United States General Accounting Office

GAO

Report to Congressional Requesters

May 2001

NUCLEAR WASTE

Agreement Among Agencies Responsible for the West Valley Site Is Critically Needed

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Abbreviations

DOE	Department of Energy
EIS	environmental impact statement
EPA	Environmental Protection Agency
GAO	General Accounting Office
NEPA	National Environmental Policy Act
NRC	National Regulatory Commission
WIPP	Waste Isolation Pilot Project

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United States General Accounting Office
Washington, DC 20548

May 11, 2001

The Honorable Sherwood L. Boehlert
Chairman, Committee on Science
House of Representatives

The Honorable W.J. (Billy) Tauzin
Chairman, Committee on Energy and Commerce
House of Representatives

The West Valley nuclear facility, in western New York State, was built in the 1960s to convert spent nuclear fuel from commercial reactors into reusable nuclear fuel—an industrial process referred to as reprocessing. The facility was part of the nation's post-World War II effort to harness nuclear energy for commercial power generation. Specifically, the facility was intended to reprocess spent fuel in order to help meet expected commercial demand for nuclear power. New York State, as the owner of the site, and the Atomic Energy Commission—the predecessor of both the Nuclear Regulatory Commission (NRC) and the Department of Energy (DOE)—jointly promoted the venture. However, the timing of the venture was inopportune because the market for reprocessed nuclear fuel was limited and because new, more restrictive health and safety standards raised concerns about the facility. These factors contributed to its permanent shutdown in the 1970s. Also during the 1970s, U.S. policies intended to prevent nuclear weapons proliferation ran counter to the concept of commercial reprocessing because reprocessed nuclear fuel can be used to make nuclear weapons. With West Valley's shutdown, spent fuel, liquid high-level wastes, and other nuclear contamination at the facility had to be cleaned up. To facilitate the cleanup, especially the solidification of the liquid high-level wastes, the Congress enacted the West Valley Demonstration Project Act in 1980, which brought DOE to West Valley to carry out cleanup activities.

DOE originally estimated that the cleanup effort could be completed by about 1990. Over the years, DOE has developed varied and increasing estimates of the West Valley cleanup's total costs and completion time. Concerned about these changing estimates, you asked us to examine the overall status of the effort and the causes and implications of any problems that may be occurring. Specifically, as agreed with your offices, we examined (1) the status of the cleanup, (2) factors that may be

hindering the cleanup, (3) the degree of certainty in the Department's estimates of total cleanup costs and schedule, and (4) the degree to which the West Valley cleanup may reflect, or have implications for, larger cleanup challenges facing DOE and the nation. To compare DOE's cost estimates, which have been made at different times since 1978, we converted the estimates to year-2000 present value dollars. See appendix I for our detailed scope and methodology.

Results in Brief

DOE has almost completed solidifying the high-level wastes at West Valley, but major additional cleanup work remains. Since 1982, DOE has conducted a technologically challenging, first-of-a-kind industrial process to stabilize the liquid, high-level wastes left on-site—a process called vitrification. To date, this process has emptied West Valley's four on-site, underground, high-level waste storage tanks of over 99 percent of their long-lived radioactivity. The vitrification work, which represents the first phase of the cleanup, is expected to be completed in September 2002, and has enhanced the site's environmental, safety, and health status. Furthermore, as indicated by our examination of environmental and safety data for West Valley and the views of interested parties, DOE has generally operated the facility safely. Work on the overall cleanup, however, is not nearly complete. Major additional cleanup steps that must be taken include decontaminating and decommissioning structures, remediating soil and groundwater, and removing nuclear wastes stored and buried on-site. These and other steps could take up to four decades, with West Valley cleanup costs totaling about $4.5 billion, according to DOE projections.

Several factors are hindering DOE's attempts to clean up West Valley. First, and most importantly, the Department and New York State, the principal parties to the West Valley cleanup, still have not agreed on the overall future of the site, particularly their future on-site roles and responsibilities. Their differences reflect the fact that, historically, neither the federal government nor the state has wanted to take full responsibility for West Valley's nuclear wastes. Their relationship is key to facilitating the site cleanup and has been a factor in delayed environmental planning milestones for West Valley. For example, in 1996, expecting that interested parties could soon agree on the site's future, DOE estimated that a record of decision on cleaning up West Valley could be reached as early as 1997. However, the latest estimate is 2005, at the earliest. Since 1999, DOE and New York State have been attempting to resolve their differences through confidential negotiations, but this effort broke down in January 2001 without an agreement. Second, NRC cleanup standards for West Valley—referred to in the West Valley Act as decontamination and decommissioning requirements—do not exist. These standards, which are

important regulatory criteria for determining the overall future of the site, are expected to be issued in final form in 2001, perhaps in the spring. However, as drafted, they differ from the Environmental Protection Agency's (EPA) guidance and standards implementing the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Safe Drinking Water Act, which could also apply on-site. This situation could lead to costly, dual federal regulation of the site. Third, cleanup planning has been limited by uncertainty about where West Valley's nuclear wastes are to go. Under the West Valley Act, the site's high-level wastes and transuranic wastes are to be removed off-site,[1] but DOE and the state have not yet obtained access to permanent off-site disposal for either of these types of waste. Hundreds of millions of dollars in future costs could be at stake in these disposal questions, depending on which options are chosen for storing and monitoring these wastes before disposal. We are raising matters for congressional consideration and making recommendations to DOE, NRC, and EPA to address these issues.

DOE's estimates of the total costs and completion date for the West Valley cleanup are uncertain because there has been no agreement on strategic issues affecting the site—that is, the extent to which the site is to be cleaned up and what it will then look like, how the land is to be used, and what regulatory cleanup standards are to be used. Departmental estimates in the 1990s have varied by billions of dollars, and the completion schedule by decades, depending on the programmatic assumptions made. The Department currently estimates the total cleanup costs at about $4.5 billion, with the effort taking an additional 40 years—including more than two decades of major additional cleanup work, and additional time for interim on-site storage of vitrified high-level wastes. This estimate is based on a better understanding of the cleanup challenge than in 1978, when the Department generated its initial estimate—$180 million, or $1.1 billion in year-2000 dollars, with completion in about 10 years.[2] However, DOE's current estimate continues to be based on uncertain assumptions, such as what will be done with various on-site wastes and when the wastes can be shipped off-site. These uncertainties reflect an overall lack of agreement

[1] Transuranic wastes are rags, tools, and other miscellaneous waste items containing traces of radioactive elements with atomic numbers higher than uranium—principally plutonium.

[2] Among a range of cost estimates generated at the time by DOE, most interested parties, including state and federal officials, considered the $180 million estimate, as well as a startup date of about 1980, to be reasonable. Using an estimated 10-year cleanup timetable, a completion date of about 1990 was indicated.

on strategic issues related to directing the overall cleanup effort, including cleanup standards, what the site will look like when the cleanup is done, and how the wastes will be disposed of. Until such issues are resolved, any estimates of the total costs and schedule for the West Valley cleanup could change significantly.

The problems at West Valley reflect many of the same dilemmas DOE faces with its complexwide nuclear cleanup effort. Moreover, DOE's planned approach at West Valley to deal with its underground high-level waste storage tanks has potential implications for other DOE disposal efforts. Specifically, West Valley is yet another example of how complicated, uncertain, and subject to cost and schedule changes the cleanup planning process can be at sites where (1) first-of-a-kind technological cleanup challenges are being addressed; (2) major decisions on strategic cleanup issues, including cleanup standards to be used, have yet to be made; and (3) multiple types of contamination, laws and regulations, and regulators are involved. As a result, at sites such as West Valley, planners have difficulty estimating with a reasonable degree of certainty cleanup projects' overall costs and schedules. By extension, because other, larger DOE sites, such as Savannah River, South Carolina, and Hanford, Washington, also have less than fully defined cleanup goals and land uses, DOE's ability to quantify cleanup costs and timetables across the entire nuclear complex is to some degree in question. Furthermore, as the first DOE site projected to complete vitrification, West Valley is a potential test case for a national decision on what do with the over 200 underground storage tanks across the complex and the traces of wastes left in them after high-level waste vitrification. Are these tanks to be dug up, using a technology that is not yet available, and removed to an as-yet-undetermined disposal location, or can they be safely entombed in place and subjected to long-term stewardship? The Natural Resources Defense Council is currently challenging in court DOE's radioactive waste management order, under which tank entombment could be implemented at sites such as West Valley.

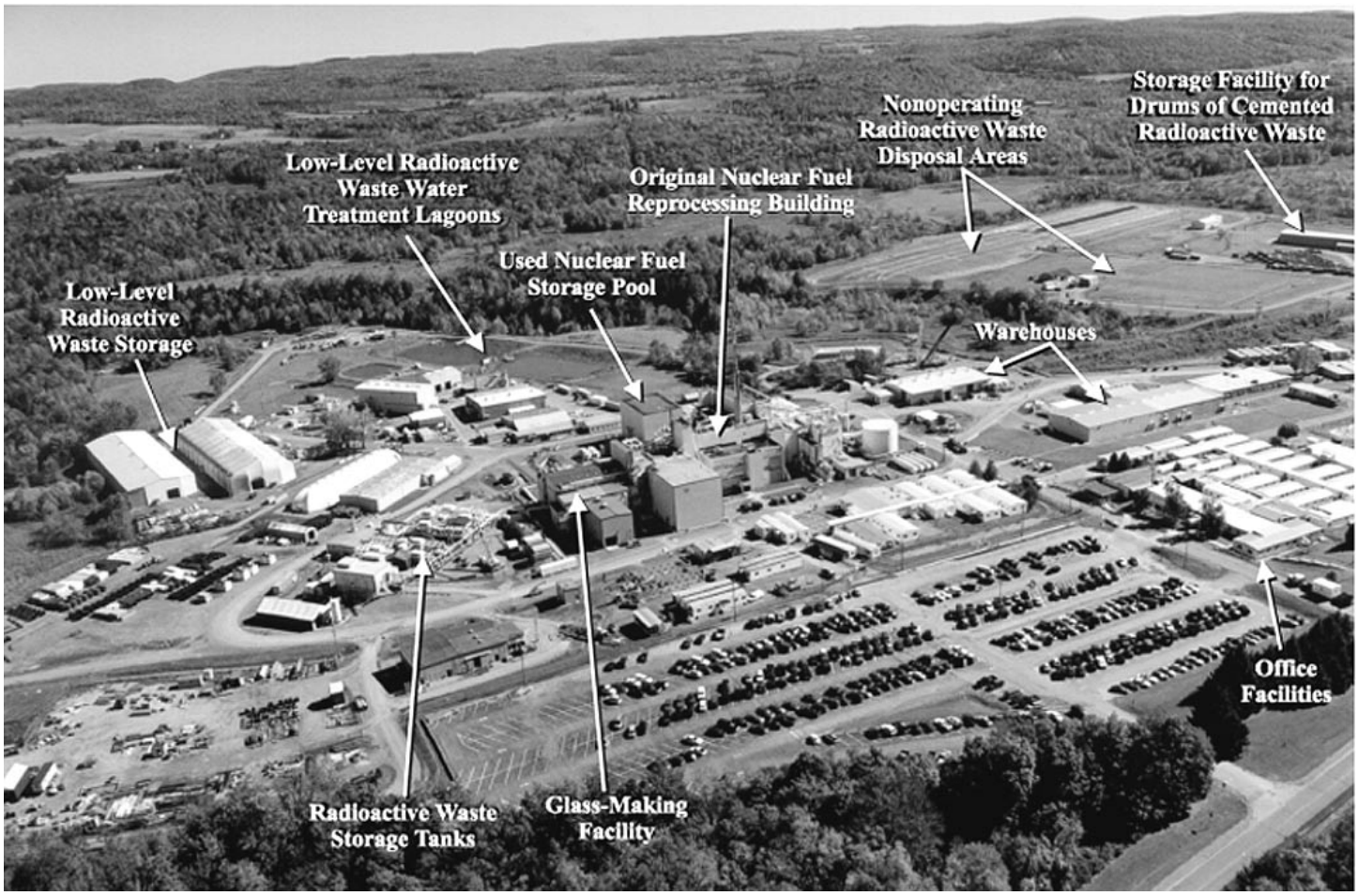
We provided a draft of this report to DOE, the New York State Energy Research and Development Authority, NRC, and EPA for comment. DOE found the report to be a credible assessment of West Valley issues, and New York State concurred in the report's conclusions. However, DOE and New York State continued to differ on who should assume ultimate responsibility at West Valley. Furthermore, DOE disagreed with our recommendation on high-level waste disposal, citing the need for New York State to enter into a disposal contract with the Department. We have modified the wording of our recommendation to more clearly recognize

that resolving the question of responsibility for the high-level wastes at West Valley is part of any long-term solution regarding their disposal. NRC and EPA provided technical clarifications only. All four agencies' technical clarifications were incorporated into the final report where appropriate.

Background

The West Valley site, about 30 miles southeast of Buffalo, includes an approximately 200-acre area of nuclear operations within a 3,300-acre area owned by the state of New York. (See fig. 1.) The facility began construction in 1963 as the first—and ultimately the only—commercial spent fuel reprocessing plant to be operated in the United States. A firm called Nuclear Fuel Services operated the plant, which reprocessed spent fuel from 1966 to 1972. Regulated by the Atomic Energy Commission (predecessor to NRC), the plant reprocessed approximately 640 metric tons of spent nuclear fuel to recover usable uranium and plutonium. In 1972, the plant was shut down to meet regulatory changes, including more stringent seismic criteria and worker safety requirements. In 1976, facing rising estimates of the cost to modify the plant to meet the new safety requirements, the operator announced its withdrawal from the business. (A time line of historical and projected West Valley milestones is presented in app. II.)

Figure 1: Aerial View of the West Valley Site During DOE Operations



Source: DOE.

The commercial reprocessing era at West Valley left behind major environmental, safety, and health risks from multiple types of nuclear contamination at the site, including high-level wastes, radioactive buried

wastes, and environmental contamination.[3] Specific on-site radiation risks that were generated then and still exist include the following:[4]

- The reprocessing building—significantly contaminated with strontium-90 and cesium-137 (both potentially carcinogenic radionuclides)—and four adjacent single-shell underground storage tanks encased in concrete vaults. These tanks originally contained about 600,000 gallons of liquid, high-level wastes generated during reprocessing.[5]

- A 5-acre, NRC-licensed waste disposal area, used from 1966 to 1986. This area contains several types of buried wastes resulting from the reprocessing era, such as about a third of a cubic meter of spent fuel from Hanford's N-Reactor; this spent fuel was buried instead of being reprocessed because the outer layer of a fuel assembly was ruptured.[6]

- A storage pool originally containing several hundred spent nuclear fuel assemblies, and now containing 125 assemblies.

- Groundwater contamination under the reprocessing building, in the form of a plume of strontium-90 that first developed during 1968 to 1971 and was identified in 1994.

[3] One safety problem noted was that some areas in the reprocessing building were designed for direct, "contact" maintenance by workers, not for more modern remote-controlled maintenance. Worker exposures increased significantly overall during 1968 to 1971, though within standards; at the time, the Atomic Energy Commission questioned the operator's efforts to limit workers' exposure to radiation.

[4] Among these problems, not all require DOE attention pursuant to the West Valley Act of 1980 and the implementing DOE-New York State cooperative agreement; while DOE and the state agree that the Department is not responsible for decommissioning the state-licensed disposal area or for cleaning up materials buried in the NRC-licensed disposal area prior to DOE's presence, they disagree on who is responsible for cleaning up some on-site contamination.

[5] Of the tanks, two are 70-feet-in-diameter carbon steel tanks, one a spare and the other originally containing most of the on-site high-level wastes. The two other tanks are 12-feet-in-diameter stainless steel tanks, one a spare and the other originally containing 12,000 gallons of acidic high-level wastes from thorium fuels. Both spare tanks have been contaminated over time. To date, the four tanks are not known to have leaked. However, the two larger tanks and vaults floated as much as 3 to 4 feet during construction from accumulated water—a "bathtubbing" problem related to abundant rainfall, and low soil permeability at the site.

[6] The area also contains low-level wastes, 42 spent fuel elements, and various other radioactive wastes.

- Contamination in the form of cesium-137 in surface soils on- and off-site, resulting from airborne releases, identified as principally occurring in 1968. The releases were caused by ventilation failures in the plant's main stack. The cesium contamination levels are only slightly distinguishable from background radiation levels. The contamination extends about 3.7 miles northwest from the plant stack into heavily wooded off-site areas.

- An inactive 15-acre, state-licensed and -managed commercial low-level radioactive waste disposal facility. This facility, which operated from 1963 to 1975, contains, among other wastes, highly radioactive wastes from naval and commercial reactors and nuclear fuel processing facilities that are buried in trenches, as shown in figure 2.

Figure 2: A Trench in the State-Licensed Disposal Area During Past Operations

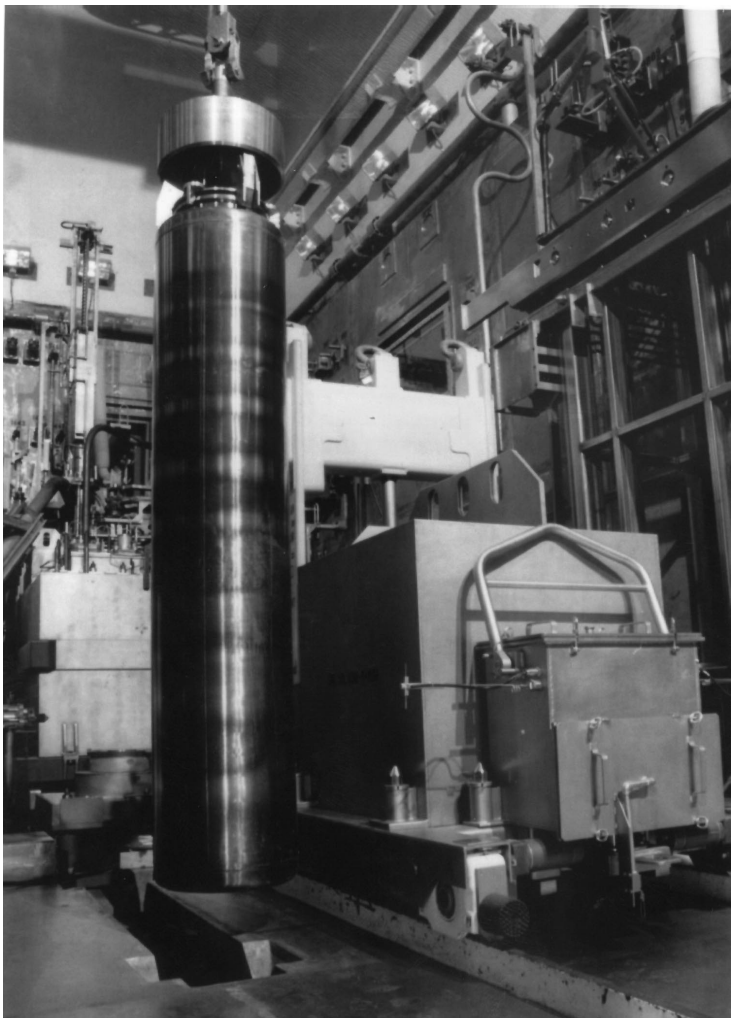
Source: Coalition on West Valley Nuclear Wastes.

The West Valley Demonstration Project Act, enacted to assist in the cleanup of the facility, was signed into law in October 1980. The act required DOE to, among other things, (1) solidify and develop suitable

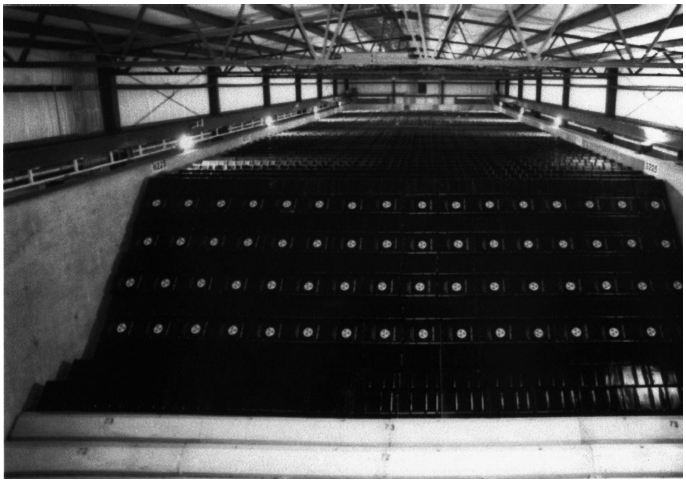
containers for the site's high-level radioactive wastes; (2) transport the solidified waste to a permanent repository; and (3) dispose of the low-level and transuranic wastes created during the project.[7] In cooperation with the state's Energy Research and Development Authority, DOE took control of project operations in 1982. The West Valley Act and an implementing cooperative agreement divided projected operating costs between DOE (90 percent) and the state (10 percent). West Valley Nuclear Services, Inc. (now under Washington Group International, Inc.) was awarded the solidification project contract and remains the primary contractor. In carrying out its responsibilities under the act, DOE has constructed the solidification facility and conducted solidification operations—referred to as vitrification. These operations have involved (1) chemically treating the high-level wastes—a step called pretreatment—to separate out voluminous less-radioactive wastes (which are then stored as low-level wastes) and (2) mixing the remaining high-level wastes with a form of molten glass and pouring the mixture into cylindrical stainless steel storage canisters. (The canisters are shown in fig. 3.) As vitrification nears completion, DOE and the New York State energy authority are shifting their focus to the remaining cleanup tasks—decontaminating and decommissioning structures, remediating soil and groundwater, and removing nuclear wastes stored and buried on-site, among other activities.

[7] Prior to enactment, we reported on West Valley issues needing resolution following the end of commercial operations, including what was to be done with the reprocessing plant and wastes, how much dealing with these wastes would cost, and who would be responsible for dealing with them. See *Issues Related to the Closing of the Nuclear Fuel Services, Incorporated, Reprocessing Plant at West Valley, New York* (EMD-77-27, Mar. 8, 1977); and *Status of Efforts to Clean Up the Shut-Down Western New York Nuclear Service Center* (EMD-80-69, June 6, 1980).

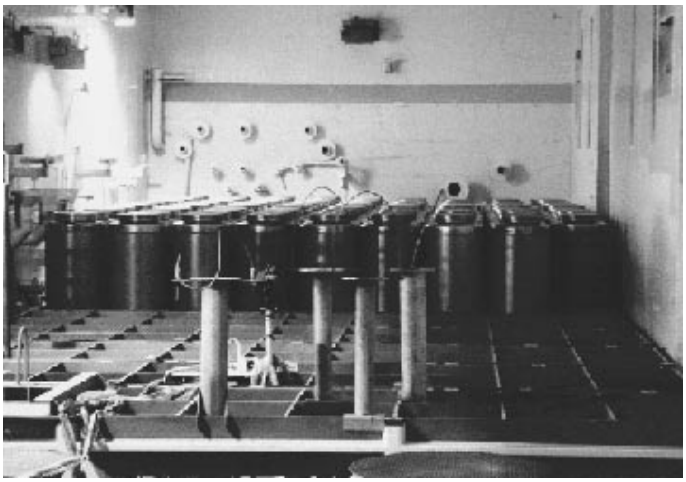
Figure 3: West Valley Nuclear Waste Vitrification and Storage



Canister of vitrified high-level waste.



Thousands of drums of low-level waste resulting from high-level waste pretreatment in storage.



Canisters of vitrified high-level waste in storage.

Source: DOE.

Various entities oversee West Valley under several statutes. The site was originally licensed to the operator and New York State by the Atomic Energy Commission and subsequently by NRC. For the duration of DOE's presence, the NRC license to the state has been placed in abeyance, leaving DOE, as authorized by the Atomic Energy Act, to regulate radioactive materials at West Valley, as it does at other departmental

facilities. After DOE concludes its on-site tasks, the site is to be turned back over to the state and the NRC license is to be reinstated and/or terminated following decommissioning. Until then, under the terms of the West Valley Act and a 1981 memorandum of understanding with DOE, NRC is to provide informal review and consultation and is authorized to prescribe decontamination and decommissioning criteria for the site. West Valley must also comply with the National Environmental Policy Act of 1969 (NEPA), which requires integrated environmental planning leading to the choice of a preferable cleanup alternative, and a 1987 Stipulation of Compromise Settlement with the Coalition on West Valley Nuclear Wastes and the Radioactive Waste Campaign, which resulted from litigation concerning DOE's on-site disposal of wastes generated by the project. The stipulation required DOE to conduct a full environmental impact study under NEPA, instead of the less detailed environmental assessment the Department had considered sufficient. Additionally, EPA and the state's Department of Environmental Conservation have oversight responsibilities at the site. For example, under authorization from EPA, the state regulates radioactive air emissions under the Clean Air Act and the hazardous components of radioactive mixed wastes under the Resource Conservation and Recovery Act of 1976 (RCRA).

High-Level Waste Vitrification Is Nearing Completion, but Other Major Work Remains

DOE has almost completed vitrifying the high-level wastes at West Valley, overcoming numerous technological challenges along the way. Vitrification has enhanced the site's environmental, safety, and health status, and on the basis of our examination of DOE data and reports, as well as interviews with interested parties, the Department has generally operated the facility safely. However, the cleanup could take four more decades, including more than two decades of major additional cleanup work that still needs to be performed, and additional time for interim on-site storage of vitrified high-level wastes. In the near term, various wastes need to be managed and structures need to be decontaminated. In the longer term, depending on the cleanup level chosen for the site, these structures need to be torn down and either removed off-site or left in place and capped, and the site needs to be decommissioned.

DOE's operations at West Valley began in 1982 and included the construction of a vitrification facility from 1985 to 1995. From the late 1980s into the mid-1990s, waste pretreatment, sludge washing operations, and vitrification testing took place. As we reported in 1989 and 1996,

construction was subject to delays and cost overruns early on.[8,9] During pretreatment (1988-95), about 1.7 million gallons of low-level waste were generated and placed into almost 20,000 drums in an on-site storage area. (See fig. 3.) Pretreatment reduced the waste volume to be vitrified by over 80 percent. Vitrification operations began in 1996. They are now nearing completion, which is scheduled for September 2002. To date, the four on-site underground high-level waste tanks have been emptied of over 99 percent of their long-lived radioactivity in tank sludge, as well as 95 percent of their cesium-137 activity. To date, 255 stainless steel, cylindrical waste canisters have been filled with vitrified high-level waste. Vitrification of the remaining traces of wastes is continuing. Tank sludge, known as "tank heel," is being removed from the tank bottoms (which have an intricate, grid-like internal support structure).

In removing the liquid, high-level wastes from the underground tanks and vitrifying them, DOE has overcome numerous technological challenges. Technological successes related to West Valley vitrification have included (1) developing a separation process for pretreating the wastes (an ion exchange method, using titanium-treated zeolite for separation, which was developed at the Pacific Northwest National Laboratory); (2) developing tank liquid mobilization pumps that would work in a highly radioactive environment (adapted from a Savannah River Site design); (3) implementing a glass melter technology developed by the Pacific Northwest National Laboratory for use at West Valley; and (4) developing a canister waste-level monitoring system using infrared detection—a system adopted at Savannah River. The West Valley and Savannah River melter technologies have subsequently been considered for low-level waste vitrification efforts being planned at Fernald, Ohio; Savannah River; Hanford; and Oak Ridge, Tennessee.

West Valley's vitrification operations are part of a multibillion-dollar DOE effort to immobilize its liquid, high-level wastes at other, larger sites—including Savannah River, Hanford, and the Idaho National Environmental

[8] *Nuclear Waste: DOE's Program to Prepare High-Level Radioactive Waste for Final Disposal* (GAO/RCED-90-46FS, Nov. 9, 1989).

[9] *Department of Energy: Opportunity to Improve Management of Major System Acquisitions* (GAO/RCED-97-17, Nov. 1996).

and Engineering Laboratory.[10] West Valley and Savannah River are currently vitrifying their wastes,[11] while the efforts at Hanford and the Idaho Laboratory—whose solid-form wastes, stored in bins, will be processed differently[12]—are not as far along. The West Valley, Savannah River, and Hanford vitrification efforts differ in technical details, including methods of pretreatment.[13] Vitrification at Savannah River could continue until the mid-2020s, according to DOE. We reported in 1999, however, that Savannah River was having difficulties with its chosen pretreatment technology. Pending resolution of this matter, the site has been restricting its vitrification efforts to the sludge in its tanks.[14] At Hanford, DOE's plans call for vitrification operations to begin in the late 2000s and continue until the mid to late 2010s for 10 percent or more of the high-level wastes, and an undetermined longer period for the rest.

According to the federal and state oversight officials and local officials we contacted, DOE has generally operated the site safely. In addition, available DOE environmental and safety monitoring data and oversight reviews for West Valley (from 1990 to 2000) do not indicate a pattern of environmental, safety, or health issues. During pretreatment and vitrification operations, DOE has not reported serious exposures to radioactivity of on-site workers, although a few incidents DOE judged to be noncritical have put workers at risk of such exposure, according to DOE and NRC records. For example, in November 1996, radioactive waste migrated into a pipe intended for demineralized water at the vitrification facility; in December 1997, two workers came into contact with

[10] The wastes stored at West Valley (before vitrification) have been less than 1 percent of the total at Department-operated facilities. As of 1988, Hanford had about 61 percent, in 177 underground tanks, containing about 57 million gallons of wastes; Savannah River had about 36 percent, in 51 underground tanks, containing about 34 million gallons of wastes; and the Idaho Laboratory had about 3 percent, in four sets of bins instead of tanks, containing about 2.9 million gallons of wastes in the form of dry waste granules called calcines.

[11] As of Feb. 2000, 775 canisters containing vitrified wastes were in storage at Savannah River.

[12] At the Idaho Laboratory, the solid wastes (or calcines) are to be immobilized into a glass-ceramic waste form for placement in canisters. Waste immobilization could take until 2035 under current plans.

[13] Pretreatment varies among the three sites because of differences in their spent fuels and the reprocessing techniques used to generate the wastes.

[14] *Nuclear Waste: Process to Remove Radioactive Waste From Savannah River Tanks Fails to Work* (GAO/RCED-99-69, Apr. 30, 1999).

radioactive waste that went onto the ground in the area of the waste tanks; and in August 1999, radioactive liquids entered pipes intended to indicate fluid levels. As reported, and according to DOE officials, none of these incidents caused a significant loss in work time, and all were aggressively investigated. The site was given a departmental award in February 2000 for excellence in occupational safety and health protection. Off-site contamination at West Valley was generally within regulatory limits in the 1980s and 1990s, according to DOE. Surface water and sediment downstream from the site in Buttermilk and Cattaraugus Creeks have not shown elevated contamination from DOE activities, according to the Department. These creeks carry groundwater and surface water from the site, through nearby Seneca Nation of Indians lands to Lake Erie (about 35 miles distant), and eventually over Niagara Falls.

Despite the progress made, decades of major cleanup work remain at West Valley, including waste management, decontamination, and decommissioning. In the near term, structures previously used for reprocessing operations and currently used for vitrification operations need to be decontaminated. In the longer term, into the mid-2020s, depending on the agreed-upon cleanup level for the site, these structures need to be torn down and either removed off-site or left in place as radioactive rubble—prospectively encased in a long-lasting protective cap. As currently projected by DOE, on-site storage of vitrified high-level wastes is to continue for another decade beyond the mid-2020s, after which the site is to be decommissioned according to NRC criteria and closed. Under current DOE plans, specific actions include the following:

- **Shutting down the vitrification facility**. This process includes melter deactivation, equipment and piping removal, and decontamination, and may extend to about 2017.

- **Placing into on-site storage and maintaining the high-level waste canisters pending permanent disposal.** On-site canister storage could extend to 2036 through 2040 (followed by site closure in 2041).

- **Decontamination and decommissioning, shipping waste, and completing various on-site tasks required by the West Valley Act.** For example, low-level wastes are being shipped off-site, possibly until 2022, and on-site transuranic wastes are to be addressed (including potentially shipping the wastes to a receiver site) from 2003 to 2021.

- **Removal of spent fuel elements stored on-site.** The fuel, in the form of 125 assemblies, is to be shipped to the Idaho Laboratory in 2001 so that deactivating the storage facility at West Valley can occur during 2001 to 2005.[15]

Some of these cleanup actions cannot be implemented without further technological advances. According to DOE, at least 50 innovative technologies are being pursued in connection with the West Valley cleanup in the following five areas:

- cleaning up vitrification equipment, including the melter;
- detecting and characterizing radioactive constituents—for example, in waste containers and wastewater discharge;
- treating and disposing of waste, including, for example, developing alternate transportation systems for transuranic wastes;
- remediating subsurface contamination, including, for example, developing a permeable barrier and construction techniques to address the on-site groundwater plume;[16] and
- decontaminating and decommissioning facilities, including, for example, reducing massive metal structures to a smaller size.

Specific needs related to cleaning up the vitrification facility have included a remote-handled tooling system to segregate, reduce in size, characterize, and package radioactively contaminated metal materials that have been removed from the facility. A system to perform this task has been in operation since July 1999 and is a first step toward a larger, remote-handled waste facility for the site. This larger facility will be needed to

[15] Of an original 750 spent fuel assemblies, by 1985, DOE returned 625 to the utilities that generated them. DOE had taken title to the remaining 125 assemblies in 1984 and plans to ship them to the Idaho Laboratory, under a 1996 settlement agreement with the state that permits shipment there after 2000.

[16] Strontium-90-contaminated groundwater, which emanated from the original reprocessing building and migrated on-site, has existed since the late 1960s to early 1970s, according to DOE, but was not identified and characterized until the mid-1990s. The plume now covers an area that is approximately 300 feet by 900 feet. The water is being pumped and treated, and a permeable subterranean wall intended to prevent further migration is being tested on an arm of the plume.

conduct comparable tasks for larger equipment and materials in the vitrification facility and in the tank area. A West Valley official said that additional technologies would need to be developed if the agreed-upon cleanup level and end state for West Valley were to require that the underground tanks, buried highly radioactive wastes, and spent fuel on-site are to be dug up and removed from the site.

Several Factors Are Hindering Progress on the West Valley Cleanup

Attempts to clean up West Valley are being hindered by several factors. First, and most importantly, DOE and New York State continue to disagree on which entity is principally responsible for exercising long-term operational stewardship of the site under the West Valley Act, which entity should pay the site's prospective high-level waste disposal fees, and what the site should look like in the future. Their differences are key to facilitating long-term progress and are contributing to delays in environmental planning milestones for the site. Specifically, because the parties to the cleanup have not yet agreed on strategic issues affecting the site's cleanup—that is, what the site is to look like after the cleanup is completed, how the land is to be used, and what regulatory cleanup standards are to be used—a final environmental impact statement (EIS) for decommissioning and closing the site has not yet been issued and the scheduled date for a record of decision on a cleanup level has been extended. An early scheduled date was 1997 but is now 2005 and could be extended further. Until recently, DOE and the state had been formally negotiating in an attempt to resolve their differences. As an incentive for agreement, DOE had included a proposal addressing the issue of the payment of prospective multimillion-dollar fees for disposal of West Valley's high-level wastes at a permanent repository. However, these confidential negotiations broke down in January 2001 without an agreement. Second, prospective NRC cleanup standards—referred to as decontamination and decommissioning criteria—for the cleanup effort are to be issued in 2001, perhaps in the spring. However, these standards as drafted differ from the EPA environmental guidance and standards under CERCLA and the Safe Drinking Water Act (as well as New York State radiation protection guidance) that could be applied on-site. Third, it is uncertain where West Valley's nuclear wastes are to go, including both high-level and transuranic wastes. Hundreds of millions of dollars in future costs could be at stake in addressing these disposal questions.

DOE and New York State Have Not Resolved Issues Concerning the Site's Future, Including Their Roles and Responsibilities and Cost-Sharing

The principal parties to the West Valley cleanup—DOE as site operator and New York State as site owner—have been attempting to reach an agreement on strategic issues affecting the site's future in order to facilitate cleanup planning and the timely and cost-effective cleanup and closure of the site. However, to date, they have not reached such an agreement. Their current relationship reflects the fact that, historically, the federal government and the state have continuously differed on who should assume responsibility for the wastes generated by commercial reprocessing at West Valley. For example, in 1980, we reported that interested parties at West Valley were influenced more by their desire to minimize their own responsibilities than by attempting to arrive at the most practical solution. The issue of who will take on-site responsibility is likely to continue for the foreseeable future.

Although the West Valley Act does not require that DOE and New York State reach agreement on the site's future or how DOE will complete the cleanup effort, NEPA encourages interested parties to cooperate in environmental decisionmaking regarding sites such as West Valley. Consequently, it has been DOE's stated policy to work closely with the state on the West Valley cleanup. Since mid-1999, the two entities have been conducting confidential negotiations on their future roles and responsibilities, particularly in the areas of (1) on-site operational stewardship, (2) future cost-sharing, and (3) an appropriate cleanup level and eventual use for the site. However, in mid-January 2001, these negotiations broke down without an agreement. Afterward, representatives of the two sides agreed that prospective long-term operational stewardship of West Valley's wastes was a major unresolved issue. In this regard, DOE, as the site operator, prefers a cleanup level that would involve significant remedial efforts but not require removal of all the nuclear wastes off-site in order to achieve unrestricted site use. DOE also foresees a limited operational presence on-site, although one which could still last for decades. Conversely, New York State, as the site owner, appears to prefer that DOE stay on-site operationally as long as nuclear wastes are there (possibly for many more decades). To date, the state has not put forward a preferred cleanup alternative for the site. It has not ruled out the idea of leaving some nuclear wastes on-site, as DOE favors, but has not yet agreed to DOE's preferred approach. New York State believes (1) the Department needs to do further analysis to demonstrate the adequacy of its favored approach and (2) reaching an agreement is contingent on DOE and the state agreeing on long-term on-site stewardship.

The two parties disagree in large part because they interpret the West Valley Act differently and because they have clearly different interests to protect. Specifically at issue is the extent of cleanup activities DOE is required to conduct under the act, as well as the duration of DOE's obligation to conduct operations on-site to deal with the radioactive contamination in buildings and burial areas resulting from commercial reprocessing operations that preceded the Department's presence. According to DOE, under the act, New York State, as the site owner, is responsible for the preexisting contamination, and ultimately responsible for addressing land use issues there. DOE plans to limit its on-site decontamination and decommissioning efforts to areas, facilities, and materials used in conducting the waste vitrification project. The Department states that after cleaning up West Valley, it does not become owner of the site. In this regard, DOE foresees a long-term, but ultimately limited, departmental operating role at West Valley, after which it expects to leave the site.[17] In recent years, DOE's estimates for completing its on-site role have ranged from 2005 to 2041, depending on programmatic and waste disposal assumptions.

On the other hand, New York State interprets the West Valley Act to require a more extensive cleanup role for DOE and a longer-term departmental operating presence—that is, as long as any nuclear waste remains on-site. According to the state, DOE is responsible for decontaminating and decommissioning all facilities and wastes in the 200-acre operations area, except for the state disposal area and the materials buried in the NRC-licensed disposal area prior to DOE's presence. The state asserts that if DOE's cleanup efforts result in the need for long-term institutional controls on-site, the Department should provide such controls. New York State estimates the federal government is responsible for about 75 percent of the spent fuel reprocessed at West Valley and therefore should rightly stay on-site as a long-term caretaker—if one is needed—for any remaining wastes generated from reprocessing.[18] New York State officials have also said the state does not want responsibility for ensuring the long-term performance of the high-level waste tanks or

[17] According to DOE, after the Department leaves West Valley, in order to help protect public health and the environment, it would bear at least a part of the financial responsibility for monitoring and maintaining—and revisiting where necessary—any on-site cleanup remedies it had put in place there.

[18] New York State further asserts that DOE has additional responsibilities for the waste in the state-licensed and NRC-licensed disposal areas under CERCLA.

other DOE-engineered barriers. As in the past, New York State believes that the federal government, in addition to its legal responsibilities, has the necessary technical and financial resources to fully clean up West Valley.

DOE and New York State also have historically disagreed on who is responsible for paying the fees that are due if West Valley's high-level wastes are to be disposed of in a permanent repository. The disagreement is not about who owns the wastes—the two sides agree that they are state owned. At issue is who should pay for disposal and under which laws. Under the Nuclear Waste Policy Act of 1982, nuclear facilities seeking access to a prospective permanent repository must sign a contract for disposal and pay a fee into the nuclear waste fund that was set up to cover the disposal costs. Notwithstanding the provisions of the West Valley Act and its implementing cooperative agreement between the Department and New York State, DOE officials said that, under the Nuclear Waste Policy Act, West Valley's owner, like the owners of other nuclear facilities, must pay this fee, which covers full disposal costs, prior to having the site's wastes disposed of in the repository. On the other hand, the state argues that the provisions of the West Valley Act and its implementing cooperative agreement make the signing of a disposal contract under the Nuclear Waste Policy Act of 1982 both inappropriate and redundant.[19] In the state's view, the Nuclear Waste Policy Act requires payment from a nonfederal party only for the disposal of spent fuel or high-level waste from a civilian nuclear power reactor. According to the state, the West Valley high-level wastes are a unique federal-civilian mixture not covered under the Nuclear Waste Policy Act (or, if covered, are "wastes from atomic energy defense activities" for which DOE is liable).

DOE has unsuccessfully pursued the resolution of this matter for many years. In the recent confidential negotiations, the Department offered a proposal concerning the degree to which DOE and New York State would be responsible for paying the fee, in order to give the state an incentive to reach a timely agreement on a proposed cleanup level for the site and to resolve other important issues at the site. According to DOE, under its proposal, (1) to settle all outstanding issues between the Department and

[19] Under an agreement between New York State and the original site operator and the 1980 cooperative agreement between DOE and New York, the state has been managing a perpetual care fund for West Valley that was intended to be paid to the Department upon delivery of the solidified high-level wastes to a repository. Currently, this fund contains about $21.9 million. This amount, according to DOE, does not begin to cover the site's total prospective costs for high-level waste disposal.

the state, the Department would agree to assume a portion of New York State's responsibility to pay for the disposal of the high-level waste in return for monetary and other valuable considerations from the state and (2) DOE would still have no obligation to take title to and dispose of West Valley's high-level waste unless New York State enters into a disposal contract under the Nuclear Waste Policy Act and pays the disposal fee. According to DOE officials, the proposal would achieve long-term, multimillion-dollar overall cleanup cost savings for both DOE and the state. Following the recent breakdown of the DOE-New York State negotiations, DOE withdrew the proposal, and it is unclear whether it could be revived. According to DOE, the Department and New York State are exchanging information to help determine when negotiations should appropriately be resumed.

The DOE-New York State relationship is key to facilitating the cleanup of West Valley and has been a factor in delaying environmental planning milestones for the site. The differences between the two parties were less important in the past, when on-site cleanup efforts were focused almost entirely on vitrification—a cleanup step favored by all interested parties. However, the parties' differences have become more prominent in recent years as cleanup planning has turned increasingly toward long-term decommissioning and closure of the facility. Facility decommissioning will require decisionmaking on controversial, unresolved issues, such as prospective off-site high-level waste tank removal versus entombment on-site.

The differences between DOE and the state, including their lack of agreement on the site's future, are affecting the pace of the West Valley environmental planning process under NEPA. Under NEPA, the Department is required to integrate environmental considerations into its planning, and the Department has historically included the state as a joint participant in the environmental analysis for the site. DOE has conducted NEPA compliance efforts for West Valley since the 1980s,[20] but this

[20] An environmental impact statement (EIS) for the vitrification phase at West Valley was completed in 1982. In 1987, a U.S. district court in New York State approved a Stipulation of Compromise that outlined NEPA compliance requirements for DOE to follow, directing the Department to include its on-site waste disposal practices in a full EIS for West Valley, instead of addressing these wastes in a less extensive environmental assessment that the Department had regarded as sufficient. The stipulation resulted from a suit brought by the Coalition on West Valley Nuclear Wastes and Radioactive Waste Campaign, local environmental interests that were concerned about DOE's waste disposal practices at the site.

process still has not resulted in a final EIS for the site or a record of decision on a cleanup level.[21] Specifically, because of a lack of agreement among the parties, including DOE and the state, the draft EIS for cleaning up the site was issued in 1996 without including a preferred cleanup alternative. Instead, it laid out five cleanup alternatives that ranged widely, from limited remedial actions, referred to as "in place stabilization" of the contamination (at costs ranging from about $400 million to about $1.1 billion, depending on the specific option chosen), to more extensive actions, ranging from "on premises storage" of the contamination in new facilities (at a cost of about $3.7 billion) to full cleanup of the site to an unrestricted end state—referred to as the "removal" option (at a cost of about $8.3 billion). To date, none of these alternatives has been selected as preferred, and no final EIS has been issued.

The continuing inability of the parties, especially DOE and New York State, to choose among cleanup alternatives for West Valley limits progress with NEPA compliance, as well as overall cleanup planning, and has resulted in changing DOE estimates of when—following issuance of a final EIS—a record of decision for the site could be issued. The estimated date for a record of decision has been extended several times, from October 1997, to May 2000, to the latest estimate of 2005.[22] In retrospect, according to DOE officials at West Valley, the changing estimates indicate overly optimistic past assessments of how difficult it might be for interested parties to decide on a preferred cleanup alternative for the site. They said the 2005 date is a reasonable current estimate, and while it could be marginally accelerated, if at all, it could also be extended if there is no agreement soon on the site's future. Concerned about potential cleanup delays, DOE has recently chosen to split the EIS development process into

[21] NEPA requires agencies, prior to major programmatic actions such as the West Valley cleanup, to consider whether these actions will significantly affect the quality of the human environment. Under NEPA, similar to the cleanup process required by CERCLA, interested parties work toward an agreed end-state for a site cleanup, which they develop through (1) issuing a draft EIS, (2) choosing a preferred cleanup alternative, (3) issuing a final EIS, and (4) issuing a record of decision formally detailing the cleanup agreement.

[22] If met, this date will conclude a roughly two-decade West Valley cleanup decisionmaking process under NEPA.

two phases, so that near-term post-vitrification cleanup work will not be delayed by NEPA compliance considerations.[23]

DOE and New York State officials maintain that their negotiating differences have not yet seriously affected the pace of environmental planning for West Valley or the overall progress of the cleanup. According to DOE headquarters and field officials, this is because, until recently, the Department has been more focused on vitrification than on later phases of the cleanup and is only now turning more attention to decontamination and subsequent decommissioning. Also, according to the Department, its environmental planning for West Valley does not depend on its negotiating efforts with the state, and therefore if no agreement is reached with the state, the Department can proceed with its NEPA compliance efforts without the state's participation. A DOE official said that difficulties in developing a preferred alternative and the desire to give the public an ample opportunity to comment have been reasons for not including a preferred alternative in the 1996 draft EIS and for not having made it final since then. Departmental officials said that despite the lack of a preferred alternative for West Valley, day-to-day cleanup work is continuing, focusing on nearer-term work steps (such as decontamination of structures) that will be necessary regardless of which alternative is eventually chosen.

According to DOE, the Department can complete all of its responsibilities under the West Valley Act even if negotiations with New York State never resume, but a DOE official said that if differences with the state continue in coming years, there could be more serious effects on the overall costs and schedule of the cleanup. In our view, the Department underestimates the degree to which the continuing lack of agreement among the parties—especially DOE and New York State—concerning the site's long-term future is already limiting the precision and pace of DOE's cleanup planning for West Valley, as evidenced in lengthy NEPA compliance efforts, frequently changing planning milestones, and uncertain, varying cleanup cost and schedule estimates.

[23] In September 2000, DOE announced that it would continue its environmental impact analysis for West Valley in two phases, with two separate final EISs—the first phase covering agreed-upon cleanup steps (over the next year or 2), and the second phase covering more controversial cleanup steps that have not yet been agreed upon (over the next few years).

NRC Has Drafted Cleanup Standards for West Valley, but EPA's Guidance and Standards Could Also Apply at the Site

Under the West Valley Act, DOE's cleanup of the facility is to occur in accordance with cleanup standards to be issued by NRC.[24] However, these standards, which are important regulatory criteria for decontaminating and decommissioning the site, have been lacking since the act was passed in 1980. NRC first developed cleanup standards for its licensees, such as commercial nuclear power plants, in 1997. However, these standards (referred to as NRC's license termination rule) were not designed specifically for West Valley. Prospective standards for West Valley were issued in draft form in December 1999 and are based substantially on the 1997 standards. Following a period of public comment, NRC is now reviewing the draft standards, and NRC officials expect them to be issued in 2001, perhaps in the spring.[25] Such standards—principally including numerical limits on public exposure to any remaining on-site nuclear radiation after the site is cleaned up—are a necessary component of any nuclear cleanup effort. Commonly expressed as millirem of exposure to an individual annually, these limits help to quantify "how clean is clean" at a cleanup site.[26]

Like NRC's 1997 standards, the prospective West Valley standards are to include an exposure limit of 25 millirem a year to an individual from all means of exposure (or "pathways")—through air, water, and soil on-site at West Valley. Also, according to NRC officials, the standards will likely include higher limits for on-site locations where the level of 25 millirem a year for unrestricted access is not attainable. In such locations, such as burial areas for high-activity wastes, higher limits (100 or 500 millirem a year, depending on the situation) would be applicable, combined with restrictions on public access to these areas. Such a regulatory approach would recognize the need for long-term institutional controls at some locations at West Valley.

The timing of the issuance for, and the prospective content of, the West Valley standards have been of concern to interested parties. Such

[24] NRC is not currently an on-site regulator but will be in the future when its license to New York State is reinstated.

[25] NRC is authorized under the West Valley Act to prescribe the standards, which it published in the *Federal Register* in the form of a *Draft Policy Statement on Decommissioning Criteria for the West Valley Demonstration Project and the West Valley Site*

[26] A millirem is a commonly used unit of measurement of the biological effect of radiation. The radiation from a routine chest X-ray is equivalent to about 6 millirem.

standards were arguably less needed in the 1980s, when the first phase of the cleanup—the high-level waste vitrification project at West Valley—was gearing up. According to the 1981 DOE-NRC memorandum of understanding accompanying the West Valley Act, NRC was to issue the standards after DOE analyzed environmental options for the site. In this regard, DOE's analyses have been ongoing for at least a decade (including the development of the 1996 draft EIS), and are still under way. The Department has been concerned that NRC may issue final cleanup standards prematurely, before West Valley's environmental analyses are completed. Specifically, DOE has said that the issued standards could contain restrictions developed on the basis of incomplete environmental analysis that could prevent consideration of potentially cost-effective cleanup alternatives. On the other hand, some observers, such as the Natural Resources Defense Council, have argued that issuance of the NRC standards is long overdue and should not be further delayed because they are needed to help guide cleanup planning and analysis. Some have said the standards should adhere closely to the 1997 decommissioning standards and not include provisions, or "exceptions," that could circumvent the standards' protective intent. According to NRC officials, a few years after the final standards for West Valley are issued, prior to a prospective record of decision for the site, the agency plans to (1) review whether DOE applied the standards in developing a decommissioning EIS for the facility and (2) decide whether DOE's preferred cleanup approach in the EIS meets NRC's standards. The officials said the evaluation would take into account lessons learned from any further environmental analysis that DOE may conduct in the meantime.

Although NRC has standard-setting authority under the West Valley Act, EPA's environmental guidance and standards—which apply to both chemicals and radionuclides, versus NRC's radiation-specific standards—could also apply on-site. In this regard, implementation of the West Valley Act does not preclude EPA from exercising its own, potentially more restrictive cleanup authority at West Valley under CERCLA and the Safe Drinking Water Act.[27] While NRC's standards could be applied on-site

[27] While NRC's standards are radiation-dose-based, CERCLA is risk based (a lifetime cancer risk range of 1 in 10,000 to 1 in 1 million from both chemicals and radionuclides). Also, under EPA's CERCLA guidance, radiation exposure to individuals is limited to 15 millirem a year from all exposure means. Further, under the Safe Drinking Water Act, EPA's approach includes separate, additional groundwater protection to meet drinking water standards (which originally were roughly equivalent to 4 millirem a year, but now vary in dose equivalency, depending on the radionuclide).

during decommissioning, CERCLA could be separately enforced—for example, in response to a citizen's petition, according to EPA and NRC officials. In regard to groundwater protection, an area of special EPA protective concern, EPA's approach may be more restrictive than NRC's and therefore potentially significantly more costly to comply with. In addition, New York State's Department of Environmental Conservation has issued cleanup guidance that could apply to West Valley.[28]

On the basis of its 1987 and 1995 assessments, EPA does not plan to take future remedial actions at West Valley under CERCLA. However, in a May 1999 letter to DOE's West Valley office, EPA cautioned that cleaning up the site to prospective NRC standards of 25 millirem a year might not adequately protect human health or the environment. In addition, in commenting in January 2000 on NRC's developing standards for West Valley, EPA called for West Valley's groundwater to be protected to drinking water standards and for additional site-specific analysis to ensure such protection in the long term. NRC, EPA, and New York State officials have had discussions during 2000 on their different standards and guidance. They have agreed that they need to further explain to DOE how their various criteria and guidance may apply to different locations and activities at West Valley. However, to date, they have not said how their different standards and guidance are to be implemented on-site so as to avoid potential dual regulation.

As we reported in 1994 and in June 2000, NRC and EPA have had ongoing differences on cleanup standards.[29] They have recently attempted to resolve the differences through a memorandum of understanding. Their history of disagreement at other NRC-licensed sites indicates that cleanup standards for West Valley could also be disputed, especially with respect to groundwater protection. According to EPA, the two agencies have generally coordinated their regulatory activities effectively at NRC-licensed sites where their standards both apply. However, NRC and EPA

[28] New York State guidance calls for 10-millirem-a-year protection to an individual, plus 4 millirem a year for groundwater. New York State officials have spoken in favor of one set of sitewide standards for West Valley.

[29] *Nuclear Health and Safety: Consensus on Acceptable Radiation Risk to the Public Is Lacking* (GAO/RCED-94-190, Sept. 19, 1994); *Radiation Standards: Scientific Basis Inconclusive, and EPA and NRC Disagreement Continues* (GAO/RCED-00-152, June 30, 2000). In the latter report, we recommended that the congressional committees of jurisdiction may wish to clarify the two agencies' regulatory responsibilities relating to decommissioning NRC-licensed sites.

have disagreed for many years on this matter and have been attempting for over a year to issue a final memorandum of understanding clarifying their regulatory roles. Such a memorandum could likewise apply to West Valley (an NRC-licensed site whose license is currently in abeyance). As of March 2001, the two agencies were keeping the Congress informed of their efforts but had not completed a final memorandum.

The Future Location of West Valley's Nuclear Wastes Is Unresolved

Unresolved issues concerning the disposal of West Valley's high-level and transuranic nuclear wastes may also hinder cleaning up the site in a more timely manner. The vitrified high-level wastes are being temporarily stored in a work room or "cell" in the current vitrification facility (which is part of the former spent fuel reprocessing facility), awaiting further disposition. (See fig. 3.) The transuranic wastes are currently stored at two locations—a building for so-called "lag" storage and the chemical process cell waste storage area (and some were buried in the NRC-licensed disposal area during commercial reprocessing operations).[30] Questions of where these wastes will eventually go, when, and at what cost are still to be addressed.

Under the West Valley Act, both types of waste are to be disposed of before the cleanup is completed. If disposal does not happen in a timely manner, their care and maintenance could add substantially to the overall costs and schedule for the West Valley cleanup—potentially hundreds of millions of dollars, with schedule extensions of up to two decades. In 1997, DOE issued a policy—in the form of a programmatic EIS and two records of decision—stating that high-level and transuranic wastes are to remain stored at sites where they have been generated for the foreseeable future, pending a decision on final disposition. Thus, any options for interim off-site storage of West Valley's high-level and transuranic wastes would require the Department to make an exception to this policy. [31]

Off-site removal of West Valley's high-level wastes could result in hundreds of millions of dollars in potential savings, in part through not having to construct an interim storage facility for the canisters at West Valley. This could be accomplished by removing the wastes to another DOE site for interim storage, followed by later disposal in a permanent repository. Other DOE sites, such as Savannah River, the Idaho

[30] About 521 cubic meters of transuranic wastes are in the inventory, and 24 cubic meters more are expected to be generated during the cleanup.

[31] In regard to on-site low-level waste, substantial quantities (over 61,000 cubic feet) have been shipped off-site to the Envirocare facility in Utah since 1997.

Laboratory, Hanford, and the Nevada Test Site, could feasibly accept the West Valley wastes for interim storage, according to DOE officials. They said such a step could result in net cost savings from the elimination of years of storage and maintenance costs at West Valley. Sites such as Savannah River are expected to spend substantial amounts for storage of their own vitrified high-level wastes, beyond which the added costs of storing a relatively few canisters from West Valley are likely to be marginal. Furthermore, a 1997 DOE headquarters analysis estimated cost avoidance of about $770 million over the next 10 years through interim off-site storage of West Valley's high-level wastes.[32] The analysis assumed that early deployment of a high-level waste shipping system and off-site interim storage of the West Valley wastes would occur as part of an integrated, DOE-wide nuclear waste management effort. However, DOE officials recognized that state compliance agreements, other legal constraints, and political equity considerations among states could preclude taking such an action.

DOE's plans in the 1990s to ship the West Valley canisters to the Savannah River Site at the beginning of the 2000s are a case in point. The canisters could have been added to the larger inventory there on an interim basis, pending removal to a permanent repository. According to various DOE West Valley analyses, shipment would have begun anywhere from 2001 to 2007. The Department presented the option to the Savannah River citizens' advisory board, which recommended the option be implemented (with some dissenters on equity grounds). In 1999, however, the state of South Carolina halted the plan. According to DOE officials, state officials said DOE had not properly informed them of the plan and the governor opposed it. DOE officials said that on the basis of the recent experience with the state of South Carolina, they have no current plans for interim off-site storage of West Valley's high-level wastes.

With regard to permanent disposal, DOE currently plans to remove the West Valley canisters to a permanent repository. Yucca Mountain, Nevada, is the prospective repository and, if approved, is projected to open in 2010. However, meeting this target date will depend on many technological and political factors. As discussed earlier, not the least of these factors is a timely decision on who—New York State or DOE—should pay the fee for

[32] *Contractor Report to DOE on Opportunities for Integration of Environmental Management Activities Across the Complex (pre-decisional draft),* INEL/EXT-97-00065, Mar. 1997. In the report, cost avoidance represented money that would not have to be added to departmental 10-year plans to fill program gaps.

disposal of West Valley's wastes. Because DOE assumes a pessimistic scenario for prospective disposal of West Valley's wastes at Yucca Mountain, the Department currently projects that the high-level waste canisters would not be shipped to the prospective Nevada repository until 2036 to 2040, at the end of the time frame projected for disposal there. Current DOE estimates indicate that if the wastes could instead be shipped to permanent off-site disposal in the mid 2020s, up to $100 million in West Valley cleanup costs could be saved.[33]

With respect to West Valley's transuranic wastes. millions of dollars could be saved in disposal costs, depending on which disposal option is chosen.[34] Under the West Valley Act, the transuranic wastes generated as part of project activities are to be disposed of prior to site closure. DOE's recent plans do not specify a destination, but the latest plans have projected off-site removal of these wastes between 2007 and 2021. Both interim off-site storage and direct shipment to permanent disposal may be options, depending on technological, legal, and political factors, and any of several larger DOE sites could be candidates for interim storage.

An existing transuranic waste disposal facility—the Waste Isolation Pilot Project (WIPP) in New Mexico, which has been in operation since 1999—appears to be a feasible permanent destination for West Valley's transuranic wastes. However, under the authorizing legislation for WIPP, the facility is to receive only transuranic wastes generated in connection with defense-related activities. According to DOE officials, West Valley's transuranic wastes do not meet this criterion and are considered commercial wastes. Departmental officials said options for gaining access for these wastes to WIPP include seeking an amendment to the WIPP Land Withdrawal Act or an administrative change to recategorize West Valley's transuranic wastes as defense-related. The basis for such an administrative change would be the fact that the site's transuranic wastes consist of

[33] Beyond off-site disposal of West Valley nuclear wastes, DOE-wide consolidation of nuclear wastes now located at multiple sites around the country could save many billions of dollars. For example, DOE's Mar. 1997 study on integration opportunities estimated total savings for high-level waste storage at over $18 billion over 10 years, and for transuranic waste storage at over $3 billion. The study took legal and regulatory constraints into account but did not attempt to fully account for equity considerations and political acceptability.

[34] These wastes come in two forms: Some are more highly radioactive, requiring remote handling by machinery for worker safety; others are less radioactive and can be handled by personnel wearing protective clothing.

commingled wastes resulting from spent fuel generated in both commercial and defense nuclear reactors. According to a DOE official, the Department currently favors obtaining a legislative change to gain access to WIPP for West Valley's wastes, but officials said that seeking an immediate amendment to the WIPP Land Withdrawal Act may be inopportune since implementation of disposal operations at WIPP has only recently begun.

The 1997 DOE study on integration opportunities estimated that $13 million in cost avoidance could be achieved over 10 years at West Valley if a significant portion of the site's remote-handled transuranic wastes could be shipped to off-site locations for interim storage, pending potential WIPP access. This estimate assumed appropriate packaging in large containers for shipment to alternate sites and the implementation of a new transportation package to handle the containers.[35] The same analysis estimated that disposing of all of West Valley's transuranic wastes at WIPP (assuming access was obtained) could avoid about $4 million in storage and maintenance costs at West Valley.[36] As with high-level waste disposal, state compliance agreements, other legal constraints, and equity issues among states could be factors in any effort to implement an interim storage approach for West Valley's transuranic wastes. States with facilities that could readily accept such wastes—such as South Carolina and Washington State, for example—do not wish to be perceived as continually receiving transuranic and other nuclear wastes from other states, particularly from states that may have historically carried an arguably lesser share of the overall national burden for disposing of nuclear waste. In states that host DOE's nuclear facilities, the Department has already invested substantial time and resources in negotiating acceptable arrangements for nuclear waste management, in response to the requirements of the Federal Facility Compliance Act and commitments made to governors.

[35] This analysis also assumed that these efforts would be part of an overall departmental waste management integration effort.

[36] Moreover, the analysis estimated that implementing mobile packaging systems for use at multiple sites where transuranic wastes were located—and using such a system to package 466 cubic meters of remotely handled transuranic wastes at West Valley—could potentially avoid $250 million in costs.

West Valley's Total Cleanup Costs and Schedule Cannot Be Estimated With Reasonable Certainty Until the Future of the Site Is Agreed On

DOE's estimates of West Valley's total cleanup costs and a date for completing the cleanup have been uncertain and will remain so until strategic issues are agreed upon, including the extent to which the site is to be cleaned up and what it will then look like, how the land is to be used, what regulatory cleanup standards are to be used, and where the site's nuclear wastes are to go. DOE's estimates have shown large cost increases and schedule extensions—as well as variations—since DOE first reported them to the Congress in 1978, as part of congressional deliberations leading to enactment of the 1980 West Valley Act. In 1978, the estimated cleanup cost was $180 million, or about $1.1 billion in year-2000 dollars, with cleanup completion in 1990.[37] These were preliminary estimates, made before the cleanup challenge at the site was fully understood. Estimates in the 1990s have shown considerably greater costs. These cost estimates also have varied by billions of dollars, and the completion schedule by decades, depending on the programmatic assumptions made. DOE's current estimate of total cleanup costs is about $4.5 billion, with site closure by 2041. The various estimates are listed in table 1.

[37] In 1978, the Department estimated initial costs could range between $41.6 million and $1.1 billion (in 1978 dollars) depending on the cleanup option chosen. As we stated in our report, *Status of Efforts to Clean Up the Shut-Down Western New York Nuclear Service Center* (EMD-80-69, June 6, 1980), most parties, at that time, agreed that a more reasonable initial cost estimate would be about $180 million (in 1978 dollars). The Department also estimated in the 1978 report that the cleanup could begin as early as October 1980 and, depending on the cleanup option chosen, be completed within about 10 years, or by about 1990.

Table 1: Changes in Estimated Total West Valley Cleanup Costs and Completion Schedule

Dollars in billions (Present Value 2000)

Date and source of DOE estimate	Estimated total cleanup cost	Estimated completion date	Cost above 1978 estimate	Years more than 1978 estimate
Nov. 1978: Study supporting the West Valley Act[a]	$1.1	1990		
June 1996: Baseline Report[b]	5.8	2025	$4.7	35
July 1996: Ten- Year Plan[c]	3.8	2005	2.7	15
Dec. 1997: Draft 2006 Plan[d]	3.8	2005	2.7	15
Feb. 1998: Paths to Closure Update[e]	3.8	2006	2.8	16
July 1999: Paths to Closure Update[f]	4.3	2015	3.3	25
May 2000: Current plan[g]	4.5	2041[h]	3.5	51

[a]The estimates were contained in the study, *Western New York Nuclear Services Center Study*, TID-28905-2, made before the West Valley Act was enacted. The estimates were preliminary, based on a study that assumed cleanup could begin as early as October 1980. The estimates used available information and experience rather than detailed designs. In the study, DOE identified technical options for cleaning up the facilities and nuclear waste at the site. Included in the study were cost and schedule estimates associated with these options. We examined these options closely, focusing on the cost estimates in the study that were most consistent with the Department's currently preferred cleanup approach—a degree of aggressive on-site cleanup, with some radioactive contamination left in place under long-term stewardship. We converted the 1978 estimates to present value 2000 dollars, resulting in estimated cleanup costs of about $1.1 billion. Similarly, we focused on schedule estimates in the study that were most consistent with DOE's currently planned cleanup approach, resulting in an approximate cleanup start date of October 1980 and an approximate completion date of September 1990.

[b]*Baseline Environmental Management Report*. The report, called BEMR, averaged the cost of several cleanup alternatives reported in the *West Valley Draft Environmental Impact Statement*, Jan. 1996, DOE/EIS-0226-D.

[c]Ten-Year Plan. The plan was used to support DOE's fiscal year 1998 budget formulation.

[d]Fiscal year 1997-98 Draft 2006 Plan. The plan was used to support DOE's fiscal year 1999 budget formulation and became known as the *Accelerated Clean-up: Paths to Closure* report.

[e]*Fiscal year 1998 Accelerated Clean-up: Paths to Closure (ACPC) Update.* The plan was used to support DOE's fiscal year 2000 budget formulation.

[f]*Fiscal year 1999 ACPC Update*. The plan was an internal DOE document used to support DOE's fiscal year 2001 budget formulation. Estimated completion date based on funding at a higher, more efficient level. Funding at a level closer to actual current appropriations was estimated to extend the completion date to 2023.

[g]*Fiscal year 2000 Integrated Planning Accountability and Budgeting System (IPABS) Planning Module Update*. The plan was an internal document used to support the fiscal year 2002 budget formulation and is consistent with implementation of DOE's currently envisioned action alternative for site closure. We did not include in the table a publicly released DOE estimate, in the report entitled *Status Report on Paths to Closure, March 2000*, which was based on 1999 data.

[h]Estimated completion date, based on the most likely funding level, is 2023 for all tasks except disposition of high-level waste canisters. DOE's plan is to ship the canisters to an off-site federal repository from 2036 to 2040, with site closure in 2041.

As shown in table 1, the initial cost estimate has more than quadrupled, from about $1.1 billion to about $4.5 billion in the latest estimate, while the initial time estimated to complete the cleanup has increased by about 50 years (from 1990 to 2041). Several factors contributed to these changes. The initial 1978 DOE estimates were preliminary, using available information and experience rather than detailed designs. Furthermore, according to DOE officials, when the initial estimate was made of project costs and cleanup duration, it did not adequately consider the changing environmental landscape for this first-of-a-kind project and did not anticipate the complex regulatory environment and laws that have since come into existence. In addition, as we previously reported, DOE management problems occurred at West Valley in the 1980s, resulting in cost and schedule overruns.

As also shown in the table, during the 1990s, the estimated costs for West Valley varied, with totals ranging from $3.8 billion to $5.8 billion. Moreover, different estimates both extended and shortened the estimated schedule, with the estimated increase in the duration of the cleanup ranging from 15 to 51 years. These different totals reflect different, evolving departmental initiatives to quantify the total costs and schedule of the Department's cleanup effort across the nuclear complex. Causes of variations in the estimates have included different estimation methods and varying major assumptions related to cleanup and nuclear waste disposal. For example, DOE officials said the June 1996 Baseline Report estimates for West Valley were part of a first departmental attempt to quantify the extent of the cleanup problem complexwide, and these estimates were not precise. They were taken from data supporting the site's 1996 draft EIS and simply averaged the cost of several cleanup alternatives shown in the draft.

The July 1996, 1997, and 1998 estimates for West Valley were lower than the Baseline Report estimates, in part because they were based on departmental guidance that called upon DOE's sites, including West Valley, to use ambitious assumptions aimed at accelerating the cleanup and reducing costs within current budget trends. For example, these estimates assumed an accelerated period of about 10 years to complete the cleanup, off-site interim storage of the high-level waste canisters, and generally flat funding of $123 million annually. Accelerating the cleanup schedule at West Valley without funding adjustments created a substantial planning gap between funding needs and availability within the given time frame. The Department proposed closing the gap through cost savings generated by conducting cleanup projects more efficiently. However, according to DOE West Valley officials, the idea of accelerating the

cleanup of West Valley to achieve completion in 2005 was not realistic and could not be implemented.

The current estimate of about $4.5 billion with completion in 2041 is based on DOE's latest cleanup plans for West Valley. DOE officials said this estimate is reasonable, solidly grounded, and the best available based on known information. The estimate, according to these officials, includes opportunities to lower the cost as well as areas that could end up costing more. For example, the current estimate indicates completion of major cleanup tasks by the mid-2020s, and assumes that the high-level waste canisters cannot be shipped to a permanent off-site repository until 2036 through 2040 (with site closure in 2041). According to DOE, although this time frame assumes a lack of earlier access to a prospective permanent repository, such as Yucca Mountain, earlier shipment is a possibility if a valid contract assigning disposal costs can be signed with New York State. Shipping them earlier, such as in the mid-2020s, would lower the total cost of the cleanup. Conversely, some cleanup tasks, such as dealing with the melter used in vitrification, might cost much more than currently estimated because of uncertainty about how to conduct these tasks. DOE officials recognize that the current estimate is uncertain, in part because it does not reflect an agreed-upon cleanup level and site end use. Depending on the cleanup level, on-site cleanup costs could vary widely, as illustrated in the analysis done for DOE's 1996 draft EIS for West Valley. In the draft EIS, DOE outlined action alternatives ranging from limited remedial actions, referred to as "in place stabilization" of the contamination (at costs ranging from about $400 million to about $1.1 billion, depending on specific options), to more extensive actions such as "on premises storage" of the contamination in new facilities (at a cost of about $3.7 billion), to full cleanup of the site to an unrestricted end state—referred to as the "removal" option (at a cost of about $8.3 billion).[38] A DOE official said that until an appropriate end state for the site is agreed upon, any estimates of total West Valley cleanup costs and completion date will not be entirely credible.

[38] In 1996 dollars.

West Valley Reflects DOE-Wide Cleanup Dilemmas and Has Implications for National Decisions on Nuclear Waste Disposal

The problems DOE faces at West Valley reflect many of the same dilemmas it faces elsewhere in the nuclear complex. West Valley is yet another example of how complicated, uncertain, and subject to cost and schedule changes the cleanup process can be, especially at technologically difficult cleanup sites where an appropriate cleanup level and land use have not been agreed upon and multiple types of contamination are involved. In such circumstances, planners find it difficult to estimate with a reasonable degree of certainty an individual cleanup project's overall costs and schedule. By extension, DOE's ability to quantify with a degree of certainty the costs and timetables for the cleanup across the entire complex is to some degree in question—especially at other, larger DOE sites that also lack fully agreed-upon cleanup levels and/or end states. With regard to nuclear waste disposal, West Valley is part of an approaching national decision on what to do with the over 200 underground tanks across the DOE complex and the traces of high-level wastes left in them after vitrification. Are the tanks to be dug up, using technologies that are still to be developed and that potentially require significant expenditures, and removed to an as-yet-undetermined disposal location, or can they be safely left in place and under long-term stewardship? The Natural Resources Defense Council is currently challenging in court DOE's waste management order that could permit a tank "entombment" strategy to be implemented at West Valley and elsewhere.

West Valley Reflects Dilemmas in DOE's Complexwide Cleanup Planning

Since the late 1980s, DOE has been committed to estimating total cleanup costs and schedules complexwide. Such estimates are potentially useful to the Department in planning for over 300 cleanup projects at its over 100 nuclear sites. The estimates are also useful to the Congress in fulfilling its oversight responsibilities, and they help to inform the public about the status of the cleanup program. These estimates have grown over time as more is learned about the number of sites contaminated and the types of contamination. However, as we have previously reported, these estimates have varied considerably, and their reliability has been questioned. In April 1999, we reported that the uncertainty of DOE's estimates of the cost and schedule for the complexwide cleanup was a matter of concern and depended on various programmatic assumptions.[39] Such assumptions may include funding levels, the facilities and wastes that are to be included in

[39] *Nuclear Waste: DOE's Accelerated Cleanup Strategy Has Benefits but Faces Uncertainties* (GAO/RCED-99-129, Apr. 30, 1999).

the scope of the analysis, the availability of waste disposal options, or other factors.

West Valley's recent widely varying cost and schedule estimates call into question DOE's estimates at other sites, especially those that lack agreed-upon cleanup levels and land uses. Many sites across the complex lack a final agreement with their regulators, such as EPA and the state, on the cleanup levels that must be achieved—that is, "how clean is clean." Furthermore, two of the largest cleanup sites in the complex, Savannah River and Hanford, have long-term cleanup goals that have been less than completely defined. Hanford has a land use plan, but cleanup levels and disposal standards remain to be established, and Savannah River has a comprehensive site use plan, but land uses could change significantly as they are further considered by interested parties. Moreover, like West Valley, both sites face decisions on high-level waste disposal and the disposition of their on-site underground storage tanks. The disposition of these tanks—51 at Savannah River and 177 at Hanford—remains a multibillion-dollar cost uncertainty. The estimated total costs at these two sites alone will likely dominate DOE's cleanup program for the foreseeable future because they account for a major part of the cost of the entire program. (In 1998, Hanford's total costs were estimated at about $50 billion and Savannah River's at about $30 billion, compared with a then-estimated complexwide cost of $147 billion.)

On a complexwide basis, DOE's cleanup cost and schedule estimates are likely to be revised as more becomes known at many sites about the levels of cleanup that must be reached and the technologies to be used. In this regard, the Department has made some recent strides in improving the quality of its annual estimates of the costs and schedule for cleaning up the complex. As we reported in 1998, DOE has called upon field offices to provide more information on (1) the range of potential site cleanup options for sites whose cleanup levels are uncertain and (2) long-term maintenance and surveillance costs for sites that have been cleaned up. The latest estimate, about $198 billion, is based on a range of from $184 billion to $212 billion. According to DOE, the range reflects uncertainties recognized in the estimate and better communicates the uncertainties of projects that are innovative and complex.[40]

[40] To obtain the estimates, DOE's environmental management office analyzed field office data to estimate projects' base, high, and low costs, using a Monte Carlo model to find the cost uncertainty range.

West Valley Illustrates DOE-wide Cleanup Funding Dilemmas

West Valley also illustrates some of the dilemmas created by DOE's approach to funding the cleanup across the nuclear complex. DOE's current estimate for total West Valley cleanup costs is based on maintaining funding for the foreseeable future at current levels—about $107 million a year. This planning approach is referred to as "flat" funding. According to DOE officials, DOE's Ohio Area Office has implemented the flat funding approach for West Valley and four other nuclear cleanup sites in the region that it oversees.[41] DOE Ohio and West Valley officials said they do not consider the flat funding approach appropriate for West Valley, but they said it is the policy direction of DOE headquarters, on the basis of Office of Management and Budget direction. DOE Ohio and West Valley officials said the Ohio office receives an annual cleanup funding allocation for the five cleanup sites combined, including West Valley. In recent years, these offices have worked within the current "flat" budget estimates while at the same time working to accelerate the cleanup—an ambitious undertaking.

Flat funding may not always be cost-effective. In fact, according to DOE officials, the cost profile of cleanup projects is generally not flat: Often, annual costs increase early in the project and are followed by declining costs in later years. As a result, flat funding can add to overall costs and extend the time needed for project completion. Ohio and West Valley DOE officials agreed that flat funding may be a factor in the costs and time required to complete the West Valley cleanup, but they said any extra funds directed to West Valley could reduce the amount of funds directed to one or more of the other sites overseen by the Ohio office. In 2000, a departmental analysis done at West Valley showed that incrementally higher funding for West Valley could help to complete the cleanup faster and with substantial cost savings. Specifically, if the West Valley cleanup could be funded at about $130 million annually from 2006 through 2013, and at $135 million in 2014 and 2015, instead of $107 million for those years, West Valley's total cleanup costs could decrease by about $509

[41] During 1996-98, West Valley's funding actually decreased, from $119 million a year, to $118 million, to $114 million, and has been flat at $107 million for 1999 and 2000. It is projected to be flat at $107 million for 2001 and 2002.

million and essential cleanup tasks could be completed about 8 years earlier.[42]

Funding constraints at West Valley are not unique. They reflect DOE's funding dilemma across the nuclear complex. Complexwide, the Department has assumed that cleanup work will be funded annually at the same level. This assumption is based on recent appropriations and Office of Management and Budget guidance to promote balanced federal budgets, according to DOE officials. For DOE's nuclear cleanup program, such an approach can result in a significant gap between the funds needed for the complex cleanup versus the funds available, leading to cleanup delays and cost growth. To illustrate, as we testified in June 2000, projected annual cleanup needs for 2001 through 2010 at DOE's Paducah, Kentucky, uranium enrichment plant could exceed average annual funding by many millions of dollars.[43] This gap could delay the Paducah cleanup and add to its overall costs. Extended across the complex, the costs multiply. In 1998, DOE estimated a complexwide gap of $3.9 billion from 1999 to 2006 (in 1998 dollars), assuming flat funding of the Department's cleanup program at $5.75 billion a year. Our 1999 report on DOE's accelerated cleanup strategy questioned whether DOE sites could achieve the assumed cleanup goals and schedule, given the flat funding assumption. On the other hand, according to DOE, fiscal realities are likely to prevent fully closing the gap between funding needs and available funds.

West Valley Has Implications for National Decisionmaking on High-Level Waste Disposal

As the first DOE location likely to have all of its on-site high-level waste vitrified, West Valley is a potential early test case on the important issue of tank entombment versus removal. According to DOE plans, a record of decision on the disposition of the site's high-level waste tanks could be issued in 2005. At West Valley, four tanks are involved, but Hanford and Savannah River, which are also involved in making tank disposition decisions, have a combined total of over 200 tanks. At issue is whether these tanks are to be dug up, at great potential expense, and removed to

[42] The estimated time saved excludes disposition of the high-level waste canisters. The canisters are assumed to remain on-site in interim storage until shipment to a federal repository between 2036 and 2040. Thus, final site closure would occur in 2041, even with funding at a level somewhat above flat funding.

[43] *Nuclear Waste Cleanup: DOE's Cleanup Plan for the Paducah, Kentucky, Site Faces Uncertainties and Excludes Costly Activities* (GAO/T-RCED-00-225, June 27, 2000).

locations not yet chosen, or whether they can safely be left in place and subjected to long-term stewardship.

Tank closure is addressed in DOE orders, as well as in NRC decommissioning requirements and EPA and state of New York RCRA closure requirements. A DOE radioactive waste management order (O435.1) and accompanying manual provide a process that can result in reclassification of high-level wastes, allowing for the possibility of managing the wastes as low-level wastes. This could allow traces of the high-level wastes to remain in place, entombed in the tanks. In the waste management manual, these traces are referred to as "wastes incidental to reprocessing." With regard to Savannah River and Hanford, NRC has been advising DOE on its methodology for classification and stabilization of incidental waste. In the case of Hanford, NRC recommended three criteria for categorizing the wastes as incidental. Under these criteria, first, the wastes must be processed to remove key radionuclides to the maximum extent technically and economically practical; second, it must be shown that the wastes will be incorporated in a solid form at a concentration that does not exceed applicable concentration limits in applicable regulations (10 C.F.R., part 61); and third, the wastes must be managed pursuant to the Atomic Energy Act to meet safety requirements comparable to the performance objectives in the regulations (10 C.F.R., part 61, subpart C). In the case of Savannah River, NRC in June 2000 approved a more risk-informed and performance-based approach in analyzing DOE's methodology, principally aimed at satisfying the first and third criteria. For West Valley, NRC is considering whether to deal with the incidental waste issue in its cleanup standards.

Dealing with the tanks at West Valley and elsewhere will be costly and challenging. If West Valley follows these criteria and empties the site's four tanks as completely as technically feasible and at "economically practical" costs, and leaves them in place, such a decision would preclude anything approaching an unrestricted future use for the site. Conversely, according to DOE estimates, if the wastes are removed off-site so that future use of the site can be unrestricted, total cleanup costs for the site could roughly double, to over $8 billion. Moreover, this estimate is very uncertain because technologies for cutting the tanks up and removing them from the ground have yet to be developed. By extension, at Savannah River and Hanford, more extensive technological challenges and broader decisions costing many more billions of dollars are at stake.

Any decision on what to do with the tanks will be controversial. Some local interested parties appear to support to some degree DOE's idea of

entombing the West Valley tanks, recognizing that digging them up would be costly, may not be technologically feasible, and would put workers and the public at greater risk of radiation exposure. There is some indication that New York State could agree to a form of tank entombment that would involve something less than an unrestricted land use for the site. However, the state's Energy Research and Development Authority has said that if incidental waste is to be left at West Valley, DOE should remain on-site to administer long-term institutional controls. Some, including New York State officials, have spoken in favor of the idea of monitored retrievable storage of the tanks.[44] On the other hand, according to the Natural Resources Defense Council, the West Valley Act makes no provision for incidental quantities of high-level wastes to be exempted from permanent off-site disposal. The matter may be resolved in the courts. Currently, the Natural Resources Defense Council is challenging in court DOE's radioactive waste management order that could permit a tank "entombment" strategy to be implemented at Savannah River and other DOE sites.[45] In addition, according to a DOE official, there could be a legal challenge to any record of decision at West Valley to entomb the site's high-level waste tanks.

Conclusions

Substantial cleanup progress has been made at West Valley, particularly the successful vitrification of the site's high-level wastes. However, several factors are affecting the costs and pace of the remaining cleanup, and need resolution. In particular, if the differences between DOE and New York State on strategic issues affecting the site's future continue, including disagreements over their respective roles and responsibilities, they will likely further limit the precision of cleanup planning and potentially add to the costs and schedule for the West Valley cleanup. DOE and the state have spent several years trying to resolve their differing views on their long-term stewardship responsibilities at West Valley, particularly who will pay for permanent disposal of the site's vitrified wastes, and the extent to

[44] The local citizens' task force has recommended that all wastes remaining at the site be stored so they can be monitored and retrieved if the containment system and/or institutional controls fail. The group does not want a permanent "monolith" built at the site. DOE has supported this retrievable storage concept by developing a special grout (referred to as "reversible") with which the tanks would be filled. A DOE official at West Valley said the grout is considered suitable for removal from the tanks, should they be dug up in the future.

[45] Also, the Natural Resources Defense Council has petitioned NRC to exercise what the council interprets to be NRC licensing authority over the 51 tanks at Savannah River, although NRC does not agree that it has such authority, as stated in the *Federal Register* on Oct. 18, 2000.

which the site is to be cleaned up. The recent breakdown in negotiations, along with the historical federal-state conflict on who should take responsibility for West Valley's wastes, indicates to us that the two parties simply may not be able to resolve these issues on their own. In addition, the long-standing NRC-EPA disagreement on cleanup levels for NRC-licensed sites could have ramifications for West Valley's cleanup levels and costs. In June 2000, we raised as a matter for congressional consideration the need to clarify the two agencies' regulatory responsibilities relating to decommissioning NRC-licensed sites. In this context, specific steps by EPA and NRC to avoid dually regulating West Valley are warranted. Finally, a timely decision about the final disposition of West Valley's high-level and transuranic wastes could save hundreds of millions of dollars.

Matters for Congressional Consideration

Because DOE and New York State appear to be unable to reach an agreement on their future responsibilities under the West Valley Act, the Congress should consider amending the act to clarify their responsibilities—especially their respective stewardship responsibilities for historical radioactive contamination left on-site and their financial liabilities for fees that are to be paid for permanent disposal of high-level waste in an off-site repository.

Recommendations for Executive Action

To help address NRC's and EPA's regulatory responsibilities at NRC-licensed sites, we recommend that, specifically for West Valley, the Chairman, NRC, and the Administrator, EPA, in coordination with New York State, agree on how their different regulatory cleanup criteria should apply to the site.

To resolve where West Valley's high-level wastes should go, once DOE's and New York State's stewardship and cost-sharing responsibilities have been clarified, and potentially save hundreds of millions of dollars, we recommend that the Secretary of Energy pursue the timely removal of on-site vitrified high-level wastes, where feasible, either directly to a permanent repository, or to an interim site until a permanent repository is available.

To clarify where West Valley's transuranic wastes should go and potentially save millions of dollars, we recommend that the Secretary of Energy pursue timely removal of the site's transuranic wastes to an interim off-site storage location, or to WIPP for permanent disposal, as appropriate, either through administrative action or by seeking an amendment to the WIPP Land Withdrawal Act.

Agency Comments and Our Evaluation

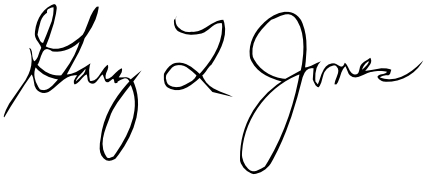
We provided DOE, the New York State Energy Research and Development Authority, NRC, and EPA with a draft of this report for their review and comment. DOE found the report to be a credible synopsis and assessment of the issues West Valley faces, while New York State concurred with the report's conclusions that clear radiological requirements, an agreed-upon preferred cleanup alternative, and resolution of nuclear waste disposal issues are critical to the success of the cleanup. However, in their comments, DOE and New York State continued to differ on who should assume ultimate responsibility for the wastes generated by past commercial reprocessing at West Valley. For example, DOE stated that, under the West Valley Act, it does not become the owner of the site and that after site decommissioning it does not envision a continuous on-site presence or long-term operational control there. DOE did say that in the event it leaves wastes behind, in the interest of public health and environmental protection, it would bear at least part of the financial responsibility for monitoring any remedies it had put in place. In contrast, New York State commented that one of the complicating factors at West Valley has been the conflicting interests of the state as site owner and DOE as site operator, and stated that one way to resolve conflicting jurisdictions on-site would be for DOE to agree to assume title and custody of the site pursuant to the Nuclear Waste Policy Act of 1982. Finally, the Department supported our recommendations concerning regulatory cleanup standards and the disposal of transuranic wastes, but disagreed with the recommendation on high-level waste disposal, stating that the Department has no disposal obligation until New York State enters into a disposal contract under the Nuclear Waste Policy Act. In this regard, we have modified the wording of our recommendation to more clearly recognize that resolving the question of responsibility for the high-level wastes is part of any long-term solution regarding their disposal.

DOE and New York State also provided technical clarifications on the draft report. NRC's and EPA's comments were limited to technical clarifications—NRC's by letter and EPA's by e-mail. We incorporated all four agencies' clarifications in the final report where appropriate. (The DOE, New York State Energy Research and Development Authority, and NRC comment letters are included in apps. III, IV, and V.)

As arranged with your offices, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days after the

date of this letter. At that time, we will send copies to the Honorable Spencer Abraham, Secretary of Energy; the Honorable Richard Meserve, Chairman, Nuclear Regulatory Commission; and the Honorable Christine Todd Whitman, Administrator, Environmental Protection Agency. We will also make copies available to others upon request.

If you have any questions about this report, please contact me on (202) 512-3841. Major contributors to this report were James Noel, Dave Brack, Michael Sagalow, and Ginger Tierney.



(Ms.) Gary L. Jones,
Director, Natural Resources
and Environment

Appendix I: Scope and Methodology

As requested, we examined (1) the status of the cleanup, (2) factors that may be hindering the cleanup, (3) the degree of certainty in the Department of Energy's (DOE) estimates of total cleanup costs and schedule, and (4) the degree to which the West Valley cleanup may reflect, or have implications for, larger cleanup challenges facing DOE and the nation. Specifically, to address the status of the cleanup, we interviewed and obtained documents from several federal, New York State, and local area officials associated with West Valley. Specifically, we spoke with representatives of, and/or obtained documents from, the following agencies:

- DOE, including the headquarters Offices of Environmental Management, Civilian Radioactive Waste Management, Environment, Safety, and Health, General Counsel, and Inspector General; and the DOE Ohio and West Valley field offices;

- The Nuclear Regulatory Commission (NRC) and Environmental Protection Agency (EPA), including headquarters and regional officials of both agencies; and

- New York State's Energy Research and Development Authority and Department of Environmental Conservation.

In addition, we interviewed representatives of, and/or obtained documents from, the Coalition on West Valley Nuclear Wastes, the Citizen's Task Force on West Valley, the Seneca Nation of Indians, and the Natural Resources Defense Council. To obtain information on past site status, we examined several GAO reports issued since 1977, as well as historical DOE reports. In addition, in order to independently assess DOE's environmental, safety, and health performance at West Valley, we talked to a range of federal, state, and local officials and examined DOE and NRC safety and oversight reports. In addition, we examined DOE data on West Valley in several departmental databases related to environmental, safety, and health matters.

To address factors that may be hindering the cleanup, we interviewed and/or obtained documentation from representatives of many of the above-listed federal, state, and local agencies and other interested parties. Using this documentary and testimonial evidence, we examined in particular the pace of the National Environmental Policy Act's compliance process at West Valley, as well as matters at issue in negotiations between DOE and the state of New York on their responsibilities for the site. Our review was limited in that these negotiations were and continue to be

considered confidential between the two parties. As a result, while we had access to various details of the negotiations, this report does not fully describe the negotiating positions of the two parties. Additionally, we documented the status of NRC's development of cleanup standards for the site, as well as the current status and potential future disposition of the site's high-level and transuranic wastes.

To address the degree of certainty in DOE's cleanup cost and schedule estimates, we interviewed DOE headquarters, Ohio, and West Valley officials and obtained documentation from them. To compare DOE's cost estimates to clean up the West Valley site that were made at different times since 1978, we converted the estimates of future costs to year-2000, present value dollars, using a 5.5-percent discount rate (i.e., the U.S. 30-year Treasury bond rate at the time of our conversion). For all cost estimates except the 1978 estimate, we used annual cost data (annual cost data for the 1978 estimate was not given) to make the conversion process more precise. To further obtain meaningful comparisons, we added historical annual costs to any DOE estimate that did not already include these costs, and future valued (i.e., escalated) all historical costs to year 2000 dollars using the actual U.S. 30-year Treasury bond rate for the respective year of each estimate. For the 1978 estimate, we future-valued the lump-sum amount to year-2000 dollars, using an 8.5-percent rate (i.e., the actual 1978 30-year U.S. Treasury bond rate). Because the 1978 estimate was a lump sum, its conversion to year-2000 dollars slightly biases upward the resulting year-2000 cost estimate, thereby reducing the estimated increase of the other cost estimates above the 1978 estimate.

To address the degree to which the West Valley cleanup may reflect, or have implications for, larger cleanup challenges facing DOE and the nation, we compared our analysis of West Valley with analyses we and others have performed of DOE's environmental management and nuclear waste disposal programs. We used this comparison to develop observations about West Valley's cleanup in context with the cleanup challenges at other DOE sites.

We performed our review from June 2000 through April 2001 in accordance with generally accepted government auditing standards.

Appendix II: West Valley Time Line

1960s	1966: Reprocessing of 640 metric tons of spent nuclear fuel begun at West Valley
1970s	1972: Plant is shut down for modifications due to new regulatory requirements; modifications estimated to cost $15 million and take 2 years to complete 1976: Modifications reestimated to cost $600 million; operator decides to abandon business and site
1980s	1980: President Carter signs West Valley Demonstration Project Act 1982: Record of decision published establishing vitrification as high-level waste solidification method; DOE and contractor assume operational control of site 1987: Coalition on West Valley Nuclear Wastes and DOE sign Stipulation of Compromise 1988: DOE publishes notice of intent to prepare closure EIS
1990s	1991: NRC becomes cooperating agency in the EIS process 1996: Draft cleanup and closure EIS issued; vitrification of high-level waste begun 1999: Negotiations between DOE and New York State on site stewardship begun; NRC issues draft West Valley cleanup standards
2000s	2001: DOE and New York Energy Authority negotiations break down without agreement; final NRC cleanup standards expected to be issued 2002: Virtrification of high-level waste expected to be completed 2005: West Valley decommissioning record of decision projected to be issued
2010s	2010: Federal high-level waste repository projected to open
2020s	2023: Projected completion of all cleanup tasks except disposition of high-level waste
2030s	2036: West Valley projected to begin shipping high-level waste to federal repository
2040s	2041: Projected site closure

Future event

Appendix III: Comments From the Department of Energy

Note: GAO comments supplementing those in the report text appear at the end of this letter.

Department of Energy
Washington, DC 20585

13 APR 2001

Ms. Gary L. Jones
Director
Natural Resources and Environment
General Accounting Office
441 G Street, NW
Washington, D.C. 20548

Dear Ms. Jones:

We are writing to provide the Department of Energy's (DOE) response to the General Accounting Office (GAO) Draft Report "Nuclear Waste: An Agreed-Upon Cleanup Level for the West Valley Site is Critically Needed," (GAO-01-314).

Overall, we commend GAO for the review team's thorough research and attention to detail that is apparent in this report. We find the report to be a credible synopsis and assessment of the challenging issues the West Valley Demonstration Project (WVDP) faces. The Department appreciates GAO's observations regarding our successful efforts thus far in executing the Project and the challenges that have already been overcome in solidifying the liquid high-level waste (HLW) and reducing the risk to the environment posed by the site.

See comment 1.

Since a major portion of the report pertains to the issues and challenges associated with the inability of DOE and New York State (NYS), represented by the NYS Energy Research and Development Authority (NYSERDA), to reach agreement on their respective responsibilities for the site, we would like to take the opportunity to clarify several aspects of the relationship. First, the West Valley Demonstration Project (WVDP) Act does not require that DOE and NYS reach agreement on DOE's decisions for how it will complete the Project. However, it is DOE policy to work closely with its key stakeholders as it makes cleanup decisions; therefore, DOE would prefer to arrive at a decision for meeting its remaining obligations that is not only agreeable to NYS but also consistent with decisions for which New York is responsible. For these reasons, and as encouraged by the National Environmental Policy Act (NEPA), DOE and NYS made the decision early on to jointly evaluate their respective decisions under NEPA. However, DOE could, if necessary to facilitate completion of its obligations under the WVDP Act, proceed with its own NEPA decision-making process for those areas where it alone is responsible, that is, for its responsibilities established in the WVDP ACT.

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See comment 2.

Second, under the WVDP Act, DOE does not become the owner of the site, nor is it authorized or required to address future land use of the site, as suggested in the draft report. After decommissioning pursuant to the WVDP Act, DOE is to return the 200-acre Project site to NYSERDA which, as the site's owner, is ultimately responsible for issues pertaining to future land use. Additionally, the draft report in some ways is confusing with regard to the issues between the parties surrounding long-term stewardship. The Department has clearly stated both to the public and to NYSERDA that DOE would, in the event it leaves waste behind, bear at least a part of the financial responsibility for monitoring the remedies it put in place and for maintaining those remedies. The DOE has also indicated that it would, if necessary, revisit the controls it put in place. However, this role, does not require a continuous on-site presence by DOE or long-term operational control of the site by DOE, so that the Department would be able to return the site to NYSERDA as envisioned in the WVDP Act. Further, it is the Department's position that the WVDP Act does not authorize DOE to remain at the site once DOE has completed decommissioning pursuant to the Act.

See comment 3.

We would also like to take this opportunity to respond to the statement on page 17 of the draft report that "the status of the proposal is unclear following the recent breakdown of the DOE-New York State negotiations." The current status of DOE's proposal is clear. The DOE withdrew the proposal at the conclusion of negotiations in January. However, the day-to-day working relationship between the respective DOE and NYSERDA organizations continues to foster informal communications and information exchange that will help both parties determine the appropriate time to resume formal negotiations. Also, it is important to point out that cleanup work at the site continues and that DOE can complete all of its responsibilities under the WVDP Act even if negotiations never resume.

See comment 4.

The DOE supports GAO's recommendations concerning regulatory cleanup criteria and identification of a disposal pathway for transuranic waste. With respect to high-level waste, however, DOE cannot accept GAO's recommendation. The DOE has no obligation to take title to and dispose of high-level waste unless and until NYSERDA enters into a disposal contract under the Nuclear Waste Policy Act and pays an equitable disposal fee to the Nuclear Waste Fund.

In summary, GAO has addressed many facets of what may be the most unique cleanup site in the DOE complex. We thank you for the opportunity to comment on the report. Enclosed are additional are more specific comments, which are offered to help clarify some of the complexities of the Project and further assist Congress in better understanding the issues. The DOE remains committed to

fulfilling its responsibilities pursuant to the WVDP Act and looks forward to resolving the challenges associated with this commitment.

If you have further questions, please contact me at (202) 586-7710 or have a member of your staff contact Mr. James Fiore, Deputy Assistant Secretary for Office of Site Closure, at (202) 586-6331.

Sincerely,

Carolyn L. Huntoon

Carolyn L. Huntoon
Acting Assistant Secretary for
Environmental Management

Enclosure

The following are GAO's comments on the letter dated April 13, 2001, from the Acting Assistant Secretary for Environmental Management, Department of Energy.

1. We agree that the West Valley Act does not require DOE and New York State to reach an agreement on the overall future of the site or how DOE should complete its responsibilities there. We also agree that the National Environmental Policy Act (NEPA) encourages DOE and the state to cooperate on environmental decisionmaking. Accordingly, wording in the final report has been clarified. Furthermore, we believe DOE's stated policy of cooperation with the state in addressing strategic issues related to the West Valley cleanup—and its specific pursuit of negotiations with the state—is a preferable course of action as well as key to progress with the cleanup. Nevertheless, because DOE and the state appear to be unable to reach agreement on these strategic issues, we have raised the matter of clarifying their on-site responsibilities for congressional attention.

2. We agree that DOE does not become the site owner after the cleanup is completed, and wording has been clarified in the final report to reflect DOE's views. However, we believe DOE's ongoing and prospective cleanup tasks, as the Department views them under NEPA and the West Valley Act, are inevitably related to West Valley's overall future—its ultimate end state and land use. For example, if DOE's mandated tasks are to involve leaving the high-level waste tanks in place, this could preclude achieving an end state for the site that would permit unrestricted land use. Considering this, we believe it was appropriate that DOE and New York State, in their recent unsuccessful negotiations, attempted to reach agreement on the site's overall future—in the form of a preferred cleanup alternative or "vision" for the site.

3. We have clarified wording in the final report to reflect DOE's views. Nevertheless, from reading both DOE's and the New York State Energy Research and Development Authority's comments on our draft report, it remains unclear to us if or when the proposal will be revived and/or formal negotiations resumed.

4. We have modified the wording of our recommendation on high-level wastes to more clearly recognize that resolving the question of ultimate responsibility for the wastes is part of any long-term solution regarding their disposal.

Appendix IV: Comments From New York State

Note: GAO comments supplementing those in the report text appear at the end of this letter.

NYSERDA New York State Energy Research and Development Authority
William R. Howell, *Chairman*
William M. Flynn, *President*
West Valley Site Management Program, 10282 Rock Springs Road, West Valley, NY 14171-9799
(716) 942-4387 • Fax: (716) 942-2148 • http://www.nyserda.org/

April 11, 2001

James Noel
Assistant Director
General Accounting Office
Rm. 2440
441 G St. NW
Washington, DC 20548

Dear Mr. Noel:

I want to thank you for the opportunity to review and comment on the General Accounting Office's draft report titled "An Agreed-Upon Cleanup Level for the West Valley Site is Critically Needed." I have enclosed NYSERDA's comments on the report, which I sent via e-mail on April 10 to Mr. Dave Brack per his request.

If you have any questions, please call me at (716) 942-4378.

Sincerely,

WEST VALLEY SITE MANAGEMENT PROGRAM

Paul L. Piciulo, Ph.D.
Program Director

PLP/ams
Enclosure:
(1) *Comments of the New York State Energy Research and Development Authority (NYSERDA) on the Report of the General Accounting Office (GAO) Entitled "An Agreed-Upon Cleanup Level for the West Valley Site is Critically Needed"*

cc: D. Brack, GAO (w/enc.)
H. Brodie (w/enc.)
File #10200-0203 (w/enc.)

PLP/01ams034.plp

COMMENTS OF THE NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY (NYSERDA) ON THE REPORT OF THE GENERAL ACCOUNTING OFFICE (GAO) ENTITLED "AN AGREED-UPON CLEANUP LEVEL FOR THE WEST VALLEY SITE IS CRITICALLY NEEDED"

See comment 1.

Use of the term "cleanup level" to refer both to the preferred alternative for the cleanup (*i.e.*, removal or in-place closure of wastes and facilities) and to the radiological criteria that any preferred alternative must meet (generally expressed as a maximum dose to a population) is confusing. Under the West Valley Demonstration Project Act, the Nuclear Regulatory Commission (Commission) must prescribe requirements for decontaminating and decommissioning the facilities and materials used in carrying out the Project. It is the task of the Department of Energy (DOE), in cooperation with NYSERDA, to devise and carry out a preferred alternative that must ultimately meet the requirements prescribed by the Commission in order to complete the Project.

NYSERDA concurs with the GAO's conclusion that it is critical to the continuing success of the Project to have both clear radiological requirements and an agreed-upon preferred alternative. NYSERDA has participated extensively in the process through which the Commission has been developing the radiological requirements for the West Valley site. NYSERDA also negotiated in good faith for almost two years with DOE to develop a mutually acceptable preferred alternative for the site. NYSERDA was disappointed when DOE decided to withdraw its negotiating proposals in January 2001, and remains committed to return to the table as soon as DOE is ready to complete those negotiations.

Complicating factors at West Valley that make the site different from other DOE projects are the conflicting interests of NYSERDA as site owner and DOE as site operator, and the potentially conflicting regulatory authorities of the Commission, the Environmental Protection Agency and the New York State Department of Environmental Conservation. One way to resolve these jurisdictional conflicts would be for DOE to agree to assume title and custody of the West Valley site pursuant to section 151(b) of the Nuclear Waste Policy Act of 1982 (Public Law 97-425) (NWPA). This would put West Valley on the same footing as other DOE sites with high-level waste tanks and allow DOE to determine national policy for high-level waste tanks and associated facilities in a consistent manner complex-wide.

NYSERDA concurs with GAO that resolution of issues concerning where West Valley's nuclear wastes will go is also critical to the success of the Project. With respect to transuranic wastes, NYSERDA believes that those wastes can and should be disposed of at the Waste Isolation Pilot Plant (WIPP). Section 2 (19) of the WIPP Land Withdrawal Act (Public Law 102-579) defines WIPP as a facility authorized to "demonstrate the safe disposal of radioactive waste materials generated by atomic energy defense activities. The term "atomic energy defense activity" is defined in section 2 (3) of NWPA to include "any activity of the Secretary performed in whole or in part in carrying out any of the following functions: ....(E) defense nuclear waste and materials by-products management." The West Valley Demonstration Project is clearly an activity of the Secretary performed, at least in part, to manage defense nuclear waste. [Sixty percent of the spent fuel reprocessed at West Valley was from the Hanford N-reactor.] Thus, the West Valley Demonstration Project is an "atomic energy defense activity" and waste from that activity may be disposed of at WIPP. The solution to this problem requires only an administrative decision by DOE.

The following are GAO's comments on the letter dated April 11, 2001, from the Program Director, West Valley Site Management Program, New York State Energy Research and Development Authority.

1. We agree with this comment about the use of the term "cleanup level" and have changed the title of the final report and selected language throughout the report.

Appendix V: Comments From the Nuclear Regulatory Commission

Note: GAO comments supplementing those in the report text appear at the end of this letter.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

April 13, 2001

Ms. Gary L. Jones, Director
Natural Resources and Environment Team
United States General Accounting Office
Washington, DC 20548

Dear Ms. Jones:

See comment 1.

I am responding to your request dated March 27, 2001, to review and comment on the U.S. General Accounting Offices's (GAO's) draft report entitled, "Nuclear Waste - An Agreed-Upon Cleanup Level for the West Valley Site is Critically Needed," dated April 2001. We have identified inaccuracies, concerning our responsibilities, that should be corrected. In addition, we made some general comments and suggestions for the GAO to consider before finalizing the report.

Our comments and suggestions on the draft report are enclosed. If you have any questions, please contact Mr. Martin Virgilio, Director, Office of Nuclear Material Safety and Safeguards, at (301) 415-7800.

Sincerely,

William D. Travers
Executive Director
for Operations

Enclosure: U.S. NRC Comments

The following are GAO's comments on the letter dated April 13, 2001, from the Executive Director for Operations, Nuclear Regulatory Commission.

1. Where appropriate, wording reflecting NRC's clarifications has been added to the final report.

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