Cleaning Up America's Nuclear Weapons Complex

A Governor's Guide

National Governors' Association • Center for Best Practices

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By Ann M. Beauchesne and Jerry Boese

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Since their initial meeting in 1908 to discuss interstate water problems, the Governors have worked through the National Governors' Association to deal collectively with issues of public policy and governance. The association's ongoing mission is to support the work of the Governors by providing a bipartisan forum to help shape and implement national policy and to solve state problems.

The members of the National Governors' Association (NGA) are the Governors of the fifty states, the territories of American Samoa, Guam, and the Virgin Islands, and the commonwealths of the Northern Mariana Islands and Puerto Rico. The association has a nine-member Executive Committee and three standing committees—on Economic Development and Commerce, Human Resources, and Natural Resources. Through NGA's committees, the Governors examine and develop policy and address key state and national issues. Special task forces often are created to focus gubernatorial attention on federal legislation or on state-level issues.

The association works closely with the Administration and Congress on state-federal policy issues through its offices in the Hall of the States in Washington, D.C. The association serves as a vehicle for sharing knowledge of innovative programs among the states and provides technical assistance and consultant services to Governors on a wide range of management and policy issues.

The Center for Best Practices is a vehicle for sharing knowledge about innovative state activities, exploring the impact of federal initiatives on state government, and providing technical assistance to states. The Center works in a number of policy fields, including agriculture and rural development, economic development, education, energy and environment, health, social services, technology, trade, transportation, and workforce development.

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Preface

Meeting the environmental challenges inherited from the Cold War and making informed and responsible nuclear weapons waste disposal decisions calls for our attention and commitment. When the Governors of Colorado, Idaho, Nevada, New Mexico, Ohio, South Carolina, Tennessee, and Washington met with U.S. Secretary of Energy Bill Richardson at the 1999 National Governors' Association (NGA) winter meeting, they discussed developing goals and objectives for a more coordinated national waste management policy.

During this discussion it became clear that a document that would allow the Governors to fully understand the configuration of the Department of Energy's (DOE) facilities for treatment and, especially, disposal of nuclear waste would be an invaluable tool. Governors are interested in handling their fair share of the cleanup burden, but need to clearly see the implications for the movement of waste into or out of a state—as well as the bigger picture of past and future benefits and burdens resulting from the nuclear weapons complex.

This report is designed to provide an overview of the nuclear weapons complex, the sites' past and current missions, and, most importantly, their connection to each other. The report also highlights the states' perspectives on some of the critical issues faced by the DOE sites. To protect public health and the environment, Governors need objective information and analysis, and this report by NGA's Center for Best Practices makes an important contribution.

Executive Summary

The United States began to develop technology capable of producing nuclear weapons under the U.S. Army Corps of Engineers' Manhattan Engineer District (known as the Manhattan Project) in 1942. The nuclear weapons complex has changed dramatically since then. Its initial development involved the rapid construction of three sites: Oak Ridge, Tennessee (for uranium enrichment); Hanford, Washington (for plutonium production); and Los Alamos, New Mexico (for the research, design, and production of the first wartime atomic weapons). The year 1950 brought the development of the hydrogen bomb and, with it, the significant expansion of the nuclear weapons program. This vast research, production, and testing network comprised dozens of industrial facilities and laboratories across the country. At its peak, this complex consisted of 16 major facilities, including vast reservations of land in Idaho, Nevada, South Carolina, and Washington. Its national laboratories in California and New Mexico designed weapons for production in Colorado, Florida, Missouri, Ohio, Tennessee, and Washington.

In the late 1980s and early 1990s, environmental and safety concerns and the end of the Cold War caused many nuclear weapons production sites to shut down. However, a few key nuclear weapons production sites remain in operation. Because the various types of nuclear weapons wastes differ in physical characteristics, chemical form, and radioactivity, each requires different handling. Cleaning up the enormous environmental legacy of the race to build nuclear weapons is the largest environmental management program in the world.

Restoring the environmental balance at these federal facilities calls for a coordinated effort at the state and federal levels. This report is designed to provide an overview of the nuclear weapons complex, the sites' past and current missions, and, most importantly, their connection to each other. The report also highlights the states' perspectives on some of the critical issues faced by the U.S Department of Energy (DOE) sites.

The enactment of the Federal Facilities Compliance Act (FFCA) of 1992 brought Governors and their state regulatory staff into a new and mutually beneficial relationship with DOE. The overarching area of common interest to DOE and the states is to complete the cleanup of the nuclear weapons complex in a manner that provides protection to the citizens, workforce, and environment that surround the sites. While the immediate tasks envisioned under the FFCA have been completed, states have benefited from the continuing exchange of information and ongoing dialogue with DOE. As cleanup of the sites proceeds and transitions into long-term stewardship, it will be essential to continue this positive and open exchange of information between Governors and the department. This will ensure that decisions are made in light of complete information and that states can fully understand their part in the nuclear weapons complex.

Introduction

In the grand scheme of things, we as a nation are only halfway through the full cycle of splitting the atom for nuclear weapons. The first half started in 1942, with the first nuclear chain reaction and the Manhattan Project, and ended with the end of the Cold War in 1990, by which time the U.S. had shut down production throughout most of its nuclear weapons complex. The second half is now upon us. It involves cleaning up the enormous legacy of waste and contamination that was ignored or indefinitely postponed when the top priority was to win the Cold War. This is the largest environmental management program in the world.

The Nuclear Weapons Complex

In 1942 the United States began to develop technology capable of producing nuclear weapons under the U.S. Army Corps of Engineers' Manhattan Engineer District (known as the Manhattan Project). By mid-1945, the United States had exploded the first atomic device at a site near Alamogordo, New Mexico; these devices helped the United States win World War II. With the enactment of the Atomic Energy Act of 1946, nuclear weapons development and production were transferred to the newly created Atomic Energy Commission (AEC). Congress abolished the AEC in 1975, and its nuclear weapons production mission was incorporated into the Energy Research and Development Administration (ERDA), which was subsumed into the U.S. Department of Energy (DOE) in 1977.

The success of the Manhattan Project left the United States as the sole nuclear power in the world until August 1949, when the Soviet Union successfully conducted its first nuclear test, "First Lightning." This test gave new focus to the American nuclear program, and in 1950 President Harry S. Truman gave the order for the AEC to develop the hydrogen bomb. That same year, Congress authorized significant expansion of the nuclear weapons program, leading to the development of a vast research, production, and testing network that came to be known as "the nuclear weapons complex" (see Figure 1). The nuclear weapons complex comprised dozens of industrial facilities and laboratories across the country. At its peak, this complex consisted of 16 major facilities, including vast reservations of land in Idaho, Nevada, South Carolina, and Washington. Its national laboratories in California and New Mexico designed weapons for production in Colorado, Florida, Missouri, Ohio, Tennessee, and Washington. The U.S. Department of Energy currently manages the complex.

The Environmental Legacy and Scope of the Effort

The U.S. spent billions of dollars to produce nuclear weapons and to commercialize nuclear power in the 1950s and 1960s, while spending only a few hundred million to research disposal processes. In the late 1970s, Congress enacted a series of environmental protection laws that empowered both federal and state regulatory agencies to oversee federal activities affecting the environment.

Growing awareness of environmental and safety problems caused DOE to temporarily suspend various operations throughout the complex in the early 1980s and early 1990s. With the end of the Cold War and the subsequent collapse of the Soviet Union, many of these temporary shutdowns became permanent. But

because the shutdowns were viewed as temporary at the time, the department did not make the necessary long-term waste disposition plans prior to suspending operations. Almost every site in the complex is contaminated to some extent with radioactive or other hazardous materials such as solvents or heavy metals. The contamination can be found not only in buildings but also in the soil, groundwater, and surface water. Most sites have considerable and complicated problems that have been compounded over several decades.

The U.S. spent over $300 billion (1995 dollars) on this enterprise from the Manhattan Project through 1995. What was once a bringer of jobs to states and local economies has now become a burden of responsibility in overseeing the long-term cleanup of radioactive wastes whose half-lives range from 29 years to 4.4 billion years. The budget for DOE's cleanup program is now about $6 billion per year. This is roughly the same as the entire U.S. Environmental Protection Agency (EPA) budget, and is about twice the size of annual Superfund expenditures. In the long term, the ultimate cost of the cleanup was estimated in 1998 to be $147 billion.[1] Earlier estimates were as much as $250 billion.

The cleanup mission of DOE also presents many opportunities. In pursuing its goal of remediating all sites, DOE has an ongoing environmental management mission. The cleanup mission generates many business opportunities and jobs in communities throughout the complex. As parcels of land are decontaminated, many are being returned or made available to communities as wildlife management areas or industrial development areas.

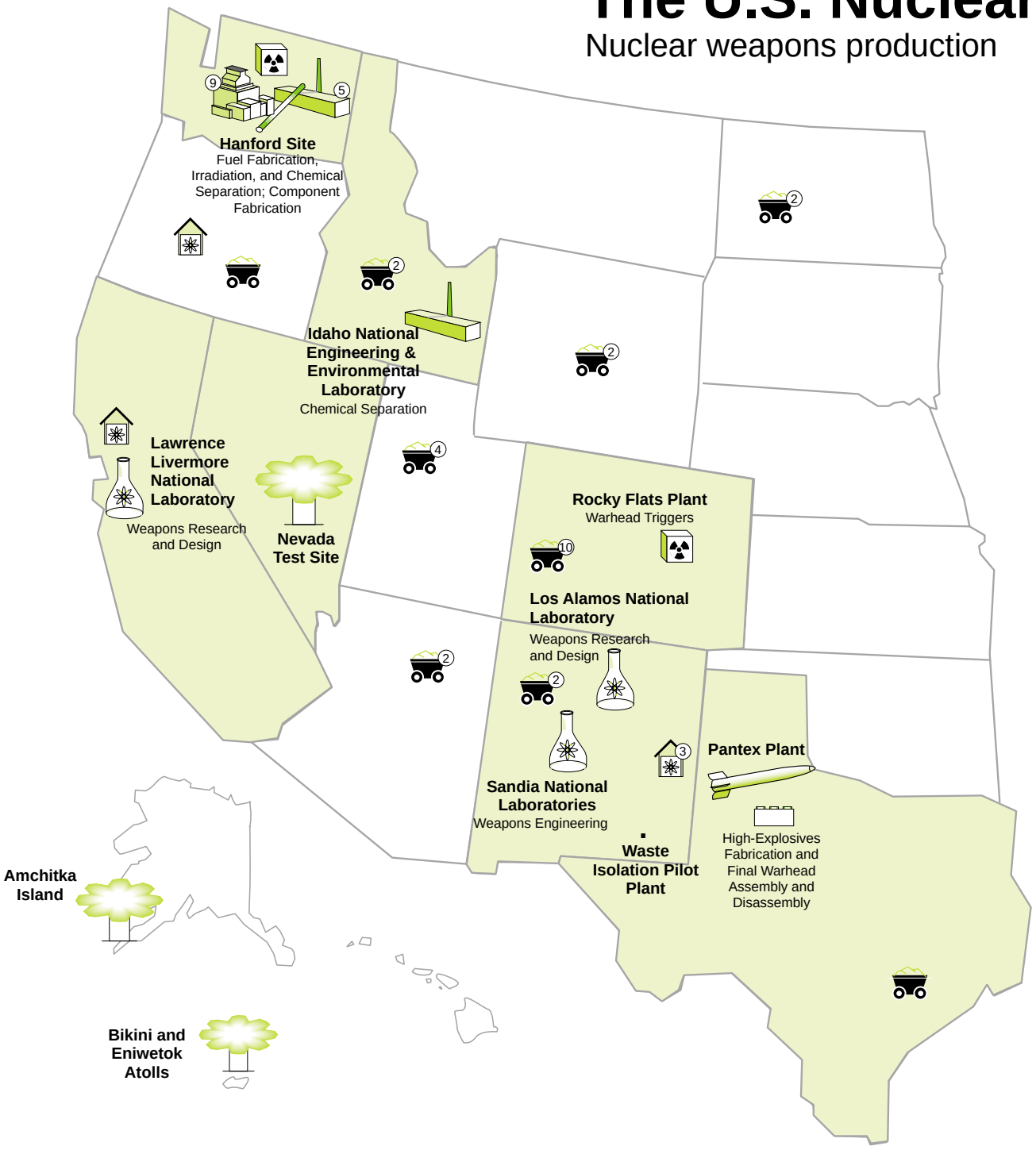
Restoring the environmental balance at federal facilities requires a coordinated effort at the state and federal levels. Changing world conditions, a decrease in the priority placed on nuclear weapons production, and the public's increasing concerns about protecting human health and the environment highlight the need for Governors and DOE to work together to make responsible disposal decisions and to meet the environmental challenges inherited from the Cold War.

1 As this document went to press, DOE issued a status report on *Paths to Closure*. The department estimates in this report that, based on data collected in 1999, $151 billion to $195 billion will be needed by 2070 to complete the cleanup.

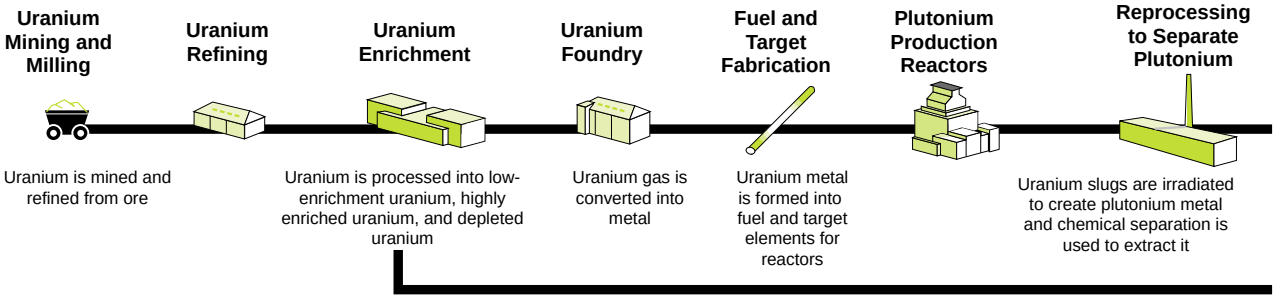
Figure 1

The U.S. Nuclear

Nuclear weapons production

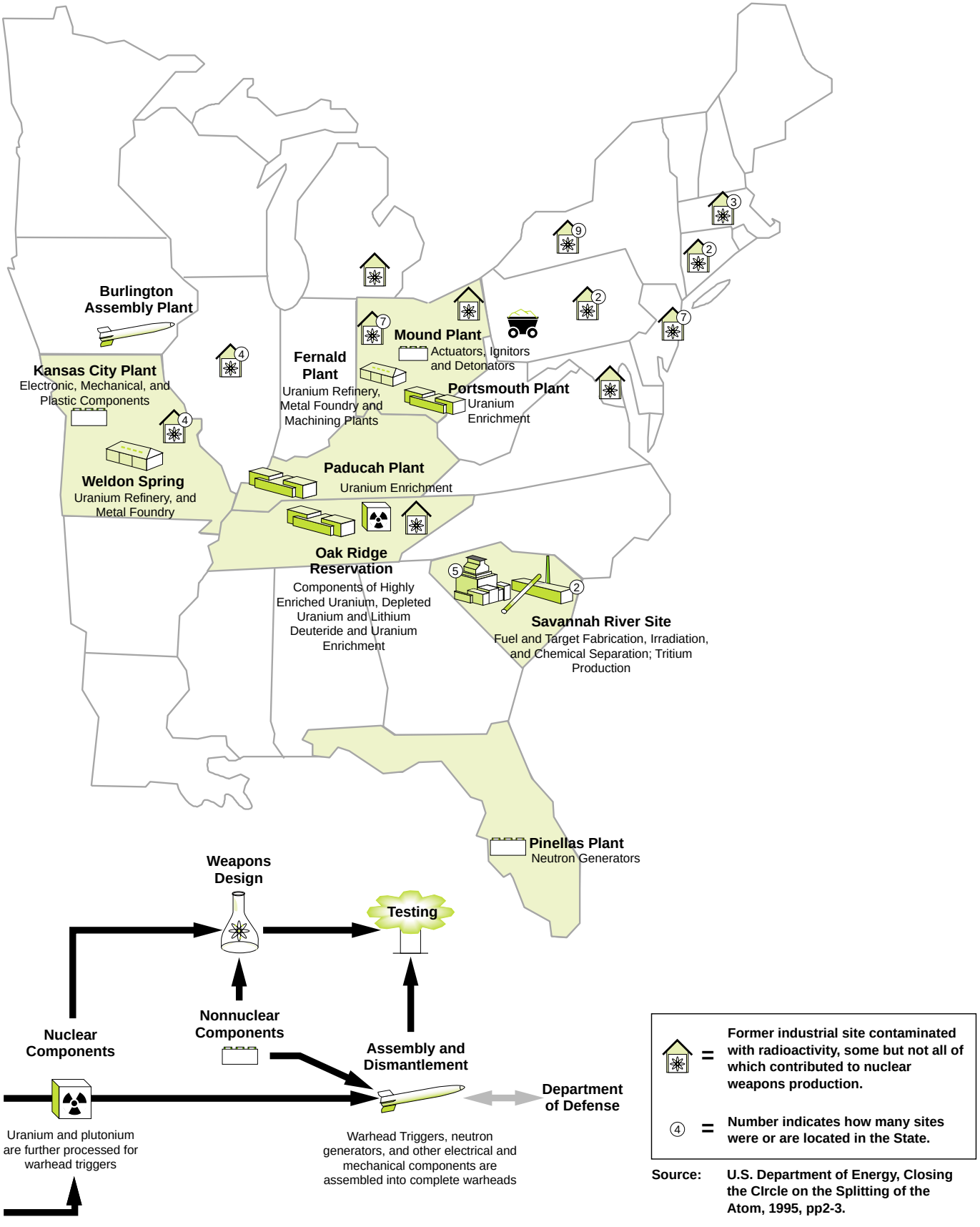


Nuclear Weapons Production



Weapons Complex

occurred from World War II until the late 1980s



= Former industrial site contaminated with radioactivity, some but not all of which contributed to nuclear weapons production.

④ = Number indicates how many sites were or are located in the State.

Source: U.S. Department of Energy, Closing the CIrcle on the Splitting of the Atom, 1995, pp2-3.

How Are Cleanup Decisions Being Made?

With the exception of certain environmental remediation issues, DOE has been self-regulated since the enactment of the Atomic Energy Act in 1946. Total self-regulation of weapons production activities was deemed necessary because of the urgency and nature of the mission at hand. In the 1980s, however, DOE found it increasingly difficult to justify complete self-regulation, and several court rulings granted authority to the U.S. Environmental Protection Agency (EPA) to regulate DOE activities to ensure compliance with environmental laws. Many states now have similar authority as well, through federal laws for clean water and hazardous waste.

Federal Facilities Compliance Act

In 1992 Congress passed the Federal Facility Compliance Act (FFCA), which required DOE to prepare site treatment plans for approval by the appropriate state. These plans only apply to the treatment of that portion of DOE's waste known as "mixed" waste. This waste contains hazardous constituents regulated by states under the delegated federal hazardous waste program and radioactive constituents self-regulated by DOE. The site treatment plans were developed in consultation with the states and were completed in 1995. They are now being implemented under regulatory orders between DOE and the states. These plans do not address disposal of radioactive waste.

In 1998, in an effort to improve the management of the enormous cleanup[2] effort and to accelerate cleanup at many DOE sites, DOE produced *Accelerating Cleanup: Paths to Closure*, a planning document that provides a site-by-site, project-by-project projection of the technical scope, cost, and schedule required to complete all 353 projects at DOE's 53 remaining cleanup sites in the United States. DOE committed to completing cleanup at 43 of the remaining 53 sites by 2006.

National Environmental Policy Act

The framework for many of DOE's waste management decisions is governed by the National Environmental Policy Act (NEPA). Within the NEPA framework, many decisions have been or will be made for the variety of nuclear materials and waste that represent DOE's Environmental Management program. The official vehicle for much of DOE's waste legacy decisionmaking is the final Waste Management Programmatic Environmental Impact Statement (WM-PEIS) of May 1997.

What Waste Was Considered in the Scope of the WM-PEIS?

The WM-PEIS analyzes alternatives for managing several types of radioactive waste, including high-level waste (HLW), transuranic waste (TRU), low-level waste (LLW), and mixed low-level waste (MLLW). LLW and MLLW analyzed were those wastes left over from nuclear weapons production and energy research, as well as projected waste generation from those missions and some cleanup activities during the next 20 years.

Because Records of Decision governing the management of high-level waste and transuranic waste were issued some time ago, this *Governor's Guide* focuses on the recent decisions related to LLW and MLLW. Notwithstanding the limited focus for this document, states are very concerned about the disposition of *all*

2 As used here, "cleanup" refers to cleanup of contaminated soil, groundwater, and facilities (also called environmental restoration); and to treatment, storage, and disposal of waste left over from weapons production and other activities (waste management).

nuclear materials as well as of those materials classified as wastes. Similarly, the public demonstrated that its concerns also extend beyond waste, to cover all nuclear materials. This emerged most clearly during a series of DOE-sponsored workshops in the summer of 1998 facilitated by the League of Women Voters' Education Fund. DOE's current plans for disposition of nuclear materials and wastes are reflected in the tables in Appendix B.

Waste Disposal Decisions

The WM-PEIS focuses on the question of *where* the waste would be treated and disposed of. In the disposal of LLW and MLLW, DOE examined whether waste from a given site should be disposed of on site or off site, ultimately narrowing the list of candidate disposal sites for LLW and MLLW to the following six: Idaho National Engineering and Environmental Laboratory (INEEL) in Idaho, Nevada Test Site in Nevada, Los Alamos in New Mexico, the Savannah River Site in South Carolina, Oak Ridge Reservation in Tennessee, and Hanford in Washington.

On February 25, 2000, DOE announced its final decision for LLW and MLLW treatment and disposal sites. This decision enables the department to move forward with the closure of former defense nuclear facilities and redirect the millions of dollars now being spent on waste storage back into actual cleanup work.

For **LLW treatment**, DOE will continue the practice of having each site treat its own waste. For **LLW disposal**, DOE will continue (consistent with current practice and to the extent practicable) disposal of on-site waste at sites that already have LLW disposal facilities (Hanford, INEEL, Los Alamos, Nevada Test Site, Oak Ridge, and Savannah River) and will use the Hanford site and the Nevada Test Site for disposal of LLW from DOE sites that do not have disposal capacity or a corresponding waste acceptance criteria.

For **MLLW treatment**, DOE will continue to use Hanford, INEEL, and Oak Ridge to treat waste from other DOE sites and will begin to use the Savannah River site to treat waste from other DOE sites. For **MLLW disposal**, DOE will use the disposal facilities already constructed at the Hanford site and at the Nevada Test Site for off-site waste.

DOE's decision is intended to improve safety and to address public health concerns about untreated waste now in storage at DOE sites around the country. The decision is also intended to improve the efficiency and flexibility of operations and to decrease costs. By selecting regional treatment and disposal facilities, DOE believes energy department sites will have operational flexibility to align their waste streams with corresponding disposal facility waste acceptance criteria. In addition, the use of existing facilities will avoid potential health and safety impacts associated with new facility construction and avoid capital construction costs.

Superfund Wastes Are Subject to a Different Decisionmaking Process

The disposal of LLW and MLLW contaminated soil, groundwater, and buildings is addressed in various site-specific decisions under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA, also known as Superfund). Such decisions are made at the local site level, in conjunction with state regulators and EPA, based on land uses that reflect local conditions and, to the extent possible, the preferences of local stakeholders. Waste managed through an on site CERCLA disposal cell is not within the scope of the WM-PEIS. CERCLA decisions must analyze, as appropriate, the tradeoffs of disposal on site, off site at a DOE Waste Management (WM) program disposal facility, and off site at a commercial disposal facility. Because of this potential to transfer the waste from the cleanup program to the WM program, DOE's WM-PEIS analyzed the potential impacts associated with disposing of these cleanup-generated wastes at WM facilities.

Estimates of DOE Radioactive Waste

Figure 2 illustrates volumes of all the waste, by state, that DOE presently estimates are in inventory and to be generated over the next 20 years.

Figure 2

Estimates of DOE Radioactive Waste

Waste volumes subject to decisions under DOE's Waste Management Programmatic EIS*

State	High-Level Waste (HLW) Complex-wide volume 378,000 m³ % of DOE Inventory*	Transuranic Waste (TRU) Complex-wide volume 165,300 m³ % of DOE Inventory*	Low-Level Waste (LLW) Complex-wide PEIS volume – approx. 1 million m³ % of DOE Inventory*	Low-Level Waste (LLW) Potentially targeted for off-site disposal	Mixed Low-Level Waste** (MHLW) Complex-wide PEIS volume – approx. 177,000 m³ % of DOE Inventory*	Mixed Low-Level Waste** (MHLW) Potentially targeted for off-site disposal
CO		5	6	*100%*	38	*100%*
ID	3	48	3	*21%*	<1	*100%*
NV		<1	20	*0%*	0	*0%*
NM		10	16	*10%*	2	*100%*
OH		<1	15	*100%*	2	*100%*
SC	40	18	12	*6%*	2	*100%*
TN		2***	7	*100%*	14	*100%*
WA	56	15	14	*0%*	2	*100%*
Other States	1	1	6	100%	2	*100%*
DISPOSAL	a	b	c		d	

a. All HLW is targeted for disposal in a geologic repository. Yucca Mountain, Nevada, is currently being investigated for its suitability to serve as the geologic repository for the U.S.

b. DOE Record of Decision (ROD) determined that all defense TRU waste will be disposed of in the WIPP facility, New Mexico. (63 *Federal Register* 3623, January 23, 1998)

C. DOE's ROD determined that six DOE sites will have some disposal of low-level waste from on-site, and that two DOE sites will receive LLW from off site for disposal. DOE estimates that NV could receive approx. 360,000 m³, and WA approx. 70,000 m³ from off site over 20 years.

d. DOE's ROD determined that two DOE sites will receive MLLW from off site for disposal. DOE estimates that NV could receive approx. 25,000m³, and WA approx. 110,000 m³ from off site over 20 years. Actual volumes to be determined based on case-by-case evaluations of waste streams.

NOTES

Other states are CA, IA, IL, KY, NY, NJ.

"Potentially targeted for off-site disposal" includes waste targeted for disposal in off-site DOE (i.e., not commercial) facilities. Numbers are the percentage of the waste inventory at that site.

*Complex-wide PEIS waste volumes are estimates of waste volumes subject to programmatic level decisions under the PEIS over the 20-year period 1998-2017. "Inventory" reflects volumes already in inventory plus volumes expected to be generated through 2017.

**LLW and MLLW volumes do not include waste targeted for commercial disposal or waste from the Environmental Restoration program unless likely to be transferred to the Waste Management program.

***While TN has 2% of the existing and projected (20 years) total TRU inventory, it presently has 76% of the *remote-handled* TRU Waste Inventory in the Complex.

Source: U.S. Department of Energy, 1998 *Paths to Closure* database; *The National TRU Waste Management Plan*, Revision 1, 12/97, page 3; and H. Belencan & K. Guevara, personal communication.

What Are the Main Issues of Common Interest to States and DOE?

Many issues are of common interest to DOE and the states. Certainly the overarching area of common interest is to complete the cleanup of the nuclear weapons complex in a manner that provides protection to the citizens, workforce, and environment that surround the DOE sites. A discussion of some of the key issues follows.

Sufficient Funding to Get the Job Done

Cleanup of the waste that is the legacy of decades of nuclear weapons construction is a monumental task. If progress is to be made, it is important that all cleanup funding is used wisely, that sufficient funding be requested from Congress to achieve compliance with all state-DOE agreements, and that the funds appropriated are enough to meet cleanup commitments for 2006 and beyond. Governors have supported DOE in its efforts in recent years to secure sufficient, stable funding from Congress to keep this major effort on track.

Appropriate Spending Priorities

An additional issue is how to assure a funding stream that will meet the needs of long-term stewardship of sites after active remediation is completed. DOE is required by Executive Order 12088 to request a budget that complies with environmental requirements. In addition, the budget must address and balance overall risk reduction and the need to complete the cleanup and close individual sites. While DOE's emphasis on cleanup and closure of as many sites as possible by 2006 is laudable, states are concerned that this focus may delay work on some of the greatest environmental and public health risks until after 2006. States and other stakeholders have urged DOE to make risk reduction and compliance with regulatory orders its highest priorities.

Equity: Sharing the Cleanup Burden

No state wants to be perceived as the "nation's dumping ground." On the other hand, everyone understands the necessity for providing safe, permanent solutions for treatment and disposal of hazardous and radioactive residues, those generated by the weapons and related processes and those that are the inevitable byproducts of management and remediation occurring throughout the complex. Equity also requires consideration of past and future benefits and burdens resulting from production and research.

Cleanup Levels

DOE has relied on a series of assumptions about cleanup levels to develop cost and schedule estimates. While DOE recognizes that site-by-site cleanup levels will be determined in accordance with relevant statutes and stakeholder input, these assumptions have raised questions among states regarding DOE's plan and the cost projections if they turn out to underestimate the eventual scope of actual cleanup at a site.

External Oversight

Unlike any other industrial facility, DOE's facilities are almost entirely self-regulated. States feel strongly that they have the ability to oversee the shipment, treatment, and disposal of DOE's wastes to ensure the health and safety of their citizens as well as the integrity of the environment. The states are concerned about DOE's recent decision to discontinue a shift towards external regulation that was initiated in 1996. Many states believe that DOE should examine options

for delegating shared regulatory oversight of waste disposal operations to states, given the long-term stewardship responsibilities disposal will require.

Transportation of Radioactive Waste

DOE has a responsibility to design and operate a safe transportation system. In their role as first-line regulators charged with protecting the public safety and health, states (with local governments) have the role of providing emergency response and other services to assure safe shipment within their borders. It is essential for DOE to continue its efforts to plan and coordinate transportation activities in full consultation with all local responders.

Disposal of High-Level Waste, Nevada

A permanent solution for the disposal of HLW and spent fuel is of great concern for sites and for states that have both such materials and the need for their final disposition. In 1987, Congress designated Yucca Mountain, Nevada, as the potential site for the nation's geological repository for spent fuel and high-level waste. Detailed investigations of the site's geology and suitability as a repository are ongoing, and a recommendation on whether to go forward with the site is scheduled for 2001.

Disposal of Transuranic Waste (TRU) at WIPP, New Mexico

Twenty years after its authorization by Congress, the Waste Isolation Pilot Plant (WIPP) received its first shipments of TRU waste for permanent disposal in March 1999. All retrievable TRU waste (including mixed TRU) is ultimately destined to go to WIPP for disposal. States are concerned about the pace and sequence in which TRU waste is moved to WIPP. Some states have additional concerns about DOE's timetable for disposal of remote-handled TRU waste.

Long-Term Stewardship

Even when cleanup at most major DOE sites is considered complete, additional measures will be needed to ensure adequate protection of human health and the environment. These additional measures—referred to as long-term stewardship activities—can include varying degrees of surveillance; monitoring of the migration of residual contamination and the effectiveness of remedies; inspection; restrictions on public access; limitations on future uses of land and water; maintenance of relevant information; and general, responsible long-term care of the site. A reliable long-term stewardship program should be an integrated program, with roles and responsibilities shared appropriately among DOE offices, states and local governments, tribal nations, and other federal agencies as needed. States have a strong interest in DOE's vision for funding long-term stewardship and would like to work with the department to develop mechanisms to move away from reliance on annual appropriations.

The Major DOE Sites: A State-by-State Overview

Below is a brief overview of the major DOE sites and some of the critical issues they face. Waste volumes quoted focus on waste subject to decisionmaking under DOE's WM-PEIS. Therefore, the volumes *exclude* CERCLA cleanup waste (unless it is expected to be transferred to the WM program) and any waste targeted for disposal at a commercial facility. The volumes quoted are 1998 estimates of waste that DOE expects to manage over the 20-year period 1998–2017. These numbers are summarized in Appendix A.

Colorado: Rocky Flats Environmental Technology Site

The Rocky Flats Environmental Technology Site is an environmental cleanup site located about 15 miles northwest of downtown Denver. Rocky Flats is similar to a small city and comprises more than 700 structures located on a 385-acre industrial area surrounded by nearly 6,000 acres of controlled open space. Until December 1989, the Rocky Flats Plant made components for nuclear weapons using various radioactive and hazardous materials, including plutonium, uranium, and beryllium. The current annual Rocky Flats budget is approximately $665 million, and today the sole mission at Rocky Flats is cleanup.

The Rocky Flats Cleanup Agreement, signed by DOE, the U.S. Environmental Protection Agency, and the Colorado Department of Public Health and Environment in 1996, is the binding regulatory agreement that provides the framework for and governs cleanup activities at the site.

Site-Specific Issues

Colorado is primarily concerned with access to off-site disposal to allow timely site cleanup and closure by 2006. Shipments of TRU waste have begun, and decisions on low-level waste disposal have been made. However, Colorado officials are concerned that shipments of plutonium metals and oxide material will not begin on schedule.

Relationship to Other Sites in the Complex

To support its goal of closing Rocky Flats by 2006, DOE is relying on being able to ship nuclear waste and materials to other sites in the complex. Through its closure in 2006:

- Rocky Flats will have about 65,000 cubic meters of LLW, or about 6 percent of the complex-wide total of approximately 1 million cubic meters of LLW. The site tentatively plans to ship all of its LLW to off-site disposal facilities.

- Rocky Flats will have about 68,000 cubic meters of MLLW, comprising about 38 percent of the complex-wide total MLLW of approximately 177,000 cubic meters. Rocky Flats plans to ship all of its MLLW to DOE facilities or to a commercial facility for disposal.[3]

Idaho: Idaho National Engineering and Environmental Laboratory

The Idaho National Engineering and Environmental Laboratory (INEEL) is located on 890 square miles in the southeastern Idaho desert, with additional INEEL research and support facilities located in Idaho Falls.

3 Commercial facilities are mentioned separately because they constitute facilities where licensing decisions have already been made to allow disposal within given parameters. The Record of Decision for LLW and MLLW disposal at DOE facilities was announced February 25, 2000; however, decisions on specific waste streams have not been made.

Within the laboratory complex are nine major applied engineering, interim storage, and research and development facilities. Established in 1949 as the National Reactor Testing Station, for many years INEEL was the site of the largest concentration of nuclear reactors in the world. Fifty-two reactors—most of them first-of-a-kind—were built at INEEL, including the Navy's first prototype nuclear propulsion plant. Today, INEEL is being tapped to help meet regional, national, and international cleanup needs and is leading the DOE complex-wide effort to more closely integrate technology development with specific cleanup objectives to get work done faster and at a lower cost. INEEL's budget is about $435 million.

Three agreements embody the regulatory framework at Idaho. The Federal Facilities Agreement Compliance Order mandates milestones for cleanup under CERCLA. The Site Treatment Plan and associated regulatory orders govern certain waste management activities. In addition, in October 1995, Idaho, the U.S. Navy, and DOE reached an agreement settling a lawsuit filed by the state to prevent shipment of spent nuclear fuel to INEEL for storage.

Site-Specific Issues

The future of the INEEL site and the implementation of a 1995 court settlement and other legal agreements between DOE and the state, including access to disposal of TRU waste at WIPP, are Idaho's primary concerns. The settlement also calls for interim storage and eventual removal of spent fuel from Idaho.

Relationship to Other Sites in the Complex

INEEL has relationships with other DOE sites that are critical to completing the requirements of the settlement agreement, including the WIPP site for disposal of transuranic waste. In addition to high-level waste and spent nuclear fuel generated on site, INEEL stores the damaged reactor from Three Mile Island and spent nuclear fuel from Navy vessels and foreign research reactors. Disposal of high-level waste and spent nuclear fuel from INEEL is dependent on future decisions about permanent geologic disposal.

Cleanup at INEEL requires access to several sites around the country for several types of wastes and materials. During the next 20 years:

- INEEL LLW will comprise about 3 percent of the complex-wide LLW. Most of this is tentatively planned for on-site disposal, with the remainder potentially targeted to off-site DOE disposal.

- INEEL MLLW will comprise less than 1 percent of the complex-wide MLLW (not including in situ or ex situ environmental restoration waste). This waste will be disposed of at commercial or off-site DOE facilities. Much of INEEL's environmental restoration of mixed low-level and low-level waste will probably remain on site, either in place or consolidated in on-site disposal facilities.

As part of its role in cleaning up the complex, INEEL serves as a storage facility for naval spent nuclear fuel and civilian fuel, including foreign research reactors. In addition, INEEL treatment facilities, such as the Waste Experimental Reduction Facility (WERF), play a key role in treating mixed low-level waste from around the complex.

Nevada: Nevada Test Site

The Nevada Test Site (NTS) is a DOE installation occupying approximately 1,350 square miles (more than 800,000 acres) in southeastern Nye County, Nevada. The NTS is larger than Rhode Island (the site occupies over 40 percent of all DOE land holdings). Site features include deserts, playas, and mountainous terrain. The NTS is located about 65 miles northwest of Las Vegas, Nevada. Las Vegas is home to about 1.2 million residents and is one of the fastest growing metropolitan areas in the nation. The NTS is a DOE defense program site; its primary mission is to maintain the capability to resume nuclear testing. While the NTS has a relativity small Environmental Management (EM) cleanup budget (i.e., $80 million, or 2 percent of all DOE cleanup funds), the site contains significant contamination in surface soils and groundwater. Nearly 30 percent of all underground nuclear tests conducted at the site (more than 250 tests) were performed in the vicinity of the groundwater.

The Yucca Mountain site is in the southwest corner of the NTS, adjacent to the Nellis Air Force Range and on land currently under the control of DOE, the U.S. Air Force, and the U.S. Bureau of Land Management. The site covers approximately 87 square miles (55,000 acres). DOE is evaluating Yucca Mountain for its suitability as a geologic repository for spent nuclear fuel and high-level radioactive waste. In July 1999, DOE released the Draft Environmental Impact Statement for the Yucca Mountain site. This report was followed by a proposed EPA rule that will eventually set an environmental radiation protection standard for the site.

The NTS has two agreements dealing with mixed waste storage. The first is a settlement agreement for storage of mixed transuranic waste that was signed June 23, 1992. The waste covered by this agreement was subsequently incorporated into the Federal Facilities Compliance Act. The NTS also has a mutual consent agreement, signed January 14, 1994, for managing newly generated mixed low-level waste from DOE environmental restoration activities in Nevada. In May 1996, DOE and Nevada also signed the Federal Facility Agreement and Consent Order (FFACO). This agreement governs remediation of historical contamination through corrective actions based on public health and environmental considerations. The agreement stipulates a process to ensure that DOE and the U.S. Department of Defense thoroughly investigate and complete corrective actions for contaminated sites on the NTS and the Nellis Air Force Range.

Site-Specific Issues

Although it is expected that large volumes of LLW will be shipped to the NTS for disposal, Nevada officials are concerned that some LLW may not be suitable for typical shallow land burial at NTS (i.e., high-activity LLW considered equivalent to commercial greater-than-class-C waste). The state is also seeking shared regulatory oversight over LLW operations at NTS through delegation of authority by DOE under the Atomic Energy Act. Nevada officials believe that DOE should establish and fund a baseline health-effects study. The study is needed to establish a baseline of the health effects from past DOE activities in Nevada to determine what, if any, health effects may occur from future DOE activities, such as waste disposal or the creation of a geological depository at Yucca Mountain. State officials also think that consideration should be given to placement of radiation detection equipment on all trucks shipping to NTS and at strategic locations along transportation routes.

Additionally, Nevada strongly opposes the use of Yucca Mountain as the site for the nation's geologic repository. This opposition also applies to interim storage of commercial or DOE spent fuel at the site.

Relationship to Other Sites in the Complex

The vast majority of waste at the NTS will be managed on site; the exception is a relatively small quantity of transuranic waste (TRU waste) currently in storage at the site. This waste will be shipped to DOE's WIPP disposal site in New Mexico. During the next 20 years:

- The NTS LLW will comprise about 20 percent of the complex-wide LLW to be managed under the Waste Management Program. This waste will be disposed on site. Under the Record of Decision for LLW disposal, NTS is one of two sites (with Hanford) to be designated to receive LLW from off site for disposal, and DOE has estimated that NTS will likely receive about 360,000 cubic meters of LLW from off site during the 20 years for which estimates are available. Actual volumes will be determined by case-by-case evaluations of waste streams.

- The NTS has almost no MLLW on site. Under the Record of Decision for MLLW disposal, NTS is one of two sites (with Hanford) to be designated to receive MLLW from off site for disposal, and DOE has estimated that the NTS will likely receive about 25,000 cubic meters of MLLW from off site during the 20 years for which estimates are available. Actual volumes will be determined by case-by-case evaluations of waste streams.

New Mexico: Los Alamos, Sandia, WIPP

The Los Alamos National Laboratory (LANL), established in 1942, was the first nuclear weapons research and development facility in the United States. It still serves as a key center for weapons and basic science research. Sandia National Laboratories began in 1945 on Sandia Base in Albuquerque, New Mexico, as Z Division, part of what is now LANL. In 1979, Congress authorized the building of the Waste Isolation Pilot Plant (WIPP). DOE constructed WIPP 26 miles east of Carlsbad, New Mexico, during the 1980s. WIPP became the nation's first operating underground repository for defense-generated transuranic radioactive waste, receiving the first shipment on March 26, 1999. Today, site missions include stockpile stewardship, science and technology, and waste management. The combined site cleanup budgets today are about $320 million.

The compliance order from the New Mexico Environment Department (NMED) addresses mixed waste storage and treatment per the Federal Facilities Compliance Act. New Mexico also has a compliance agreement on the remediation of the transuranic waste storage pads at Los Alamos National Lab. The final Resource Conservation and Recovery Act (RCRA) Hazardous Waste Part B permit for transuranic waste disposal at WIPP was issued by NMED in November 1999.

Site-Specific Issues

New Mexico's key concern is compliance with the RCRA permit, which regulates mixed TRU waste shipped to WIPP for disposal. Additionally, the state desires to keep the national laboratories operating.

Relationship to Other Sites in the Complex

Though most of the sites in New Mexico will have continuing missions associated with national defense, Los Alamos and Sandia National Labs still have significant quantities of waste that will require disposition. Most of this waste will be disposed of or treated on site, but these sites will still require access to other sites in the DOE complex for disposition of specified materials. During the next 20 years:

- LLW from DOE sites in New Mexico will comprise about 16 percent of the complex-wide LLW. DOE estimates that up to 10 percent of the LLW at LANL could be disposed off site, the remainder would be disposed on site.

- MLLW from DOE sites in New Mexico will comprise approximately 2 percent of the complex-wide MLLW. Disposal of this waste is expected to occur off site at DOE and commercial facilities.

Ohio: Fernald, Mound, Portsmouth, Columbus

The Ohio Field Office manages five sites in Ohio. These sites include Ashtabula Environmental Management Project (RMI Extrusion Plant); Columbus Environmental Management Project (Battelle Columbus Laboratories, two sites); Fernald Environmental Management Project; and Miamisburg Environmental Management Project (Mound Plant). DOE's Oak Ridge operations office funds Portsmouth environmental management activities and is responsible for generated waste. The mission at the Ohio sites consists of various projects focused on the general tasks of decontamination, deactivation, excavation and treatment of contaminated soils, groundwater remediation, and many other related projects. Current plans call for cleanup at all sites by 2008. The combined annual site budgets are about $450 million.

A consent order with Ohio that addresses mixed waste storage and treatment was approved and in place prior to October 6, 1995, as established in the Federal Facilities Compliance Act. (There are multiple orders and cleanup agreements with the Ohio sites.)

Site-Specific Issues

Ohio's main concerns are adequate funding and follow through by DOE and fulfillment of their compliance and accelerated cleanup commitments. One component is access to off-site LLW and MLLW disposal facilities. In addition, safe conversion of depleted ura-

nium hexafluoride is a major issue at the Portsmouth site. Another major concern is long-term stewardship of closed DOE sites.

Relationship to Other Sites in the Complex

The missions of Ohio's DOE sites are focused primarily on the cleanup of nuclear weapons research and manufacturing facilities. As such, over the next six to nine years, DOE sites in Ohio will be sending materials and wastes to other sites in the complex to facilitate their timely cleanup and closure. Proposals may be made to move relatively small volumes of TRU and remote-handled TRU waste to other DOE sites for interim storage and repackaging prior to shipment to WIPP. DOE is currently proposing to move approximately 6,000 depleted uranium hexafluoride (DUF6) cylinders from Oak Ridge to Portsmouth for conversion.[4] During the next 20 years:

- LLW from DOE facilities in Ohio will comprise 15 percent of the complex-wide LLW to be managed under the Waste Management program. Ohio sites are expected to dispose of all of this waste at off-site DOE and commercial facilities. This excludes a substantial volume of cleanup waste disposed of at Fernald in an on-site CERCLA disposal cell.

- MLLW from DOE facilities in Ohio will comprise about 2 percent of the complex-wide MLLW. This waste is expected to be disposed of at off-site DOE and commercial facilities.

South Carolina: Savannah River Site

DOE's Savannah River Site (SRS) complex covers 310 square miles in western South Carolina. SRS was constructed during the early 1950s to produce special radioactive isotopes for national security purposes. The primary purpose of this mission was the production of strategic isotopes (plutonium-239 and tritium) used in the development and production of nuclear weapons for national defense. After the Cold War, emphasis at SRS shifted from nuclear material production to cleanup. Despite this shift, SRS remains a major defense installation capable of processing and purifying tritium and plutonium. Currently, the site's cleanup budget is about $1.2 billion.

The consent order with South Carolina addresses mixed waste storage and treatment under the Federal Facilities Compliance Act. In addition, relevant state statutes and regulations are applied to DOE cleanup activities, including incineration of waste and treatment of wastewater.

Site-Specific Issues

There are several ongoing site missions, and their continuation and expansion are important to the state. South Carolina officials are concerned about issues pertaining to exposure of workers and about questions of equity in funding allocation decisions made by DOE.

Relationship to Other Sites in the Complex

SRS will play a significant role in the processing and manufacture of nuclear materials for the next several years. While it moves ahead with these missions, significant volumes of waste still will require treatment or disposal at other sites in the complex. In 1998 DOE designated SRS as the immobilization or conversion facility for much of the nation's surplus plutonium. During the next 20 years:

- Savannah River LLW will comprise about 12 percent of the complex-wide LLW. About 93 percent of this is targeted for on-site disposal, with the remainder expected to be disposed of at off-site DOE and commercial facilities.

- Savannah River MLLW will comprise about 2 percent of the complex-wide MLLW, and this is expected to be sent to an off-site DOE facility for disposal.

4 More than 50 years ago, DOE began its uranium enrichment program that resulted in more than 14 billion pounds of stored DUF6 in Kentucky, Ohio, and Tennessee. The wastes are being stored outdoors in thousands of corroding cylinders.

Tennessee: Oak Ridge Reservation

Located in a water-rich environment in eastern Tennessee, along the Clinch River and within the boundary of the city of Oak Ridge, DOE's 35,252-acre Oak Ridge Reservation (ORR) played a major role in the production of materials for the Manhattan Project during World War II. Since the end of the Cold War, the focus has shifted to cleaning up the legacy of nuclear weapons production. Today, more than 45,000 people in Tennessee reside within five miles of a DOE facility. Oak Ridge Operations (ORO) is responsible for major DOE missions in environmental management, research and development, uranium enrichment, defense programs, and other activities. Tennessee expects the missions of the Y-12 Plant and the Oak Ridge National Laboratory to continue and improve. Environmental management funding for ORO is approximately $626 million. This includes environmental management at Paducah, Kentucky; Weldon Spring, Missouri; Portsmouth, Ohio; and funding for the Uranium/Thorium Fund. Approximately $444 million is dedicated for environmental cleanup (including decommissioning and decontamination (D&D),[5] waste management, and facility maintenance activities at the ORR.

Several agreements embody the regulatory framework at ORR. The Federal Facilities Agreement, issued in 1992, establishes environmental cleanup and restoration procedures and milestones for ORR; and a consent order issued in 1993 by the Tennessee Department of Environment and Conservation (TDEC) modified storage and treatment permits regarding out-of-state waste from DOE-owned facilities. A TDEC commissioner's order issued in 1994 relates to the storage and handling of the pond waste; another commissioner's order, issued in 1995, addresses mixed waste treatment and storage at all DOE facilities on ORR, as established in the Federal Facilities Compliance Act. A consent agreement in 1999 relates to the storage and disposition of UF6 cylinders located on the Reservation. In addition, relevant state statutes and regulations are applied to DOE waste management and cleanup activities, including incineration of waste and treatment of wastewater.

Site-Specific Issues

Tennessee's primary concern is to assure its citizens that their health, safety, and environment are being protected. Tennessee, DOE, and EPA are working together with stakeholders to address the following problems:

- groundwater contamination on and off the Oak Ridge Reservation;
- 100 miles of contaminated rivers and streams (addressed through fish advisories and institutional controls);
- 130 acres of buried waste, containing 40 million pounds of uranium and 6 million curies of buried radioactive waste, including deep well injections;
- 250,000 curies of radioactive waste discharged into surface streams;
- 339,000 pounds of mercury discharged into East Fork Poplar Creek and the Clinch and Tennessee Rivers;
- 6 shutdown nuclear-research reactors;
- 400 surplus facilities in deteriorating condition; and
- the largest stored waste inventory in the DOE complex (44 percent of the low-level radioactive waste, 56 percent of the mixed low-level waste, and 76 percent of the remote-handled TRU waste).

Tennessee rejected DOE's Toxic Substances Control Act's (TSCA)[6] incinerator burn plans in 1998 and 1999 and restricted use by non-ORO off-site waste generators. Critical issues identified include funding, equity, cleanup levels, disposal, stewardship, and the health and safety of workers and citizens in and around the Oak Ridge Reservation. DOE's TSCA incinerator currently accepts waste from ORO sites located in Kentucky and Ohio as well as from additional DOE facilities that present an immediate threat to human health or the environment. Tennessee is working with DOE to develop and implement a revised TSCA burn policy that will satisfy state equity and regulatory requirements and meet DOE complex-wide mixed waste treatment needs. Tennessee is concerned that there is insufficient funding to ship waste that is currently stored on site, even if access to other disposal sites is available. Tennessee officials want a financial assurance mechanism to provide for long-term stewardship.

5 D&D refers to retirement of a nuclear facility, including decontamination and dismantlement.
6 The Toxic Substances Control Act (TSCA) incinerator facility at Oak Ridge is the only such facility in the complex permitted to treat radioactive waste contaminated with polychlorinated biphenyls (PCBs). Therefore, significant demand exists among other sites to treat their waste at Oak Ridge's facility.

Relationship to Other Sites in the Complex

A Record of Decision was signed in November 1999 to construct an on-site CERCLA waste disposal cell at ORR. The on-site cell is necessary to reduce the volume of material that requires off-site disposal. DOE also signed a November 1999 consent agreement with Tennessee to establish a mechanism to assure funding for long-term institutional care of this facility.

Off-site disposal options are also necessary to accommodate certain remediation and operational waste streams from Oak Ridge that are not suitable for on-site disposal. As part of its cleanup strategy, DOE is proposing to dispose of significant quantities of Oak Ridge's waste off site. During the next 20 years:

- Oak Ridge LLW will comprise about 7 percent of the complex-wide LLW. A portion of this waste will be disposed of on site in the existing interim waste management facility. The remainder will be disposed of at an off-site DOE or commercial facility. This does not include cleanup waste targeted for the on-site CERCLA disposal facility.

- Oak Ridge MLLW will comprise about 14 percent of the complex-wide MLLW. All of this waste will be sent off site for treatment at commercial facilities and disposal at DOE and commercial facilities.

Washington: Hanford Site

Located in southeastern Washington, along the Columbia River, Hanford played a critical role as a plutonium production facility for more than 50 years, beginning in the 1940s with the Manhattan Project. Plutonium from Hanford was used to power the Nagasaki bomb. Hanford produced roughly half of the total defense plutonium produced by the United States. Today, Hanford's largest mission is to clean up and manage the site's wastes, and its annual cleanup budget is about $1 billion.

Washington, DOE, and EPA Region 10 entered into the Hanford Federal Facility Agreement and Consent Order, commonly known as the Tri-Party Agreement, on May 17, 1989. The Tri-Party Agreement covers all aspects of cleanup at Hanford, including but not limited to tank waste removal and treatment, mixed waste treatment and disposal, environmental restoration activities, and low-level waste disposal.

Site-Specific Issues

Washington's primary concern is the rate of progress towards cleanup of 177 underground tanks containing millions of gallons of intensely radioactive high-level waste. About half of the tanks are known to be leaking and a threat to the Columbia River. The current plan calls for a privatized vitrification plant, but the state is also concerned about the rate at which advance funding will be provided. This is the single most expensive cleanup project in the complex and will take decades to complete. The state is also concerned about the rate of progress on cleanup of the K-basins, where corroding spent fuel is stored in pools in close proximity to the Columbia River and leaks to groundwater have been detected. Additionally, because Hanford has already been receiving LLW from nondefense sites, submarine reactor vessels, spent fuel, and plutonium (in addition to its own on-site LLW), state officials are concerned about equity issues such as taking mixed low level waste from other sites for disposal at Hanford. Moreover, Washington officials would like assurance of long-term funding (i.e., through approximately 2050) to ensure cleanup, especially once most other sites are cleaned up.

Relationship to Other Sites in the Complex

While much of Hanford's cleanup activities will occur on site, the need remains to send waste and materials to other sites in the complex. Hanford hosts one of only two existing mixed waste disposal facilities in the DOE complex (the other is located at NTS). To reduce storage and "mortgage" costs,[7] significant demand exists from other sites in the complex for disposal at Hanford. Hanford is expected to continue to dispose of low-level waste from nondefense facilities, and the recent Record of Decision will allow other DOE sites to send LLW for disposal. During the next 20 years:

7 DOE refers to the site infrastructure and support services as "mortgage" costs.

- Hanford LLW will comprise about 14 percent of the complex-wide LLW. All of this will be disposed of on site. Under the Record of Decision, Hanford is one of the two sites (with NTS) to be designated to receive off-site LLW for disposal; DOE has estimated that Hanford will receive about 70,000 cubic meters of LLW from off site during the 20 years for which estimates are available. Actual volumes will be determined based on case-by-case evaluations of waste streams.

- Hanford MLLW has about 39 percent of the complex-wide MLLW on site. All of this waste is expected to be disposed of on site. Under the Record of Decision, Hanford is one of the two sites (with NTS) to be designated to receive MLLW from off site for disposal, and DOE has estimated that Hanford will receive about 110,000 cubic meters of MLLW from off site during the 20 years for which estimates are available.

Conclusion

During the 1990s, the nation began the second half of the cycle of splitting the atom—the job of cleaning up the legacy of nuclear waste left behind from decades of weapons production. Just as the production phase took decades, the cleanup phase will take decades—and a sustained commitment to complete. DOE and the states have a common interest in completing the cleanup of the nuclear weapons complex in a manner that protects the citizens, the workforce, and the environment. Moreover, even after cleanup is completed, some sites will not be able to return to unrestricted land use because of residual levels of contamination. Such sites will require long-term stewardship to protect public health and the environment.

The enactment of the Federal Facilities Compliance Act (FFCA) of 1992 brought Governors and their state regulatory staff into a new and mutually beneficial relationship with DOE. While the immediate tasks envisioned under the FFCA have been completed, states have benefited from the continuing exchange of information and ongoing dialogue with DOE. As cleanup of the sites proceeds and transitions into long-term stewardship, it will be essential to continue this positive and open exchange of information between Governors and DOE. This will ensure that decisions are made with complete information and that states can fully understand their part in the complex-wide design.

Appendix A

LOW-LEVEL WASTE INVENTORY

20 year estimate of LLW volumes targeted for disposal in DOE facilities 1998–2017

Waste included: (1) WM and (2) potential transfers from ER to WM program

STATE	Targeted On-site	Targeted Off-site	TOTAL
	cubic meters		
CO	0	65,087	65,087
ID	24,393	6,419	30,812
NM	154,159	16,389	170,548
NV	215,503	0	215,503
OH	0	158,992	158,992
SC	116,435	8,000	124,435
TN	0	73,023	73,023
WA	148,530	0	148,530
Others	0	68,399	68,399
Total	*659,020*	*396,309*	*1,055,329*

Other states include: California, Illinois, Iowa, Kentucky, New Jersey, New York, and Texas

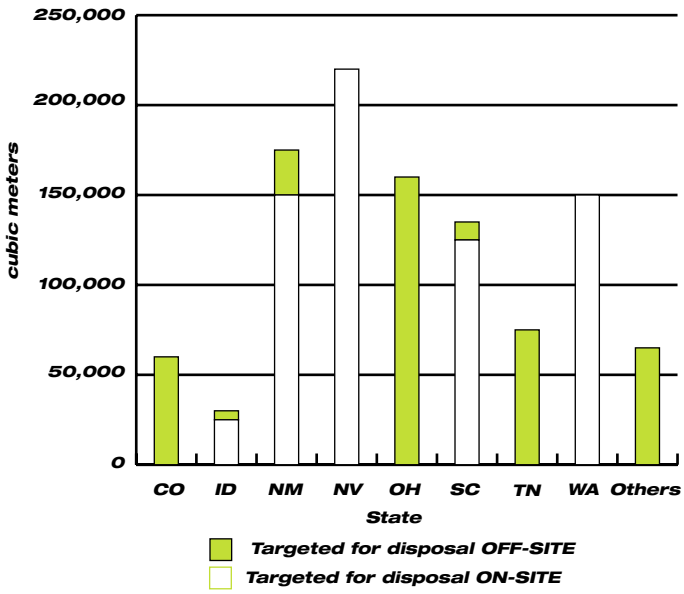
MIXED LOW-LEVEL WASTE INVENTORY

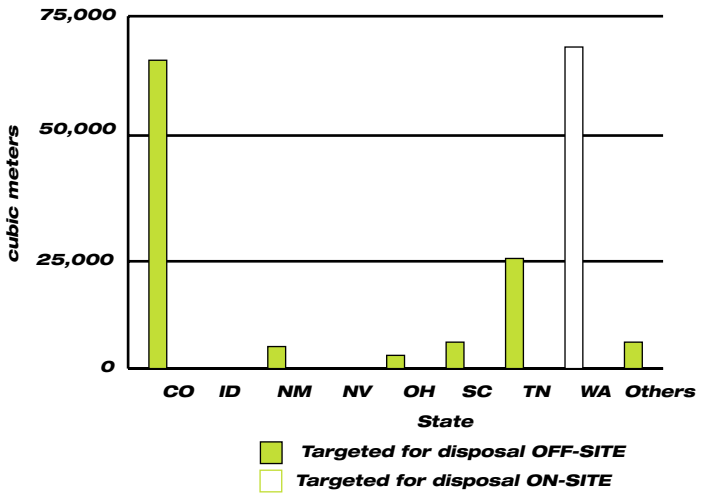
20 year estimate of MLLW volumes targeted for disposal in DOE facilities 1998–2017

Waste included: (1) WM and (2) potential transfers from ER to WM program

STATE	Targeted On-site	Targeted Off-site	TOTAL
	cubic meters		
CO	0	68,144	68,144
ID	0	16	16
NM	0	3,531	3,531
NV	0	0	0
OH	0	2,873	2,873
SC	0	4,085	4,085
TN	0	25,462	25,462
WA	69,226	0	69,226
Others	0	4,063	4,063
Total	*69,226*	*108,174*	*177,400*

Other states include: California, Kentucky, and New York





NOTES for LLW and MLLW:

—Waste volumes do not include waste targeted for commercial facilities or ER waste unless transferred to WM program.
—Volumes shown as targeted for on- or off-site disposal are DOE estimates and do not represent final decisions.
—Although all digits are displayed, expected accuracy is no more than two significant digits.
—"Inventory" reflects volumes already in inventory, plus volumes expected to be generated through 2017.

Source: U.S. DOE, 1998 *Paths to Closure* database; and H. Belencan & K. Guevara, personal communication.

LOW-LEVEL WASTE INVENTORY

Estimate of LLW volumes targeted for disposal in DOE facilities, 1998–2017

		Waste Management (WM) program		Potential transfers from Environmental Restoration (ER) program to WM		TOTAL		GRAND TOTAL
		Targeted On-site	Targeted Off-site	Targeted On-site	Targeted Off-site	Targeted On-site	Targeted Off-site	
STATE SITE		cubic meters		cubic meters		cubic meters		cubic meters
CO	Grand Junction				55		55	55
CO	Rocky Flats		20,215		44,817		65,032	65,032
ID	INEEL	24,251	6,419	142		24,393	6,419	30,812
NM	ITRI		670				670	670
NM	LANL	116,737	12,971	37,422		154,159	12,971	167,130
NM	Sandia		1,361		1,387		2,748	2,748
NV	NTS	368		215,135		215,503		215,503
OH	Portsmouth		2,031				2,031	2,031
OH	Battelle Col				9,193		9,193	9,193
OH	Fernald				83,591		83,591	83,591
OH	Mound				64,177		64,177	64,177
SC	SRS	70,623	8,000	45,812		116,435	8,000	124,435
TN	ORR		73,023				73,023	73,023
WA	Hanford	148,530				148,530		148,530
"Other states"								
CA	LBNL		209				209	209
CA	LLNL		10,975				10,975	10,975
CA	ETEC				3,401		3,401	3,401
CA	General Atomics				337		337	337
CA	GE Vallecitos				20		20	20
IA	Ames		34				34	34
IL	ANL-East		3,677		778		4,455	4,455
KY	Paducah		4,379				4,379	4,379
NJ	Princeton		688				688	688
NY	Brookhaven		4,758		18,421		23,179	23,179
NY	SPRU				8,220		8,220	8,220
NY	West Valley		11,297				11,297	11,297
TX	Pantex		1,205				1,205	1,205
	Subtotal-Other		*37,222*		*31,177*		*68,399*	*68,399*
	Subtotal	*360,509*	*161,912*	*298,511*	*234,397*	*659,020*	*396,309*	*1,055,329*
	TOTAL	***522,421***		***532,908***		***1 ,055,329***		

—Waste volumes do not include waste targeted for commercial facilities or ER waste unless transferred to WM program.
—Volumes shown as targeted for on- or off-site disposal are DOE estimates and do not represent final decisions.
—Although all digits are displayed, expected accuracy is no more than two significant digits.

Source: U.S. DOE, 1998, *Paths to Closure* database; and H.Belencan & K.Guevara, personal communication.

MIXED LOW-LEVEL WASTE INVENTORY

Estimate of MLLW Volumes targeted for disposal in DOE facilities, 1998–2017

STATE	SITE	Programmatic source of the waste: Waste Management (WM) program — Targeted On-site	Waste Management (WM) program — Targeted Off-site	Potential transfers from Environmental Restoration (ER) program to WM — Targeted On-site	Potential transfers from Environmental Restoration (ER) program to WM — Targeted Off-site	TOTAL — Targeted On-site	TOTAL — Targeted Off-site	GRAND TOTAL
		cubic meters		cubic meters		cubic meters		cubic meters
CO	Rocky Flats		7,362		60,782		68,144	68,144
ID	INEEL				16		16	16
NM	LANL				3,373		3,373	3,373
NM	Sandia		158				158	158
NV	NTS							0
OH	Portsmouth		2,837		36		2,873	2,873
SC	SRS		4,085				4,085	4,085
TN	ORR		25,462				25,462	25,462
WA	Hanford	69,226				69,226		69,226
"Other states"								
CA	ETEC				1,365		1,365	1,365
KY	Paducah		2,664		8		2,672	2,672
NY	West Valley		26				26	26
Subtotal		69,226	42,594		65,580	69,226	108,174	177,400
Total		***111,820***		***65,580***		***177,400***		

—Waste volumes do not include waste targeted for commercial facilities or ER waste unless transferred to WM program.
—Volumes shown as targeted for on- or off-site disposal are DOE estimates and do not represent final decisions.
—Although all digits are displayed, expected accuracy is no more than two significant digits.

Source: U.S. DOE, 1998, *Paths to Closure* database; and H. Belencan & K. Guevarra, personal communication.

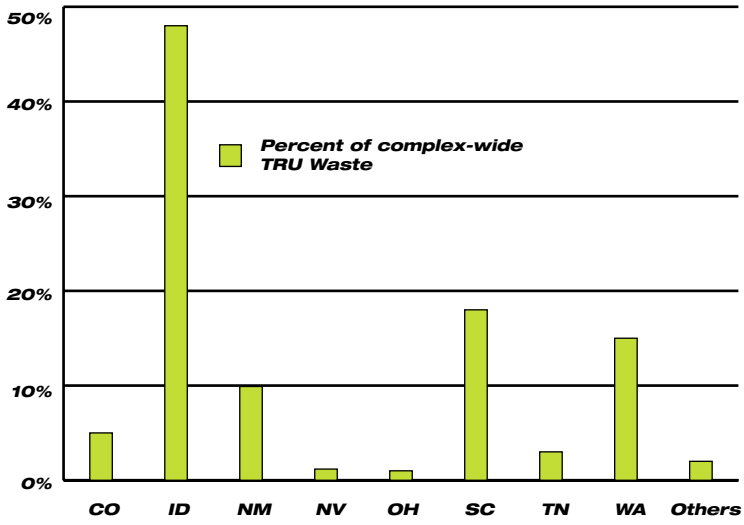
Transuranic and High-Level Waste Inventory

TRU WASTE

State	cubic meters	% of total
CO	8,493	5%
ID	79,723	48%
NM	17,079	10%
NV	637	0.4%
OH	610	0.4%
SC	29,558	18%
TN	2,465	1.5%
WA	25,214	15%
Others	1,509	0.9%
Total	***165,288***	***100%***

Source: U.S. DOE, *National TRU Waste Management Plan*, Rev.1, 12/97, page 3

TRU Waste Inventory
All TRU waste is to be disposed of in the Waste Isolation Pilot Plant (WIPP), New Mexico



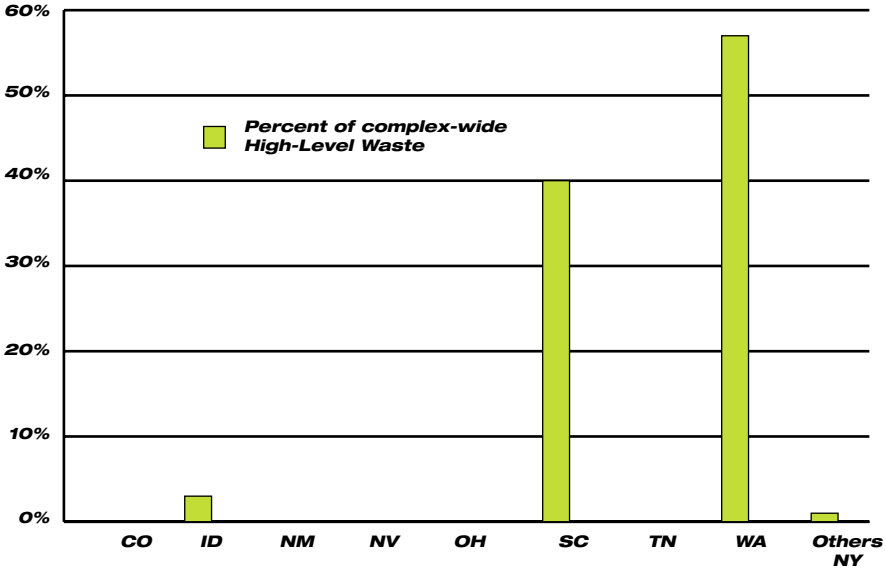
Source: U.S. DOE, *National TRU Waste Managment Plan*, Rev. 1, 12/97, page 3

HIGH-LEVEL WASTE

State	cubic meters	% of total
CO	-	0%
ID	10,400	3%
NM	-	0%
NV	-	0%
OH	-	0%
SC	152,000	40%
TN	-	0%
WA	213,000	56%
Other-NY	2,200	1%
Total	***377,600***	***100%***

Source: U.S. DOE, 1998, *Paths to Closure* database

High-Level Waste Inventory
All HWL is targeted for disposal in a geologic repository.
The current proposal for a repository is Yucca Mtn, Nevada.



Source: U.S. DOE, 1998, *Paths to Closure* database

Appendix B

The following tables show what type of material or waste a state may be sending to other DOE sites for treatment, storage, or disposal, as well as what material or waste a state may potentially receive from other sites. Information on wastes is derived from the *Waste Management Programmatic EIS* (the WM-PEIS did not address nuclear materials such as plutonium, tritium, and highly enriched uranium).

Tables do not necessarily reflect current actual sending and receiving of waste, but rather the potential for waste movement based on DOE's WM-PEIS decisions. Also, these tables do not reflect actual or potential movement of DOE's waste to commercial facilities for treatment or disposal. As of April 2000, one commercial facility (Envirocare, Utah) accepts certain DOE LLW and MLLW waste streams for treatment and disposal.

COLORADO

COLORADO—Sending		
Materials/waste to be sent	***Site and state to receive it***	***Purpose***
Plutonium residues	WIPP, NM Savannah River Site, SC	**Disposal** Stabilization
Scrub alloys	Savannah River Site, SC	Immobilization/ conversion to MOX fuel
Plutonium pits, components	Pantex, TX Lawrence Livermore Lab, CA Los Alamos National Lab, NM Savannah River Site, SC	Use/reuse, storage pending disposition
Highly enriched uranium	Oak Ridge, TN Savannah River Site, SC	Storage and blend down for use
Transuranic waste	WIPP, NM	**Disposal**
Low-level waste	Nevada Test Site, NV Hanford, WA	**Disposal**
Mixed low-level waste	INEEL, ID Oak Ridge, TN Savannah River Site, SC Hanford, WA	Treatment
Mixed low-level waste	Hanford, WA Nevada Test Site, NV	**Disposal**

IDAHO

IDAHO—Sending

Materials/waste to be sent	*Site and state to receive it*	*Purpose*
Highly enriched uranium	Savannah River Site, SC Oak Ridge, TN	Stabilization/ conversion
High-level waste	Repository, location TBD	**Disposal**
Transuranic waste	WIPP, NM	**Disposal**
Mixed low-level waste	Nevada Test Site, NV Hanford, WA	Treatment
Low-level waste	Nevada Test Site, NV Hanford, WA	**Disposal**

IDAHO—Receiving

Materials/waste to be received	*Site and state to receive it*	*Purpose*
Naval reactor spent nuclear fuel	Naval shipyards from around the country, the country, including CA; Mare Island, Pearl Harbor, HI; Charleston, SC;Norfolk, VA; and Puget Sound, WA	Storage
DOE spent nuclear fuel	Oak Ridge, TN West Valley proejct, NY	Storage
Foreign research reactor	Through naval facilities in CA and SC.	Storage spent nuclear fuel
Non-DOE reactor spent nuclear fuel	Hospitals and universities in several states	Packaging and storage
Mixed low-level waste	May receive MLLW from any DOE site for treatment	Treatment
Low-level waste	Sandia National Lab, NM	Treatment

NEW MEXICO

NEW MEXICO—Sending

Materials/waste to be sent	*Site and state to receive it*	*Purpose*
Low-level waste	INEEL, ID Oak Ridge, TN	Treatment
Low-level waste	Nevada Test Site, NV Hanford, WA	**Disposal**
Mixed low-level waste	INEEL, ID Savannah River Site, SC Oak Ridge, TN	Treatment
Mixed low-level waste	Nevada Test Site, NV Hanford, WA	**Disposal**

NEW MEXICO—Receiving

Materials/waste to be received	*Sending site(s)*	*Purpose*
Plutonium residues	Rocky Flats, CO	Recovery/reuse
Plutonium oxides	Mound Plant, OH Oak Ridge, TN	Recovery/reuse
Transuranic waste	Several sites from around the DOE complex, including: • Lawrence Livermore Lab, CA • Rocky Flats, CO • INEEL, ID • Argonne National Lab, IL • Paducah Gaseous Diffusion Plant, KY • Nevada Test Site, NV • Mound Plant, OH • Savannah River Site, SC • Oak Ridge, TN • Hanford, WA	**Disposal**

NEVADA

NEVADA—Sending

Materials/waste to be sent	*Site and state to receive it*	*Purpose*
Transuranic waste	WIPP, NM	**Disposal**
Mixed low-level waste	Oak Ridge, TN	Treatment

NEVADA—Receiving

Materials/waste to be received	*Related sites*	*Purpose*
Mixed low-level waste	Under the Record of Decision, may receive MLLW from any DOE site for disposal	**Disposal**
Low-level waste	Under the Record of Decision, may receive LLW from any DOE site for disposal	**Disposal**

OHIO

OHIO—Sending

Materials/waste to be sent	*Site and state to receive it*	*Purpose*
Plutonium oxide	Los Alamos, NM	Stabilization/reuse
Uranium tetrafluoride	Oak Ridge, TN	Storage
Tritium	Savannah River Site, SC	Recovery/reuse
Transuranic waste	WIPP, NM	**Disposal**
Mixed low-level waste	INEEL, ID Oak Ridge, TN Hanford, WA	Treatment
Mixed low-level waste	Nevada Test Site, NV Hanford, WA	**Disposal**
Low-level waste	Nevada Test Site, NV Hanford, WA	**Disposal**

SOUTH CAROLINA

SOUTH CAROLINA—Sending

Materials/waste to be sent	*Site and state to receive it*	*Purpose*
Special nuclear material	INEEL, ID Oak Ridge, TN	Storage
Highly enriched uranium	Oak Ridge, TN	Blend down for tritium production
High-level waste	Repository, location TBD	**Disposal**
Transuranic waste	WIPP, NM	**Disposal**
Mixed low-level waste	INEEL, ID Oak Ridge, TN	Treatment
Mixed low-level waste	Nevada Test Site, NV Hanford, WA	**Disposal**
Low-level waste	Nevada Test Site, NV Hanford, WA	**Disposal**

SOUTH CAROLINA—Receiving

Materials/waste to be received	*Sending site(s)*	*Purpose*
Plutonium residues	Rocky Flats, CO	Stabilization
Plutonium material	INEEL, ID Hanford, WA	Stabilization/ conversion
Tritium	Ohio site	Recovery/reuse
Highly enriched uranium	INEEL, ID Portsmouth, OH Oak Ridge, TN Hanford, WA	Blend down for tritium production
Spent nuclear fuel	Oak Ridge, TN	Storage
Mixed low-level waste	Rocky Flats, CO Sandia National Lab, NM Mound Plant, OH Any other DOE site, pending permit modifications at SRS	Treatment

TENNESSEE

TENNESSEE—Sending

Materials/waste to be sent	*Site and state to receive it*	*Purpose*
Highly enriched uranium	Savannah River Site, SC	Storage and blend down
Plutonium residuals	Savannah River Site, SC	Immobilization/ conversion
Plutonium oxides	Los Alamos, NM	Stabilization and materials
Spent nuclear fuel	INEEL, ID Savannah River Site, SC	Storage
Transuranic waste	WIPP, NM	**Disposal**
Mixed low-level waste	Nevada Test Site, NV Hanford, WA	**Disposal**
Low-level waste	Nevada Test Site, NV Hanford, WA	**Disposal**

TENNESSEE—Receiving

Materials/waste to be received	*Sending site(s)*	*Purpose*
Highly enriched uranium	Rocky Flats, CO INEEL, ID Savannah River Site, SC	Blend down for tritium production
Uranium tetrafluoride	Portsmouth, OH	Storage
Special nuclear material	Savannah River Site, SC	Conversion to fuel for tritium production
Mixed low-level waste	May receive MLLW from any DOE site for treatment	Treatment
Low-level waste	Paducah Gaseous Diffusion Plant, KY Sandia Lab, NM Los Alamos, NM	Treatment (currently no capacity for treat ment of out-of-state LLW)

WASHINGTON

WASHINGTON—Sending

Materials/waste to be sent	*Site and state to receive it*	*Purpose*
Plutonium	Savannah River Site, SC	Immobilization/ conversion
High-level waste	Repository, location TBD	**Disposal**
Transuranic waste	WIPP, NM	**Disposal**
Mixed low-level waste	INEEL, ID	Treatment

WASHINGTON—Receiving

Materials/waste to be received	*Sending site(s)*	*Purpose*
Mixed low-level waste	Rocky Flats, CO INEEL, ID Battelle-Columbus, OH Any other DOE site	Treatment
Mixed low-level waste	Under the Record of Decision, may receive MLLW from any DOE site for disposal	**Disposal**
Low-level waste	Under the Record of Decision, may receive LLW from any DOE site for disposal	**Disposal**

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