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Report to the Chairman, Committee on Armed Services, U.S. Senate

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DEPARTMENT OF ENERGY

Accelerated Closure of Rocky Flats: Status and Obstacles

GAO/RCED-99-100

GAO

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Resources, Community and
Economic Development Division

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April 30, 1999

The Honorable John W. Warner
Chairman, Committee on
Armed Services
United States Senate

Dear Mr. Chairman:

In response to your request, this report reviews the Department of Energy's ability to close the Rocky Flats Environmental Technology Site by the end of 2006. Specifically, it examines (1) DOE's plans for accelerating the site's closure and challenges that could impede closure; (2) the condition of the site at closure and the activities that will remain after closure; and (3) the costs of closing the site and the savings expected from accelerating its closure.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 15 days after the date of this letter. At that time, we will send copies of this report to the Honorable Bill Richardson, Secretary of Energy; the Honorable Jacob Lew, Director, Office of Management and Budget; and other interested parties. Copies will also be made available to others upon request.

Please call me at (202) 512-3841 if you or your staff have any questions. Major contributors to this report are listed in appendix II.

Sincerely yours,

(Ms.) Gary L. Jones
Associate Director, Energy,
Resources, and Science Issues

Executive Summary

Purpose

In 1989, the Rocky Flats Environmental Technology Site stopped making plutonium components for nuclear weapons, leaving the Department of Energy (DOE) with the challenge of managing and cleaning up nearly 40 years' worth of contamination at the site. Compared with the other sites in DOE's former nuclear weapons production complex, Rocky Flats has some of the most dangerous and highest-risk materials and facilities. Currently, DOE is spending approximately two-thirds of the site's annual budget of nearly $700 million to maintain the site in a relatively safe and secure state, with the remaining one-third going to cleanup. Partly because of these high maintenance costs, the Department developed plans in fiscal year 1994 to clean up and close the site. Subsequently, DOE advanced the site's goal for closure several times, from the original date of 2070 to the current date of 2006.

Concerned about the Department's ability to meet its current goal to close Rocky Flats by the end of 2006, the Chairman of the Senate Committee on Armed Services asked GAO to review (1) DOE's plans for accelerating the site's closure and challenges that could impede closure; (2) the condition of the site at closure and the activities that will remain after closure; and (3) the costs of closing the site and the savings expected from accelerating its closure.

Background

The Rocky Flats site, located at the base of Colorado's Rocky Mountains, lies about 16 miles northwest of Denver. More than 2.5 million people live within a 50-mile radius of the site. Of particular concern are the site's special nuclear materials--such as plutonium and uranium--and radioactive wastes, which pose substantial risks to workers, the public, and the environment. In 1995, after entering into a 5-year contract with DOE to manage Rocky Flats, Kaiser-Hill Company, L.L.C., began to stabilize and consolidate these materials for safe storage until they could be removed from the site. Kaiser-Hill and DOE also began to arrange for other DOE and commercial facilities to receive the various radioactive and hazardous materials and wastes that had accumulated at the site or were by-products of cleanup activities. Some wastes will be generated in large quantities throughout the site's cleanup.

In 1996, DOE signed the Rocky Flats Cleanup Agreement with the U.S. Environmental Protection Agency (EPA) and the state of Colorado, the primary regulators of cleanup activities at Rocky Flats. Under the cleanup agreement, special nuclear materials will be removed by 2015; other

radioactive and hazardous wastes will be removed; and all buildings will be decontaminated, decommissioned, and demolished. DOE plans to close the site when those tasks are complete. Also in 1996, DOE's Office of Environmental Management revamped its plans for cleaning up the Department's contaminated sites, attempting to accelerate the closure of sites and coordinate cleanup activities across the DOE complex. In response, in 1997, Kaiser-Hill proposed advancing Rocky Flats' closure to 2010.[1] This plan remains in effect today, even though DOE has since accelerated the target date for closing the site to the end of 2006.

The cleanup and closure of Rocky Flats involves not only DOE and the site's contractor and subcontractors but also regulatory and oversight agencies and others with an interest in the site's cleanup and closure. In addition to EPA and Colorado, the site's regulatory and oversight bodies include the Department of the Interior's Fish and Wildlife Service and the Defense Nuclear Facilities Safety Board. Other interested parties--or stakeholders--include local governments; citizen, community, business, and environmental groups; and individuals.

Results in Brief

While DOE and Kaiser-Hill have had some success in accelerating cleanup activities, it is questionable whether they can meet the Department's target date of 2006 for cleaning up and closing Rocky Flats at the costs and savings originally projected. They face numerous challenges, significant compression of scheduled activities, and unresolved issues relating to the disposal of certain wastes and the site's condition at closure.

Kaiser-Hill has encountered delays in implementing its plan to close the site in 2010 and expects to have a detailed plan and schedule for closing the site by the end of 2006 in May 1999. DOE and Kaiser-Hill believe that the contractor can take advantage of "learning curves and efficiencies" gained through early efforts to expedite cleanup and closure activities. However, DOE and Kaiser-Hill must overcome various challenges to accelerate key activities to close the site by the end of 2006. For example, they have to compress the 2010 schedule, which calls for decontaminating and decommissioning the majority of the site's buildings from 2005 through 2007 and demolishing over two-thirds of the buildings in 2006 or later. However, the contractor has not determined how to compress these

[1]The 2010 plan is based on closing the site by the end of fiscal year 2010.

activities enough to close the site by the end of 2006, and some site officials question both the feasibility of compressing the schedule and the availability of resources, especially of qualified workers. Furthermore, while the plans for closing the site depend on other organizations within and outside the Department to take the site's materials and wastes for storage or disposal, several types of materials and wastes--including some low-level radioactive waste and some uranium--have no sites available to take them. Nevertheless, DOE and Kaiser-Hill officially maintain that the contractor can close the site by the end of 2006, primarily by taking advantage of lessons learned and efficiencies gained through experience.

DOE, EPA, and Colorado have agreed, in general, on the condition of the site when it is closed. Nevertheless, many specific decisions still must be made. Issues remaining to be resolved include how the site will be used in the future and what level of cleanup will be required. If a more stringent cleanup level will be required than the interim level agreed to by DOE, EPA, and Colorado, the site's closure could be delayed. In addition, DOE is just starting to consider issues that will be important after the site is closed, such as who will own, monitor, and maintain the site and what barriers will be used to prevent exposure to residual contamination. Developing plans and cost estimates for the site after closure will be difficult until agreement has been reached on all aspects of the site's closure and on future uses of the site.

The costs of cleaning up and closing Rocky Flats could be higher than DOE's official estimate of $7.3 billion[2] for fiscal year 1997 through fiscal year 2010. Although DOE has not validated the accuracy of this estimate, DOE and contractor site managers maintain that the site can be closed for $7.3 billion. However, the contractor's 1998 detailed cost estimate, based on the costs of specific projects needed to close the site, totaled $8.4 billion. Assumptions underlying both estimates have changed or have the potential to change, generally indicating higher costs. In addition, these estimates do not include the costs that will be incurred after the site is closed, which could range from hundreds of millions to billions of dollars over a period of the first 30 to 40 years. Finally, the savings estimate for accelerating the site's closure from 2010 to 2006 was based on avoiding the costs of operating and maintaining the site for 4 years. Therefore, if closure occurs after 2006, the savings could be less than DOE's $1.3 billion

[2]Unless otherwise noted, dollar values represent the sum of annual expenditures and incorporate an annual 2.7-percent increase for expected inflation.

estimate. A preliminary estimate presented by the contractor in February 1999 indicates that the savings from closing the site by the end of 2006 could be lower.

DOE's decision to accelerate the closure of Rocky Flats to 2006 is laudable. If the cleanup and closure can be accelerated, health and safety risks may be reduced and financial benefits may be achieved. With the May 1999 issuance of Kaiser-Hill's detailed plan for closing the site by the end of 2006, the likelihood of this effort's success and the accompanying potential benefits will become clearer.

Principal Findings

DOE Faces Many Challenges in Accelerating the Site's Closure

Although Kaiser-Hill does not expect to have detailed plans for closing the site by the end of 2006 until May 1999, both DOE and the contractor believe that the accelerated closure date is feasible. While developing detailed plans, the contractor is attempting to advance scheduled activities, especially those viewed as critical to closing the site by the end of 2006. However, some of the work completed to date has fallen behind the existing schedule for closing the site in 2010. For example, the contractor has encountered delays in preparing several types of nuclear wastes for removal, as well as delays in shipping special nuclear materials from the site--both considered key to closing the site in 2010.

The contractor has identified four key activities that must be accelerated to close the site by the end of 2006. These include (1) removing about 106 metric tons of plutonium-contaminated residues left over from nuclear weapons production; (2) shipping approximately 16.5 metric tons of special nuclear materials off-site; (3) decontaminating and decommissioning the site's 691 buildings and facilities; and (4) constructing barriers to prevent exposure to residual contamination. The contractor has had some successes in accelerating some of these activities. However, challenges in implementing each of these activities could hinder acceleration. For example, the site has had difficulty readying the residues and special nuclear materials for removal from the site; decontamination and decommissioning are costing more and taking longer than anticipated; and DOE and the contractor have not reached agreement with the site's regulators or stakeholders on the use of protective barriers over portions of the industrial area.

Other challenges within and outside the Department could also hinder closure. For example, the operation of DOE's Waste Isolation Pilot Plant in New Mexico was delayed because of regulatory issues and litigation.[3] Consequently, Rocky Flats could not dispose of radioactive waste there. In addition, several types of "orphan" materials and wastes--including some low-level radioactive and hazardous wastes and some uranium contaminated with plutonium or hazardous materials--have no site available to take them. To overcome these challenges, DOE is working with the site's regulators and stakeholders to coordinate Rocky Flats' cleanup and closure activities with other organizations within and outside the Department. However, DOE's progress in accelerating the site's closure will depend, in part, on the priority given to Rocky Flats' activities by other DOE sites and organizations; the availability of transportation resources; and litigation, which is largely outside DOE's control.

Status of the Site at Closure and Activities Required After Closure Have Not Been Defined

Although there is general consensus that Rocky Flats should be closed, DOE has not reached agreement with regulators or other stakeholders on specifics of the condition of the site at closure or on its future uses. According to DOE, it is moving forward on decisions concerning the closure of the site and activities after closure in accordance with the regulatory requirements governing the site's cleanup. In the meantime, DOE and the contractor are basing their closure plans and estimates on broad goals and objectives addressed in the Rocky Flats Cleanup Agreement. These include removing the site's special nuclear materials, radioactive and hazardous wastes, and buildings, as well as cleaning up the site's 6,000-acre buffer zone for use as open space and its 385-acre former production area for potential industrial use or for use as restricted open space.

Decisions or changes to assumptions about the status of Rocky Flats at closure could affect current and future cleanup requirements and, therefore, the feasibility of closing the site by the end of 2006. For example, the specifics of the future uses of the site are still undecided. Similarly, the interim soil cleanup level agreed to by DOE and the regulators has been questioned by local governments and by citizen and environmental groups. A change to a more stringent cleanup level could

[3]The Waste Isolation Pilot Plant is DOE's deep geologic repository for transuranic and transuranic mixed waste, located in an underground salt formation near Carlsbad, New Mexico. On Mar. 26, 1999, DOE made its first shipment to the facility from Los Alamos. DOE anticipates beginning shipments from Rocky Flats over the next several months.

entail more cleanup work and could ultimately affect the site's closure date.

DOE is just beginning to consider how Rocky Flats will be used after it is closed. No decisions have been made about whether additional cleanup or the removal of roads and other remaining infrastructure will be required; who will own, monitor and maintain the site; or what kinds of barriers (physical or legal) will be used to prevent exposure to residual contamination at the site. Although DOE is developing draft guidance for all of its sites on activities and responsibilities after closure, this guidance will take several years to develop. In any event, until DOE and the regulators have agreed on the condition of the site at closure and its future uses, DOE may not be able to plan effectively for activities after closure.

Costs of Closing Rocky Flats May Be Higher Than Estimated

DOE's official estimate of the costs to clean up and close Rocky Flats is $7.3 billion. This estimate is based on a 1997 proposal by Kaiser-Hill to close the site in 2010. Both DOE and the contractor maintain that the site can be closed in 2010 for $7.3 billion; however, several factors suggest that the costs could be substantially higher. First, Kaiser-Hill's mid-level managers responsible for specific projects necessary for closure recently estimated that it would cost $8.4 billion to close the site. This estimate was based on the same major assumptions and schedule that Kaiser-Hill used for the $7.3 billion estimate. Finally, a number of assumptions underlying the $7.3 billion estimate have changed or have the potential to change in ways that would generally increase costs. For example, the contractor's assumptions about the costs of decontaminating and decommissioning the site's facilities changed with experience, causing the contractor to nearly triple the cost estimate for these activities.

DOE's costs to manage Rocky Flats will not end when the site is closed. Because DOE and the regulators have not yet defined DOE's responsibilities after closure, DOE has not developed detailed cost estimates. However, according to DOE site officials, DOE could incur costs of as much as $100 million[4] for additional cleanup; $20 million to $50 million per year for monitoring and maintenance,[5] and at least $50 million

[4]Unless otherwise noted, the cost estimates for activities after closure are in fiscal year 1998 constant dollars and are net of inflation.

[5]Site officials estimate that the total cost of monitoring and maintaining the site through 2040, including adjustments for expected inflation, will be nearly $1.5 billion.

per year for workers' pensions and benefits. In addition, DOE could be exposed to litigation seeking compensation for damages resulting from the effects of the site's activities on workers, nearby residents, or natural resources.

DOE originally estimated that it would save $1.3 billion by closing the site by the end of 2006 instead of in 2010. This estimate represented the basic costs of operating and maintaining the site for 4 years--costs that DOE would avoid by closing the site 4 years earlier. However, given the progress to date and the challenges that remain, several site officials questioned the feasibility of closing the site by the end of 2006. As long as the site remains open, DOE will continue to incur operations and maintenance costs, thereby reducing the savings. In addition, the contractor's February 1999 preliminary cost estimate for closing the site by the end of 2006 indicated that the savings from closing the site 4 years earlier may be only $700 million.

Recommendations

This report makes no recommendations.

Agency Comments

GAO provided a draft of this report to DOE for its review and comment. The Department generally concurred with the facts of the report, stating that GAO had done a thorough job of documenting the complexity, uncertainties, and challenges the Department is facing in accelerating the closure of Rocky Flats. However, the Department commented that while the report does note some of the site's accomplishments, it does not adequately recognize the progress already made or the obstacles already overcome. GAO added material to the report to more thoroughly discuss the actions that DOE has taken. In addition, the Department raised a concern that the report identifies uncertainties facing the site's closure that (1) are subject to the regulations governing the cleanup, (2) are not at a point where resolution is necessary, or (3) are not obstacles to closure because the resolution of some uncertainties falls under the Rocky Flats Cleanup Agreement. On the basis of DOE's comments, GAO added information to the report, such as statements about the Department's actions under the regulations governing the site's cleanup, including the Comprehensive Environmental Response, Compensation, and Liability Act. While DOE does not view the issues discussed as obstacles to closure, GAO believes that the issues could affect the site's closure because they are

subject to a number of decisions and changes; as a result, GAO did not revise this part of the report.

More detailed discussions of the Department's comments are included at the end of chapters 2 and 3. The full text of DOE's comments is presented in appendix I. The Department separately provided a number of technical comments, and GAO revised the report, where appropriate, to reflect them.

Contents

Abbreviations

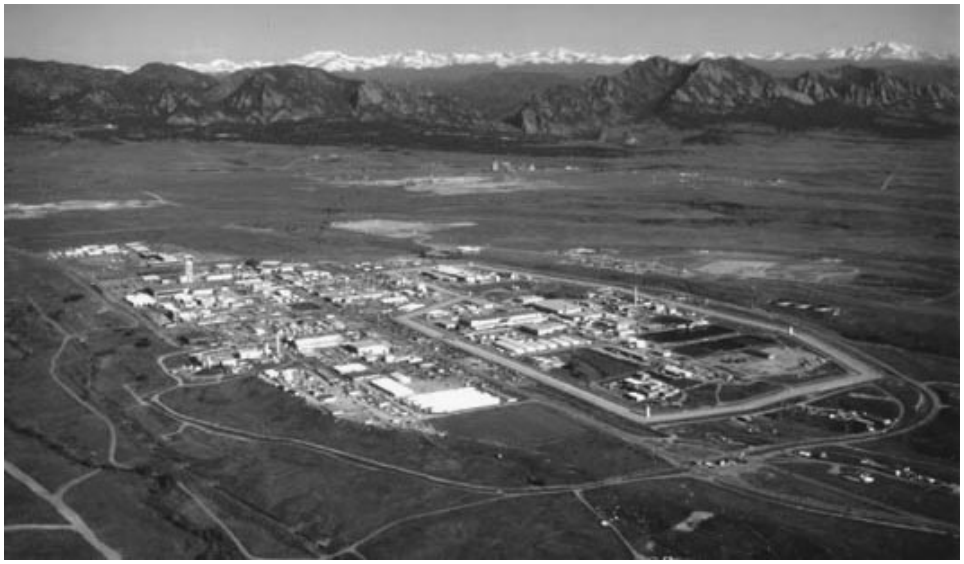
DOE	Department of Energy
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
EPA	Environmental Protection Agency
GAO	General Accounting Office
PCB	polychlorinated biphenyl
RCRA	Resource Conservation and Recovery Act
TRUPACT	Transuranic Package Transporter
WIPP	Waste Isolation Pilot Plant

Introduction

History of Rocky Flats

Rocky Flats Environmental Technology Site, shown in figure 1.1, occupies about 6,300 acres at the base of the foothills of the Rocky Mountains, about 16 miles northwest of Denver, Colorado. The site began operations in 1952 and, at the height of the Cold War, was 1 of 16 major U.S. defense nuclear facilities. Rocky Flats received plutonium that was manufactured elsewhere and produced plutonium triggers, or "pits," for nuclear weapons. Most nuclear materials and other hazardous substances used in the production of plutonium pits were employed in the site's industrial area--about 385 acres in the center of the site, where most of the 691 buildings and facilities were located. The remaining nearly 6,000 acres served as a buffer zone to help ensure the security of the nuclear material and of the site's operations, as well as the safety of nearby residents.

Figure 1.1: Rocky Flats Environmental Technology Site



Source: Kaiser-Hill.

For years, the site's principal regulators--the Environmental Protection Agency (EPA) and the state of Colorado--expressed concerns about potential threats to the environment and human health and safety at Rocky Flats. In 1986, the Department of Energy (DOE) signed an agreement with EPA and Colorado to ensure compliance with certain environmental regulatory requirements and to establish milestones for major cleanup operations. However, in 1989, Federal Bureau of Investigation agents and

EPA officials raided Rocky Flats, responding to alleged violations of federal environmental laws and regulations. After the raid, DOE stopped production at the site. Environmental studies revealed that, over time, radioactive and hazardous substances had been released into the environment, contaminating the groundwater, soil, and surface water at the site. In 1991, DOE signed a new agreement with EPA and Colorado to ensure compliance with environmental laws and regulations and to set milestones for certain cleanup activities. However, DOE fell behind these milestones and, in 1994, agreed to regulatory penalties and supplemental environmental projects costing an additional $2.8 million.

In fiscal year 1994, the Department developed plans to close Rocky Flats. In 1996, DOE signed another agreement with EPA and Colorado, called the Rocky Flats Cleanup Agreement, which allowed DOE and the regulators to set priorities, make decisions on cleanup and closure, and establish decision-making processes. Of particular concern to the regulators were the weapons-grade special nuclear materials (plutonium and enriched uranium) and other radioactive and hazardous materials left at the site when production ceased. These materials pose substantial threats to the environment and could jeopardize human health and safety. An estimated 2.5 million persons live within 50 miles of Rocky Flats, and recent growth around the site, including residential and industrial construction adjacent to the buffer zone, has raised concerns for DOE and the regulators about possible future uses of the site.

Magnitude of the Cleanup and Closure Effort

When Rocky Flats was shut down in 1989, DOE assumed that the site would resume production and left much of its 16.5 metric tons[1] of special nuclear materials in processing systems or short-term storage. But the site did not resume operations, and the short-term storage proved inadequate for the longer term, especially for plutonium, plutonium-contaminated residues, and plutonium- and uranium-bearing solutions. In 1994, DOE's Plutonium Working Group identified numerous problems with Rocky Flats' storage of plutonium and contaminated residues, including containers that had ruptured because the materials were improperly packaged and stored.[2] The group also reported that many of the site's buildings and much of the equipment, some dating back to the 1950s and 1960s, had deteriorated with

[1]A metric ton is equal to 1 million grams, or 1.1 tons.

[2]Plutonium Working Group Report on Environmental, Safety and Health Vulnerabilities Associated with the Department's Plutonium Storage (DOE/EH-0415, Nov. 1994).

age. Furthermore, some of the safety systems for these buildings and equipment had become unreliable. Today, DOE and its contractor, Kaiser-Hill, face massive challenges in cleaning up the results of nearly 40 years' worth of nuclear weapons production--removing the site's materials and waste, cleaning up and demolishing the site's structures, and reducing the contamination at the site to agreed upon levels.

The Site's Nuclear Materials and Wastes

To close the site, Kaiser-Hill must prepare and ship huge quantities of materials and wastes from the site, many of them radioactive. These activities must be largely completed before the contractor can remove the site's structures and perform further cleanup activities. Each type of material and waste presents its own challenges. The type of processing and packaging required for each type of nuclear material and waste varies in complexity. Descriptions of the primary types of nuclear materials and wastes follow.

- Special nuclear materials. When the decision was made to close Rocky Flats, there were approximately 16.5 metric tons of special nuclear materials on the site—about 6.7 metric tons of enriched uranium and about 9.8 metric tons of plutonium metals and oxides and plutonium pits--to prepare and ship off-site. Uranium is a naturally occurring radioactive element that can be enriched to increase the percentage of a particular uranium isotope for use in nuclear weapons or as reactor fuel. Some of the site's enriched uranium must be processed to remove plutonium contamination before it can be packaged and shipped to a site designated to receive the material. The contractor recently started shipping enriched uranium to DOE's Oak Ridge Reservation and expects to complete its shipments of uranium to this facility by September 1999. The contractor reports that as of January 1999, it had shipped 40 percent of the enriched uranium off-site. Plutonium, a man-made radioactive element produced by irradiating uranium in nuclear reactors, is primarily in the form of metals, oxides (fine powders), and pits. The plutonium metals and oxides must be stabilized before they can be shipped. Stabilization includes brushing the metals to remove loose oxides and heating the oxides to a high temperature to remove moisture and other impurities, and reduce the potential for dispersal. Both the metals and the oxides must then be packaged in long-term storage containers, which are packed into containers certified by the regulators as safe for transporting special nuclear materials.[3] The contractor has not yet started shipping plutonium metals and oxides. A plutonium pit is the central core of a nuclear weapon, which can be compressed with high explosives to create a nuclear explosion.[4] To be shipped from Rocky Flats, the plutonium pits must be packaged in certified transportation containers. As of January 1999, the contractor had shipped about 80 percent of the plutonium pits off-site. Both the plutonium and the enriched uranium must be shipped in specially designed trucks and trailers.
- Residues. Residues are plutonium-contaminated materials left over from nuclear weapons production, such as plutonium-contaminated ash; combustibles (including paper, rags, cloth, and gloves that can ignite easily); fluorides (compounds containing fluorine); salts (chloride

[3]For additional information on the Department's management of its plutonium, see Department of Energy: Plutonium Needs, Costs, and Management Programs (GAO/RCED-97-98, Apr. 17, 1997) and Department of Energy: Problems and Progress in Managing Plutonium (GAO/RCED-98-68, Apr. 17, 1998).

[4]In a thermonuclear weapon, the pit is the primary device that is imploded to cause a fission reaction to generate heat and energy to create a fusion reaction in the secondary part of the weapon.

salts); sand, slag, and crucibles (from plutonium metal production); and scrub alloy (a plutonium and aluminum alloy from plutonium recovery operations). The plutonium content of these residues ranges from one-tenth of a percent to 80 percent. During production, Rocky Flats retained its residues to recycle the plutonium from them. When the site was shut down, it was left with about 106 metric tons of residues, contaminated with about 3.1 metric tons of plutonium. Each type of residue may require a different method of preparation for shipment; some residues must be stabilized, while others can be processed and packaged in their current form. The variety of residues, and the mixture of other materials with them, makes their management difficult.[5] The contractor is making progress in processing and repackaging residues and recently shipped a small quantity of more highly contaminated and higher-risk residues to DOE's Savannah River site for processing.

- Transuranic and transuranic mixed waste. Transuranic waste is radioactive waste contaminated with elements heavier than uranium, such as plutonium, in concentrations above 100 nanocuries per gram of waste.[6] This waste includes materials ranging from clothing and gloves to pieces of equipment or other materials that are contaminated with radioactivity. Figure 1.2 shows examples of typical transuranic waste drums.

[5]For additional information on Rocky Flats' residues, see Nuclear Materials: Removing Plutonium Residues From Rocky Flats Will Be Difficult and Costly (GAO/RCED-92-219, Sept. 4, 1992), Nuclear Materials: Plutonium Storage at DOE's Rocky Flats Plant (GAO/RCED-95-49, Dec. 29, 1994), and Department of Energy: Problems and Progress in Managing Plutonium (GAO/RCED-98-68, Apr. 17, 1998).

[6]A nanocurie is one-billionth of a curie, which is the amount of radioactivity in 1 gram of radium.

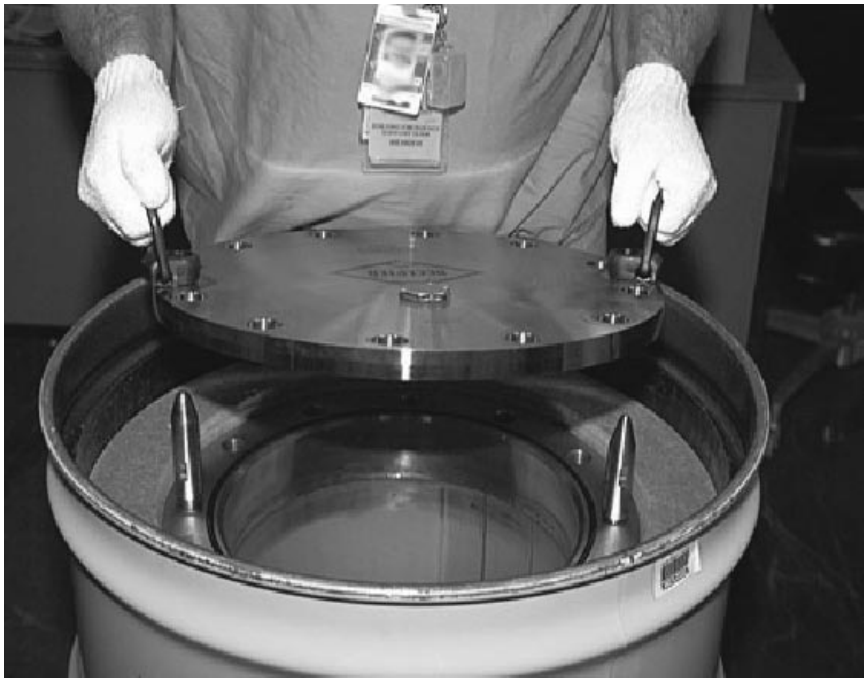
Figure 1.2: Cutaway View of Transuranic Waste Drums

Source: Kaiser-Hill.

Transuranic mixed waste contains hazardous as well as radioactive materials. The contractor at Rocky Flats plans to dispose of approximately 14,500 cubic meters of transuranic and transuranic mixed waste generated through former production activities or anticipated from the decontamination, decommissioning, and demolition of the site's buildings. In addition, the site plans to dispose of most of its residues as transuranic waste after they are processed and packaged in robust storage containers, called "pipe and go" containers, that are then packed into 55-gallon drums (see fig. 1.3). In total, site officials expect the site could generate up to 80,000 drums of transuranic and transuranic mixed waste, which must be shipped in specially designed transportation casks. The contractor has not

started shipping its transuranic wastes because the facility designated to receive these wastes, the Waste Isolation Pilot Plant (WIPP) in New Mexico, has not been available to receive these wastes.[7] The contractor is in the process of implementing additional storage for the site's transuranic wastes to allow processing and packaging and cleanup activities to continue while the site awaits the ability of WIPP to take Rocky Flats' transuranic wastes.

Figure 1.3: Sample "Pipe and Go" Container for Residues to Be Disposed of at the Waste Isolation Pilot Plant



Source: Kaiser-Hill.

- Low-level and low-level mixed waste. Low-level waste has less radioactive content than transuranic waste--100 or fewer nanocuries per gram of waste. Low-level mixed waste is low-level waste that contains hazardous materials. At Rocky Flats, these two types of waste consist

[7]WIPP is DOE's deep geologic repository for transuranic and transuranic mixed waste, located in an underground salt formation near Carlsbad, New Mexico. On Mar. 26, 1999, DOE made its first shipment to the facility from Los Alamos. DOE anticipates beginning shipments from Rocky Flats over the next several months.

mainly of rags, paper, plastic, glassware, filters, soil, and building rubble with low levels of contamination. Through cleanup and closure, the site expects to ship over 180,000 cubic meters of low-level and low-level mixed waste. Because this waste is less radioactive than transuranic waste, it does not require the same degree of special handling. After being packaged, it can be shipped by standard semitrailer trucks and trailers. Site officials reported that, in fiscal year 1998, the contractor shipped about 2,600 cubic meters of the site's projected 143,000 cubic meters of low-level waste to a disposal facility on DOE's Nevada Test Site and about 6,500 cubic meters of the site's projected 60,000 cubic meters of low-level mixed waste to a commercial disposal facility in Utah. According to DOE, the site has met its 1999 targets for shipments of low-level and low-level mixed waste.

Cleanup and Closure of the Site

In addition to preparing and shipping the site's nuclear materials and waste, DOE and the contractor are cleaning up and demolishing the site's structures and cleaning up the site for closure.

- Decontamination and decommissioning of the site's 691 buildings and facilities. This work involves removing or reducing radioactive and/or hazardous contamination to stabilize the environment and to prepare the buildings and facilities for demolition. Decontamination and decommissioning may include dismantling equipment or scrubbing down portions of buildings. One hundred thirty-one of the site's 691 buildings and facilities have some radiological contamination, and 6 have significant radiological contamination. Others may be contaminated with hazardous materials. As of March 1999, decontamination and decommissioning had been completed for 48 buildings, 3 of which had some radiological contamination. In addition, the contractor reported that as of March 1999, 7 additional buildings were being decontaminated and decommissioned--3 with some radiological contamination and 4 with significant radiological contamination. Buildings and facilities on the site range from small tanks to massive processing buildings, including tents, trailers, towers, slabs, pads, stacks, and pipelines.
- Demolition of nearly 3.5 million square feet of buildings and facilities. After being decontaminated and decommissioned, the site's 691 buildings and facilities will be demolished. As of January 1999, the contractor had demolished 48 buildings and facilities comprising 109,266 square feet, or about 3 percent of the total square footage. According to contractor officials, this is consistent with the site's

decontamination and decommissioning strategy, in which the majority of facilities are demolished later in the closure project.

- Remediation of 116 designated contaminated environmental sites. According to DOE, 116 of an estimated 367 environmental sites are expected to require soil remediation. The 367 environmental sites are locations on Rocky Flats where DOE and the regulators believed there could be radioactive or hazardous contamination. A DOE official reported that of 367 sites identified, 25 have been remediated, 116 may still require remediation, and the remainder may require no further action, because further examination revealed or may reveal that contamination levels are less than expected or nonexistent. The 116 environmental sites that may still require remediation include areas where radioactive or hazardous materials were buried or leaked. Remediation could include removing contaminated soil or water or employing other treatment options. In addition, surface water leaving the site must be safe for all uses, including drinking. Some of these contaminated sites are beneath existing structures, and their cleanup will not begin until after the structures have been demolished. Some environmental sites may be very complex and expensive to clean up, while others may be less so. Other contaminated environmental sites may be identified in the future, especially because the amount and level of contamination in the industrial area--especially under the buildings--has not yet been determined. Contractor officials expect that many of the remaining environmental sites may not require further cleanup. Figure 1.4 shows workers in protective clothing conducting remediation activities at one of Rocky Flats' contaminated environmental sites.

Figure 1.4: Remediation Activities at One of Rocky Flats' Contaminated Environmental Sites

Source: Kaiser-Hill.

- Disposal of up to 1 million items of personal property. Estimates of the site's personal property (including computers, chairs, and desks) vary--from approximately 600,000 to 1 million items--because a complete inventory has not been done.[8] DOE officials said that much of the personal property is old and may be more of a liability than an asset. Therefore, in May 1998, the site was authorized to use expedited disposal methods, which allow the site to bypass certain federal disposal requirements, including those for screenings to determine whether other federal agencies can use the property before disposing of it. However, before releasing property to the public, the contractor must follow specific procedures to ensure that items are not contaminated with radiological or hazardous substances. According to the contractor, from fiscal year 1996--when the site started disposing of its personal

[8]For more information on Rocky Flats' property management, see Department of Energy: The Property Management System at the Rocky Flats Plant Is Inadequate (GAO/RCED-94-77, Mar. 1, 1994), Department of Energy: Property Management Has Improved at DOE's Rocky Flats Site (GAO/RCED-96-39, Dec. 28, 1995), and Department of Energy: Management of Excess Property (GAO/RCED-99-3, Nov. 4, 1998).

property in preparation for closure--through mid-February 1999, Rocky Flats disposed of almost 100,000 items of personal property. About one-fourth of these items were disposed of using the expedited procedures, which were implemented near the end of fiscal year 1998.

Parties Involved in Rocky Flats' Cleanup and Closure

The cleanup and closure of Rocky Flats is a complex undertaking, involving not only DOE; the site's primary contractor, Kaiser-Hill; and subcontractors but also regulatory and oversight agencies and others with an interest in the site's cleanup and closure. The regulatory and oversight bodies include the EPA, the state of Colorado, the Department of the Interior's Fish and Wildlife Service, and the Defense Nuclear Facilities Safety Board. Other stakeholders include local governments; citizen, community, business, and environmental groups; and individuals.

DOE

DOE's Office of Environmental Management, a headquarters organization, is responsible for cleaning up the Department's nuclear weapons complex and closing down facilities, including Rocky Flats, that are no longer needed for producing nuclear weapons. In June 1998, Environmental Management released Accelerating Cleanup: Paths to Closure,[9] which projects the technical scope, cost, and schedule required to clean up and/or close these facilities. At the Rocky Flats Field Office, approximately 230 DOE employees manage and oversee the site's cleanup. Other DOE headquarters organizations also play a role in the site's cleanup and closure, including the Office of Defense Programs, the Office of Fissile Materials Disposition, and the Office of Worker and Community Transition. In addition, other DOE sites play a significant role in Rocky Flats' cleanup and closure, especially those that are scheduled to receive materials or wastes from Rocky Flats.

Contractor and Subcontractors

In 1995, through a competitive procurement process, Kaiser-Hill Company, L.L.C. (Kaiser-Hill),[10] was awarded the contract to manage Rocky Flats through June 2000. Kaiser-Hill proposed managing the site's work through four principal subcontractors, which now include Rocky Mountain Remediation Services, L.L.C.; Safe Sites of Colorado, L.L.C.; Rocky Flats

[9] Accelerating Cleanup: Paths to Closure (DOE/EM-0362, June 1998).

[10] A company formed through a joint venture by IFC Kaiser International, Inc. and CH_2M Hill.

Closure Site Services, L.L.C.;[11] and Wackenhut Services, L.L.C. The first two companies perform most cleanup activities, the third handles support services, and the last provides security. Kaiser-Hill and the four principal subcontractors enter into contracts with other subcontractors to perform various site operations and cleanup activities.

Regulatory and Oversight Agencies

EPA and the Colorado Department of Public Health and Environment are the primary regulators for Rocky Flats. EPA derives its regulatory authority primarily from the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA)[12] and the Resource Conservation and Recovery Act of 1976, as amended (RCRA).[13] Colorado exercises regulatory authority over hazardous wastes under RCRA and the Colorado Hazardous Waste Act[14] and other legislative and regulatory requirements. Both regulatory agencies have field staff at Rocky Flats to oversee cleanup and closure activities. These federal and state laws cover hazardous wastes, but not special nuclear materials.[15]

Under the Rocky Flats Cleanup Agreement, DOE, EPA, and Colorado annually establish or update regulatory milestones for the site for the next 2 fiscal years. If these milestones are not met, the regulators can fine DOE according to a penalty schedule included in the agreement.[16] In general, EPA has primary authority over the site's buffer zone, while Colorado has primary authority over the site's industrial area.

The Department of the Interior's Fish and Wildlife Service has had a regulatory presence at Rocky Flats for many years. The Fish and Wildlife Service derives its regulatory authority from the Endangered Species Act.[17]

[11]Rocky Flats Closure Site Services, L.L.C., replaced DynCorp of Colorado as a top-level subcontractor in 1998. DynCorp continues to provide some services at Rocky Flats as a lower-tier subcontractor.

[12]42 U.S.C. section 9601 et seq.

[13]42 U.S.C. section 6901 et seq.

[14]Colorado Revised Statutes 25-15-301 et seq.

[15]These federal and state laws do not cover special nuclear materials or source or by-product materials as defined in the Atomic Energy Act of 1954, 42 U.S.C. 2014. However, the Rocky Flats Cleanup Agreement defines plutonium as a hazardous material under CERCLA.

[16]According to DOE, to date, the site has not missed a regulatory milestone without an excusable delay (such as delays in WIPP's opening).

[17]16 U.S.C. section 1531 et seq.

The Endangered Species Act prohibits DOE from taking any actions that would jeopardize the existence of species listed as threatened or endangered. The Fish and Wildlife Service, through a consultative process, may require mitigation efforts to ensure the protection and recovery of listed species.

The Congress created the Defense Nuclear Facilities Safety Board in 1988 to oversee DOE's defense nuclear facilities and to ensure the protection of public health and safety. The Board is charged with identifying safety problems at DOE's nuclear facilities and recommending corrective actions to the Secretary of Energy. If the Secretary accepts a recommendation, DOE develops an implementation plan. The Board has issued several recommendations pertaining to Rocky Flats, including recommendations about the safety of the site's plutonium and residues, and the site is implementing corrective actions to address these recommendations. Although the Board does not have regulatory authority over DOE, a memorandum of understanding attached to the Rocky Flats Cleanup Agreement recognizes the Board as the primary oversight entity for Rocky Flats' special nuclear materials and activities relating to them.

Other Stakeholders

The site's other stakeholders include local governments; community, business, and citizen groups; and individuals. The Rocky Flats Cleanup Agreement requires that these stakeholders be consulted during the development of cleanup plans. The stakeholders may also provide input to and exert influence on the regulatory and oversight agencies, as well as their local, state, and federal elected representatives. The stakeholders' level of involvement varies. Some of the stakeholders and their roles are listed below.

- Rocky Flats Citizens Advisory Board. The Citizens Advisory Board was formed in 1993 to provide informed, community-based recommendations to EPA, the state, and DOE on the cleanup of Rocky Flats. The board consists of up to 30 volunteers, including local citizens; businesspersons; Rocky Flats employees; and representatives of local governments, academia, and public interest and environmental organizations.
- Local communities. Because they are located near Rocky Flats and could be affected by its cleanup and closure activities, cities such as Arvada, Broomfield, and Westminster provide input to DOE and the contractor on cleanup and closure issues. Partly because the communities surrounding Rocky Flats do not depend for their economic

vitality on jobs related directly or indirectly to the site, the cities generally agree on the need to close it. However, they do not agree on how the site should be used in the future. For example, Arvada wants to see part of the site used as an industrial area, while Broomfield and Westminster would like to have all of it converted to open space, with little or no development.

- County governments. Rocky Flats is located almost entirely within Jefferson County, along the foothills of the Rocky Mountains. Although the county government has only recently become involved in the site's cleanup and closure, DOE officials expect it to become a major stakeholder as the cleanup progresses and the site nears closure. About 35 acres of the site lie within Boulder County, which also borders the site on the north. Boulder County has also begun to take an interest in the site's cleanup and closure.
- Rocky Flats Local Impacts Initiative. Formed in 1991 and funded by DOE, this organization represents and serves as a focal point for the views and concerns of about 60 organizations, including businesses and environmental, academic, and citizen groups. It also advises DOE on the impact of workforce restructuring on local communities and manages several DOE-funded programs to help mitigate the impact of downsizing on these communities. Outside this organization, according to site officials, business groups such as the Denver and Northwest Metro Chambers of Commerce, the Colorado Forum, and various other groups also provide input to the site on issues concerning the cleanup and closure of Rocky Flats. The Rocky Flats Local Impacts Initiative will be disbanded in early 1999, and in April 1999, a new organization, the Rocky Flats Coalition of Local Governments, will begin operations. The coalition's mission will be to "provide an effective mechanism for local governments in the vicinity of Rocky Flats and their citizens to work together on issues of mutual concern relating to the safe, prompt and effective cleanup and closure of Rocky Flats, its future use and long term protection. . . ."
- Environmental/activist groups. These types of groups have been involved in issues at Rocky Flats for many years. The groups' activities have ranged from conducting antinuclear protests during the site's production years to taking stands on current cleanup and closure issues.

Objectives, Scope, and Methodology

Concerned about the Department's ability to meet its current goal to close Rocky Flats by the end of 2006, the Chairman of the Senate Committee on Armed Services asked us to review (1) DOE's plans for accelerating the site's closure and challenges that could impede closure; (2) the condition of

the site at closure and the activities that will remain after closure; and (3) the costs of closing the site and the savings expected from accelerating its closure.

We performed our work at DOE headquarters in Washington, D.C.; DOE's Inspector General Denver Audit Group in Golden, Colorado; and the Rocky Flats Field Office, located on the Rocky Flats site, near Golden, Colorado. We also performed work at the primary contractor's and some of the subcontractors' locations on the site. We contacted other DOE sites and headquarters organizations whose activities either affect or are affected by Rocky Flats' closure. In addition, we performed work at EPA's Region VIII in Denver, Colorado, and at two Colorado offices—the Office of Policy and Initiatives, within the Office of the Governor, and the Department of Public Health and Environment, both in Denver. We also obtained information from stakeholders in communities surrounding the site.

To examine DOE's plans for accelerating the site's closure and challenges that could impede closure, we reviewed many complexwide and site-specific planning documents, including Accelerating Cleanup: Path to Closure: Rocky Flats Environmental Technology Site and Closure 2006--Rocky Flats Closure Project: Management Plan, both dated June 1998, as well as plans and schedules from the Rocky Flats Field Office and Kaiser-Hill. We also obtained and analyzed other documents. In addition, we interviewed DOE officials from the Office of Environmental Management, the Rocky Flats Field Office, and other DOE sites with activities related to Rocky Flats' closure. We also interviewed representatives of Kaiser-Hill and some of its subcontractors, as well as officials from EPA, Colorado's Office of the Governor and the Department of Public Health and Environment, and the Defense Nuclear Facilities Safety Board's Rocky Flats office. We obtained documents from and interviewed representatives of numerous stakeholder groups, including the Rocky Flats Citizens Advisory Board; the Rocky Flats Local Impacts Initiative; the Rocky Mountain Peace and Justice Center; and local city governments, including those of Broomfield and Westminster, Colorado.

To determine the condition of the site at closure and the activities that will remain after closure, we obtained and analyzed the Rocky Flats Cleanup Agreement and interviewed officials from the three organizations that developed it: DOE (headquarters and Rocky Flats Field Office), EPA, and Colorado (the Office of the Governor and the Department of Public Health and Environment). In addition, we obtained and analyzed documents and interviewed officials from DOE's Office of Inspector General, Kaiser-Hill,

some of the subcontractors, and the Defense Nuclear Facilities Safety Board. We also toured various facilities and cleanup projects at the site. Finally, we obtained documents and interviewed representatives from several local stakeholder groups, including the Rocky Flats Citizens Advisory Board, the Rocky Flats Local Impacts Initiative, the Rocky Mountain Peace and Justice Center, and local city governments.

To determine the costs of closing the site and the savings expected from accelerating closure, we obtained and analyzed documents and interviewed officials from DOE's Office of Environmental Management and Rocky Flats Field Office and from Kaiser-Hill. Specifically, we reviewed cost and savings estimates in closure planning documents, including Closure 2006--Rocky Flats Closure Project: Management Plan; cost estimates prepared by Kaiser-Hill and the Rocky Flats Field Office, including project baseline descriptions and project baseline summaries; and other reports by DOE and the contractor on the site's cost and savings estimates. We also interviewed regulatory officials and representatives of local stakeholder groups to obtain their views on the Department's cost and savings estimates for Rocky Flats.

We provided DOE with a copy of a draft of this report for its review and comment. DOE's comments are discussed and evaluated at the ends of chapters 2 and 3. The full text of DOE's comments appears in appendix I. We conducted our review from May 1998 through March 1999 in accordance with generally accepted government auditing standards.

Challenges to Accelerating the Site's Closure

DOE and the primary contractor, Kaiser-Hill, are attempting to accelerate the closure of Rocky Flats to meet the Department's new target date of 2006. The contractor has not yet developed a detailed plan and schedule for closure by the end of that year and has encountered some delays in implementing the earlier plan for closing the site in 2010.[1] The contractor is developing a plan for closing the site by the end of 2006 and believes that it can take advantage of "learning curves and efficiencies" gained through early efforts to expedite required cleanup and closure activities. However, although DOE and the contractor have made progress in some areas, they face challenges that could hinder efforts to accelerate the site's closure. In addition, extensive requirements for coordinating the work at Rocky Flats with work at other DOE sites and challenges outside of DOE's control could further hinder efforts to close Rocky Flats by the end of 2006.

Detailed Plan Assumes That the Site Will Be Closed in 2010

In fiscal year 1994, when the Department developed plans to close Rocky Flats, DOE estimated that the site could be closed as late as 2070. In 1995, DOE selected Kaiser-Hill to manage and operate Rocky Flats. At that time, Kaiser-Hill proposed closing the site in 2015. Then, in 1996, DOE's Office of Environmental Management announced efforts to accelerate the cleanup of contaminated sites throughout DOE's nuclear complex. In 1997, Kaiser-Hill proposed closing the site in 2010 and developed a detailed plan and schedule to support its proposal. This plan remains in effect today, even though DOE has advanced the date for closure to the end of 2006. To meet the 2006 target, the contractor must complete the tasks set forth in the 2010 plan in about 30 percent less time. Kaiser-Hill has started developing a detailed plan to close the site by the end of 2006. According to contractor officials, this plan will be submitted to DOE by the end of May 1999. In the meantime, both contractor and DOE officials are attempting to get ahead of the 2010 plan by accelerating activities they view as critical to closing the site by the end of 2006.

While making progress in some areas, the contractor has incurred delays in some activities considered important to closing the site. These delays could affect the schedule for accomplishing other cleanup activities. For example, the contractor fell behind the 2010 schedule in preparing three types of plutonium-contaminated residues for removal from the site, as well as in shipping plutonium pits to DOE's Pantex Plant, the site designated to receive and store most of DOE's nuclear weapons

[1]The 2010 plan is based on closing the site by the end of fiscal year 2010.

components. Such delays can have a cumulative impact because many of the site's cleanup and closure activities must be completed in sequence. For example, delays in removing residues and special nuclear materials from the buildings where they are now stored can delay efforts to decontaminate, decommission, and demolish these buildings.

Site officials maintain that the contractor can make up for the delays experienced thus far and accelerate activities to close the site by the end of 2006. According to many site officials, the contractor is climbing a learning curve in many of the activities, and once it has gained experience, it will be able to accelerate activities and achieve efficiencies. However, the officials have not yet clearly indicated how learning curves and efficiencies will accelerate later activities in time to meet the 2006 target. Furthermore, subsequent cleanup tasks may present different problems.

Despite DOE's and Kaiser-Hill's position that they can close the site by the end of 2006, several DOE and contractor personnel told us that although they think some acceleration of the 2010 plan is possible, they are not sure that closure by the end of 2006 is feasible. Some of these personnel believe that a date between 2006 and 2010 may be more realistic, while others characterize even the 2010 date as ambitious. Many of the site's regulators and stakeholders said they support efforts to accelerate Rocky Flats' closure but are more concerned that it be done right than that it be done by the end of 2006. The contractor's recent risk analysis of the 2010 closure plan identified uncertainties and technical problems that the contractor must overcome to close the site. The uncertainties and problems include such key areas as preparing the site's nuclear materials and wastes for shipment, establishing sites to take Rocky Flats' materials, and decontaminating and decommissioning the site's buildings and facilities. The risk analysis determined that unless the contractor resolves these existing uncertainties and technical problems, it has a 1-percent chance of closing the site by the end of fiscal year 2010.[2] Kaiser-Hill management stated that this risk analysis is a tool to identify and focus management's attention and planning efforts on cost and schedule uncertainties and problems that could affect the site's closure. Whether and when these uncertainties and technical problems are resolved will also affect the prospects for closing the site by the end of 2006. Both DOE and Kaiser-Hill

[2]According to Kaiser-Hill, a schedule risk analysis process was initiated in 1998 to periodically identify and prioritize uncertainties that must be overcome to close the site by 2006. An initial analysis identified uncertainties associated with several technically complicated activities scheduled to occur in the later stages of closure; consequently, a 1-percent chance of overall success resulted.

officials emphasized that the site has been able to resolve or overcome uncertainties and problems in the past.

Numerous Challenges Could Hinder Efforts to Accelerate Closure

DOE and the contractor have identified four primary activities that will need to be accelerated in order to close the site by the end of 2006: (1) processing and removing plutonium-contaminated residues; (2) shipping special nuclear materials off-site; (3) decontaminating and decommissioning buildings; and (4) constructing closure caps--man-made protective barriers between contamination that remains on the site and the public or the environment. According to DOE and contractor officials, the contractor may be able to accelerate the removal of special nuclear materials and residues by 2 years, allowing for closure in 2008, largely by identifying and implementing more expeditious ways of processing and shipping the residues and special nuclear materials. However, the officials are less confident that they can gain 2 more years by compressing the schedule for decontaminating and decommissioning buildings and constructing closure caps. These activities are scheduled for later years and largely require the completion of other activities first. We found challenges in each of the four areas that could hinder efforts to close the site by the end of 2006.

Challenges in the Residues Program

Recently, as well as historically, Rocky Flats has faced problems and delays in managing its plutonium-contaminated residues. According to DOE officials, to close the site by the end of 2006, the contractor needs, by 2003, to treat, package, and ship approximately 106 metric tons of residues to sites designated to receive them. However, DOE, the Defense Nuclear Facilities Safety Board, and we have reported that Rocky Flats has had problems managing its residues in the past.[3] To accelerate the removal of residues from the site, Rocky Flats is no longer planning to extract the plutonium from them. The site is now planning to send most of the residues that are high in plutonium content or categorized as high risk to DOE's Savannah River Site in South Carolina for processing. It is also planning to prepare the bulk of the residues--sometimes by blending them with less contaminated or clean material to lower the percentage of

[3]See Plutonium Working Group Report on Environmental, Safety and Health Vulnerabilities Associated with the Department's Plutonium Storage (DOE/EH-0415, Nov. 1994), Recommendation 94-1, Improved Schedule for Remediation in the Defense Nuclear Facilities Complex, Defense Nuclear Facilities Safety Board (59 FR 28848, May 1994), and Department of Energy: Problems and Progress in Managing Plutonium (GAO/RCED-98-68, Apr. 17, 1998).

plutonium and sometimes by just repackaging the materials--for disposal as transuranic wastes at the Waste Isolation Pilot Plant (WIPP) in New Mexico. A DOE official estimates that this change will shave at least 1 year from the residues program and save at least $50 million. Figure 2.1 shows a Rocky Flats worker handling plutonium residues in a glovebox.[4]

Figure 2.1: A Rocky Flats Worker Handling Plutonium Residues in a Glovebox

Source: Kaiser-Hill.

However, even under this revised approach to managing the site's residues, the contractor has recently experienced additional delays in processing and repackaging some of the site's residues. According to a DOE official overseeing the processing, repackaging, and removal of residues, some repackaging efforts have fallen behind schedule and some processes have been temporarily shut down. According to Kaiser-Hill officials, they are

[4]A glovebox is a sealed glass, metal, or plastic chamber designed to protect a worker handling radioactive or hazardous materials from exposure to contamination. The worker, who remains outside the box, uses gloves attached to the wall of the chamber to handle the contaminated materials.

adding funding and other resources—primarily additional workers and equipment—to make up for these problems, catch up to the 2010 schedule, and accelerate future processing and repackaging efforts. According to contractor officials, despite some of the earlier delays, progress is being made in processing and repackaging residues.[5] The contractor told us that it has already made up for some of the delays and is working to overcome the others. According to DOE, as of April 1999, the site had caught up to the 2010 processing schedules for four of the five major residue types. In addition to the contractor's efforts, DOE redirected an additional $2 million to $3 million in fiscal year 1999 funding to residue repackaging activities, according to site officials. The recent delays have nevertheless prompted regulatory and DOE officials to question whether the contractor will meet its fiscal year 1999 and 2000 goals for processing and repackaging the site's residues.

In addition, the site has had problems obtaining the certification, or approval, it will need from DOE's Carlsbad Area Office to ship its processed and packaged residues to WIPP for disposal. In August and September 1998, auditors from the Carlsbad Area Office found adverse conditions, such as inadequate record-keeping and verification procedures, that required correction before the residues could be certified for eventual disposal at WIPP. A DOE site official told us that the audit results indicated a serious cultural problem--a failure by subcontractor engineers and managers to understand DOE's requirements and make a commitment to meeting them. The residues will not require further processing, and after the site takes the required corrective actions, the auditors will return to certify the residues. Their return visit was scheduled for March 1999. According to Kaiser-Hill officials, the contractor has completed correcting the findings from the 1998 audit. An audit of the site's transuranic waste characterization and certification processes in March 1999 resulted in no major audit issues.

Challenges to Accelerating the Shipment of Special Nuclear Materials Off-Site

Rocky Flats has shipped about 80 percent of its plutonium pits off-site, and the remainder are expected to be shipped to the Pantex Plant near

[5]In Mar. 1999, Kaiser-Hill officials said that the contractor is approaching the production rates needed to finish reprocessing all of the residues by fiscal year 2002, a date the officials view as critical to closing the site by 2006.

Amarillo, Texas, or to the national laboratories by September 1999.[6] However, most of the site's plutonium metals and oxides must still be stabilized, packaged in long-term storage containers,[7] and then shipped to DOE's Savannah River Site for storage until they can be processed for ultimate disposal at DOE's high-level waste repository. The Savannah River Site is modifying an existing structure to accommodate the accelerated shipment of Rocky Flats' plutonium metals and oxides.

The site is now planning to accelerate the stabilization, packaging, and shipment of its plutonium metals and oxides by 2 years. The 2010 closure schedule called for this plutonium to be stabilized, packaged, and shipped to Savannah River by the end of fiscal year 2004. The site now expects to complete these tasks by May 30, 2002. However, as we reported in April 1998, the site has encountered problems--including difficulties in procuring an automated plutonium stabilization and packaging system--that have delayed its progress and increased its costs.[8] Recently, because of reliability and technical difficulties, the site decided to use manually operated furnaces to stabilize the plutonium oxides instead of the stabilization portion of the automated system. Site officials estimate that these furnaces should be ready to stabilize the plutonium oxides in April 2000. The packaging portion of the automated system, turned over--a year late--to the contractor in September 1998, must be operational by December 1999 to meet the accelerated shipping schedule. However, as of February 1999, the complex automated plutonium packaging system was still in a warehouse in a community near the site. The automated packaging system proved very sensitive and performed below expectations during off-site testing and required unanticipated modifications. The contractor must still move the system to the site, install it in a building within the site's protected area, test it, and bring it up to operational capability--tasks that may require months' worth of adjustments to the equipment, given its complexity and sensitivity. While the contractor has developed and is implementing a schedule to install the equipment to enable the stabilization and accelerated shipment of the plutonium metals

[6]DOE anticipates that the pits that can be shipped to the Pantex Plant will be shipped by the end of May 1999.

[7]Some plutonium metals are classified because of their shape or constituents and will require additional processing at another site to make them unclassified before they can be stored. These metals will be shipped to the site designated to receive them, where they will be processed and then packaged into long-term storage containers.

[8]Department of Energy: Problems and Progress in Managing Plutonium (GAO/RCED-98-68, Apr. 17, 1998).

and oxides, some site officials note the challenges ahead and question the contractor's ability to meet the required time frames.

Challenges in Decontaminating and Decommissioning Buildings

Of the 691 buildings or facilities at Rocky Flats, as of March 1999, 48 had been decontaminated, decommissioned, and demolished. Three of these buildings had some radiological contamination. In addition, the contractor reported that as of March 1999, seven additional buildings were being decontaminated and decommissioned--three with some radiological contamination and four with significant radiological contamination. According to the 2010 closure plan, the majority of the remaining buildings, including some of the most difficult radiologically contaminated buildings, are now scheduled for decontamination and decommissioning from 2005 through 2007, and over two-thirds of the demolition is scheduled from 2006 through 2009. Contractor officials have not yet determined how the schedule for decontamination, decommissioning, and demolition can be compressed enough to close the site by the end of 2006. The contractor is developing a detailed decontamination and decommissioning schedule as part of its detailed plan for closing the site by the end of 2006. According to the contractor, its senior management recognizes that the site faces a daunting task in achieving the accelerated decontamination and decommissioning of the site's nuclear facilities; nevertheless, the managers remain convinced that the earlier closure can be accomplished. However, some DOE and contractor officials have questioned both the feasibility of completing the work under the compressed schedule and the availability of resources--especially of qualified workers--to carry out the work on time.

The contractor has successfully conducted some of the more complex early decontamination and decommissioning work nearly on schedule, but at double the anticipated cost. In decontaminating and decommissioning two of the first major buildings at the site—a health science building and a plutonium processing building--the contractor found that the work on these radiologically contaminated buildings took longer and cost more than planned. The tasks proved to be more complex and generated more waste than expected, and unanticipated radiological or hazardous contamination was found. The contractor offset delays of several months through the use of overtime work and the application of lessons learned, especially in reducing the time for packaging waste materials. As a result, the contractor finished decontaminating and decommissioning one building only about a month behind schedule and expects to do the same for the second building. However, overcoming these problems and delays had a significant cost. The contractor more than doubled the cost estimate for

decontaminating and decommissioning the plutonium processing building, from $21.1 million in November 1997 to $55.4 million in October 1998.[9]

Contractor officials said they expect to learn from their early efforts and develop efficiencies that will enable them to make up for lost time, reduce costs, and accelerate the decontamination and decommissioning of the remaining buildings. For example, according to Kaiser-Hill officials, the subcontractor was able to remove gloveboxes five times faster from the plutonium processing building by applying lessons learned--using better tools and learning to cut the gloveboxes to better fit into the disposal containers--and by funding overtime work. According to contractor officials, as of March 1999, over 120 gloveboxes had been removed from this building. However, earlier efforts may not always be applicable because each building--especially each radiologically contaminated building--may present unique problems. Because different types of activities took place in the buildings where nuclear weapons were produced, the buildings contain widely different levels and types of contamination, requiring different cleanup activities.

Adding to the challenges involved in decontaminating, decommissioning, and demolishing the site's buildings and facilities, the contractor increased its estimates of the wastes expected from these efforts. These wastes will ultimately have to be packaged and removed from the site. Primarily on the basis of its experience with decontaminating and decommissioning the first major buildings and some subsequent changes in approach, in July 1998, the contractor increased its estimates of transuranic waste from about 9,500 cubic meters to over 14,500 cubic meters and of low-level waste from about 66,000 cubic meters to nearly 143,000 cubic meters. It also decreased its estimate of low-level mixed waste by over 20,000 cubic meters. Contractor officials stated that they believe they will be able to ship these wastes off-site at the rate they are generated by decontamination, decommissioning, and demolition activities.

Contractor and DOE officials told us that decontamination and decommissioning activities tend to be labor intensive, especially for former nuclear weapons production buildings in the site's protected area.[10]

[9]These cost estimates are for decontaminating, decommissioning, and demolishing the building cluster, which consists of the primary plutonium processing building and its support buildings and facilities.

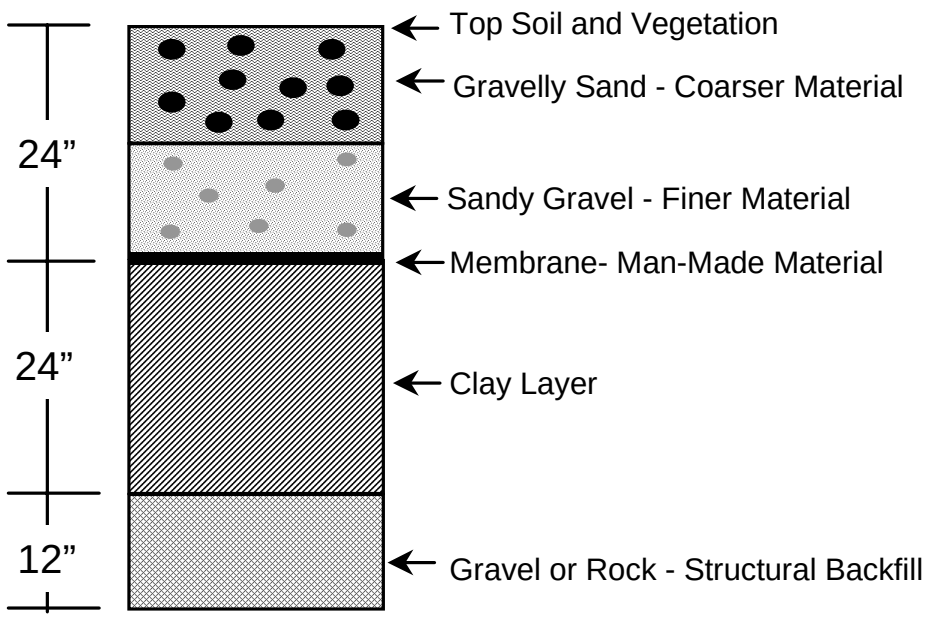
[10]The protected area is a safeguarded zone within the site's industrial area where activities that involve special nuclear materials are conducted. Access requires special authorization, and a protective force of guards and physical barriers provide security for the nuclear materials.

Workers, who require special training and security clearances, must go through time-consuming procedures to dress in required protective gear and enter contaminated buildings. Site officials said they plan to create special decontamination and decommissioning teams to work simultaneously on different radioactively contaminated buildings. They noted that using teams should create efficiencies, allowing them to compress the schedule for decontamination and decommissioning. According to contractor officials, the majority of the site's buildings are not contaminated and their decontamination and decommissioning will not require special training, security clearances, or protective equipment.

Challenges With the Use of Closure Caps

The contractor is planning to use closure caps to isolate residual contaminants in four areas, but the site's regulators have agreed to the use of these caps for only two of the areas. Closure caps are man-made barriers designed to isolate contaminants from the surrounding environment or the public. Descending layers are made of increasingly finer materials to restrict the infiltration of water to contamination below (see fig. 2.2).

Figure 2.2: Diagram of the Layers of a Closure Cap



Source: GAO's presentation of data provided by Kaiser-Hill and DOE.

As allowed under the Rocky Flats Cleanup Agreement, the contractor plans to construct closure caps over the site's landfills and solar evaporation ponds[11] (about 33 acres of caps). However, the contractor also plans to construct closure caps over two portions of the industrial area (an additional 31 acres) after the contaminated buildings have been demolished. DOE and the contractor are just starting to discuss the use of these additional caps with the regulators and stakeholders, and no agreements have been reached. Contractor officials told us they need a final decision on the use of closure caps for the two portions of the industrial area by 2004 if they are to finish constructing the caps by the end of 2006. If the contractor is not allowed to use caps in these areas, site officials said, the costs of closure could be higher and the site's closure could be delayed.

Many of the site's stakeholders oppose the use of additional closure caps because they are concerned that the caps will not provide an adequate barrier for the industrial area for as long as necessary. Given current technology, they expect the caps to fail long before the radiological contamination ceases to pose a threat to human health and the environment--many thousands of years in the future. A DOE official said that closure caps have failed in the past, primarily because the construction was not adequate for the conditions or the caps were not properly maintained.

Coordination of Closure Activities Could Affect Acceleration

Closing Rocky Flats depends on coordinating activities across the DOE complex, as well as outside the complex. Virtually everything at the site must go somewhere else for storage or disposal.[12] Currently, DOE does not have sites to receive all of the materials and wastes that must be removed from Rocky Flats. Furthermore, other DOE facilities will need sites to receive their materials and wastes, and Rocky Flats will be competing with these other facilities for storage and processing services, as well as for vehicles and containers to transport materials and wastes. The Department has made some efforts to coordinate activities across the DOE complex to support Rocky Flats' accelerated closure, including

[11]According to documentation from the site, these ponds were used to store and evaporate radiological and hazardous wastes.

[12]Exceptions include some uncontaminated or slightly contaminated materials that may be disposed of on-site.

establishing a headquarters office, a senior management team, and a management plan.

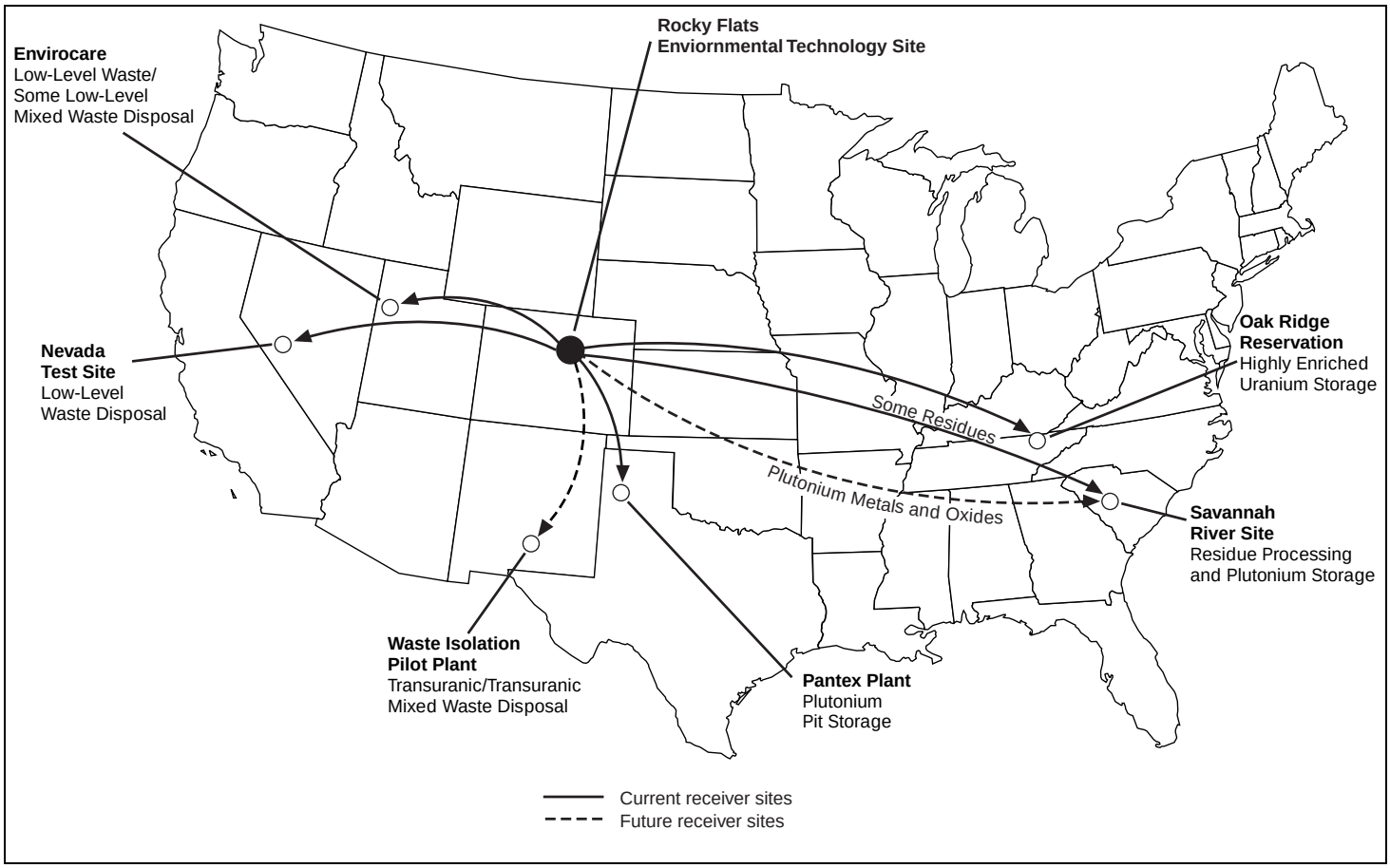
Rocky Flats Does Not Have Facilities to Take Some of Its Materials and Wastes

Rocky Flats has shipped some of its nuclear materials and wastes to other DOE sites and commercial facilities. It has also designated other sites to receive additional types of materials, but these sites have not yet been able to receive the materials from Rocky Flats. However, no sites are available to take several "orphan" materials and wastes, including some low-level mixed wastes and uranium contaminated with plutonium or hazardous materials. No sites are available to take these materials because existing facilities are not licensed to accept them.

Rocky Flats has already shipped plutonium pits to the Pantex Plant near Amarillo, Texas; low-level waste to a disposal site on the Nevada Test Site; and enriched uranium to the Oak Ridge Reservation in Tennessee. In addition, some materials have been sent to commercial facilities. For example, some low-level mixed waste has gone to the Envirocare disposal facility in Utah, and some sanitary waste (nonradioactive and nonhazardous waste) has gone to a landfill near Erie, Colorado.

Other types of materials and wastes have been designated to go to other DOE sites. As noted, the Savannah River Site in South Carolina is designated to receive the site's plutonium metals and oxides, and the WIPP facility near Carlsbad, New Mexico, is designated to receive transuranic and transuranic mixed waste. (Fig. 2.3 shows the location of the sites that have accepted or expect to receive Rocky Flats' nuclear materials and wastes.)

Figure 2.3: Sites That Have Accepted and Expect to Receive Rocky Flats' Nuclear Materials and Wastes



Key: Solid lines indicate that shipments have occurred; broken lines indicate that no such shipments have taken place.

Note: The map shows the sites that are receiving or are designated to receive the majority of these types of materials. Small amounts of the materials may be sent to other sites.

Source: GAO's presentation of data provided by DOE.

Rocky Flats currently has nowhere to send low-level mixed waste with higher plutonium contamination (10 to 100 nanocuries per gram of material). Rocky Flats expects to generate about 10,000 cubic meters of this kind of waste, but no commercial or DOE facility has the RCRA permits required to accept it.[13]

According to site officials, the most promising option for disposing of the site's orphan low-level mixed waste is to enter into a contract with a waste management company that is interested in operating a low-level mixed waste disposal facility in eastern Colorado. The company is currently operating a hazardous waste disposal facility at this location but does not have the authority to accept low-level mixed waste. However, according to DOE officials, the Department is required under a DOE order to use DOE facilities for radioactive waste disposal and can use commercial facilities only on an exception basis.[14] DOE recently analyzed this waste disposal policy to determine if it needed to be changed. DOE headquarters put the proposal for the Colorado waste disposal facility on hold during this study. On March 11, 1999, the Department announced that the policy analysis had concluded that DOE should continue its preference for using DOE disposal facilities for DOE wastes and should use commercial facilities under an exemption process when disposal at DOE facilities is not practical. DOE has delegated the exemption authority to the managers of its field offices--in consultation with its Office of Environment, Safety and Health--to facilitate the process when the use of commercial facilities is necessary and in DOE's best interest.

According to site officials, if the Colorado disposal facility is not established, Rocky Flats may have to store its orphan low-level mixed waste on-site, greatly diminishing the likelihood of closing the site by the end of 2006. Alternatively, site officials say, the site could send this orphan waste to existing disposal facilities at another DOE site (if the site could obtain a state permit to dispose of hazardous waste) or to a commercial facility (if the facility could obtain a license to dispose of low-level radioactive waste). However, according to the site officials, these alternatives appear unlikely.

[13]Low-level mixed waste includes hazardous wastes and therefore is subject to regulation under RCRA. Authorized state hazardous waste programs issue permits for hazardous waste treatment, storage, and disposal within their borders.

[14]Department of Energy Order on Radioactive Waste Management (DOE 5820.2A, Sept. 26, 1988).

Rocky Flats also needs a site to receive about one-fourth of its enriched uranium that is contaminated with plutonium. The site is sending most of its enriched uranium to the Oak Ridge Reservation. However, Oak Ridge is unable to take uranium that is contaminated with plutonium, and Rocky Flats cannot remove enough of the plutonium contamination to send all of its uranium to Oak Ridge. Rocky Flats may be able to send this plutonium-contaminated uranium to Savannah River, which can process the material. However, DOE is evaluating other technical options and is attempting to determine where existing environmental impact statements allow for the disposition of the remaining uranium.[15]

Still another orphan material at the site is depleted uranium contaminated with polychlorinated biphenyls (PCB), a toxic substance.[16] A few drums of this material were unearthed during a recent environmental cleanup project at the site. The one DOE facility that can process depleted uranium with PCBs is the Oak Ridge Reservation. However, Tennessee is not allowing the site to accept this waste. DOE is currently exploring potential commercial disposal options for this material.

Other Coordination Issues Could Affect the Site's Closure

To close by the end of 2006, Rocky Flats will need adequate numbers of specialized transportation vehicles to ship large amounts of special nuclear materials and nuclear wastes in the near future. However, contractor officials regard the coordination of shipping schedules as a "key challenge," given projected generation rates, volumes, and storage capacity. For example, plutonium and enriched uranium must be shipped in specially equipped trucks and trailers called Safe Secure Transports, managed by DOE's Albuquerque Operations Office. Some Rocky Flats officials have questioned whether enough of these transports will be available when the site needs them, especially when shipping schedules change and other sites are competing for their use. The site's transuranic wastes must be shipped in another type of truck and trailer with specialized transportation casks called Transuranic Package Transporters (TRUPACT), managed by DOE's Carlsbad Area Office, where WIPP is located. DOE has only 15 TRUPACTs available, and, according to site officials, Rocky Flats will need two to three

[15]Environmental impact statements are prepared to accompany major federal actions under the National Environmental Policy Act, 42 U.S.C. 4321 et seq.

[16]Depleted uranium is natural uranium that has had most of its fissionable isotope, uranium 235, stripped out for use in weapons or nuclear fuel production. PCBs are regulated by EPA under the Toxic Substances Control Act, 15 U.S.C. 2601 et seq.

times that number to meet its schedule for shipping transuranic wastes, at the same time that other DOE sites will also need to ship transuranic waste to WIPP. For example, under a court-approved consent order, the Idaho National Engineering and Environmental Laboratory must begin shipping transuranic waste off-site by April 30, 1999, ship 3,100 cubic meters of this waste off-site by December 30, 2002, and remove all transuranic waste from the site by 2018. As these dates approach, the laboratory's needs will grow more critical and could take priority over Rocky Flats'. The priority given to Rocky Flats for limited transportation and other resources will have an important impact on DOE's ability to close the site by the end of 2006. However, the Carlsbad Area Office has assured Rocky Flats that sufficient numbers of TRUPACTs will be available to support the shipping schedule for the site's accelerated closure.

The question of how much priority will be given to Rocky Flats' needs is not limited to transportation resources. Rocky Flats is located organizationally under the Office of Environmental Management and often depends on receiving cooperation, priority for its needs, and budgetary support from other DOE organizations to move forward with activities required to close the site. In some instances, other DOE organizations have not given priority to such activities. For example, Rocky Flats depends on the Pantex Plant, which is managed by DOE's Office of Defense Programs, to receive and store the majority of its plutonium pits. In fiscal year 1998, Defense Programs' funding for the Pantex Plant to receive Rocky Flats' plutonium pits was not sufficient, and this, in part, caused some shipments to be delayed. This issue was resolved in June 1998 when Defense Programs and Environmental Management agreed that Defense Programs would provide the resources needed to support the transportation, receipt, and storage of the pits at the Pantex Plant.

DOE Has Taken Steps to Promote Coordination

DOE has made efforts to coordinate activities across the Department to support Rocky Flats' accelerated closure. These efforts include establishing a headquarters office, a senior management team, and a management plan.

Under the Office of Environmental Management, the Rocky Flats Program Office at headquarters works to coordinate Rocky Flats' closure activities, primarily by working with the program people within various DOE organizations and sites. According to DOE officials, the staff in the Rocky Flats Program Office have worked to establish sites to receive Rocky Flats' materials and wastes, resolve issues raised under the National

Environmental Policy Act, and resolve property disposition and workforce restructuring issues.

In May 1998, the Deputy Secretary of Energy established the Rocky Flats Closure Team (Senior Closure Team) to bring together assistant secretaries and high-level managers from cognizant DOE organizations to focus on crosscutting activities needed to accelerate Rocky Flats' closure. According to site and DOE headquarters officials, the Deputy Secretary's focus on this team persuaded headquarters organizations to cooperate, focus on Rocky Flats' closure, and provide budgetary support for closure activities. For example, Defense Programs agreed to continue to work with the site and provide adequate resources for shipping plutonium pits to the Pantex Plant.

In June 1998, DOE issued a management plan outlining actions needed to accelerate Rocky Flats' cleanup and closure. Entitled Closure 2006--Rocky Flats Closure Project: Management Plan, the plan recognizes that the site's closure requires DOE-wide coordination and cooperation to ensure the availability of sites to receive materials and wastes from Rocky Flats and to manage the shipping network so that materials and wastes can be removed expeditiously. This plan discusses strategic initiatives, supported by specific actions. According to site officials, former Secretary Peña conceived the plan as a means to institutionalize the closure of Rocky Flats within the Department—to assign responsibility to appropriate DOE entities, beyond the site and Environmental Management, and to hold these entities accountable for certain initiatives essential to the site's closure. Despite the development of this management plan and the site's resolution of many of the issues and obstacles, the site still faces unresolved obstacles to accelerating the site's closure, including the need for other sites to take all of Rocky Flats' wastes and materials.

In addition to coordinating within the Department, DOE and Kaiser-Hill are recognizing the importance of coordinating and cooperating with entities outside the Department, especially the site's regulators and other stakeholders. Site officials stated that they have achieved broad consensus with the regulators and stakeholders on a number of issues, including the decision to clean up and close the site, the future use of the site's buffer zone as open space, the demolition of the site's buildings, and the requirement that surface water leaving the site be safe for any and all uses. The Rocky Flats Cleanup Agreement is cited by DOE, EPA, and Colorado as an example of successful cooperation between DOE and the site's regulators. Despite some instances of contentiousness, officials from both

EPA and Colorado say that under the cleanup agreement, cooperation has improved with both DOE and the contractor. Some of the site's other stakeholders--including representatives of local communities and of activist and environmental groups, as well as members of the Rocky Flats Citizens Advisory Board—acknowledge that cooperation has improved since the site's production days but say that, at times, their input is neither solicited nor used by DOE.

Challenges Outside DOE's Control Could Affect Closure

Several challenges that have already affected or could affect the schedule for closing Rocky Flats are outside DOE's control. The biggest challenge was presented by continuing delays in opening WIPP.[17] These delays--caused by regulatory issues with the state of New Mexico and lawsuits—prevented Rocky Flats from shipping its transuranic wastes off-site for disposal.

Although EPA certified WIPP to receive transuranic waste in May 1998, DOE did not ship any waste to the facility until late March 1999, in part because New Mexico refused the first scheduled shipment--from Los Alamos National Laboratory—until the laboratory performed additional sampling and analysis to prove the waste did not contain hazardous materials.[18] It is not clear whether New Mexico will establish similar requirements for the sampling and analysis of transuranic waste shipments from Rocky Flats, but such requirements could increase Rocky Flats' costs and create additional delays. In addition, DOE is seeking to obtain a required permit from New Mexico for WIPP to accept transuranic waste with hazardous materials. New Mexico issued a draft of this permit for public comment in May 1998. However, according to DOE officials, the state received over 10,000 comments on this draft and issued another draft for comment. According to DOE officials, New Mexico could issue the final permit in late 1999 or early 2000.

Federal lawsuits have also prevented DOE from shipping transuranic waste to WIPP for disposal. In 1992, one such lawsuit led to an injunction barring shipments to WIPP. No shipments could occur until the court made a decision concerning the injunction. In March 1999, a federal district court judge ruled that the 1992 injunction does not prevent the shipment of the

[17]For a discussion of uncertainties about DOE's ability to open WIPP by its projected date, see Nuclear Waste: Uncertainties About Opening Waste Isolation Pilot Plant (GAO/RCED-96-146, July 16, 1996).

[18]The state has the authority under RCRA to administer a hazardous waste program.

designated Los Alamos waste to WIPP. DOE's first shipment of transuranic waste (with no hazardous materials) from Los Alamos arrived at WIPP on March 26, 1999. DOE anticipates sending additional shipments of transuranic waste to WIPP from Los Alamos, Idaho National Engineering and Environmental Laboratory, and Rocky Flats over the next several months. The Department still cannot ship transuranic wastes that include hazardous materials to the WIPP facility. In addition, another lawsuit, filed in July 1998, challenged EPA's decision to certify WIPP for disposing of transuranic waste. According to DOE officials, this lawsuit could result in an injunction against WIPP's operation.

At current and projected rates of waste generation, Rocky Flats will run out of storage for transuranic waste in the spring or summer of 1999. Therefore, the site is implementing a contingency plan to provide about 2 years' worth of additional short-term interim storage at a capital cost of about $3.2 million in fiscal year 1999, plus about $865,000 per year in operating costs. In addition, the site is planning a new four-module structure for longer-term interim storage, expected to cost about $12.5 million for one module and nearly $50 million for the entire structure. The site must decide whether to proceed with construction by August 1999. Because neither the short-term nor the longer-term storage was planned when the site's closure budget was developed, the funding for both facilities would come at the expense of closure activities.

Observations

We support DOE's efforts to reduce the threats posed by Rocky Flats to the people in the vicinity, as well as the costs of the site's continuing operations and maintenance. The Department believes that accelerating the site's cleanup and closure will achieve both of these worthwhile purposes. Although the DOE and the contractor are committed to closing the site by the end of 2006 and are drawing up a plan and schedules to reach this goal, the success of their efforts will depend on overcoming many obstacles and challenges. Establishing sites to take all of the wastes and materials that must be removed from Rocky Flats--finding sites to take the orphan materials and overcoming obstacles to the use of designated sites like WIPP--is critical to the success of the acceleration effort. Furthermore, promptly addressing technical and other difficulties, coordinating activities within DOE, and cooperating closely with regulators and other stakeholders will be key to accelerating the site's closure. DOE and the contractor continue to make progress in all of these areas, but the magnitude of the remaining challenges and uncertainties is such that the site's closure by the end of 2006 appears difficult at best.

Agency Comments and Our Evaluation

In overall comments on this report, the Department generally concurred with the facts as presented, stating that GAO had done a thorough job of documenting the complexity, uncertainties, and challenges DOE is facing in accelerating the closure of Rocky Flats. DOE noted that the issues identified are known to the Department and are being addressed at this time. In addition, the Department stated that the report validates the overall direction and movement toward accelerating the site's closure, as well as DOE's and the contractor workforce's commitment to it.

The Department commented that the report does not adequately recognize the progress already made or the obstacles already overcome in accelerating Rocky Flats' closure. In its comments, the Department stated that its performance track record in the last few years justifies continued confidence in its ability to close the site by the end of 2006. While we recognize that progress has been made in cleaning up the site, we believe that the challenges to acceleration that we identified--in the residues program, the shipment of special nuclear materials, the decontamination and decommissioning of buildings, and the use of closure caps--need to be surfaced and addressed. The Department also provided a list of obstacles identified in the report that have been resolved. On the basis of DOE's comments and changes that have occurred since the draft report was prepared, we updated the relevant information in the report.

The full text of DOE's comments is contained in appendix I. The Department separately provided technical comments, which we incorporated into the text as appropriate.

Status of the Site at Closure and Activities After Closure Have Not Been Defined

Although there is broad consensus that Rocky Flats should be closed, the Department has not reached agreement with the site's regulators and other stakeholders on several aspects of the condition of the site at closure or its future uses. Nonetheless, DOE and Kaiser-Hill are moving toward a vision of closure set forth in the Rocky Flats Cleanup Agreement. This vision consists of broad goals and objectives, including the removal of special nuclear materials and radioactive and hazardous wastes from the site; the decontamination, decommissioning, and demolition of the site's buildings; and the site's cleanup to certain levels.[1] However, other decisions about the site remain to be made or may be subject to change, including its future uses, the degree to which the soil must be cleaned up, the disposition of the site's building foundations and utilities, and the use of closure caps for portions of the former industrial area. Without agreement with regulators and stakeholders on these issues, the feasibility of closing the site by the end of 2006 is open to question. According to DOE, it is moving forward on decisions about the site's closure and the activities that will be required after closure in accordance with its schedule for making needed decisions and the regulatory requirements governing the site's cleanup. Although DOE has started the process to obtain input from the regulators and other stakeholders, early resolution of these issues would allow DOE and the contractor to address their ramifications promptly in plans and schedules for the site's closure.

DOE is just starting to consider its responsibilities and activities at Rocky Flats after the site is closed. For example, it is considering how much additional cleanup may be required; who will own and monitor the site; and what barriers will be used to prevent exposure to residual contamination. Developing plans for the site after closure will be difficult until agreement has been reached on the status of the site at closure and the future uses of the site.

Full Agreement on the Status of the Site at Closure Has Not Been Reached

The Rocky Flats Cleanup Agreement generally describes the site as it should be after it closes, whether closure occurs by the end of 2006, in 2010, or some other date. Briefly, the agreement requires

- cleaning up and closing the site safely and in compliance with applicable laws;

[1]Under CERCLA (42 U.S.C. 9601 et seq.), the final condition of the site will be determined in a record of decision.

- minimizing risks to the public or workers from contamination and accidents;
- disposing of wastes and materials, buildings and facilities, and infrastructure;
- ensuring that surface water leaving the site is of acceptable quality for any use; and
- cleaning up the site to the level needed for the buffer zone to be used, in general, as open space and for the industrial area to be used as restricted open space or for industrial purposes.

The vision of the site at closure set forth in the Rocky Flats Cleanup Agreement was designed to guide the regulators—EPA and Colorado—and to give DOE the flexibility to clean up and close the site. Under the cleanup agreement, special nuclear materials will be removed by 2015; other radioactive and hazardous wastes will be removed; and all buildings will be decontaminated, decommissioned, and demolished. However, DOE has since established 2006 as its goal to close the site. Under the agreement, the regulators set milestones annually for the site's cleanup activities, which are enforceable by stipulated financial penalties.

The Rocky Flats Cleanup Agreement provides DOE and the regulators with a guide to reach the site's closure, but not to go beyond it. Under CERCLA,[2] the final condition of the site will be determined in a record of decision.[3] This record of decision will address future uses of the land; ownership, stewardship, monitoring, and liability; and barriers to prevent human or environmental exposure to residual contamination. As part of the decision-making process, DOE and the regulators must seek input from the site's stakeholders.

Decisions on the Status of the Site at Closure May Affect Accelerated Cleanup

DOE, the regulators, and the site's stakeholders still have to agree on important issues affecting the site's closure, including the (1) future uses of the site, (2) appropriate cleanup level for the soil; (3) disposition of the site's building foundations and utilities, and (4) use of closure caps over portions of the former industrial area. According to DOE site officials, under the CERCLA and other regulatory processes, these issues are in various stages of discussion with the regulators and stakeholders, and time

[2]42 U.S.C. 9601 et seq.

[3]The cleanup agreement provides that the regulators, in consultation with DOE, have the authority to decide when the site is closed.

remains for their resolution. However, decisions on each of these issues—or the failure to reach a decision—could affect the progress of the site's cleanup and closure.

Future Uses of the Site

The Rocky Flats Cleanup Agreement provides only a very general description of the site's future uses. According to DOE officials, there is broad consensus with the site's stakeholders on the use of the buffer zone as some type of open space, but not on the use of the industrial area for future industrial use. DOE must still clearly define and reach consensus with the site's regulators and other stakeholders on the specifics of these future uses. The Department has been discussing possible future uses with some of the site's stakeholders and regulators since 1994. Decisions on the future uses could affect the site's cleanup requirements. For example, a protected wildlife habitat with limited human presence might require less cleanup than an industrial development with extensive human use. Currently, some local communities are debating whether to allow development on any or part of the site's buffer zone or industrial area. In addition, DOE must consult with the Fish and Wildlife Service about proposed actions that might affect the endangered or threatened species on the site. In May 1998, the Preble's meadow jumping mouse, which inhabits portions of the site, was added to the list of threatened species. DOE officials stated that the need to protect the mouse's habitat may have an impact on some closure activities. However, DOE site officials stated that, at this point, no stakeholder group has formally requested a future use of the site that is inconsistent with assumptions in the cleanup agreement.

Soil Cleanup Level

The Rocky Flats Cleanup Agreement sets an interim cleanup level of 1,429 picocuries[4] of plutonium per gram of soil.[5] Although DOE site officials said that the soil cleanup level for Rocky Flats is legally enforceable, it is, as an interim level under CERCLA, subject to change.[6] Some local stakeholders disagree with this cleanup level, noting that DOE agreed to more stringent

[4]A picocurie is a trillionth of a curie, which is the amount of radioactivity in a gram of radium. The picocurie level was based on a maximum annual absorbed dosage level of radiation.

[5]According to DOE, the cleanup levels for the site, as set in the regulatory agreement, are based on communities' recommendations on future land uses contained in reports of the Future Site Use Working Group (1995) and the Industrial Area Transition Task Force (1998).

[6]According to DOE, iterative implementation is the CERCLA process; interim levels have been set, and the CERCLA process specifies that final cleanup levels will be set through the record of decision for the site.

levels at other DOE sites. For example, DOE reported that cleanup levels were set at 200 picocuries of plutonium per gram of soil at the Nevada Test Site and 34 picocuries of plutonium per gram of soil at the Hanford Site in Washington State. DOE officials explained that the different cleanup levels reflect differences in each site's geological and environmental conditions and anticipated future land uses. The anticipated future use of a site is one factor in determining how much cleanup is considered necessary to protect humans from undue exposure to residual contamination. Because Rocky Flats is expected to be used primarily as open space, with some industrial use, DOE officials said that it should require a less stringent cleanup level than the Nevada Test Site, which is expected to be used for farming or ranching, and the Hanford Site, which is expected to be used for rural housing. To establish each site's cleanup level, DOE used a computer model incorporating about 70 different variables, including geological and environmental conditions and anticipated uses. Site-specific historical data on the forms of plutonium at the site and the migration of this material was available for Rocky Flats, and these data were used in the model to set the soil cleanup level. According to DOE officials, such site-specific data were not available for the other sites, and default values, which assumed a more soluble form of plutonium that is more easily ingested, were used in the model. The cleanup agreement recognizes that the soil cleanup level set by the existing model could change with new regulations, different guidance, improved calculations or models, or better input variables. However, according to site officials, changing the soil cleanup level for the site would require a formal public process and agreement among DOE, EPA, and Colorado.

In response to stakeholders' concerns about the cleanup level set for the soil at Rocky Flats, DOE agreed, in fiscal year 1998, to provide approximately $500,000 to fund a review of that cleanup level. The Rocky Flats Citizens Advisory Board is overseeing this review, which is being conducted by a technical subcontractor. Representatives of the board said that if the study supports greater cleanup of the site, they will recommend that DOE adopt a more stringent cleanup level. These representatives estimated that potential recommendations should be available in late 1999. According to the Rocky Flats Cleanup Agreement, officials from DOE, Colorado, and EPA will have to decide whether and how to take action on any recommendations resulting from the review.

The Rocky Flats Cleanup Agreement also requires that surface water leaving the site be acceptable for any and all uses (including drinking water). DOE established a series of holding ponds, ditches, and dams to

trap contaminants and prevent their migration off-site in surface water. However, in August 1997, monitoring devices recorded unacceptably high levels of plutonium and americium[7] in surface water leaving the site. EPA fined DOE $45,000, in fiscal year 1998, for this violation.[8] The source of the contamination has not been identified. According to site officials, the contamination could have been either concentrated in the soil in a single location or spread throughout the soil and later concentrated by the water when it collected and flowed through the site. According to DOE officials, the site has not had any further water quality violations. Colorado and EPA can require DOE to take additional action to clean up the soil if such action is needed to ensure that surface water meets water quality standards.

DOE is also conducting another study at Rocky Flats to determine the presence of radioactive contaminants and track their movement through the soil. Although the final results of the study may not be available for several years, site and regulatory officials say the results should provide valuable information on the cleanup necessary to prevent the migration of radioactive contaminants.

Disposition of Building Foundations and Utilities

DOE and contractor officials began discussions with the regulators and stakeholders in 1998 on the disposition of the site's building foundations, and a document has been issued for public comment. Kaiser-Hill officials are proposing that the foundations be left in place, believing that the costs of removal would be prohibitive and that the act of removal could cause contaminants to be released into the environment. In addition, Kaiser-Hill is proposing that the foundations be filled in with noncontaminated, inert rubble (such as concrete) from the demolition of buildings on-site. Contractor officials argue that this proposal would save time and money. Otherwise, clean fill would have to be shipped in to fill in the foundations. Although the Rocky Flats Cleanup Agreement does not discuss the use of rubble as fill, it does allow noncontaminated building rubble to remain on-site. DOE, Colorado, and EPA must agree on Kaiser-Hill's proposal, and no decisions have yet been made. The regulators want additional information on the contamination around and under the building foundations before they make their decisions. However, some regulator officials have expressed support for the use of noncontaminated rubble as fill.

[7]Another man-made radioactive element.

[8]The Department is disputing EPA's findings, on the grounds that the water samples were too small for valid results. The dispute has been sent to an EPA administrative law judge for a hearing.

DOE and the contractor have started discussions with the regulators and stakeholders on the removal of utilities and their associated infrastructure at the site. After the buildings are demolished, underground cables, pipes, and other utilities will remain throughout the facility. Currently, the plans for closing the site assume that they will remain in place. Kaiser-Hill officials are concerned that their removal would be prohibitively expensive and could stir up contaminants, releasing them into the environment. According to these officials, utilities that might contain radioactive or hazardous materials should be sealed and left in place. However, according to a regulatory official, under the Rocky Flats Cleanup Agreement, radiological or hazardous contamination must be cleaned up to the required standards or managed over the long term to prevent the contamination from harming the public or the environment. Some stakeholders also said that potentially contaminated utilities should be removed to prevent future health hazards. They added that DOE cannot rely on physical, legal, or regulatory barriers to prevent mining, construction, or other invasive activities in the future, because contamination left in place could remain hazardous for thousands of years.

Use of Closure Caps

Closure caps, usually consisting of several layers of earthen or manufactured materials, are designed to establish a protective barrier between contamination that remains on-site and the public or the environment. To accelerate the site's closure, the contractor plans to construct closure caps over portions of the industrial area after the radioactively contaminated buildings have been demolished, but Colorado and EPA officials said that no decisions have been made about using closure caps in these areas. Furthermore, the Rocky Flats Cleanup Agreement does not discuss the use of closure caps for areas other than landfills and solar evaporation ponds. According to DOE, this use of closure caps has not yet been formally proposed for comment as part of any specific cleanup project, but a formal proposal will be made on a timetable consistent with the site's cleanup schedule and CERCLA's guidance.

Some stakeholders have suggested that the contractor may be planning to rely on closure caps instead of removing contaminants to the agreed-upon cleanup level. These stakeholders are concerned that the contractor may propose less stringent cleanup levels in the portions of the industrial area to be capped. In addition, several stakeholders said they expect the closure caps to fail long before the contamination ceases to be a threat. DOE and contractor officials acknowledged that closure caps are likely to fail over

time, particularly if they are not adequately maintained. DOE officials further noted that some closure caps at other facilities have failed. DOE officials said that closure caps would have to be monitored and maintained after the site's closure and might need to be augmented by other physical and legally restrictive barriers[9] to ensure that they provide the required protection.

DOE's Activities and Responsibilities After Closure Have Not Been Defined

DOE has just begun to consider its activities and responsibilities at Rocky Flats after the site is closed. For example, the site may require additional cleanup, questions of ownership and stewardship remain to be resolved, and decisions about the use of physical and regulatory barriers need to be made. Certain programmatic, legal, or fiscal liabilities may be associated with these activities and responsibilities. The Rocky Flats Cleanup Agreement primarily guides the cleanup of the site to closure but provides only limited guidance without specifying activities or liabilities after closure.

Additional Cleanup of the Site

The Rocky Flats Cleanup Agreement allows some of the site's infrastructure to stay in place, including roads, parking lots, and other such remnants of DOE's facilities. DOE officials said that the removal of this infrastructure is not included in the Department's cost and schedule estimates for the site's closure. Although these officials had no detailed estimates available, they said that such work "would take a long time to complete." Colorado and EPA officials said they are aware that closure does not include the removal of all infrastructure. However, they recognized that other stakeholders, as well as the general public, might expect a "green field" at closure, rather than a site with roads, parking lots, and other remnants of the site's infrastructure. In addition, some stakeholders, including the Rocky Flats Citizens Advisory Board, would like cleanup activities to continue after closure and, ultimately, would like

[9]Legally restrictive barriers may include laws and regulations designed to preclude future development of the area or other disturbance of residual contamination.

the site cleaned up to background levels—that is, until the only remaining radiation is indistinguishable from background radiation.[10] However, the cleanup agreement notes that cleanup to background levels is not required and may not be technically or economically feasible.

Ownership and Stewardship of the Site

DOE has not started negotiations with its regulators or other stakeholders over who will own Rocky Flats after it is closed. No decisions have been made about whether DOE will retain ownership. Even if it does not retain ownership, DOE will almost certainly face ongoing responsibility and liability for the site. Similarly, no decisions have been made about stewardship requirements, including whether DOE or some other organization will maintain and monitor the site after closure. The Department will continue to have a role at Rocky Flats after it is closed, but the extent or duration of that role has not been defined. Stewardship activities after the site is closed could include monitoring groundwater; taking soil samples; maintaining infrastructure, such as fences; maintaining closure caps or other barriers to prevent contaminants from being released; and preserving records of cleanup activities and residual contamination at the site.

Institutional Barriers

DOE is considering a variety of institutional barriers to contain residual contamination at the site or separate it from the public and the environment. Physical barriers—such as fences and caps--are designed to prevent exposure to contaminants released by disturbing the soil or other means. Other institutional barriers—such as laws and regulations--are designed to document the contamination and legally preclude future development or other disturbance in contaminated areas. Because residual radioactivity is expected to remain for thousands of years, institutional barriers will be needed, especially in the more contaminated areas.

DOE has not reached agreement with the site's regulators or other stakeholders on which institutional barriers to use at Rocky Flats. According to DOE, issues to be considered when making this decision include the site's potential future uses, the expected longevity of the barriers, and the maintenance required for the barriers. As noted, closure caps and fences are expected to degrade over time and would need to be

[10]This is the naturally occurring radiation in the environment, emitted mainly by rays from space and natural radioactive elements in the soil, such as potassium, uranium, and thorium.

repaired or replaced. Decisions also remain to be made on whether DOE or some other government entity will be responsible for (1) monitoring and maintaining the physical barriers; (2) enforcing legal barriers, such as legislation or regulations; (3) replacing failed barriers; (4) addressing liabilities that may result from failed barriers; and (5) determining when barriers are no longer necessary.

Guidance for Activities and Responsibilities After Sites' Closure

DOE's Office of Strategic Planning and Analysis has recently begun to develop draft guidance for the Department's activities and responsibilities after its sites are closed. Without this guidance, DOE has been addressing these issues on a case-by-case basis as sites have been closed. DOE officials said the guidance should address ownership and stewardship issues, as well as potential future liabilities and plans for dealing with residual contamination or institutional barriers. However, the officials do not expect the guidance to be available for several years. At Rocky Flats, DOE officials do not expect to have plans and cost estimates for the Department's activities and responsibilities after closure for another 2 years. Because these activities and responsibilities for Rocky Flats have not been defined, DOE officials are unable to estimate the duration of DOE's long-term responsibilities.

To date, DOE has given stewardship responsibilities for many of its closed facilities to the Long-Term Surveillance and Maintenance Program at the Department's Grand Junction Project Office in Colorado. Grand Junction reports that it is responsible for 25 sites, most of them former uranium mines. However, none of the sites under this program is nearly as large or complex as Rocky Flats. DOE has not decided whether Grand Junction will be responsible for Rocky Flats after closure.

Observations

Resolving the many outstanding issues associated with the closure and future uses of Rocky Flats appears vital, not only for closing the site by the end of 2006 but also for planning activities and responsibilities after closure. Until DOE has reached agreement with its regulators and other stakeholders on these issues, it cannot determine specifically what it must do to reach closure or whether it will be able to achieve this goal by the end of 2006. Furthermore, decisions on outstanding issues, such as the disposition of the site's utilities or the use of closure caps over portions of the former industrial area, could have serious repercussions for the site's closure schedule. Early resolution of these outstanding issues would allow DOE and the contractor to address their ramifications and mitigate their

impact on efforts to accelerate the site's closure. Planning for the site after closure also requires reaching agreement on its condition at closure and its future uses.

Agency Comments and Our Evaluation

The Department raised a general concern that "this report identifies uncertainties facing the closure that are either rooted in the regulatory structure governing the clean up, that are not ripe for resolution or that in fact are not obstacles to closure." The Department stated that in several of the areas of uncertainty discussed in this chapter, DOE has reached significant agreement. Furthermore, DOE stated that it is moving forward in accordance with the needed decision schedule and the CERCLA regulatory and statutory regime that govern this cleanup. Finally, DOE stated that the Rocky Flats Cleanup Agreement sets the bounding conditions within which the issues identified by GAO need to be resolved, but that these issues are not obstacles to closing the site by the end of 2006. On the basis of DOE's comments, we added information to the report on the Department's actions within the regulations governing the site's cleanup, as well as other issues. However, we do not agree with DOE's position that the uncertainties described and the decisions that remain would have no impact on the site's closure. We note that the agreements that are in place, such as the Rocky Flats Cleanup Agreement, are broad in nature, leaving many of the specific details to be resolved. Moreover, in its comments, the Department states that it has not yet issued formal documents for public comment on several of the issues, so it is not clear how the issues will be resolved or what the results will be. Our purpose is not to question the regulatory processes, but to point out where decisions remain to be made or changes could occur. While DOE does not view the issues discussed as obstacles to the site's closure, we believe that these issues—the site's future uses, the soil cleanup level, the disposition of the building foundations and utilities, and the use of closure caps--are subject to a number of decisions and changes that could affect closure to varying degrees.

The full text of DOE's comments is contained in appendix I. The Department separately provided technical comments, which we incorporated into the text as appropriate.

Costs of Closing Rocky Flats May Be Higher Than Estimated

The costs of cleaning up and closing Rocky Flats could be higher than DOE's estimate of $7.3 billion, and the savings from accelerating its closure could be lower than the Department's $1.3 billion estimate.[1] Site managers representing both DOE and the contractor said that for $7.3 billion, Rocky Flats could accomplish the activities planned from fiscal year 1997 through 2010,[2] if the assumptions underlying this estimate were met and the plans for closing the site did not change significantly. However, a more recent detailed cost estimate, developed by the contractor's mid-level managers and based on the same major assumptions as the $7.3 billion estimate, indicated that closing the site would cost at least $8.4 billion. In addition, many of the assumptions underlying the $7.3 billion estimate have changed or may change, indicating higher costs for some closure activities. As a result, the actual cost of closing the site could be significantly higher than $7.3 billion. Furthermore, this cost estimate does not include costs DOE expects to incur after the site is closed; these costs could range from hundreds of millions to billions of dollars. Finally, the savings of $1.3 billion that DOE expects to achieve by closing the site by the end of 2006 instead of in 2010 represent the costs it expects to avoid by not having to pay for operations and maintenance during those 4 years. Therefore, if the site cannot be closed by the end of 2006, DOE will continue to incur these costs, and the savings will be less. Moreover, according to a preliminary cost estimate presented by the contractor in February 1999, the savings from accelerating the site's closure by 4 years would be only about half as great as DOE estimated.[3]

Closure Costs May Be Higher Than Estimated

In fiscal year 1997, Kaiser-Hill proposed five closure scenarios for Rocky Flats and developed schedule and cost estimates for each of them. These estimates included the costs of activities at the site from fiscal year 1997 through the site's closure. The proposals ranged from closure by the end of fiscal year 2027 at a cost of $16.1 billion to closure by the end of fiscal year 2010 at a cost of $7.3 billion. DOE officials chose to pursue the proposal for closure in 2010. DOE and Kaiser-Hill managers maintain that they have a high level of confidence in the $7.3 billion estimate as long as the closure plan does not change significantly and certain assumptions are met--such

[1]Unless otherwise noted, dollar values represent the sum of annual expenditures and incorporate an annual 2.7-percent increase for expected inflation.

[2]The 2010 plan is based on closing the site by the end of fiscal year 2010.

[3]This preliminary cost estimate for the 2006 closure plan had not yet been formally presented to the Department.

as consistent, stable funding for the site and no new construction on the site. However, a more recent estimate developed by Kaiser-Hill's mid-level managers indicates substantially higher costs, and assumptions underlying the $7.3 billion estimate have changed, also indicating higher costs.

New Estimate Reflects Higher Closure Costs

In 1998, Kaiser-Hill developed a second, more detailed cost estimate for closing Rocky Flats in 2010. This estimate, which totaled $8.4 billion, was based on the same major assumptions and schedule as the first estimate but was developed through the use of a different budget estimating system. Specifically, the contractor required mid-level managers to provide support for and details on labor, materials, and other factors that could affect the costs of specific projects needed to close the site. The mid-level managers were also required to weight their cost estimates to reflect the degree of risk inherent in each project's cost, schedule, and technology. According to Kaiser-Hill officials, the mid-level managers' conservative approach in developing this detailed "bottoms-up" estimate increased the projected cost to $8.4 billion.

Although DOE site officials have reviewed portions of both the $7.3 billion and the $8.4 billion cost estimates covering the first 2 years, they have not reviewed either estimate in its entirety. DOE has, however, reviewed the cost estimates for certain projects in the contractor's estimating system and has questioned both the accuracy of and support for these estimates, which are components of the $8.4 billion estimate. Although DOE's reviews identified some cost estimates that erred on the side of conservatism, they also noted that Kaiser-Hill provided inadequate documentation to justify some costs and relied too heavily on previous estimates for which there was little support. Kaiser-Hill managers acknowledged that DOE has valid concerns about the cost estimating system and cost estimates but said they hope to correct deficiencies in the system through internal reviews and external verification of the estimates.

DOE site managers said they directed the contractor to hire an independent auditing firm to review and verify the $7.3 billion estimate, using the plans for closure in 2010. DOE officials said they expect this review to identify possible systemic deficiencies in planning and budgeting and to provide lessons that Kaiser-Hill can use in developing plans and estimates for closing the site by the end of 2006. The contractor expects this independent review, which started in January 1999, to have results available in the spring of 1999. The site's regulators, however, questioned whether an independent review could validate Kaiser-Hill's closure plans

and cost estimates within these time frames, given the complex and technical requirements for closure.

In addition to the independent review of the contractor's 2010 closure plans, the Department's Office of Field Management is planning to hire an independent auditing firm to verify the detailed plans and cost estimates that Kaiser-Hill is developing for closure by the end of 2006. According to DOE site officials, this validation could take place during the summer of 1999.

Changes in Assumptions May Increase Costs

Although DOE site managers expressed confidence in Kaiser-Hill's $7.3 billion cost estimate, they were concerned about the many changes in assumptions about closure that have occurred since that estimate was developed in 1997. As noted, these changes were also not incorporated in the contractor's $8.4 billion estimate. While some changes have led to savings, most are expected to increase costs. Descriptions of some of the actual and potential changes and their likely impact on costs follow.

- Residues program. Kaiser-Hill's new approach to managing residues—packaging them in "pipe and go" containers for shipment to WIPP--is expected to cost at least $50 million less than the on-site processing originally planned.
- Decontamination and decommissioning. After completing a detailed analysis of the initial costs of decontamination, decommissioning, and demolition of the first significantly contaminated building to date, the contractor revised the sitewide cost estimate for this activity from $332 million to $912 million.[4]
- On-site storage. If designated sites do not take Rocky Flats' plutonium and transuranic waste as planned, Rocky Flats could incur unanticipated costs for ongoing storage. For example, if Rocky Flats cannot ship its plutonium metals and oxides to Savannah River, it would have to spend about $43 million to construct a vault for storing these materials, plus about $40 million a year for operations.[5] Similarly, if

[4]According to the contractor, the $332 million estimate is in constant 1998 dollars and the $912 million estimate is in constant 1999 dollars. The difference between these dollar estimates would be slightly smaller if the same dollar base year were used to develop both estimates. Constant dollars are net of inflation. The contractor expects that benchmarking of the site's decontamination and decommissioning to commercial standards, as well as incorporating learning and other efficiencies, will reduce the $912 million estimate.

[5]Estimates are in fiscal year 1999 constant dollars.

Rocky Flats cannot ship its transuranic and transuranic mixed wastes to WIPP, it would have to spend about $50 million to construct a longer-term interim storage facility, plus an estimated $8 million a year for operations. Finally, if DOE cannot find a site to take its low-level mixed waste with higher plutonium content, it would have to spend $23 million to construct a temporary storage facility, plus $10 million to $15 million per year to operate it. DOE site officials emphasized that issues surrounding these potential costs are largely unknown at this time.

- Plutonium stabilization and packaging. Because of reliability and technical problems with the stabilization portion of an automated system, DOE decided to use manually operated furnaces in place of the automated system to stabilize plutonium metals and oxides. As a result, DOE expects to spend about $3 million more than planned in fiscal year 1999 to procure the furnaces and associated equipment for the site. In addition, because of a recent DOE headquarters decision, the site will be spending an additional $2 million in fiscal year 1999 and $12 million in fiscal year 2000 to procure transportation containers for shipping the plutonium metals and oxides and storing them at Savannah River. Originally, the containers were to be procured by Savannah River.
- Status of the site at closure. Decisions about the condition of the site when it is closed, such as the acceptable levels of contaminants in soil and water, could have a significant impact on DOE's costs, both before and after closure. For example, water quality issues have already proved costly. According to site officials, since the early 1990s, DOE has spent over $100 million to comply with the Clean Water Act's requirements and to protect local communities' water supplies. DOE expects to spend over $770,000 in 1999 on another project to protect the water supply for one of these communities. Some existing projects will require maintenance and possible replacement, and other projects--including diversion dams, ditches, or holding ponds--are likely to be constructed in the future, at DOE's expense.
- Threatened and endangered species. Because of requirements to protect the designated habitats of endangered and threatened species found at the site, DOE could incur additional costs for activities related to closure. For example, DOE officials stated that protecting the habitat of the threatened Preble's meadow jumping mouse, which inhabits portions of the site's buffer zone, may entail additional costs. DOE has not estimated the impact of protecting the mouse's habitat on its cleanup activities or costs. However, DOE is required to consult with the Fish and Wildlife Service on any projects that may affect threatened or endangered species on the site. The Fish and Wildlife Service may require mitigation efforts to ensure the protection of these species'

habitats. In some cases, DOE may be required to submit a biological assessment to evaluate the potential impact on a species and to propose mitigation plans to minimize that impact.

While DOE officials have maintained that minor changes in the assumptions underlying Kaiser-Hill's $7.3 billion estimate could be offset by cost efficiencies elsewhere, they have acknowledged that major disruptions or changes in these assumptions could have a major impact on the estimate. DOE officials said that concern about major changes was part of the reason they called for an independent review and verification of the current closure plans and cost estimate.

Some regulators and other stakeholders have questioned the validity of the $7.3 billion cost estimate, recognizing the potential for higher costs. Stakeholders were concerned that the Congress might suspend or reduce funds for the site's cleanup if the work costs much more or takes much longer than planned, leaving cleanup work undone and unfunded. Some stakeholders were also concerned that only the high-risk, high-profile cleanup work would be done, leaving activities such as environmental remediation unfunded or underfunded. Other stakeholders said that although they are not averse to accelerating the site's closure, they are much more interested in seeing the cleanup work done safely and correctly.

Costs After Rocky Flats Is Closed Could Be Substantial

DOE's costs for Rocky Flats will not end when the site is closed. The $7.3 billion cost estimate for closure does not include the costs of activities and responsibilities after the site is closed. DOE officials have begun developing plans for these activities and responsibilities, including additional cleanup of the site, stewardship of the site, and workforce and legal liabilities.

Potential Costs of Activities After the Site Is Closed

DOE is likely to have some additional cleanup and other responsibilities after the site is closed. Under legislative and regulatory requirements, DOE may be liable for remaining contamination and infrastructure, as well as future problems that may arise at the site. For example, DOE may be responsible for the following activities:

- Removing the site's remaining infrastructure. Site officials said the site's stakeholders may press for the removal of roads, parking lots, and other remnants of the site's infrastructure after closure. Such activities would

have to be negotiated with the stakeholders, but site officials estimate that the additional cleanup could cost tens of millions of dollars.[6]

- Storing nuclear materials and wastes on-site. If DOE is unable to find sites to take all of Rocky Flats' nuclear materials and wastes before closure, it is likely to incur storage and cleanup costs after the site is closed. Without knowing which materials and wastes it will have to store after closure, or for how long, DOE's liability for operating and subsequently decontaminating, decommissioning, and demolishing storage facilities could exceed $100 million. For example, DOE estimates it would cost about $40 million a year to operate a plutonium storage vault on-site, plus $8 million for decontamination, decommissioning, and demolition. Similarly, it would cost an estimated $8 million a year to operate a longer-term interim transuranic waste storage facility, plus an estimated $5 million for decontamination, decommissioning, and demolition. Finally, it would cost $10 million to $15 million per year to operate a temporary low-level mixed waste storage facility and $3 million to perform decontamination, decommissioning, and demolition.
- Maintaining water quality. Water quality issues have already proved costly for DOE. DOE may have to perform additional soil cleanup to maintain water quality, even if the site has been closed. DOE has no cost estimates for such cleanup activities, but a site official acknowledged that the costs could be significant.
- Reducing soil contamination. The Rocky Flats Citizens Advisory Board and other stakeholders have considered asking DOE to clean up the soil at Rocky Flats to background radiation levels. While recognizing that such extensive cleanup is "beyond the reach of today's technology, budgetary resources, and legal requirements," the Rocky Flats Cleanup Agreement states that "further cleanup efforts will be made where feasible as fiscal resources and cost effective technology allow." According to site officials, if DOE's record of decision on the site's final condition requires additional cleanup of the soil after closure, the costs could be significant.
- Responding to unanticipated problems. Finally, DOE officials said the Department may be liable for further cleanup if unanticipated problems occur in the future, particularly if they have a negative impact on human health or the environment. For example, an unanticipated release of residual contamination could require mitigation efforts, such as a

[6]Unless otherwise noted, costs estimates for activities and responsibilities after the site is closed are in fiscal year 1998 constant dollars.

response to the release, additional cleanup, repairs, or payments for damages. Costs associated with these potential future liabilities cannot be estimated, but DOE officials indicated that they could be substantial. DOE site officials said that over the next 2 years, they hope to work with the site's regulators and stakeholders to define the extent of DOE's liability in the event of unanticipated future problems.

Potential Costs of Stewardship Activities

No decisions have been made about stewardship activities at Rocky Flats after the site is closed, but DOE site officials estimate that the long-term monitoring and maintenance required under the Rocky Flats Cleanup Agreement and federal regulations could cost from $20 million to $50 million per year. Given that DOE is required to monitor and maintain the site after closure, a DOE site official estimates that stewardship activities through 2040 could cost nearly $1.5 billion.[7] However, under the cleanup agreement, DOE must perform monitoring and maintenance "for as long as necessary for the protection of public health, [the] environment, and safety," so these activities could be required beyond 2040. Long-term maintenance will be required for the diversion dams, holding ponds, closure caps, and other structures that remain on-site. Monitoring of the site's residual radiological and hazardous contaminants--which could remain dangerous to the public or the environment for thousands of years--could also be required for an indefinite period. The frequent sampling and analysis of groundwater, soil, air, and surface water--required to track conditions at the site--could add substantially to the cost of the site's stewardship. Specific maintenance and monitoring activities will be set forth in the Department's record of decision on the final condition of the site.

DOE has not determined which, if any, DOE entity will be responsible for the long-term stewardship activities at Rocky Flats. According to DOE officials, the Department may be able to pay another federal, state, or local entity to assume some or all of these activities. In either case, DOE officials said, liability for the site is likely to remain with DOE (or a subsequent federal entity), and the long-term stewardship costs are likely to be borne by taxpayers.

[7]This estimate represents the sum of annual expenditures through 2040 and incorporates a 2.7-percent annual increase for expected inflation.

Future Workforce and Legal Liabilities

Although DOE has not estimated the total potential costs for the contractor workforce after the site is closed, a site official expected these costs to be substantial—at least $50 million per year—in the first few years after the site's closure and to decrease over time. DOE is developing proposals for retention benefits (to keep contractor employees with critical skills through closure) and separation benefits (to downsize the workforce, when necessary). These proposals may include health care and retirement benefits, incentive pay, and relocation and education benefits. About 2,300 of the 3,000 contractor employees could be eligible for separation benefits.

In addition, DOE officials expect the Department to face long-term liability for health care costs[8] and potential litigation associated with Rocky Flats. DOE may be required to pay certain health care costs, such as health screening for workers exposed to beryllium[9] while working on the site. DOE may also face health-related litigation from former workers and perhaps from nearby residents. Finally, DOE may face litigation for damages to property or natural resources[10] arising from former activities at the site.

Estimated Savings May Be Reduced

By closing Rocky Flats by the end of 2006 instead of in 2010, DOE expects to save $1.3 billion, primarily by avoiding the costs of operating and maintaining the site for 4 additional years. But if it closes the site later than planned, DOE will not avoid some of these costs--for safeguards and security, building maintenance, and other activities required to keep the site functioning safely—and its savings will be less than expected.

In addition, in February 1999, Kaiser-Hill presented a preliminary estimate of the cost of closing the site by the end of 2006.[11] According to this cost

[8]These include the costs of workers' compensation and health surveillance programs that the Department may authorize, such as the current Beryllium Health Surveillance Program.

[9]A low-density metal that was used in manufacturing nonnuclear weapons components at the site, beryllium is highly toxic and can enter the body when dust and fumes are inhaled. Under proposed DOE regulations establishing the Chronic Beryllium Disease Prevention Program, DOE must provide for medical surveillance designed for the early diagnosis of health problems associated with beryllium. Health care costs for job-related illnesses or injuries of current and former Rocky Flats contractor employees are covered by the Colorado State Workers Compensation program.

[10]CERCLA permits the recovery of damages caused to natural resources, 42 U.S.C. 9607(a).

[11]According to the contractor, it is expected that the detailed plan for closing the site by the end of 2006, to be submitted to DOE in late May 1999, will have a total cost estimate of approximately $6.2 billion, excluding the cost of operating DOE's Rocky Flats Field Office.

estimate, the savings from closing the site 4 years earlier would be about $700 million,[12] or about half of DOE's $1.3 billion savings estimate.

Rocky Flats receives appropriations from the Defense Facilities Closure Projects account for its cleanup, maintenance, and other ongoing activities. This arrangement gives DOE site officials more flexibility than they would otherwise have had to move funding among activities as circumstances and priorities warrant. Site officials said this flexibility has allowed timely responses to unanticipated work requirements and changing priorities. However, only one-third of the site's total budget is currently devoted to cleanup activities. The remaining two-thirds is committed to the site's basic operations and maintenance. DOE's plans show these proportions shifting as building are demolished and the need for basic operations and maintenasnce decreases.

[12]This savings estimate factors in DOE program funds for operating of the Rocky Flats Field Office.

Comments From the Department of Energy

Department of Energy
Washington, DC 20585

April 8, 1999

Ms. Gary Jones
Associate Director
Energy, Resources, & Science Issues
General Accounting Office, Rm 2T23
441 I. Street, NW
Washington, D.C. 20548

Dear Ms. Jones:

This is in response to your draft proposed report entitled Department of Energy: Accelerated Closure of Rocky Flats: Status and Obstacles (GAO/RCED-99-100). The General Accounting Office (GAO) has done a thorough job in documenting the complexity, uncertainties and challenges that face achieving the safe closure of the Rocky Flats Environmental Technology Site (Site) by the end of 2006. This report accurately catalogs and analyzes the numerous issues that still need to be resolved to achieve this goal. Moreover, every issue identified in this report is known to DOE and is actively being worked.

In addition to specific technical comments provided separately to GAO, the Department of Energy (DOE) has three general responses and comments:

1. ***This report does not adequately recognize the progress DOE has already made or the obstacles DOE has already overcome in closing the Site.***

   In 1995, DOE projected that closing the Site would cost $36 billion and take more than 60 years. Now, just four years later, the Site is focusing on accelerating closure from 2010 to the end of 2006 and reducing the cost from $7.3 billion to $6.6 billion.

   Since 1995, DOE and their contractor have made significant progress towards closing the Site. Not all of this progress was fully noted in the report. DOE has removed numerous obstacles that stand in the way of closure, and has put in place the organizational infrastructure necessary to achieve closure:

   - *In 1996, DOE negotiated a regulatory agreement that prioritizes concrete steps towards closure and enables its regulators to work with DOE as partners towards closure.*

- *The integrating management contractor at the Site, Kaiser-Hill Company, L.L.C. (Kaiser-Hill), has renegotiated collective bargaining agreements with Site unions designed to focus the site workforce on closure.*
- *DOE has refined the use of performance incentives in its contract with Kaiser-Hill to achieve greater progress towards closure.*
- *The Site has made progress in plutonium stabilization and consolidation, reducing worker risks.*
- *In 1996, DOE and its regulators established action levels for radionuclides in soil, based on an exhaustive technical process. With these action levels in place, the Site successfully completed numerous environmental remediation projects.*
- *In 1998 alone, the contractor completed $40M of unfunded work through efficiency and innovation.*
- *DOE is actively engaged in shipping Rocky Flats' low level waste, low level mixed waste, plutonium pits, highly enriched uranium, and residues.*
- *DOE has successfully resolved issues with other federal agencies and developed a solid property disposition process.*
- *DOE has successfully resolved the issue of providing adequate safeguards for the nuclear material contained in residues to enable the Site to ship certain residues directly to the Waste Isolation Pilot Project, saving the taxpayers tens of millions of dollars.*
- *DOE has significantly improved productivity in critical path activities such as residue processing and glovebox removal.*

Since GAO initiated this audit, DOE has been successful in resolving obstacles identified in this report. For example:

- *DOE has recovered our 2010 processing schedules for four of five of the major residue waste types and we are rapidly gaining ground on our 2006 schedule.*
- *DOE has begun shipments of high priority residue (sand, slag and crucible) and expects to have completed shipments of pits by the end of May.*
- *DOE is continuing to ship low level and low level mixed waste. The Site has met its 1999 targets in this area.*
- *DOE has issued the policy statement on commercial disposal of low level waste.*
- *The first shipment of DOE transuranic waste to WIPP was completed March 26, 1999.*

Some of the accomplishments were noted in the draft report but in summary, the GAO report does not give sufficient recognition to the obstacles that have been overcome and the progress that has been made. If GAO had come to Rocky Flats a year ago or two years ago it likely would have concluded that there were seemingly intractable obstacles to the Site reaching the point it has in fact reached. Additionally, if GAO was

to return to the Site one to two years from now, it would find current issues largely resolved and a whole new set of issues looming ahead. It is true that we cannot provide a specific blueprint of how we will resolve every issue – known and unknown – that we encounter as we continue the clean up. However, we believe that we have the systems and infrastructure in place to provide confidence that we can achieve closure by the end of 2006. We also believe that our performance track record in the last few years justifies continued congressional and public confidence in our ability to reach this goal.

2. ***This report identifies uncertainties facing the closure that are either rooted in the regulatory structure governing the clean up, that are not ripe for resolution or that in fact are not obstacles to closure.***

The report states that uncertainties regarding the end-state of the site may impact DOE's ability to close Rocky Flats by the end of 2006. The report states that DOE has not reached final decisions or achieved complete agreement with stakeholders and regulators on several key issues, including the use of closure caps, clean-up levels for radionuclides in soils, disposition of clean building rubble, detailed plans for post-closure maintenance and detailed agreement on future uses.

However, in all of these areas, DOE has in fact reached significant agreement and convergence. Additionally, DOE is moving forward in accordance with the needed decision schedule and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) regulatory and statutory regime that govern this clean up. Closure caps are a commonly used and approved CERCLA remedy which are also contained in Site planning documents as operating assumptions of the clean up. Closure caps have not yet been formally proposed for formal comment as part of any specific project clean up nor should they be proposed yet according to CERCLA guidance. GAO is in effect stating that DOE does not have regulatory or public agreement for a proposal that has not yet been made. Each specific clean-up action will be developed collaboratively with regulators and submitted for formal public comment when it is ripe for action. This will take place on a timetable consistent with the clean-up schedule and CERCLA guidance.

The report states that DOE's soil clean-up levels are "subject to change," but iterative implementation is the CERCLA process; interim levels have been set and the CERCLA process specifies that final clean-up levels are set through the site Record of Decision. The discussion of disposition of debris states that DOE does not yet have final regulatory approval for onsite disposal of clean building rubble. In fact, the DOE has not yet submitted a formal document for public comment. We are working this issue with the community and are pleased with our progress so far. But we cannot be

reasonably faulted for failing to achieve consensus prior to issuing a document for public comment.

As for future site uses, the DOE has a broad consensus on future uses that enables us to proceed with clean up. The clean-up levels for the Site, as set in our regulatory agreement, are based on community recommendations on future land uses contained in the Future Site Use Working Group report (1995) and the Industrial Area Transition Task Force report (1998). Although GAO is correct in identifying issues that have not been resolved, none of these impact the clean-up levels prescribed in the Rocky Flats Cleanup Agreement (RFCA). The RFCA sets the bounding conditions within which the details identified by GAO will need to be resolved, but they are not obstacles to closure by the end of 2006. None of the decisions or issues identified by GAO for post closure use and maintenance will in fact impact achieving closure by the end of 2006.

3. ***The GAO has validated the overall direction and movement of this Site to closure.***

In the last few years, there has been an enormous transformation in the culture of Rocky Flats. There is an overall commitment to safely closing down this facility. This commitment is shared by federal employees, contractors, stakeholders and regulators. This change in the culture and outlook of the Site has been perhaps the most significant obstacle DOE has had to overcome in placing the Site on a path to closure. DOE believes that, in essence, this GAO report validates and confirms this change.

Fundamentally, the DOE believes that the path we are on to close Rocky Flats safely by the end of 2006 is the best and the only logical course for the federal government. It provides the best value to the taxpayer; it reduces risks and liabilities and provides for protecting public health and the environment. Slowing down the cleanup keeps the risks present longer and costs more money. Stopping the cleanup would keep the risks present indefinitely and would immediately end up costing the Government more, due to the fixed mortgage costs of the facilities.

This report, by analyzing the obstacles to closure by the end of 2006, provides the strongest possible validation of this point. DOE and the contractor workforce are committed to closing down Rocky Flats, safely, as quickly as possible. DOE does agree with the GAO's assessment that this task is difficult, at best, but worth doing.

Sincerely,

Jessie M. Roberson
Manager

Sincerely,

James M. Owendoff
Acting Assistant Secretary
for Environmental Management

Major Contributors to This Report

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Related GAO Products

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Department of Energy: Management of Excess Property (GAO/RCED-99-3, Nov. 4, 1998).

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