Strategic Theme 4

# Environmental Responsibility

**Protecting the environment by providing a responsible resolution to the environmental legacy of nuclear weapons production**

The scope of the Department's environmental cleanup includes stabilization and disposition of some of the earth's most hazardous materials generated from spent nuclear fuel and nuclear radioactive waste material. The cleanup program resulting from over five decades of nuclear weapons production and energy research is the largest active cleanup program in the world. In addition, after active cleanup, residual risks will remain for significant periods of time at most DOE cleanup sites. The Department will take appropriate action to protect human health and the environment from these residual risks. The Department continues its effort to construct a repository for the final disposal of spent nuclear fuel and high level radioactive waste.

Over the next six years, the Department will apply advanced science, engineering, and cleanup technology to help ensure that it meets its national environmental cleanup strategic goals.

## Environmental Responsibility Challenges

Cleanup of the nuclear weapon's legacy is an enormously complex undertaking involving significant challenges. DOE is also faced with Federal, State, and local regulatory policies that create challenges. The Department's effort to construct a repository for the final disposal of spent nuclear fuel and high level radioactive waste continues to meet regulatory challenges. Finally, despite aggressive environmental cleanup efforts, the Department must be prepared to address residual risks that will remain for significant periods of time at most DOE sites. The following strategic goals address these environmental responsibility challenges.

## Environmental Responsibility Strategic Goals

### Goal 4.1 – Environmental Cleanup

Complete cleanup of the contaminated nuclear weapons manufacturing and testing sites across the United States.

**Description:** DOE is responsible for the risk reduction and cleanup of the environmental legacy of the Nation's nuclear weapons program, one of the largest, most diverse, and technically complex environmental programs in the world. The Department will successfully achieve this strategic goal by ensuring the safety of DOE employees and U.S. citizens, acquiring the best resources to complete the complex tasks, and by managing projects throughout the United States in the most efficient and effective manner. DOE has made significant progress in the last four years in shifting away from risk management to embracing a mission completion philosophy based on cleanup and reducing risk. The Department continues to demonstrate the importance of remaining steadfast to operating principles while staying focused on the mission.

The Department has made progress in recent years in cleanup and/or closure of sites. As many as seven sites will be completed by the end of 2006 including: Rocky Flats, Fernald, Columbus, Ashtabula, Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory-Main Site, and Kansas City Plant.

DOE will maintain a focus on site completion, with an additional ten sites or areas projected to be completed by the end of 2009. These include: Argonne National Laboratory–East, Miamisburg, Brookhaven National Laboratory, East Tennessee Technology Park at Oak Ridge, Energy Technology Engineering Center, Lawrence Livermore National Laboratory-Site 300, Inhalation Toxicology Laboratory, Pantex Plant, Sandia National Laboratory, and the Stanford Linear Accelerator Center. Eight Nevada "Off-sites" will be transferred to the Office of Legacy Management in FY 2007. Three of these eight sites (the Central Nevada Test Area, Project Shoal Area, and the Rio Blanco Site) are scheduled to close in 2010.

In addition to its emphasis on site cleanup and closures, the Department is also focusing on longer-term activities required for the completion of the cleanup program. These include:

- Constructing and operating facilities to treat radioactive liquid tank waste into a safe, stable form to enable ultimate disposition.
- Securing and storing nuclear material in a stable, safe configuration in secure locations to protect national security.
- Transporting and disposing of transuranic and low-

level wastes in a safe and cost-effective manner to reduce risk.

### Strategies to reach this goal

• Identify and eliminate the most serious risks to worker safety, human health, and the environment.

• Ensure safe and secure management of nuclear materials and radioactive wastes and enable final disposition of these materials in a geologic repository.

• Reduce the facility infrastructure footprint to maximize resources for environmental cleanup.

• Leverage science and technology to directly address the specific, applied needs for cleanup and closure.

• Utilize project management best practices to improve implementation and performance of clean-up work.

## Goal 4.2 – Managing the Legacy

Manage the Department's post-closure environmental responsibilities and ensure the future protection of human health and the environment.

**Description:** Over the last 15 years, the Department has made significant progress in environmental remediation. Millions of cubic meters of waste have been removed, stabilized, or disposed of, and a number of former weapons facilities have been transformed for other uses. The overall risk to human health and the environment will continue to decrease as the Department completes additional cleanup work. The new challenge will be to successfully manage the environmental remedies and the residual risks in a manner that enables the optimal future use of the land and facilities while continuing to protect human health. This is true for both the sites that are closing and for those that continue to support ongoing DOE missions.

In addition to the sites cleaned up by the Office of Environmental Management, DOE is responsible for sites remediated by other parties. The Department has responsibility for long-term surveillance and maintenance at sites associated with the Formerly Used Sites Remedial Action Program (cleanup is performed by the U.S. Army Corps of Engineers) and uranium mining and mill tailing sites (as specified by the Uranium Mill Tailings Radiation Control Act).

By 2015, DOE will be conducting long-term surveillance and maintenance at approximately 120 sites where there is no longer an ongoing Departmental mission. Roughly two dozen sites with ongoing missions will also have surveillance and maintenance activities; those activities will be managed as an integral part of the overall site operation.

A geologic repository at Yucca Mountain, Nevada, is vital for moving temporarily stored legacy materials from former nuclear weapons sites to a safe, central storage location. The repository is also necessary for preserving the nuclear option for electricity generation which provides approximately 20 percent of the Nation's electricity supply (nuclear energy is also addressed in Strategic Goals #1.1 and #1.2). Integral to attaining this goal is the near-term licensing, subsequent construction, and operation of the permanent repository for nuclear waste at Yucca Mountain authorized under the Nuclear Waste Policy Act.

### Strategies to reach this goal

• Protect human health and the environment through surveillance and maintenance activities that verify workable environmental remedies.

• Preserve, protect, and ensure accessibility of legacy records and information associated with current and historical site and facility operations.

• Optimally re-use lands ensuring that human health and the environment are protected and that regulators and the community are involved.

• Use environmental conflict resolution techniques to assist in the resolution or prevention of disputes.

• Implement the Nuclear Waste Policy Act by completing the construction of a repository for the final disposal of spent nuclear fuel and high-level radioactive waste.

### Crosscutting Science Integration

Based on discussions with the science community, as well as environmental managers across DOE, the Department has identified several areas relating to subsurface biogeochemistry and contaminant transport in groundwater in which hard work in basic science could yeild signifigant benefits to the DOE cleanup mission. Molecular/atomic-scale science addressing the chemical nature of environmental processes

furthers the basic understanding of chemical, physical, and biological processes occurring at larger scales in the subsurface. Investigations of biological processes will lead to a better understanding of the myriad capabilities of microorganisms to affect contaminant transport in the subsurface. The integration of molecular biology and genomics techniques into subsurface science is essential to a mechanistic understanding of biological processes controlling contaminant transport and bioremediation processes in the subsurface. This research coupled with a more complete understanding of groundwater movement and the chemical nature of reactive transport will help to advance new conceptual models of the mobility and fate of contaminants in the environment. Research into novel monitoring and measurement tools is needed to verify the performance of groundwater remediation techniques and long-term stewardship strategies. Resolving subsurface contamination issues requires an integrated scientific approach with teams of researchers working in the laboratory and in the field across scales to decipher and predict the mechanisms controlling contaminant mobility in the environment. And there is both need and significant opportunity to address chemistry and separations for radioactive waste; modeling, simulation, and scaling issues for environmental management; and predictions of high level waste system performance over extreme time horizons. While these are not exhaustive lists, they represent an initial and ambitious set that offer high potential payoff, thus challenging the science and technology communities to work together in the years ahead.

## External Factors

The following external factors could affect the Department's ability to achieve the Environmental Responsibility theme:

### Changes in Regulatory Requirements

The Department must comply with all applicable environmental laws and regulations. Changes in these laws and regulations can affect the requirements associated with the environmental remedies and the resulting surveillance and maintenance activities.

### Cleanup Standards

The end-state for cleanup at many sites is not fully determined at the time of initial project planning, resulting in changing requirements. The extent of cleanup required to satisfy interested parties greatly affects cost, schedule, and scope of work.

### Technology

Technological development is critical for solving complex cleanup issues, but the success of such developments is inherently unpredictable. Suitable and feasible cleanup technologies do not always exist when the development and deployment of such innovative technologies could help reduce risk, lower cost, and accelerate cleanup.

### Uncertain Work Scope

Uncertainties are inherent in the environmental cleanup program due to the complexity and nature of the work. The Department is working to fully understand the types of contaminants, their prevalence, and concentrations at a given site prior to the execution phase of the cleanup.

### Changes in Demographics and Land Use

Changes to the surrounding land use and demographics can affect the Department's approach to environmental protection, as well as the land use on the Federally-owned property. Close coordination with surrounding land owners and communities is necessary to anticipate and adjust to changes that could affect DOE-owned land and facilities.

### Advances in Science and Technology

Advances in science and technology can improve the understanding of the natural environment, efforts to protect the environment, and the potential impact to human health from residual risks. Scientific transformations could enable improved and more cost-effective environmental remedies and/or allow a broader variety of land and facility use.