flats must achieve significant enhanced performance goals if the site is to be closed by 2006. The Richland and Savannah River summaries are shown here because they illustrate the complexity of the closure effort associated with two other major Department of Energy (DOE) sites. Appendix E presents the EM cleanup strategy summaries of the other eight Operations / Field Offices. The selection of Rocky Flats, Savannah River, and Richland as examples for Chapter 3 does not imply any priority between these sites and the others discussed in Appendix E.

The Rocky Flats Field Office, the Richland Operations Office, and the Savannah River Operations Office summaries that follow contain a discussion of the EM mission managed by the Operations / Field Office. The discussion is broken into five sections: a general overview; a discussion of end state assumptions; the cost and completion dates for the sites and projects; a work scope summary; and the critical closure paths and programmatic risks of the strategy managed under the Operations / Field Office.

Additional information on all of the Operations / Field Offices can be found in the site versions of *Paths to Closure.*

Included as part of each work scope summary is a "Conceptual Summary Disposition Map." These maps show a summary of each office's current conceptual life-cycle approaches for managing EM wastes, nuclear materials and contaminated media — from their current status, through storage, treatment, and disposal — to achieve the assumed site end states described in the relevant site strategy. In some cases, these conceptual approaches include shipping and off-site treatment and disposal.

Conceptual Summary Disposition Maps compile information for the sites that report through the Operations or Field Offices. The maps do not reflect Headquarters-directed or national-level strategies for each site, Operations Office, or Field Office. Within each map, activities are organized into "streams," which are defined as groups of materials, media, or wastes having similar origins, management requirements, or barriers to disposition. The following seven waste, material, and media categories are depicted in the maps:

- High-level waste
- Transuranic waste
- Mixed low-level waste
- Low-level waste
- Environmental restoration activities
- Spent nuclear fuel
- Nuclear materials

As has always been the case for this planning effort (reflected in December 1996 and October 1997 guidance to sites for environmental management strategy development), implementation of each element of the EM closure strategy is contingent upon the completion of whatever evaluation is required under the National Environmental Policy Act (NEPA), the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), or other statute.

Decisions that remain to be made include those resulting from two DOE Environmental Impact Statements (EISs). Decisions on disposition of certain nuclear materials will be made pursuant to the Department's *Management of Certain Plutonium Bearing Residues and Scrub Alloys at the Rocky Flats Environmental Technology Site Environmental Impact Statement*. Until these decisions are made, the Conceptual Summary Disposition Maps reflect the "to be decided" (or "TBD") status of those materials.

Decisions on five waste types have been or will be made pursuant to the Department's May 1997 Final *Waste Management Programmatic Environmental Impact Statement* (WM PEIS). This nationwide NEPA analysis examined the potential environmental impacts of managing more than 2 million cubic meters of radioactive wastes from past, present, and future DOE activities. The Final WM PEIS identified preferred alternatives for transuranic waste treatment and storage, high-level waste storage, and hazardous waste treatment. The Department has identified preferred management strategies for mixed low-level waste treatment and disposal and low-level waste treatment and disposal. Preferred sites for these management activities have not yet been identified. The Department has committed to publicly identify its preferred sites at least 30 days prior to issuing any Records of Decision for these two waste streams. As of February 1998, one Record of Decision has been issued from the WM PEIS — that for transuranic waste treatment and storage, and the Conceptual Summary Disposition Maps show specific disposition of transuranic waste, consistent with that Record of Decision.

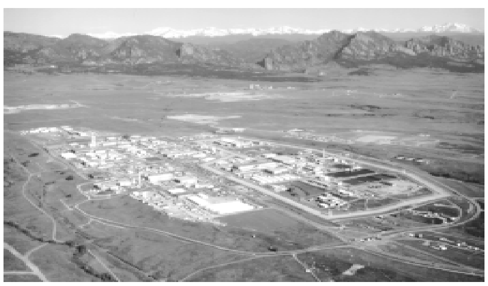
The Conceptual Summary Disposition Maps' depiction of environmental restoration activities differs from other waste or material management activities. Disposition paths for environmental restoration activities begin with "Contaminated Media" and show a "Response Strategy" for the media. All environmental restoration planning assumptions are still being evaluated under NEPA, CERCLA and/or the Resource Conservation and Recovery Act (RCRA), and may change as more media characterization data becomes available, as comments are received from local stakeholders through public involvement processes, or as the regulatory agencies review and evaluate the various cleanup alternatives.

The Conceptual Summary Disposition Maps represent a "roll-up" from site-, waste-, material-, and media-specific maps. Volumes are approximate and have been rounded to two significant figures.

3.1 Rocky Flats Field Office Summary

The Rocky Flats Environmental Technology Site (RFETS) is located approximately 15 miles northwest of Denver, Colorado. Construction of the site started in 1951. Facilities at the site are located on approximately 385 acres of an industrial area, surrounded by a buffer zone of approximately 1,600 acres of prairie terrain. RFETS has over 700 permanent structures that were built to support its mission. The primary mission of the site was the manufacture and assembly of nuclear and nonnuclear weapons components, as well as to recover plutonium. In January 1992, the nuclear weapons production mission of the site was terminated formally; the nonnuclear mission of the site was completed in October 1994. The only remaining mission of the site is cleanup and remediation. The potential risks to health and safety at RFETS arise principally from the large amounts of special nuclear materials (SNM), residues contaminated with plutonium, and radioactive wastes that are stored at the site.

Rocky Flats Environmental
Technology Site



1998

End State

3.1.1 End State

Interim end state expectations for RFETS were developed through a detailed discussion, negotiation, and approval process that resulted in the Rocky Flats Cleanup Agreement (RFCA). Approved in July 1996, this agreement establishes a legally binding relationship between the U.S. Department of Energy (DOE), the Environmental Protection Agency, and the Colorado Department of Public Health and Environment that governs cleanup at the site.

According to the RFCA, planned cleanup levels will permit open space use of the site's buffer zone, and the industrial area will be cleaned up for restricted open space or industrial reuse.

Approximately 100 acres of the site will be capped where complete remediation is technically or economically infeasible. The caps will reduce water infiltration and direct runoff in the area, thereby preventing migration of containments. Additional cleanup may be conducted should technological advances, increased funding, or political opportunity allow.

Post-closure stewardship requirements for the site have not yet been determined. DOE is currently participating in discussions with the community to determine when it will be appropriate to make long-term stewardship decisions and what the future use of the site should be. DOE expects that discussions about future use may continue for several years before community sentiment is well understood and the site is ready to investigate implementation. Additional information about the RFETS end state and long-term stewardship can be found in the Rocky Flats version of *Paths to Closure.*

3.1.2 Cost and Completion Dates

The Rocky Flats Field Office has separated its closure activities into 29 discrete projects. The PBS developed for each project sets forth detailed strategies for completion of the project and programmatic information that includes cost, schedule, scope, end state, and interim milestones. Exhibit 3-2 presents a summary of the Rocky Flats cost and schedule information for these projects. Additional information about the projects is available in the PBS for each.

The estimated EM life-cycle cleanup cost for the Rocky Flats Field Office is $6.3 billion (constant 1998 dollars). The majority of the work scope is scheduled for completion by 2010, after which only the closure cap and long-term surveillance and monitoring will remain.

While the baseline indicates that the site completion date for the RFETS is 2010, both EM Headquarters and the management of the Rocky Flats Field Office have undertaken the challenge of completing all closure work by the year 2006. To accomplish that challenge, significant enhanced performance goals must be achieved. The management approach, scheduling impacts, technical development, and inter-site integration needed to accomplish this goal of completion by 2006 are discussed in more detail in the Rocky Flats Field Office version of *Paths to Closure*.

The projected cost profile associated with the closure of RFETS was developed by combining the cost estimates presented in each of the Project Baseline Summaries. Exhibit 3-3 displays the resultant baseline cost profile.

3.1.3 Work Scope Summary

The scope of work necessary to achieve closure as defined in the Rocky Flats Cleanup Agreement includes the stabilization and management of plutonium metals, oxides, residues, and solutions; enriched uranium metals and oxides; and wastes generated from closure activities. Existing waste and materials, as well as the waste generated from the cleanup, will be treated (if required), packaged, and transported according to off-site waste acceptance criteria and all applicable laws and regulations. The sections below describe the major waste, material, and contaminated media volumes to be addressed by the Rocky Flats Field Office. The volumes reported are approximate, and correspond to the major waste, material, and media flows, the potential treatment processes, and the off-site disposal destinations presented in Exhibit 3-4, the Rocky Flats Field Office Conceptual Summary Disposition Map.

Transuranic Waste

Approximately 1,500 cubic meters of legacy transuranic waste are currently in inventory and 7,000 cubic meters of transuranic waste are expected to be generated over the life cycle of operations. After treatment and repackaging, 9,500 cubic meters of transuranic waste are planned to be shipped to WIPP.

Other Waste

Approximately 17,000 cubic meters of mixed low-level waste are currently in inventory (primarily "Pondcrete" and Solar Pond sludge) and 62,000 cubic meters of mixed low-level waste are expected to be generated over the life cycle of operations (including waste generated by remedial action and facility deactivation and decommissioning). After treatment, 11,000 cubic meters are expected to be disposed of at an off-site commercial facility and an additional 68,000 cubic meters are expected to be disposed of off site at a location to be determined later.

Approximately 7,100 cubic meters of low-level waste are in inventory and 58,000 cubic meters of low-level waste are expected to be generated over the life cycle of operations (including waste generated by remedial action and facility deactivation and decommissioning activities). After declassification and some treatment, 65,000 cubic meters are expected to be disposed of at the Nevada Test Site and an off-site commercial facility.

Remedial Action and Facility D&D

Approximately 790,000 cubic meters of environmental media (including 300,000 cubic meters of groundwater, 198,000 cubic meters of soils, and nearly 295,000 cubic meters of facility deactivation and decommissioning generated material) contaminated with radionuclides (including transuranic elements) and hazardous substances will be managed. After segregation and treatment, a total of 260,000 cubic meters are expected to be placed on-site and 130,000 cubic meters are expected to be disposed of at an off-site commercial facility.

Nuclear Materials

Nuclear materials volumes are classified and cannot be disclosed in this document.

The closure mission at RFETS is documented in projects that involve waste, special nuclear material (SNM), facility deactivation and decommissioning, and environmental restoration. Work in each of those areas is planned, funded, and executed under a comprehensive risk reduction strategy that places a priority on maintaining safety at the site, thereby ensuring the continued safety of site workers, the public, and the environment, and then eliminating the site's highest priority risks. Activities which address the site's highest priority risks, in order of priority are: stabilization, consolidation, and packaging of SNM; deactivation of nuclear facilities (to reduce facility baseline costs), waste management, and shipment of SNM; and facility decommissioning and environmental restoration. Long-term groundwater treatment and surveillance and monitoring, the scope of which is yet to be determined, will continue after closure.

At RFETS, the bulk of costs are driven by continued storage of SNM residues and wastes. Each building closure and infrastructure project integrates all activities necessary to eliminate buildings, including deactivation, decontamination (to the extent necessary), decommissioning, dismantlement, and environmental remediation of the land under the buildings. Management of nuclear material and waste accounts for the next major component of cost. The remainder of the work scope includes environmental remediation of land areas outside building footprints, including the buffer zone. Groundwater will be remediated and post-closure environmental monitoring will be required after site closure. The scope of the post-closure requirements will be described in the CERCLA Record of Decision at Closure. Exhibit 3-5 displays RFETS site closure costs by major work scope category.

3.1.4 Critical Closure Path and Programmatic Risk

The critical closure path schedule presented in Exhibit 3-6 sets forth the timetable for completing the closure activities at RFETS. The highlighted activities show the critical closure path, which represents the series of events that drive the overall completion date for the site. In Exhibit 3-6, the bars represent projects and critical activities, and the triangles represent critical events and milestones.

The primary key for RFETS to close on schedule is the ability to ship materials and wastes to receiver sites. The site is consolidating nuclear materials into fewer buildings to minimize operations and costs and maximize the funding available for closure activities. However, the key activity on the critical closure path in the early years is the stabilization of nuclear materials and their packaging in configurations certified for shipping. RFETS has developed a closure project plan that minimizes the total project cost by balancing the nuclear materials preparation activities (risk

reduction) with building elimination ("mortgage" reduction). In an effort to further accelerate the closure schedule, activities that have the potential to improve the efficiency of those two efforts are being identified and evaluated for implementation.

Completion of the EM mission at the Rocky Flats Field Office as scheduled will depend on the timely accomplishment of critical activities and events, some of which are external milestones (external milestones are those that are beyond the ability of the site to resolve). Management must focus attention on punctual completion of activities on the critical closure path if the closure date of 2010 is to be achieved. Exhibit 3-7 presents a summary of activities / milestones on the critical closure path that have high programmatic risk (programmatic risk scores of 4 or 5 in any category). In addition to those high programmatic risk milestones, several other external milestones have an effect on the site's ability to achieve its closure goal. Those milestones include: "Savannah River Site available to receive sand, slag, and crucible residues for stabilization" (March 1998); "Savannah River Site available to receive special nuclear material (SNM) metals, oxides, and scrub alloy for storage" (October 2002); and "SSTs (safe, secure transport) available to transport SNM to Savannah River Site" (October 2002).

Exhibit 3-7

Summary of High Programmatic Risk Activities/Milestones:

Rocky Flats Field Office

Project, Activity, Event	Start/ End Date	Programmatic Risk Categories		
		Technological	Work Scope Definition	Intersite Dependency
ORNL available to receive organic waste liquid for treatment and disposition	Dec 97	1	4	4
HQ Residue Processing Record of Decision issued	May 98	1	3	4
WIPP opens for receipt of RFETS TRU waste	May 98	1	4	4
SRS available to receive fluoride residues for stabilization	Apr 99	1	3	4
Salt distillation complete	2001	4	3	4
Complete stabilization of all solid residues (Complete DNFSB 94-1 commitments)	May 02	4	3	4

3.2 Richland Operations Office Summary

The Richland Operations Office manages the cleanup work at the Hanford Site. The Hanford Site occupies 560 square miles in southeastern Washington State. It was acquired by the federal government in 1943 for the first full-sized plutonium production operation. The Hanford Site has been used for a variety of purposes, including plutonium production, chemical processing, waste management, and research and development activities.

The current mission of the Hanford Site is to manage the facilities and inventories of special materials, remedy the environmental contamination caused by decades of activities related to the production of plutonium, and support national research efforts in the areas of environmental cleanup and other sciences. The major Hanford Site cleanup mission areas include the Tank Waste Remediation System Project for tank waste, the Waste Management Project, the Facility Transition Project, the Environmental Restoration Project, the Science and Technology Project and Other Supporting Projects.

After the defined Environmental Management cleanup mission is completed at the Hanford Site, the federal government will continue in a caretaker role due to disposed waste remaining on site. Ongoing missions at the Hanford Site will also continue primarily in the areas of science and technology development.

3.2.1 End State

Alternatives for potential future use of the Hanford Site lands were developed through a cooperative effort with the U.S. Department of Energy (DOE); the Confederated Tribes and Bands of the Yakima Indian Nation; the Nez Perce Tribe; the United States Department of the Interior; the City of Richland; and Benton, Franklin, and Grant Counties. These alternatives are being analyzed in the Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan (HRA-EIS) for the potential environmental impacts resulting from the proposed future land uses associated with each alternative. As mandated by Public Law 104-201, Section 3153, the land-use plan will address a 50-year planning period. Once established, the land-use plan will provide a framework for making land-use and facility-use decisions while DOE manages the land.

The selection of the appropriate land uses for the Hanford Site will be made through the National Environmental Policy Act (NEPA) Environmental Impact Statement (EIS) Record of Decision (ROD) process. Final decisions on the level of cleanup to be performed on individual waste sites will be made in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) response action or Resource Conservation and Recovery Act (RCRA) permit processes. As CERCLA and RCRA decisions are made, revisions to the Comprehensive Land Use Plan will be made as required. When sites are certified as complete, any CERCLA and RCRA requirements for long-term surveillance, monitoring, and maintenance will be identified, along with the appropriate institutional controls to protect human health and the environment. The planning end state of the Hanford Site will be developed in the Comprehensive Land Use Plan.

Currently, the assumption is that the federal government will remain the landlord of the site after cleanup is complete. Cleanup levels and disposal standards will be established that are consistent with projected long-term uses; and remediation will be performed to ensure the protection of human health, the environment, and the Columbia River. Groundwater use remains restricted indefinitely.

The 100 Area of the site lies along the Columbia River and is comprised of over 400 waste sites, nine retired plutonium production reactors, and their ancillary facilities. Residential cleanup standards have been established for remediation in the area. The C-Reactor was placed into Interim Safe Storage, with plans to place seven of the other reactors into safe storage. The B-Reactor structure is expected to remain as a National Historic Landmark. Groundwater remediation is being performed to protect the Columbia River.

The 200 Area of the site is expected to be maintained as a waste management area. Waste from on-site and off-site sources will be stored in the 200 Area. The Environmental Restoration Disposal Facility (ERDF) will accept waste that meets acceptance criteria from all Hanford CERCLA sites, and will be expanded to have a capacity of more than 4 million cubic yards of waste. Approximately 700 waste sites will be remediated in the 200 Area. Remediation is expected to be completed through a combination of waste excavation and placement of soil barriers over waste sites. Tank waste will be retrieved and immobilized from the 177 high-level waste tanks. The low-level waste burial grounds will be stabilized and the RCRA storage facilities will be RCRA clean-closed unless required for the follow-on caretaker mission.

The 300 Area is being remediated to meet industrial cleanup standards. Soil remediation is being performed to remediate over 100 waste sites. Facilities which will not be turned over to the private sector for further use will be demolished.

Though final end states have not been set for the site, it is anticipated that the land near the Columbia River will be remediated for recreational use. Additional information about Richland end states and long-term stewardship can be found in the Richland Operations Office version of *Paths to Closure*.

3.2.2 Cost And Completion Dates

The Richland Operations Office has divided its environmental management work into 45 discrete projects. A Project Baseline Summary exists for each project and contains detailed programmatic information, including cost, schedule, scope, end state, and interim milestones. The projected cost profile associated with the Richland Operations Office is developed by combining the cost estimates from each of the Project Baseline Summaries. Exhibit 3-8 displays the resultant baseline cost profile. A summary of the cost and schedule information for each project is illustrated in Exhibit 3-9. For additional information about these projects, see the Project Baseline Summaries.

The estimated life-cycle cost for cleanup of the Hanford site is $50.3 billion (constant 1998 dollars). This estimate does not include $500 million (constant 1998 dollars) in non-EM costs or the costs associated with federal oversight (i.e., program direction). This baseline cost profile does not reflect any potential effects of budgetary funding constraints which will likely affect the overall life-cycle cost of Hanford Site cleanup. The current baseline supports the completion of EM work (excluding long-term surveillance and monitoring) by 2046.

3.2.3 Work Scope Summary

The EM cleanup mission at the Hanford Site centers on the need to remedy the environmental contamination caused by decades of activities related to the production of plutonium. Having served as the nation's first full-sized plutonium production operation, Hanford's current projects are now specifically focused on minimizing, processing, and storing the backlog of radioactive and hazardous waste generated from 1943 through today; managing spent nuclear fuels and special nuclear material; decontaminating and decommissioning surplus facilities; and remediating the site.

The scope of work at the Hanford Site includes the management, cleanup, and disposition of soil, rubble, debris, and groundwater contaminated with radionuclides and hazardous substances as well as the management of high-level waste sludges, salts, and liquids. The sections below describe the major waste, material, and contaminated media volumes to be addressed by the Richland Operations Office. The volumes reported are approximate, and correspond to the major waste, material, and media flows, the potential treatment processes, and the off-site disposal destinations presented in Exhibit 3-10, the Richland Operations Office Conceptual Summary Disposition Map.

Transuranic Waste

Approximately 16,000 cubic meters of legacy transuranic waste are currently in inventory and 8,000 cubic meters are expected to be generated over the life cycle of cleanup operations. After sorting and repackaging, approximately 19,000 cubic meters are planned to be disposed of at WIPP.

High-Level Waste

Approximately 220,000 cubic meters of high-level waste sludges, salts and liquids are currently contained in 149 single-shell and 28 double-shell holding tanks. After sludge washing, separation, and on-site vitrification, 14,000 cubic meters of waste are expected to be disposed of in an off-site geologic repository and 240,000 cubic meters are expected to be disposed of in an on-site low-level waste vault. Once empty, all holding tanks are expected to be stabilized and closed in place.

Other Waste

Approximately 8,600 cubic meters of mixed low-level waste are currently in inventory and 64,000 cubic meters of mixed low-level waste are expected to be generated over the life cycle of cleanup operations. After treatment, 99,000 cubic meters are expected to be disposed of on site.

Approximately 180 cubic meters of low-level waste are currently in inventory and 130,000 cubic meters are expected to be generated over the life cycle of cleanup operations. An additional 32,000 cubic meters are expected to be

received from small DOE sites. After sorting, stabilization, and some commercial treatment, 230,000 cubic meters are expected to be disposed of on site.

Remedial Action and Facility D&D

Approximately 1.4 billion cubic meters of groundwater awaits a disposition decision, 20 million cubic meters of contaminated soil are expected to be capped in-place, and 980 cubic meters of waste, consisting of spent resins generated from groundwater remediation and asbestos removed during deactivation and decommissioning of facilities, are expected to be disposed of at an off-site commercial disposal facility. Additionally, soils, rubble, and debris are expected to be disposed of at the ERDF.

Approximately 1,500 cubic meters of debris contaminated with transuranic elements are expected to be generated during remediation activities. After sorting and repackaging, all 1,500 cubic meters are expected to be disposed of at WIPP.

Nuclear Materials

Nuclear materials quantities are classified and cannot be disclosed in this document.

Spent Nuclear Fuel

Over 2,100 metric tons heavy metal of spent nuclear fuel are currently in inventory. After washing, packaging, and drying, spent nuclear fuel is expected to be transferred to ANL-W or placed in a repository.

Exhibit 3-11 displays the Hanford Site closure costs by major work scope category. As depicted in the exhibit, the majority of the cost involved in the completion of environmental management activities at Richland revolves around high-level waste.

3.2.4 Critical Closure Path and Programmatic Risk

The critical closure path schedule presented in Exhibit 3-12 sets forth the timetable for completing closure activities at the Richland Operations Office. The Hanford Site critical closure path reflects those cleanup activities which are key to achieving completion of the site cleanup mission and end states. Included is the critical closure path, which is defined as the longest path (in terms of duration) through the schedule of project activities that achieve site cleanup and closure. In Exhibit 3-12, the highlighted activities show the critical closure path, which represents the series of events that drive the overall completion date for the site; the bars represent projects and activities, and the diamonds represent critical events and milestones that must occur for Richland to be completed by 2046.

As shown in Exhibit 3-12, this path goes through the retrieval, treatment, and disposition of the high-level waste currently stored in the Hanford tanks. To succeed along this critical closure path, many other activities are also critical: (1) urgent risks must have top priority, (2) the fixed costs for maintaining the site in a safe manner need to be reduced through facility stabilization and deactivation to make additional funds available for cleanup, and (3) the Environmental Restoration Project must remain a high priority because it results in visible near-term cleanup progress. Another concern is that the practice of storing wastes awaiting treatment and deferring the retrieval and processing of the transuranic retrievable wastes eventually will increase costs for additional storage facilities.

Completion of the EM mission at the Richland Operations Office as scheduled will depend on the timely accomplishment of critical activities and events. Sites have assigned programmatic risk scores to each of the critical activities/milestones. Appendix D provides a complete definition of programmatic risk. Exhibit 3-13 presents a summary of activities/milestones on the critical closure path that have high programmatic risk (programmatic risk scores of 4 or 5 in any category). Hanford shows nine activities and events that have high programmatic risk values. Three of these nine are on the critical closure path, and these three are a part of the high-level waste system (TWRS).

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One of the high programmatic risk sub-project activities concerns the retrieval of high-level waste, which is currently part of the Phase 1 privatization project. This sub-project activity has programmatic risk values of 4,4,5 for technological, work scope definition, and intersite dependency, respectively. The overall life-cycle cost of this Phase 1 project is $4.7 billion, and thus continuous management attention to this project will be an important part of controlling life-cycle cost increases at Hanford. Other high programmatic risk activities (not on the critical closure path) include K-Basin and groundwater remediation activities.

Exhibit 3-13

Summary of High Programmatic Risk Activities/Milestones: Richland Operations Office*

Project, Activity, Event	Start/ End Date	Programmatic Risk Categories		
		Technological	Work Scope Definition	Intersite Dependency
Start K-Basin fuel removal	Jul 99	4	2	2
Groundwater remediation disposition decision	Oct 00	4	5	1
Complete K-Basin fuel removal	Jul 01	4	2	2
Tank waste immobilization started	Jun 02	4	4	5
Deploy & operate initial SST & DST waste retrieval systems for Privatization Phase I	Oct 97/ Jun 02	4	4	5
Start K-Basin sludge transfer to TWRS	Oct 02	4	3	3
Complete K-Basin sludge transfer to TWRS	Sept 03	4	3	3
Complete Tank Farm closure	Sept 28/ Sept 34	5	5	2
Complete HLW disposition and storage facility D&D	Sept 34/ Sept 46	2	4	5

* Richland's critical closure path (Exhibit 3-12) identifies 12 high risk activities that were not identified in their formal PBS submission.

3.3 Savannah River Operations Office Summary

The Savannah River Site (SRS) was established in 1950 to produce special radioactive isotopes for national security purposes (e.g., plutonium-239 and tritium). In addition to this primary mission, SRS has produced other special isotopes to support research in nuclear medicine, space exploration, and commercial applications (for example, californium-252, plutonium-238, and americium-241).

Since the end of the Cold War, the mission of SRS has changed. Emphasis has shifted from nuclear material production to environmental management.[1] The Environmental Management (EM) program was initiated in 1989 to address the closure of old burial grounds and seepage basins. In FY 1992, the last of the production reactors was briefly operated. The production mission of the reactor program and supporting facilities was formally ended the following year. Current activities managed by the EM Program cover three major programs: nuclear material and facility stabilization; environmental restoration; and waste management. The primary drivers for these programs are the Federal Facility Agreement, the Federal Facility Compliance Act Consent Order, and the Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 94-1. These agreements define commitments and milestones for the Savannah River Site.

3.3.1 End State

The status of the projects is such that no significant land use changes are projected through 2006. While progress will be made to eliminate "mortgage" requirements as much as possible, the land-use designations will remain basically unchanged for any particular project area and the site as a whole. Significant changes in land-use designations may occur in the future, and will be addressed as the SRS Comprehensive Plan for the site is developed. Development of this plan began in the fall of 1997, and will be completed in 10-14 months. Stakeholder involvement in future land-use decisions has already begun with the Savannah River Site Citizens Advisory Board, area planners, chambers of commerce, municipalities and others providing suggestions for future land use. As the Comprehensive Plan is developed, internal and external site stakeholders will be continually involved in the process. Savannah River Site plans to store mixed waste off site at a RCRA Subtitle C Landfill once the mixed waste Record Of Decision (ROD) is issued.

[1] SRS also retains a significant mission for the recycle of tritium.

Savannah River Site is planning to accept 473 spent nuclear fuel casks from foreign sources and 1,241 spent nuclear fuel casks from domestic sources during the entire spent fuel receipt program (1996 through 2035). The receiving basin for the fuel is expected to remain classified as nuclear industrial use.

After the site EM mission is complete, site boundaries should remain unchanged, and the land should remain under the ownership of the federal government for either a new site mission or as the first National Environmental Research Park. Regional environmental groups and national researchers have stressed that the site boundaries should remain unchanged to preserve its unique habitats. The flora and fauna at the site are such that the site could be used as a sanctuary for environmental study and observation. Additional information about Savannah River end states and long-term stewardship can be found in the Savannah River version of *Paths to Closure*.

3.3.2 Cost And Completion Dates

The Savannah River Operations Office has divided its environmental management work into 84 discrete projects. A Project Baseline Summary exists for each project and contains detailed programmatic information, including cost, schedule, scope, end state, and interim milestones. A summary of the cost and schedule information for these projects is illustrated in Exhibit 3-14 (some of the 84 projects have been combined to simplify the graphic). For more detail on each of the projects, see the Project Baseline Summaries. The estimated EM life-cycle cost for the Savannah River Operations Office is $29.7 billion (constant 1998 dollars). This estimate does not include approximately $0.1 billion (constant 1998 dollars) of non-EM costs. This amount also does not include costs for facility decommissioning or potential environmental restoration work, as the nature of these future activities is unknown. The overall completion date for EM work scope at the Savannah River site is 2038, with long-term surveillance and monitoring activities continuing until 2070.

The projected cost profile for EM activities associated with the Savannah River Operations Office was developed by combining the cost estimates presented in each of the Project Baseline Summaries. Exhibit 3-15 displays the resultant baseline cost profile.

3.3.3 Work Scope Summary

The scope of work at the Savannah Operations Office includes the management of high-level waste sludges and salts; spent nuclear fuel from DOE facilities, universities, and foreign research reactors; soil, sludges, debris, and groundwater contaminated with radionuclides and hazardous substances; and numerous nuclear materials. The sections below describe the major waste, material, and contaminated media volumes to be addressed by the Savannah River Operations Office. The volumes represented are approximate, and correspond to the major waste, material, and media flows, the potential treatment processes, and the off-site disposal destinations presented in Exhibit 3-16, the Savannah River Operations Office Conceptual Summary Disposition Map.

All waste and material existing at the Savannah River Site, as well as the waste generated from the cleanup process itself, will be managed as described in the Savannah River Operations Office version of *Paths to Closure* and Project Baseline Summaries.

Transuranic Waste

Approximately 11,000 cubic meters of transuranic waste are currently in inventory (primarily stored in drums and black boxes) and 10,000 cubic meters of transuranic waste are expected to be generated over the life cycle of cleanup operations. After a combination of sorting, segregation, and repackaging, 16,000 cubic meters are planned for disposal at WIPP.

High-Level Waste

Over 130,000 cubic meters of high-level waste are currently in inventory and approximately 16,000 cubic meters of high-level waste are expected to be generated from future nuclear material separation operations. After sludge washing, salt processing, and vitrification, 4,000 cubic meters of vitrified high-level waste are planned to be disposed of at an off-site geologic repository and 760,000 cubic meters of low-level waste saltstone are planned to be disposed of at an on-site vault.

Forty-nine high-level waste tanks and additional facilities will be managed. After washing and stabilization, tanks and facilities are planned to be closed in place.

Other Waste

Approximately 3,500 cubic meters of mixed low-level waste are currently in inventory and over 11,000 cubic meters of mixed low-level waste are expected to be generated over the life cycle of cleanup operations. After a range of treatment activities, 3,600 cubic meters are expected to be disposed of at an off-site facility.

Approximately 26,000 cubic meters of low-level waste are currently in inventory and over 2.0 million cubic meters of low-level waste (including 1.3 million cubic meters of process water) are expected to be generated over the life cycle of cleanup operations. After a range of treatment activities, including effluent treatment and commercial compaction, 100,000 cubic meters are expected to be disposed of at an on-site disposal cell, 1,000 cubic meters are expected to be sent to an off-site commercial facility, and 3.0 million cubic meters of treated effluent are planned to be discharged through an NPDES outfall.

Remedial Action

Approximately 25 million cubic meters of environmental media including soil, rubble & debris, and groundwater contaminated with radionuclides and hazardous substances will be managed. After treatment, 4,000 cubic meters of residues are expected to be disposed of on site and 1.8 million cubic meters of environmental media are expected to be capped in place.

Nearly 160 million cubic meters of environmental media, including soil, rubble & debris, and groundwater contaminated with hazardous substances, will be managed. In addition to the planned incineration of 180 cubic meters or residues at CIF, contaminated media are expected to be addressed by a number of treatment processes, including air sparging and air stripping.

Nuclear Materials

Nuclear materials quantities are classified and cannot be disclosed in this document.

Spent Nuclear Fuel

Approximately 20 metric tons heavy metal of spent nuclear fuel are in inventory and 30 metric tons heavy metal of spent fuel are expected to be received. After on-site management, the spent fuel is expected to be placed in an off-site geologic repository.

Exhibit 3-17 illustrates the life-cycle costs by major work scope categories. High-level waste accounts for the largest portion of the total life-cycle cost at the Savannah River Operations Office. The Facility Deactivation category accounts for the second greatest portion of life-cycle costs.

3.3.4 Critical Closure Path and Programmatic Risk

The critical closure path schedule presented in Exhibit 3-18 sets forth the timetable for completing closure activities at the Savannah River Operations Office. The critical closure path identifies the sequence of major cleanup activities that have little scheduling flexibility and must occur without delay if the SRS EM cleanup mission is to be completed on time. In Exhibit 3-18, the highlighted activities show the critical closure path, which represents the series of events that drive the overall completion date for the site; the bars represent critical activities; and the diamonds represent critical events and milestones that must occur for Savannah River to be completed as planned. Sites have assigned programmatic risk scores to each of these activities and events.

Completion of the EM mission at the Savannah River Operations Office as scheduled will depend on the timely accomplishment of critical activities and events. Exhibit 3-19 presents a summary of activities and milestones on the critical closure path that have high programmatic risk (programmatic risk scores of 4 or 5 in any category). Appendix D provides a complete definition of programmatic risk. In their formal PBS submission, Savannah River identified 22 activities and events with high programmatic risk values. Four of these have high work scope uncertainty and are associated with projects that have life-cycle costs in excess of one billion dollars. Ten of the 22 sub-project activities have high technological programmatic risks associated with canyon and reactor deactivation. For more information on the management approach for these programmatic risk issues, see the Savannah River Operations Office version of *Paths to Closure*.

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Exhibit 3-19

Summary of High Programmatic Risk Activities/Milestones:

Savannah River Operations Office*

Project, Activity, Event	Start/ Completion Date	Programmatic Risk Categories		
		Technological	Work Scope Definition	Intersite Dependency
Inter-agency agreement signed with TVA	Jan 97/ Sept 98	2	4	5
Decision and disposition of HEU from other locations	Jan 97/ Sept 00	2	4	5
Np stabilization complete	Jan 97/ Nov 03	1	1	4
Four Mile Branch IOU Remediated	Oct 97/ March 09	4	3	2
Flood Plain Swamp IOU Remediated	Jun 00/ Apr 09	4	3	2
Steel Creek IOU Remediated	Nov 98/ Dec 10	4	3	2
R Reactor Deactivated	Jan 06/ Dec 11	4	3	2
K Reactor Deactivated	Jan 06/ Dec 11	4	3	2
P Reactor Deactivated	Jan 06/ Dec 11	4	3	2
C Reactor Deactivated	Jan 06/ Dec 11	4	3	2
HB Line Deactivated	Jan 06/ Dec 12	4	3	2
H Canyon Deactivated	Jan 06/ Dec 12	4	3	2
Pen Branch IOU Remediated	Dec 99/ Dec 14	4	3	2
Lower-Three Runs IOU Remediated	Oct 97/ Jun 15	4	3	2
F Canyon Deactivated	Jan 06/ Dec 15	4	3	2
FB Line Deactivated	Jan 06/ Dec 15	4	3	2

* Savannah River's critical closure path (Exhibit 3-18) identifies 13 high risk activities/milestones that were not identified in their formal PBS submission.

Summary of High Programmatic Risk Activities/Milestones:
Savannah River Operations Office (Cont'd)

Project, Activity, Event	Start/ Completion Date	Programmatic Risk Categories		
		Technological	Work Scope Definition	Intersite Dependency
RBOF Deactivated	Jan 06/ Dec 16	4	3	2
L Reactor Deactivated	Jan 06/ Dec 16	4	3	2
Upper Three Runs IOU Remediated	Jan 97/ Sept 17	4	3	2
Finish shipping vitrified waste to Federal Repository	Oct 24/ Sept 25	1	4	5
Interim SNF dry storage, conditioning, treatment, packaging and shipping facility	Sept 05/ Sept 35	3	4	4
Complete surveillance and maintenace of remediated waste units	Oct 96/ Sept 38	4	3	2