
February 2001

NUCLEAR CLEANUP

Progress Made at Rocky Flats, but Closure by 2006 Is Unlikely, and Costs May Increase



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Abbreviations

DOE Department of Energy
EPA Environmental Protection Agency
GAO General Accounting Office
WIPP Waste Isolation Pilot Plant



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United States General Accounting Office
Washington, DC 20548

February 28, 2001

The Honorable John W. Warner
Chairman
The Honorable Carl Levin
Ranking Member
Committee on Armed Services
United States Senate

The Honorable Bob Stump
Chairman
The Honorable Ike Skelton
Ranking Minority Member
Committee on Armed Services
House of Representatives

The Department of Energy (DOE) hopes to complete a monumental task—the cleanup and closure of the Rocky Flats Environmental Technology Site—by December 2006. One of the 16 major facilities that produced the nation’s nuclear weapons, the Rocky Flats site (just 16 miles northwest of downtown Denver) made plutonium triggers, or “pits,” for these weapons.¹ The site’s weapons production activities left high-risk radioactive and hazardous materials and wastes, severely contaminated buildings, and large areas of contaminated soil—all in close proximity to the 2.5 million residents of Denver and its surrounding communities. The job at hand is huge. For example, the total amount of radioactive waste that the contractor is required to package and ship off-site is enough to fill a 19-story building the size of a football field. Initially, DOE planned to maintain and gradually clean up the site until about 2070. However, in 1995, DOE undertook a more aggressive cleanup approach and signed a contract with Kaiser Hill Company, L.L.C.,² to begin cleaning up the site. Then, in 1997, the Secretary of Energy designated Rocky Flats, along with several other nuclear sites, as a pilot site for cleanup and closure within 10 years. Subsequently, DOE and Kaiser-Hill set the challenging goal of closing the site by December 15, 2006. If DOE and the contractor can achieve this goal or come close to it, the Department stands to save billions of dollars compared with what it would have spent to continue to

¹The trigger is the primary device that is imploded to cause a fission reaction. Rocky Flats has not produced plutonium triggers since 1989.

²Kaiser-Hill is a joint venture between Kaiser Group International, Inc., and CH2M Hill.

operate and maintain the site for an additional 60 years, and environmental and safety risks will be reduced that much earlier.

Concerned about the Department's ability to meet the 2006 site closure date, the Senate and House Committees on Armed Services, in Public Law 106-65 (Oct. 5, 1999), directed GAO to review several aspects of the closure project. As agreed with your offices, we reviewed (1) the status and cost of the Rocky Flats closure project, (2) the likelihood that the site will be closed by 2006, and (3) the management actions needed, if any, to improve the likelihood of the project's success.

Results in Brief

In the more than 5 years that it has been the major contractor at the Rocky Flats site, Kaiser-Hill has made significant progress toward cleaning up the site, but the majority of the work—and the most complicated—remains to be done. One of the four major activities—shipping nuclear materials such as plutonium-contaminated metals and powders—is expected to be completed in 2002. Another activity—shipping radioactive waste—has begun, but hundreds of thousands of cubic meters of waste remain to be shipped. Similarly, a third activity—cleaning up and demolishing hundreds of structures—is under way but is only about 10-percent complete. Kaiser-Hill is using some innovative techniques to speed the cleanup of the contaminated structures, including the use of specialized cutting torches in place of conventional hand tools. And finally, although three of the four planned groundwater treatment systems have been installed, the vast majority of contaminated soil areas remain to be remediated. Because of the project's difficulty, DOE entered into a cost-plus-incentive-fee contract with Kaiser-Hill. If completed on time, the project will cost about \$7.5 billion (in constant 2000 dollars) from the signing of the first cleanup contract with Kaiser-Hill in July 1995 through the 2006 closure date, and about \$1.4 billion more thereafter, for such activities as site monitoring and maintenance and for contractor employees' retirement benefits. These overall costs will increase if additional work is required or if the 2006 target date is not achieved; taking another 2 years to complete the project, for example, could add about \$530 million for such costs as employee salaries and maintenance activities.

Kaiser-Hill and DOE are unlikely to meet the December 2006 target closure date. Significant and complex challenges must be overcome first, such as (1) addressing technical problems in order to successfully operate a complex system for stabilizing and packaging plutonium—a system already 3 years behind schedule; (2) overcoming limited numbers of transportation casks and a limited loading capacity to ship huge quantities

of radioactive waste; (3) developing plans for cleaning up the site's structures and removing over 720 of them, mostly in the last 2 years before the site's closure; (4) resolving uncertainties about the extent of contamination in the soil and the amount of contamination that can be left in place; and (5) reducing the number of safety violations at the site, which not only pose risks to the workers but which can also result in lengthy building shutdowns that interrupt cleanup activities. If Kaiser-Hill and DOE cannot overcome these major challenges, the site's closure by 2006 is unlikely. In light of these challenges, as of December 2000, Kaiser-Hill estimated that it had only about a 15-percent probability of completing the project by 2006.

Kaiser Hill and DOE are developing their respective plans for managing the closure project, but DOE needs to take additional steps to effectively implement its plan. The plans are intended to clearly delineate each party's responsibilities for closure and the time frames associated with those responsibilities, and serve as tools for managing the project. DOE identified weaknesses in Kaiser-Hill's plan (referred to as the *baseline*) for managing the thousands of activities necessary to clean up and close the site, and company officials are working to resolve them. The improvements that Kaiser-Hill is making to its baseline include developing a more detailed cleanup strategy for the structures contaminated with plutonium and ensuring compliance with regulatory and oversight requirements. DOE's plan, which is still under development, is intended to identify DOE's responsibilities under the contract and the sequence of tasks for meeting them. Many elements of the plan appear to be sound, including the process of documenting the tasks required, the time frames for completion, and the organizations and sites whose contributions are critical to successfully accomplishing the tasks. However, we have concerns about DOE's ability to effectively implement its plan because no strategy is in place to identify and resolve problems. Two components are missing—a clearly established authority for reconciling competing demands for DOE's resources and a process for limiting the amount of time that a problem or conflict can languish unresolved. Without these components, Rocky Flats has had difficulty getting other DOE organizations to provide the support it needs to complete the cleanup, such as obtaining transportation resources to ship its plutonium off-site and certified containers needed for shipping nuclear materials. These features are not in the plan now because the Department has been focused on developing the basic tasks and time frames and, to date, DOE's senior managers have not been significantly involved in the project. It is important to take these steps now because implementation is already under way for certain aspects of the plan, the Rocky Flats project has a

tight time frame for completion, delays in key activities can have a cascading effect on other project activities and ultimately affect the project's completion date, and extending the project will increase its overall cost. We are recommending that DOE address these implementation issues to provide greater assurance that its plan will be effectively implemented.

Background

For nearly 40 years, the Rocky Flats site, located about 16 miles northwest of downtown Denver, served as a nuclear weapons production facility, and it now bears the scars of that role. Soil, groundwater, and surface water at the site, as well as many of the buildings, are contaminated with radioactive materials, such as plutonium and uranium; toxic metals, such as beryllium; and hazardous chemicals, such as cleaning solvents and degreasers. Accordingly, the site is now one of the Department's priorities for environmental cleanup. While most of the approximately 6,300 acres that make up the Rocky Flats site served through the years as an undeveloped buffer zone, about one-half of a square mile (385 acres) in the center of the site constituted the industrial area, where, for decades, plutonium was recycled and shaped into pits for use in nuclear weapons. About three-fourths of the site's more than 800 original structures (buildings, guard towers, storage tanks) were not radiologically or chemically contaminated by site operations over the years, but the remainder were—some severely so. This was the case, for example, for seven building complexes that housed the plutonium-processing operations.

The cleanup and closure of Rocky Flats is a complex, tedious, and labor-intensive undertaking. Because plutonium-contaminated materials must be specially contained and carefully handled, the work is hard and slow. Plutonium is dangerous to human health, even in minute quantities, especially if inhaled. Workers dealing with plutonium-contaminated materials and equipment must wear cumbersome protective suits with enclosed respiratory systems and sometimes must wield heavy and ungainly tools. The equipment being worked on must also be enclosed within plastic or glass to prevent airborne contaminants from reaching unprotected workers or surfaces. Figure 1 shows workers in protective clothing dealing with contaminated materials.

Figure 1: Workers in Protective Clothing Handling Plutonium-Contaminated Equipment



Source: Kaiser-Hill.

Within DOE, the Office of Environmental Management 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. At the Rocky Flats Field Office, approximately 190 DOE employees oversee the contractor's activities.

In July 1995, Kaiser-Hill was awarded a 5-year contract to begin cleaning up Rocky Flats. When we reported in April 1999 on the status of the cleanup project,³ Kaiser-Hill's target date to close Rocky Flats was 2010. In response to a 1996 DOE initiative to close as many sites as possible by 2006, DOE entered into negotiations with Kaiser-Hill that resulted in the current closure contract, which took effect February 1, 2000. Kaiser-Hill manages the cleanup work, which is done predominantly by subcontractors. As required by the contract, Kaiser-Hill has developed a closure project baseline, which serves as its detailed management plan for the project.

The closure contract specifies both Kaiser-Hill's and DOE's responsibilities. Kaiser-Hill is responsible for processing, packaging, and shipping off-site all of Rocky Flats' nuclear materials and radioactive and hazardous wastes;⁴ cleaning up and demolishing more than 700 structures that remained on-site in February 2000; and cleaning up the site's contaminated soil and groundwater. DOE is required to deliver a variety of services and items to support the project. Essentially, the contract requires DOE to arrange receiver sites for all the materials and wastes that must be shipped off-site and to obtain the necessary certifications for the containers in which the materials and wastes must be packed and shipped. Many DOE sites will play a significant role in Rocky Flats' cleanup and closure, especially those sites that are scheduled to receive materials or wastes from Rocky Flats, such as the Savannah River Site in South Carolina and the Waste Isolation Pilot Plant (WIPP) in New Mexico.⁵

The closure contract is structured so that DOE pays all of the cleanup costs plus an incentive fee for Kaiser-Hill's services. Kaiser-Hill will not

³See *Department of Energy: Accelerated Closure of Rocky Flats: Status and Obstacles* (GAO/RCED-99-100, Apr. 30, 1999).

⁴These wastes—items such as clothing, gloves, equipment, rags, paper, filters, and plastic—include low-level radioactive waste, transuranic waste, and mixed waste. Low-level radioactive waste contains radioactive constituents measuring 100 or fewer nanocuries of transuranic isotopes (described below) per gram of waste (a nanocurie is one-billionth of a curie; a curie is the amount of radioactivity in 1 gram of radium). Transuranic waste is radioactive waste contaminated with transuranic isotopes (i.e., isotopes of elements heavier than uranium, such as plutonium), with half-lives greater than 5 years, in concentrations above 100 nanocuries per gram of waste. And mixed waste is radioactive waste—either low-level or transuranic—that also contains hazardous wastes such as toxic metals, cleaning solvents, degreasers, and paint thinners.

⁵WIPP is DOE's deep geologic repository for transuranic and transuranic mixed wastes, located in an underground salt formation near Carlsbad, New Mexico.

receive the majority of this fee until it has finished most of the cleanup and closure tasks, as specified in the contract. Kaiser-Hill will earn a higher incentive fee if it saves on costs and finishes its work before the target completion date. In effect, DOE will share the savings from these lower costs by paying Kaiser-Hill a higher fee. Conversely, if Kaiser-Hill exceeds the contract's target date and cost, resulting in higher costs to the government, the contractor will earn a lower fee.

The contract also requires Kaiser-Hill to comply with the terms of the Rocky Flats Cleanup Agreement, which serves as the regulatory framework for the site's cleanup and closure. The agreement specifies the roles and responsibilities of DOE and the two primary regulators for Rocky Flats: the Environmental Protection Agency (EPA) and the state of Colorado's Department of Public Health and Environment. EPA derives its regulatory authority primarily from the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, commonly known as *Superfund*. Colorado exercises regulatory authority over hazardous wastes under the Resource Conservation and Recovery Act of 1976, as amended, as well as the Colorado Hazardous Waste Act. Pursuant to the cleanup agreement, EPA has the lead regulatory authority over the cleanup of the site's buffer zone, while Colorado has the lead authority over the cleanup of the industrial area. The cleanup agreement incorporates the requirements of both Superfund and the Resource Conservation and Recovery Act, and requires that the site's other stakeholders be consulted during the development of cleanup plans. These other stakeholders include the Defense Nuclear Facilities Safety Board;⁶ local governments; community, business, and citizen groups; and individuals.

Under the terms of the contract, and as used in this report, "closure" is defined as the point in time at which Kaiser-Hill has completed all of its cleanup tasks, as specified in the contract. When Kaiser-Hill notifies DOE that it has completed its work, DOE has 90 days either to accept the project as complete or to provide a list of items that Kaiser-Hill must address. The contractor will then have 9 months to complete its work on these items. Separate from how "closure" is defined under the contract, however, is the process of removing Rocky Flats from the list of

⁶The Safety Board is an independent agency created by the Congress in 1988 to oversee health and safety at DOE's defense nuclear facilities. Although not a signatory to the Rocky Flats Cleanup Agreement, the Safety Board is part of this agreement through an attached memorandum of understanding.

Superfund sites. When DOE and the regulators are satisfied that the cleanup meets all regulatory requirements, and sufficient monitoring information has been gathered on the condition of the air, water, and soil, EPA will have the information it needs to consider removing the site from the Superfund list.

After closure has been achieved, however, monitoring and maintenance activities at the site will continue for many decades. Soil and water conditions will continue to be monitored to ensure that contamination remains within acceptable levels. Also, all treatment facilities, such as groundwater treatment systems, will continue to be maintained as long as necessary. DOE's long-term cost estimates include the costs of monitoring and maintenance activities through 2070, but some of the activities will probably need to go on longer.

Considerable Cleanup Progress Has Been Made, but Much Work Remains, and Closure Costs May Exceed \$7.5 Billion

By the end of fiscal year 2000, Kaiser-Hill had made significant strides in cleaning up the Rocky Flats site, but the vast majority of the work, and some of the most technically challenging, remained. The bulk of the work entails (1) processing, packaging, and shipping various forms of plutonium and uranium; (2) processing, packaging, and shipping radioactive wastes; (3) cleaning up and demolishing buildings and other structures; and (4) remediating contaminated water and soil. The total cleanup cost is estimated to be about \$7.5 billion—in constant 2000 dollars—if the site's closure occurs by December 15, 2006. The project's total cost will grow, however, if additional work is required or if delays occur. After closure, costs will continue through at least 2070 for activities such as site monitoring and maintenance, and for contractor employee retirement benefits. These long-term costs will be about another \$1.4 billion in constant 2000 dollars.

Achievements to Date Vary by Work Category, but the Remaining Work Is Substantial

Since it began cleanup operations in fiscal year 1996,⁷ the contractor has made considerable progress toward closure in several work categories. Progress has been greatest in two areas: shipping nuclear materials and remediating groundwater. In most major areas of work, however, the lion's share remains to be done. Table 1 shows the status of the four major cleanup activities, at the end of fiscal year 2000.

⁷Although the previous Kaiser-Hill cleanup contract took effect July 1, 1995, the early months of the contract were spent mostly on planning, according to Kaiser-Hill officials. Thus, our references to the cleanup activities under that contract indicate that they began in fiscal year 1996.

Table 1: Status of Major Cleanup Activities, as of September 30, 2000

Major cleanup activities	Percentage completed
Special nuclear materials shipments	
Plutonium triggers	100
Highly enriched uranium	^a
Plutonium metals and oxides (fine powders)	^a
Waste shipments	
Low-level and low-level mixed waste	13
Transuranic and transuranic mixed waste	2
Structural cleanup and demolition	
Predemolition activities (e.g., dismantling equipment, stripping out pipelines)	10
Structures demolished (of 802)	10
Environmental remediation	
Groundwater treatment systems installed (of 4)	75
Soil remediated; regulators' approval of remedial action obtained (of 124 areas)	2
Regulators' approval to take no remedial action obtained (of 184 areas)	24

^aNational security concerns prevent the disclosure of the percentages of highly enriched uranium and plutonium metals that have been shipped. Most of the highly enriched uranium has been shipped, however, and shipments of plutonium metals have begun and are scheduled for completion by the end of fiscal year 2002.

Source: GAO's analysis of data provided by Kaiser-Hill.

Shipping Special Nuclear Materials

Kaiser-Hill has made significant progress in shipping the site's special nuclear materials (plutonium and enriched uranium). When Kaiser-Hill began cleanup work under its previous contract (in fiscal year 1996), the site had over 16 metric tons of special nuclear materials, including various forms of plutonium (e.g., pits, other metal parts, and oxides)⁸ and enriched uranium.⁹ The contractor was responsible for stabilizing¹⁰ and packaging all of the special nuclear materials and shipping them off-site, primarily to other DOE sites, such as Oak Ridge (in Tennessee), Pantex (in Texas), and

⁸Plutonium oxides are fine powders produced when plutonium metals react with oxygen, as happens during processing and storage.

⁹The site had an additional 106 metric tons of plutonium residues, which contained over 3 metric tons of plutonium. However, these residues are being disposed of as transuranic waste and are therefore included in the total for transuranic waste under the subheading "Shipping Radioactive Waste," and are not included in the total for special nuclear materials.

¹⁰Stabilization includes brushing the plutonium metals to remove loose oxides and heating the oxides to a very high temperature to remove moisture and other impurities.

Savannah River (in South Carolina). By the end of fiscal year 2000, the contractor had inventoried the special nuclear materials and had prepared and shipped all of the plutonium pits and most of the highly enriched uranium. The contractor had also shipped some of the 6.6 metric tons of plutonium metals.¹¹

Kaiser-Hill still has to stabilize, package, and ship off-site the remainder of the plutonium-contaminated highly enriched uranium, the remainder of the plutonium metals, and all 3.2 metric tons of plutonium oxides. According to a DOE official, shipments of plutonium metals began in the spring of 2000; shipments of oxides are expected to begin in June 2001. Kaiser-Hill plans to complete all shipments of metals and oxides by the end of fiscal year 2002. In the sequence of activities necessary to close the site, removal of the special nuclear materials logically precedes many of the other cleanup activities.

Shipping Radioactive Waste

Kaiser-Hill has made limited progress in processing, packaging, and shipping the various radioactive wastes, including mixed waste that also contains hazardous waste. The total amount of radioactive waste to be shipped includes waste that was already stored at the site and waste that is generated during cleanup activities. As of September 30, 2000, the contractor had exceeded its shipping goal by shipping off-site more than 34,500 cubic meters of low-level radioactive and low-level radioactive mixed wastes—about 13 percent of the total. In addition, by the end of fiscal year 2000, the contractor had shipped off-site about 320 cubic meters of transuranic and transuranic mixed wastes, or about 2 percent of the total.¹² The contractor was well below its goal for shipping transuranic waste, having shipped only 25 percent of the amount it had projected to ship in fiscal year 2000. Because waste will continue to be generated by cleanup activities, waste shipments will continue through the life of the cleanup project. From fiscal year 2001 through fiscal year 2006, for example, the contractor expects to ship nearly 224,000 cubic meters of low-level radioactive waste and about 14,400 cubic meters of transuranic waste. In part, the contractor's limited progress in shipping the transuranic waste is due to the late opening of WIPP—the Department's repository for such waste. The WIPP facility did not open until late March 1999, and

¹¹National security concerns prevent our reporting the amount or percentage of plutonium metals that has been shipped.

¹²Hereafter, "low-level radioactive waste" and "transuranic waste" include, by reference, low-level radioactive mixed waste and transuranic mixed waste.

Preparing and Demolishing Structures

shipments of transuranic waste from Rocky Flats did not begin until June 1999.

Kaiser-Hill has made headway on the vast amount of work involved in preparing buildings and other structures for demolition, and has demolished some structures. But the majority of both the preparatory work and the demolition lies ahead. From fiscal year 1996 through fiscal year 2000, the contractor dispositioned (i.e., disposed of, sold, or donated) hundreds of thousands of pieces of uncontaminated personal property; removed thousands of kilograms of plutonium and other nuclear materials from furnaces, pipes, and other locations within buildings; and drained and removed plutonium- or uranium-laden liquids or residues from process pipes and tanks. The contractor also dismantled plutonium-processing furnaces, stripped out contaminated process pipelines, and cut up and removed hundreds of contaminated glove boxes.¹³ How much of the total preparatory work has been accomplished is difficult to say, as the contractor does not measure that work separately. Nevertheless, a senior Kaiser-Hill official estimated that only about 10 percent of the total predemolition work had been completed as of September 30, 2000. Although many of the remaining tasks are similar to those already completed, others are structure-specific. For example, one building contains processing equipment that is two stories tall; another houses a huge plutonium storage vault that is the length of a football field and has 14-foot-thick concrete walls. In the six remaining plutonium-processing complexes alone, hundreds of miles of piping must be stripped out, and hundreds of contaminated glove boxes, furnaces, and other items must be cut into pieces small enough to fit into shipping containers for disposal.

Kaiser-Hill is using innovative technology to clean up the plutonium buildings. For example, it is using a fine aerosol sugar fog to clean some of the most contaminated rooms at the site. The sugar fog—called Capture Coating™—is created by a machine using sound waves to make the droplets very small. The fog is then pumped into the room through a flexible duct. Airborne radioactive particles adhere to the fog, which settles onto the walls and floor and is allowed to dry. The contaminated surfaces can then be more safely removed. Another innovative approach, developed through experience Kaiser-Hill gained cleaning up the first

¹³A glovebox is a closed glass, plastic, or metal chamber for handling hazardous or radioactive materials. The operator handles the material through gloves sealed to the chamber's wall. Gloveboxes range in size from a few square feet to thousands of square feet.

plutonium building, is using a plasma arc torch instead of conventional tools to cut up large pieces of contaminated equipment. The plasma arc torch—a device that electrically heats gas to form a plasma for high-temperature operations, such as melting metal—is much faster, and it distances workers from sharp edges on tools and contaminated metal parts. To further enhance worker safety, Kaiser-Hill is pursuing the use of robotic arms to operate the torch.

To improve the overall efficiency of cleanup and demolition activities, Kaiser-Hill is reducing the size of the site's protected area—a restricted zone within which special nuclear materials are kept under access and security controls. Maintaining a protected area is expensive, requiring the presence of extensive security equipment and armed guards. In addition, a large protected area limits the time that workers can devote to cleanup activities because only those with the necessary security clearances can enter the protected area unescorted, and the entry and exit processes are time-consuming. The protected area now includes all of the plutonium buildings. By consolidating special nuclear materials and processes into one building, Kaiser-Hill plans to reduce the protected area to about one-fifth its current size in early 2001, saving an estimated \$10 million per year in security costs from then through closure, as well as achieving productivity improvements.¹⁴ Kaiser-Hill plans to apply any such cost savings to other cleanup work at the site, in accordance with direction provided in the conference report on DOE's fiscal year 2001 appropriations.¹⁵

Nearly all of the demolition work lies ahead. By the end of fiscal year 2000, Kaiser-Hill had demolished 81 structures encompassing about 196,000 square feet. That equates to about 10 percent of the total number of structures (802) that existed at the site when cleanup began but only about 5 percent of the total square footage. Although many of the 81 structures

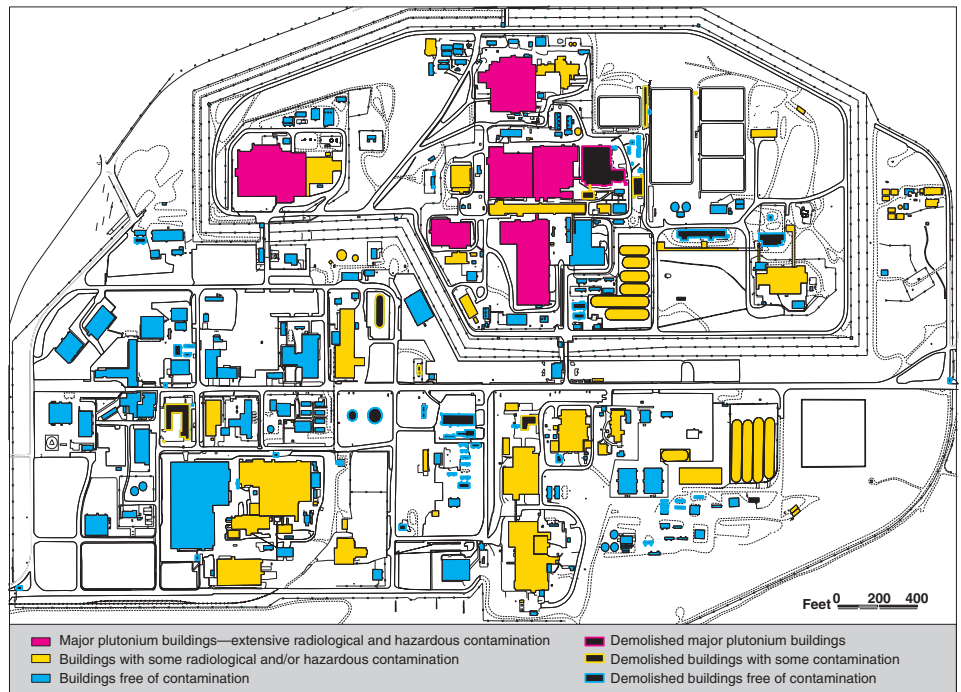
¹⁴Because of the remaining quantities of materials or classified matters, all or portions of the other plutonium buildings will still require some additional safeguards and security—although less than for a protected area. These savings estimates have not been adjusted for inflation.

¹⁵Conference Report 106-988 (Oct. 18, 2000) stated, in regard to defense facilities closure projects, that “Any savings resulting from safeguards and security costs are to be retained and used for cleanup activities at the closure sites.” In providing technical comments on this report, DOE noted that Kaiser-Hill cannot, of its own accord, redirect safeguards and security savings to closure projects. Doing so would require coordination with DOE, so that DOE could take the appropriate steps (e.g., notifying the Congress or reprogramming funds).

demolished so far are relatively minor (i.e., small or uncontaminated), others represent major accomplishments for the contractor. For example, Kaiser-Hill demolished one of the building complexes that, early in the production era, housed plutonium-processing activities. This building complex encompassed 13 structures and more than 75,000 square feet of enclosed space. Its demolition, in fiscal year 2000, was the first in the nation of a plutonium facility of that size and complexity. Remaining to be demolished (after completion of the necessary preparatory activities) at the end of fiscal year 2000 were 721 structures, encompassing about 3.4 million square feet. Most of this demolition is scheduled to occur during the last 2 years of the project.¹⁶ Figure 2 shows, by severity of contamination, the structures that remained to be demolished as of September 30, 2000, and the ones already demolished.

¹⁶Fiscal years 2005 and 2006, plus the first 11 weeks of fiscal year 2007 (up to the target closure date of Dec. 15, 2006).

Figure 2: Status of Structural Demolition in Rocky Flats' Industrial Area, by Severity of Contamination



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

Remediating Contaminated Groundwater and Soil

And finally, the bulk of the environmental remediation remains to be done, much of it also in the last 2 years of the project. Environmental remediation activities at the site are designed to clean up contaminated groundwater, surface water, and soil.¹⁷ Some contaminated groundwater seeps to the surface, particularly during periods of rain or snow, and then trickles into ditches and streams. Similarly, contaminated soil washes into ditches and streams when it rains or snows. Accordingly, the remediation of both the groundwater and the soil is designed to protect not only those elements but also the surface water. When surface water leaves the site—via ditches and streams—it must be safe for all purposes, including drinking water. Currently, the site's runoff water is collected in holding ponds and tested prior to its release to ensure that radioactive materials do not leave the site in surface water.

¹⁷The groundwater contains such contaminants as uranium, nitrates, and volatile organic compounds (degreasers and solvents such as trichloroethene, carbon tetrachloride, and chloroform); the soil contains such contaminants as plutonium, uranium, and americium.

By the end of fiscal year 2000, Kaiser-Hill had installed three of the four planned groundwater treatment systems. Each system intercepts a contaminated plume of groundwater before it can surface and funnels the plume through treatment cells that remove or reduce the contaminants. At least one more treatment system is planned—for the plume underlying the industrial area, pending an investigation of the source, type, and severity of the plume’s contaminants. But Kaiser-Hill plans no remediation of the site’s other seven contaminated plumes because it believes they are stationary under the site. According to the Rocky Flats Cleanup Agreement, stationary groundwater plumes that do not present a risk to surface water require no remediation, regardless of contamination levels. Long-term monitoring of the seven plumes will be necessary to ensure that they remain stationary.

As for the remediation of contaminated soil, most of it remains to be done. Through the end of fiscal year 2000, Kaiser-Hill had excavated or treated several areas of soil contamination that were ranked as high priorities for remediation because of their potential risk to human health or the environment. For example, the contractor excavated or treated soil contaminated by past spills or leaks of radioactive or hazardous materials. When Kaiser-Hill began its cleanup efforts at the site in fiscal year 1996, it was responsible for 308 areas of potential soil contamination. Kaiser-Hill is responsible for determining the levels of contamination present and, thus, which of these areas require remedial action pursuant to the requirements of the Rocky Flats Cleanup Agreement. At the time of our review, much of the characterization remained to be done, particularly under the buildings in the industrial area. As a result, the depth and extent of soil contamination—particularly in the industrial area—was unknown. Relying on preliminary investigations and site records, Kaiser-Hill thought it would need to remediate 124 areas (of the 308) and to take no action (or no further action) on the other 184 areas.¹⁸ Once it has finished characterizing the soil in the industrial area, however, Kaiser-Hill’s remediation plans may change. DOE and the regulators (EPA and Colorado) must approve not only each remedial action that Kaiser-Hill takes but also each proposal to take no remedial action on an area.

At the time of our review, Kaiser-Hill had completed remedial actions on 25 of the 124 areas thought to require remediation. Of the 25 remedial actions, 3 had been approved by the regulators; the other 22 were awaiting

¹⁸Further references to “no action” include “no further action.”

approval. Remediation of the other 99 areas remained to be done. Most of the remaining soil remediation is scheduled to occur toward the end of the project, to coincide with or follow demolition activities. As for the 184 areas thought to require no remediation, Kaiser-Hill had submitted 111 no-action proposals. Of these, 45 had been approved by the regulators; the other 66 were awaiting approval.¹⁹ Proposals had not been submitted on the other 73 areas.

Projected Closure Cost Is About \$7.5 Billion but May Increase

The immense task of cleaning up and closing Rocky Flats will cost about \$7.5 billion from fiscal year 1996 through the target closure date, plus about \$1.4 billion in post-closure costs through 2070.²⁰ These costs, however, could increase substantially, for various reasons.

The \$7.5 billion estimate of costs through the target closure date is made up of four components:

- **The current contract, effective February 2000.** This contract represents more than half the total cost. If closure occurs by the target date, the contract cost will be about \$4 billion.²¹ DOE will pay all costs that it determines are allowable under the terms of the contract. Kaiser-Hill's incentive fee, paid in addition to the allowable costs, is estimated to be about \$340 million but will vary—from \$130 million to \$460 million—depending on the contractor's performance. The fee is tied partly to schedule and partly to cost. Kaiser-Hill will earn the "target fee" of \$340 million if it completes its work within a specified schedule and cost range: between December 16, 2006, and March 31, 2007, at a cost between \$4

¹⁹Some of the remedial actions completed and the no-action proposals submitted had been rejected by the regulators; in other cases, the regulators had requested further information before approving an action or a proposal.

²⁰Unless otherwise noted, all costs cited in this section have been adjusted for inflation and are expressed in constant 2000 dollars. The \$7.5 billion closure cost estimate differs, for several reasons, from the \$6.3 billion estimate contained in DOE's March 2000 *Status Report on Paths to Closure*. Primarily, our estimate of \$7.5 billion is a lifecycle cost estimate through closure and, as such, includes all costs incurred by Kaiser-Hill since July 1, 1995, when Kaiser-Hill's first closure contract began. In contrast, DOE's cost estimate begins in fiscal year 1997, when the Secretary of Energy designated Rocky Flats as an accelerated closure project. Also, we express costs in constant 2000 dollars; DOE's estimate is in constant 1999 dollars. DOE's estimate of post-closure costs was similar to the estimate in this report.

²¹In this paragraph only, the cost and fee amounts are those cited in the contract; they have not been adjusted to reflect inflation.

billion and \$4.2 billion. Kaiser-Hill can earn an additional “schedule incentive” fee of up to \$20 million and an additional “cost incentive” fee of 30 cents of every dollar saved from the target cost of \$4 billion.

Conversely, for late or more costly completion, Kaiser-Hill loses a portion of its fee. For each day that closure is delayed beyond March 31, 2007, Kaiser-Hill loses about \$55,000. And for each dollar of costs in excess of \$4.2 billion, Kaiser-Hill loses 30 cents of its fee. In no case, however (aside from fee reductions stemming from safety violations), will the contractor earn a fee less than \$130 million or more than \$460 million.

- **The previous Kaiser-Hill contract.** This contract, which cost about \$2.9 billion, including the fee, took effect in July 1995 and ran through January 2000.
- **The cost of DOE’s Rocky Flats Field Office.** This cost is about \$553 million, from fiscal year 1996 through the target closure date. This cost is for staff salaries, site utilities, litigation support, regulatory oversight, and other expenses.
- **The cost incurred by other DOE sites and organizations in support of Rocky Flats’ closure.** This cost—about \$130 million, from fiscal year 1996 through target closure—is for such activities as certifying shipping containers, providing transportation for nuclear materials and wastes, and receiving and storing Rocky Flats’ materials and wastes. Although DOE has not quantified all of these sites’ costs to support Rocky Flats’ closure, DOE officials provided us with the major ones. For example, DOE is spending about \$35 million to modify a storage facility at Savannah River to accommodate nuclear material shipped from Rocky Flats. Also, through 2006, DOE will spend between \$17 million and \$22 million to ship transuranic waste from Rocky Flats to WIPP. In addition, for the same period of time, the estimated cost of the DOE headquarters office that supports Rocky Flats’ closure is about \$12 million.

The \$1.4 billion estimate of long-term (post-closure) costs is made up of two components:

- **Site monitoring and maintenance activities.** Through 2070, these are estimated to cost \$400 million. After site closure, DOE or some other entity will need to monitor environmental conditions at the site and maintain the systems and structures that remain there (such as the groundwater treatment systems and monitoring wells).
- **Post-retirement benefits for Rocky Flats’ contractor employees.** These benefits—about \$1 billion through 2070—include pensions and medical and life insurance. According to a Rocky Flats budget official, DOE is liable for such costs under the provisions not only of the current Kaiser-Hill contract but also of previous site management contracts with

Kaiser-Hill and its predecessors (i.e., Rockwell International Corporation; EG&G, Inc.; and Dow Chemical Company). This official also said that DOE has recently assembled a task force to evaluate post-closure liability issues at DOE's closure sites.

Table 2 summarizes the estimated Rocky Flats closure and post-closure costs.

Table 2: Estimates of Rocky Flats' Closure and Post-Closure Costs

In millions of constant 2000 dollars

Cost component	Cost
Closure costs through 2006 target date	
Current Kaiser-Hill closure contract, including incentive fee	\$4,004.4
Previous Kaiser-Hill cleanup contract, including incentive fee	2,883.9
Rocky Flats Field Office (1996-2006) ^{a,b}	552.8
DOE support (1996-2006) ^{a,c}	130.0
Total	\$7,571.1
Post-closure costs, fiscal years 2007-70	
Monitoring and maintenance activities	\$ 388.4
Contractor employee retirement benefits (e.g., pensions and medical and life insurance)	1,010.5
Total	\$1,398.9

^aIn fiscal years; includes first 11 weeks of fiscal year 2007.

^bCosts such as staff salaries, site utilities, litigation support, and regulatory oversight.

^cCosts borne by various DOE sites and organizations for such activities as certifying shipping containers, arranging receiver sites for materials and wastes from Rocky Flats, transporting materials and wastes off-site, and overseeing the closure project.

Source: GAO's analysis of information provided by DOE and Kaiser-Hill.

The projected costs, both through closure and after closure, could be substantially greater than those shown in table 2, as explained below.

Changes to the Contract Could Increase the Target Cost and Extend the Schedule

Changes to the scope of the project or the contract requirements could result in changes to the target cost and the duration of the project. Changes could result, for example, if DOE imposed new requirements for characterizing waste or failed to supply a service or item specified in the contract. If changes are outside the scope of the existing contract or if DOE fails to deliver as required and thereby jeopardizes the contractor's schedule and, thus, its potential fee, Kaiser-Hill could seek relief using a standard federal contracting provision called a "request for equitable adjustment." The relief could take the form of adjustments to the project's schedule, contract cost, or both.

In early November 2000, Kaiser-Hill submitted to DOE its first request for equitable adjustment, seeking a \$2 million cost increase and a \$170,000 fee increase for harm caused by DOE's directed change to the design of a shipping container for plutonium. In late November 2000, Kaiser-Hill submitted another request, which sought a \$1 million cost increase for delays and cost increases—in fiscal year 2000 alone—caused by the change in waste acceptance criteria imposed by New Mexico for the disposal of transuranic waste at WIPP. Kaiser-Hill has also advised DOE that it plans to submit another request for equitable adjustment related to the change in the WIPP waste acceptance criteria—this request will be for schedule delays and cost increases for fiscal years 2001 and beyond. The contractor was considering about eight additional requests for equitable adjustment, any of which could increase the final cost—or extend the closure date—of the project. At the time of our review, DOE officials were reviewing the requests in preparation for negotiations with Kaiser-Hill. Thus, the two parties had not yet reached agreement on what adjustments, if any, would be made to the contract's schedule and cost as a result of the first two requests.

Closure Delays Would Result in Increased Costs

If closure is delayed because Kaiser-Hill is late in completing its cleanup activities, the financial effect could be significant. For example, if closure were delayed by 2 years, the project's cost would increase by about \$530 million; these costs would be paid by DOE.²² As we discuss later in this report, we have substantial reason to expect that delays will occur.

²²A 2-year delay would increase the project's cost (e.g., the contractor's salaries and equipment) by as much as \$630 million, but this amount would be reduced by the approximately \$155 million of fee that Kaiser-Hill would lose as a result of closing the site later and at a higher cost than targeted. Furthermore, DOE would incur about \$55 million for the continued operation of the field office.

Injury to Natural Resources on or Near the Site Could Result in Claims Against the Government

The total cost at Rocky Flats would also rise if any claims for monetary damages are brought against DOE to compensate for injuries to natural resources, such as wildlife, fish, and lakes, on or near the site.²³ Since some injuries to natural resources may be addressed in a cleanup, the amount of damages for which DOE may be liable depends, in part, on the nature and extent of the remedial action. According to DOE officials, no claims for damages have been filed at Rocky Flats and DOE has not yet estimated the extent of its potential liability for natural resource damages at that site.²⁴ Costs resulting from such claims for monetary damages are not included in the estimated costs of the site's cleanup and closure presented in this report.

Site Monitoring and Maintenance Costs Could Be Greater Than Anticipated

The estimated cost of site monitoring and maintenance activities assumes that no further environmental problems will surface at the site because of DOE's past activities. However, it is unclear whether this assumption will prove to be correct. Furthermore, while the DOE estimate includes costs through 2070, some costs will continue beyond that date. Some monitoring activities, for example, are likely to continue in perpetuity.

Closing the Site by 2006 Is Unlikely, Considering the Magnitude of Remaining Challenges

To close Rocky Flats on time and within budget, Kaiser-Hill and DOE must overcome major challenges: (1) getting the automated plutonium-packaging system to reliably perform at the rate needed for timely completion; (2) overcoming limitations on the available number of transportation casks and on loading capability for transuranic waste; (3) completing the planning necessary to accomplish the cleanup, demolition, and remediation of the site's structures, most of which are scheduled for the final 2 years of the contract; (4) clarifying uncertainties about the

²³In addition to requiring the cleanup of waste sites, the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, allows federal, state, and Indian tribal officials who have been designated as trustees to file claims for monetary damages for injuries to natural resources resulting from releases of hazardous substances. Damages are usually for injuries that were not rectified by the cleanup and are to be used to restore, replace, or acquire equivalent resources. Under the act, the Department of the Interior has developed regulations for identifying and measuring injuries to resources and for determining the amount of monetary damages. For more information on natural resource damage issues at DOE, see *Natural Resource Restoration Issues at DOE* (GAO/RCED-97-28R, Dec. 18, 1996) and *Natural Resource Damages at DOE* (GAO/RCED-96-206R, Aug. 16, 1996).

²⁴DOE has disclosed, in its financial statements, a contingency for potential resource damage claims at its sites. For all of its sites, DOE estimated the range of its liability at \$1.4 billion to \$2.5 billion.

extent of contamination and cleanup requirements at the site; and (5) preventing safety problems, which can result in work shutdowns that can delay cleanup work. Kaiser-Hill and DOE are working to address these challenges, but their number and complexity make closure by 2006 unlikely. Kaiser-Hill's own risk assessment concluded that it had only about a 15-percent probability of meeting the target closure date. Furthermore, after 8 months of performance under the new contract, the project was already slightly over cost and behind schedule.

Technical Problems Continue to Delay the Stabilization and Packaging of Plutonium

The development and implementation of the site's plutonium stabilization and packaging system—a prototype for the Department—has faced numerous delays. The system was designed to package plutonium metals and oxides in long-term storage containers. Plutonium reacts with water to form hydrogen gas and, in some forms, can spontaneously ignite when exposed to oxygen. Accordingly, the first stage of the system is designed to stabilize the plutonium by heating it in furnaces to very high temperatures (at least 950 degrees Celsius) to remove moisture and impurities, and thereby stabilize the oxides. The second stage of the system—the automated packaging portion—will place the plutonium metals and oxides into specially designed, long-term storage containers, consisting of three nested cans. All the packaging steps, including laser-welding the lids to the containers, will be controlled remotely.

A number of problems delayed the system's startup and increased its costs. For example, the laser-welds on the container lids proved to be porous when tested inside the negative pressure of a glove box. The porosity had not been apparent in earlier tests at normal atmospheric pressure. Design and construction flaws caused delays as well. For example, the design of the furnaces in the stabilization portion of the system did not allow adequate access for maintenance, and the furnaces were unreliable. Consequently, the stabilization portion of the system, originally designed to be automated, was replaced by a manually operated process. In addition, the ceramic shelves in the manual furnaces took too long to heat up and had to be replaced with metal shelves. These and other problems are now resolved.²⁵ However, the delays increased the system's

²⁵We issued two reports that discuss problems with the plutonium stabilization and packaging system, which DOE supplied to Kaiser-Hill as government-furnished equipment. See *Department of Energy: Problems and Progress in Managing Plutonium* (GAO/RCED-98-68, Apr. 17, 1998) and *Department of Energy: Accelerated Closure of Rocky Flats: Status and Obstacles* (GAO/RCED-99-100, Apr. 30, 1999).

cost from an original estimate of less than \$30 million to over \$85 million, as of September 2000.²⁶

In January 2001, Kaiser-Hill estimated that the system would start operating in March 2001, but the system had not yet completed operational readiness testing, and ongoing problems may further delay startup. One ongoing problem is that in August 2000, DOE directed Kaiser-Hill to ensure that it could meet the plutonium stabilization and packaging requirements issued at that time by the Savannah River Site, where Rocky Flats' packaged plutonium will be sent for storage, pending its ultimate disposition. These requirements, for plutonium to be stored at Savannah River, include developing and implementing a plan for testing the container welds and meeting criteria for monitoring and blending the plutonium. Kaiser-Hill concluded that the additional tasks required would increase the cost and delay the start of the plutonium stabilization and packaging system. However, there is some debate between DOE and the contractor about whether these requirements are in addition to those that were included under the closure contract. If it is determined that Kaiser-Hill was directed to meet requirements in addition to those in the contract, Kaiser-Hill could request an equitable adjustment to the contract.

Once the system begins operations, it is not clear if it can sustain the necessary production rate to allow the site's closure by the target date. According to DOE officials, to complete the plutonium packaging on time before delays compressed the schedule, the system needed to operate only about 10 percent of the time.²⁷ Under its compressed schedule, though, the system must operate over 70 percent of the time. In effect, under the compressed schedule, the packaging portion of the system will have to produce eight containers a day—one container for every 2 hours of operation. Although Kaiser-Hill officials believe that this production rate is within the system's capability, no empirical evidence supports this view.²⁸ If the system cannot meet its expected production rate, many other cleanup activities will be delayed because they cannot begin until the completion of the system's activities.

²⁶These cost estimates have not been adjusted for inflation.

²⁷Kaiser-Hill plans to operate the system 16 hours a day, with two 8-hour production shifts, and perform system maintenance during a third 8-hour shift.

²⁸The plutonium packaging system has only been tested with "cold" or simulated material; its operational capability when packaging plutonium has not been proven.

Because of continuing concerns about the viability of the system, Kaiser-Hill is studying alternatives for packaging the site's plutonium; the study had not been completed at the time of our review. Thus, it is unclear whether a viable alternative exists and could be installed in time to complete plutonium-packaging operations as scheduled by May 2002.²⁹

Compression of the Transuranic Waste Shipping Schedule Stresses the Site's Limitations on Transportation Casks and Loading Capability

Removing the transuranic wastes is one of the most difficult obstacles to the site's closure because of the large quantity of wastes and the complex challenges they present. Kaiser-Hill must ship a total volume of transuranic waste comparable to over 80,000 drums (55 gallons each), or more than 2,000 truckloads.³⁰ Kaiser-Hill's ability to ship this waste off-site to WIPP by the site's target closure date is questionable for the following two reasons:

- **Limited Availability of Transportation Casks Could Affect the Shipping Rate.** Transuranic waste must be shipped to WIPP in special transportation casks approved by the Nuclear Regulatory Commission.³¹ DOE made a commitment to deliver 1,440 casks per year to Rocky Flats during the peak shipping years (fiscal years 2002-4). This number is sufficient for fiscal year 2004 but not for fiscal years 2002 and 2003. For example, to meet Kaiser-Hill's projected shipping schedule for fiscal year 2003 (696 shipments), DOE would need to provide 2,088 casks, or 648 more than DOE has agreed to provide.³² It is unclear whether DOE will provide enough additional casks. According to a DOE transuranic waste program manager, DOE will supply the 1,440 casks it has agreed to, but it

²⁹DOE made a commitment to the Defense Nuclear Facilities Safety Board to have all of the site's plutonium packaged into long-term storage containers by May 2002.

³⁰These are estimates; the final numbers will depend on actual waste generation volumes and waste packaging configurations.

³¹Each reusable cask can hold 14 of the 55-gallon waste drums, or two standard waste boxes. A standard waste box fits into the same space in a transportation cask as seven waste drums and can hold items larger than will fit into the drums, so not as many waste items have to be cut up (size-reduced) for disposal. Kaiser-Hill can ship up to three casks per trailer. A shipment may have up to 42 drums of waste, but the number in any given shipment may be restricted by weight or content.

³²According to DOE officials, Kaiser-Hill's current planned shipping schedule (from the contractor's Sept. 2000 request for government-furnished services and items) is more aggressive than the shipping schedule in the closure contract. However, in the contract, DOE agreed to use its best efforts to accelerate closure activities, including maximizing shipping flexibility and capacity.

will provide additional casks on a “best efforts basis, considering the schedules and requests from other sites.” Other DOE sites, also under pressure to ship their waste by specific dates, will be competing for use of the casks. Figure 3 shows workers loading drums into a transportation cask.

Figure 3: Workers Load 14 of the 55-Gallon Transuranic Waste Drums Into a Transportation Cask



Source: Kaiser-Hill.

- **Loading Capability May Not Meet Shipping Needs.** Kaiser-Hill may not have adequate loading capability to support its shipping needs, especially as the compressed schedule increases the projected need for loading capability in the site’s peak shipping years. The waste is loaded by crane into the transportation casks on flatbed trailers. The site currently has only one loading facility; two more comparable loading facilities are under construction and expected to be completed by November 2001. However, even with all three loading facilities operating, the amount of waste to be shipped is expected to exceed loading capacity for the next

several years. To meet the shipping schedule for the site's peak shipping years, the contractor will have to consistently operate all three loading facilities at capacity. For example, to make the number of shipments scheduled for fiscal year 2003, Kaiser-Hill will need to make over 13 shipments each week. Kaiser-Hill officials believe that the three shipping facilities together can meet the shipping schedule. This capability has not been demonstrated and is in doubt. To make 13 shipments per week, each of the three loading facilities will have to consistently load four or more truckloads of waste each week, with little or no margin for problems or delays. However, largely owing to outside factors influencing its performance, such as building shutdowns for safety problems and changes in the requirements for characterizing transuranic waste for disposal, the existing loading facility was able to perform at this level only 1 week during fiscal year 2000.

Two main factors have contributed to the compression of the site's transuranic waste shipping schedule. First, numerous delays in opening DOE's only transuranic waste disposal facility (WIPP) delayed the shipping schedule. Although fully constructed in 1988, WIPP was not certified to receive transuranic waste until 10 years later. Kaiser-Hill sent its first shipment to WIPP in June 1999—several years later than planned. As a result, the shipments that had been scheduled for earlier years had to be added to later years' shipping schedules.

Second, the shipping schedule has been compressed by changes to the requirements for characterizing transuranic waste prior to shipment. The WIPP waste acceptance criteria, which prescribe how the waste must be characterized, were revised, and New Mexico subsequently imposed additional requirements in conjunction with allowing WIPP to accept mixed waste. These revisions had not been incorporated into the contract, but DOE directed Kaiser-Hill to comply with them. As a result of the changes, the contractor stopped shipping wastes to WIPP for 4 months while it determined what changes needed to be made, implemented them, and obtained the necessary approvals for shipping the wastes to WIPP. Shipments were also delayed because 2,000 drums of waste that had been characterized under the previous requirements had to be recharacterized before they could be shipped. In addition, the new requirements increased by thousands the number of waste drums that had to go through some or all of the steps in the characterization process (depending on the type of waste): x-raying the drums to determine their contents, opening the drums to verify their contents visually, and sampling the drums to analyze their wastes and gases, among other actions. Complete characterization of a single drum takes approximately 2 to 4 weeks, costs an average of \$10,000,

and generates about 800 pages of required documentation. Because of the changed characterization requirements, Kaiser-Hill shipped only about 25 percent of the transuranic waste that it had projected it would ship in fiscal year 2000, therefore adding the remaining amount to other years' shipping schedules.

DOE and Kaiser-Hill are working to overcome these challenges, but it is unclear whether all of the transuranic waste can be shipped off-site by December 2006. In August 2000, the state of New Mexico approved several DOE requests for modifications to its WIPP permit. These modifications streamlined some of the new requirements. For example, for one type of waste, the new requirements called for gas sampling and analysis in 100 percent of the drums (previously, no sampling was required for this waste type). The approved modification reduces this sampling requirement to 10 percent of the drums of this particular waste type. DOE is submitting additional requests for permit modifications to further ease the requirements.

Kaiser-Hill has limited flexibility to adjust its schedule for shipping transuranic waste. Although the contractor does not have the characterization and loading capability to move its projected shipments from peak shipping years to those earlier years with less shipping demand, it plans to increase its shipping rates by operating multiple shifts on existing equipment and acquiring additional equipment as needed, such as the two additional loading facilities. In addition, the contractor is looking for ways to speed up various steps in the characterization process, such as acquiring automated analysis units to reduce the gas sample analysis time to hours instead of weeks, thereby reducing a key bottleneck in the characterization process. These are important improvements because Kaiser-Hill did not build extra time into the schedule to deal with delays related to characterizing, loading, and shipping the site's transuranic wastes, and it scheduled shipments right up to the target closure date. If Kaiser-Hill falls behind on its aggressive characterization and shipping schedules, subsequent delays will occur in the cleanup and demolition of the facilities housing the characterization and loading operations, as well as the storage facilities.

Incomplete Planning Could Impede Removal of the Site's Structures

Kaiser-Hill has to overcome numerous challenges to clean up and remove over 720 structures remaining at the site. These structures range in size and complexity from multistory, very large plutonium-processing buildings to small shacks and outbuildings. Kaiser-Hill's strategy is to demolish over 475 structures in the last 2 years of the project.³³ According to DOE and Kaiser-Hill officials, as part of the contractor's strategy to reduce risk, most of these buildings will have been decontaminated and otherwise cleaned out so they can be safely left standing while awaiting demolition. Kaiser-Hill expects that this approach will allow for a more efficient and continuous demolition phase.

The cleanup and removal of the plutonium buildings will be especially difficult because of their size and because they contain severe radioactive and hazardous contamination and large quantities of processing equipment. The six remaining plutonium buildings contain a total area of about 925,000 square feet. In several instances, parts of these buildings were severely contaminated by fires or accidents. Some rooms, referred to as "infinity rooms," were sealed off because of their extremely high radioactive contamination. In addition, when production activities were suddenly and unexpectedly halted in 1989, plutonium and other dangerous materials were simply left in equipment and processing pipes. Buildings other than the plutonium buildings are contaminated as well—with beryllium, uranium, or other radioactive substances. And even buildings without such contamination can present challenges; because many were built in the 1950s and 1960s, they may contain asbestos or other hazardous materials.

Kaiser-Hill has not fully planned how it will clean up and demolish the site's structures within the time available. Without detailed plans, Kaiser-Hill cannot ensure that the work will proceed in a timely and successful manner. The contractor's baseline includes some time for this work, but in several instances, insufficient detail exists to determine if the schedule is realistic. For example, Kaiser-Hill officials have not yet planned how they will clean up some radiologically contaminated facilities, such as a heavily contaminated two-story storage vault and the equipment used to stack and retrieve plutonium within it. In addition, Kaiser-Hill has allowed itself limited time in the schedule to address unforeseen problems. For example, Kaiser-Hill had allowed only 40 days for such problems in the 7-year schedule for the cleanup and demolition of one of the plutonium buildings.

³³Fiscal years 2005 and 2006, and the first 11 weeks of fiscal year 2007.

In the first 8 months of cleanup, all of these days had been used up, and the cleanup of this building was behind schedule.

Kaiser-Hill identified improved planning for the cleanup of some its plutonium buildings and buildings with other contaminants as one of its top risk mitigative actions. Kaiser-Hill officials said that they intend to develop more detailed plans over the next year. In addition, Kaiser-Hill plans to hire an outside expert to develop a detailed cleanup and demolition plan for the hundreds of remaining structures.

Uncertainties About Extent of Contamination and Cleanup Requirements Complicate Environmental Remediation

How much environmental remediation must be done, and how much it will cost, is not yet certain. For one thing, the extent of soil contamination on the site is not fully understood because the industrial area, where nuclear weapons production took place, has not been fully characterized. The soil under many of the former production buildings is contaminated, but the depth and degree is not yet known. Ongoing activities in the industrial area and the presence of the buildings themselves have prevented thorough characterization of the contamination. Until the soil in the industrial area is fully characterized, the full extent and cost of the required cleanup will not be known.

Also uncertain is “how clean is clean;” that is, how much plutonium-contaminated soil must be removed.³⁴ DOE, the regulators, and the site’s other stakeholders have not reached agreement on an appropriate level of soil cleanup, although several different levels are being considered. Pending a final decision, an addendum to the Rocky Flats Cleanup Agreement set an interim soil level³⁵ of 651 picocuries of plutonium per

³⁴In general, it is more cost effective to remove plutonium-contaminated soil than to treat and return it.

³⁵The interim levels in the addendum are actually interim “soil action levels.” An action level is a numeric level that, when exceeded, triggers an evaluation, remedial action, and/or management action. The action taken is determined through a process prescribed by the Cleanup Agreement. If remedial action is required, the cleanup may well be to a level lower than the action level. The addendum sets two different interim action levels. When contaminants are found to exceed the Tier I level (651 picocuries), that will generally trigger an action such as removal. Exceeding the Tier II level (115 picocuries) would generally trigger a less aggressive action, which may include “hotspot” removal or access restrictions.

gram of soil.³⁶ This level assumes that a future resident on the site could not receive a dose higher than 85 millirems per year from the plutonium remaining in the soil.³⁷ Another interim level being considered—115 picocuries per gram—results in a reduced maximum dosage of 15 millirems per year for that future resident. Other levels more stringent than these two are also under consideration. Because stakeholders were concerned about the sufficiency of these interim levels if they were to be used as the final cleanup levels, and as part of the periodic review process required under the Rocky Flats Cleanup Agreement, DOE funded an independent study by a private contractor, Risk Assessment Corporation. On the basis of an assumption of land use by a resident rancher family, the resulting February 2000 report recommended a level of 35 picocuries of plutonium per gram of soil. However, the ultimate soil cleanup could also be affected by the need to meet surface water quality standards because soil contamination can enter surface water through erosion. A level of 10 picocuries per gram or lower, the use of engineered controls (such as ditches and holding ponds), or both may be required to ensure compliance with surface water standards.

The soil cleanup level established for the site could have a dramatic effect on the scope and cost of cleanup. Although DOE officials believe that the level has not yet been determined,³⁸ Kaiser-Hill assumes that, under the contract, the interim level of 651 picocuries will be used. If the final decision on the level varies from this level, cost and schedule could change significantly. For example, the work scope and cost of cleaning up the 903 Pad, one of the site's biggest environmental remediation projects,

³⁶A picocurie is a trillionth of a curie, which is the amount of radioactivity in a gram of radium. The higher the soil cleanup level, the more plutonium can be left in the soil. A lower cleanup level means that less plutonium can be left, so more soil must be removed.

³⁷Although the future use of the site is expected to be open space, it is impossible to guarantee that residential use would not be considered sometime in the future. Therefore, the interim cleanup levels were designed to protect the health of the public, should this occur.

³⁸DOE officials stated that the Rocky Flats Cleanup Agreement does not explicitly state a cleanup level. Their position is that the contract assumes that the level triggering a cleanup action is 651 picocuries but that the required action could require cleanup to a level lower than 651 picocuries.

could differ dramatically, depending on the cleanup level.³⁹ Table 3 shows estimates of these differences.

Table 3: Estimated Effects of Different Soil Cleanup Levels on the Scope and Cost of the 903 Pad Cleanup

	Soil cleanup level (in picocuries of plutonium per gram of soil)			
	651pCi/gram	115pCi/gram	35pCi/gram	10pCi/gram
Acres to be cleaned up	5.4	18.8	48.8	341.7
Truckloads of waste to be removed	1,130	1,860	3,430	18,680
Estimated cost ^a	\$35,000,000	\$47,800,000	\$74,900,000	\$339,600,000

Legend

pCi = picocuries

^aCost estimates have not been adjusted for inflation.

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

The three parties to the Rocky Flats Cleanup Agreement—DOE, EPA, and the state of Colorado—are currently determining an appropriate soil level for the site. A decision is expected by the end of fiscal year 2001. If the level selected differs from the level determined to be prescribed by the closure contract, Kaiser-Hill could request an equitable adjustment to the contract.

Many of the environmental remediation activities are scheduled for the final years of the closure project, when the limited amount of time remaining before the target date makes changes more difficult to accommodate. Kaiser-Hill's ability to respond to problems may also be limited. Often owing to the logical sequencing of activities, about 65 percent of the site's remediation activities are scheduled for the last 2 years of the closure project. However, Kaiser-Hill has no time built into the remediation schedule to address unexpected problems or delays in preceding activities. As of September 30, 2000, Kaiser-Hill's schedule had

³⁹The 903 Pad is an area where, in the 1950s and 1960s, over 5,000 drums of plutonium-laden solvents and oils were stored on the open ground. Over time, the drums corroded and leaked contamination into the soil. In the late 1960s, the drums were removed, and an asphalt pad was installed to cover and contain the contamination. However, because of wind and other erosion before the pad was installed, plutonium contamination spread south and east over many acres.

Safety Problems May Delay Cleanup and Site Closure

already projected that some of the last remediation activities in the industrial area would occur after the target closure date of December 15, 2006, because of cleanup delays experienced in the plutonium buildings.

Numerous safety violations have occurred at the Rocky Flats site. In fiscal year 2000, 49 safety violations were reported, up from 27 the previous year.⁴⁰ These safety violations—mainly procedural violations—ranged in severity from relatively minor, such as inadequate or improper maintenance of equipment and paperwork problems, to major, such as improperly handling equipment, which could have caused significant injury. Safety violations can result in significant work stoppages and schedule delays because, during a safety-related building shutdown, no cleanup activities or processing operations can occur. According to a DOE safety official, shutdowns owing to safety problems occur periodically in the site's nuclear facilities—including the major plutonium buildings—and usually last hours or days, but sometimes weeks or even months.⁴¹ In fiscal year 2000, for example, work practices not in compliance with approved safety procedures resulted in a 3-month shutdown of a building that was used to store transuranic waste that had already been characterized. By the time the shutdown ended, the characterization requirements had changed, so the waste could not be shipped until it was recharacterized.

Safety violations can also result in financial penalties. Since fiscal year 1996, Kaiser-Hill and its subcontractors have received eight Price-Anderson Act enforcement actions for significant violations of nuclear safety requirements and were assessed \$353,750 in penalties.⁴² These violations included noncompliance with radiological control procedures, resulting in worker contamination; lack of controls over procurement procedures, resulting in the use of substandard waste containers; and failure to implement corrective actions sufficient to address previously identified nuclear safety problems. In addition, under the safety provisions specified in the closure contract, in July and November 2000, DOE assessed fines against Kaiser-Hill totaling \$410,000 (in fee reductions).

⁴⁰These numbers refer to violations of the site's operational and technical safety requirements.

⁴¹Neither DOE nor Kaiser-Hill maintains centralized data on the frequency or duration of the site's safety-related building shutdowns.

⁴²Under the Price-Anderson Amendments Act of 1988 (P.L. 100-408) and subsequent orders, DOE is responsible for investigating possible violations of nuclear safety rules, regulations, or orders, and can assess penalties on its contractors and subcontractors.

Under the contract, DOE can fine Kaiser-Hill for events or incidents that are considered to be symptomatic of a breakdown in the safety management system. These fines resulted from a series of violations, including unsuitable handling of low-level wastes, improper operation of a ventilation system in a plutonium building, and work control events involving hazardous electrical work and potential radioactive contamination.

Kaiser-Hill reports that it recognizes that safety is one of the company's highest priorities and that it has set targets for reducing the number and frequency of safety violations. The contractor reports that, since it took over the management of the site in 1995, it has improved the overall safety performance at the site, as measured by radiological violations, criticality infractions, and recordable employee injury rates. Despite these data, Kaiser-Hill is concerned about the recent negative trend in nuclear safety performance at the site. To address these safety concerns, Kaiser-Hill reports that it is taking several steps. For example, it is (1) encouraging workers to identify potential safety issues before they become a matter of regulatory concern and penalty, (2) providing additional worker training to address various safety issues, and (3) assessing and revising work control processes for the site's nuclear facilities.

Even with these efforts, it is unclear if Kaiser-Hill can sufficiently improve safety to avoid delaying the site's closure. The trend in the number of safety violations is not encouraging. From July 1999 through September 2000, the contractor met its monthly target for reduced safety violations (of operational and technical safety requirements) only once. Furthermore, in the spring and summer of 2000, the Rocky Flats on-site representatives of the Defense Nuclear Facilities Safety Board reported on recurring problems over the previous year caused by workers who did not follow safety procedures. For example, they reported on (1) informal changes being made to procedures without evaluating their impact on safety, (2) conduct of activities that were not authorized, and (3) failure to comply with safety procedures for planning and executing several cleanup activities.

DOE is concerned about the number and severity of safety violations that have occurred since the inception of the current contract. In a January 5, 2001, letter to the president of Kaiser-Hill, the Rocky Flats Field Office manager criticized Kaiser-Hill's failure to improve its safety record. Among the concerns she cited were that Kaiser-Hill (1) lacked an adequate process for identifying key information on safety incidents, including their root causes, and ensuring that lessons learned from safety incidents are

incorporated into future work activities; (2) lacked effective work controls; and (3) had not developed an effective safety and health organization. She also stated that Kaiser-Hill workers and supervisors, especially those engaged in critical activities involving the handling of material, did not understand their roles and responsibilities. She concluded that Kaiser-Hill's management was inadequate, "at every level and in each project," to ensure safe operations at the site. Within days of this letter, the Rocky Flats Field Office manager and the president of Kaiser-Hill sent a joint letter to every Rocky Flats worker discussing the unacceptable trend in safety incidents at the site and emphasizing the importance of safety in all aspects of the project. This letter also stated that Kaiser-Hill would be developing an improvement plan and response to DOE's concerns, and that DOE would assess the effectiveness of the corrective actions. At the time of our review, Kaiser-Hill was developing a comprehensive plan to improve its safety and compliance performance, and expected to submit this plan to DOE in February 2001.

Kaiser-Hill's Data Indicate Closure Will Be Delayed

Considering the challenges and uncertainties that must be overcome to achieve the site's closure, Kaiser-Hill's own risk assessment paints a bleak picture of the likelihood of closing the site by the December 2006 target date. Each quarter, Kaiser-Hill performs a risk assessment to identify and assign priority to risks and uncertainties that represent the greatest threat to successfully completing the closure project, so that they will receive the necessary management attention. In its December 2000 risk assessment, Kaiser-Hill estimated that it had only about a 15-percent chance of achieving the site's closure by December 15, 2006; a 35-percent chance of achieving the site's closure by March 31, 2007; and a 97-percent chance of achieving closure by December 2008—2 full years past the target date. This assessment is considerably more favorable than the one reflected in our April 1999 report, when Kaiser-Hill's risk analysis concluded that the contractor had only a 1-percent chance of closing the site by the end of fiscal year 2010. The recent improved risk assessment is due in part to Kaiser-Hill's and DOE's overcoming several obstacles to closure that were identified in our April 1999 report, such as the opening of WIPP and a decision on the disposition of the uncontaminated rubble from the demolition of the site's buildings.

Despite this progress, another indication that closure may be delayed is Kaiser-Hill's performance to date under the closure contract. After the first 8 months of the new contract, Kaiser-Hill's performance data showed that the project was already slightly behind schedule and over cost. However, Kaiser-Hill officials remain hopeful that they can recover from the

schedule slippages and complete the closure project on time, even though they know that doing so will require overcoming significant obstacles.

Kaiser-Hill and DOE Are Improving Management of the Project, but Concerns Remain About Implementation of DOE's Plan

Although both Kaiser-Hill and DOE have made considerable progress on their respective plans for managing the Rocky Flats closure project, further improvements are needed to help ensure that they meet the target date for the site's closure. At the time of our review, Kaiser-Hill and DOE were working to complete their plans, which are intended to clearly delineate each party's responsibilities for the closure project, the time frames associated with each responsibility, and the effect of delays. Kaiser-Hill was making changes to its own baseline in response to DOE's review comments. As for DOE's plan, it was still under development, but many of its elements appear to be sound, including the process of documenting the tasks required and the time frames for completion. However, two additional components would help DOE to implement the plan—a clearly established authority for reconciling the competing demands for resources among DOE's organizations and a process for limiting the amount of time that a problem can languish unresolved. These features are not part of the plan now because DOE has been focused on the more basic components of the plan and DOE's senior managers have had only limited involvement in the project. However, the absence of these implementation components in the plan has affected DOE's progress in obtaining transportation resources and certified shipping containers for Rocky Flats. It is important to address these implementation issues for several reasons, including that implementation of certain aspects of the plan is already under way and any delays in completing key project activities can affect subsequent activities and ultimately the project's completion date and cost.

Kaiser-Hill Is Working to Improve Its Closure Baseline

Kaiser-Hill is making changes and improvements to its baseline in response to concerns DOE raised during its review of the contractor's baseline. Kaiser-Hill submitted its baseline for DOE's review on June 30, 2000. At the time of our review, the Department had not yet agreed to the baseline, pending the resolution of its concerns. The following are among the many improvements that Kaiser-Hill is making to the baseline:

- **Developing a more detailed strategy for cleaning up the major plutonium buildings and reassessing the cleanup work planned for other structures.** In its review of the June 30, 2000, baseline, DOE noted that Kaiser-Hill had not provided enough detail to clearly convey the work it planned to do to clean up some of the major plutonium buildings and to

conduct environmental remediation studies and risk assessments. Accordingly, Kaiser-Hill agreed to provide additional detail in these areas.

- **Ensuring compliance with regulatory and oversight requirements.** DOE had commented that the baseline was not fully consistent with commitments to regulatory and oversight bodies and with requirements contained in the contract. For example, DOE had agreed to meet the Defense Nuclear Facilities Safety Board's recommendation that the site's plutonium would be packaged into long-term storage containers by May 30, 2002. However, Kaiser-Hill's baseline did not show this work being completed until August 2002. This inconsistency has since been resolved: DOE directed Kaiser-Hill to meet all commitments to the site's regulatory and oversight bodies, and Kaiser-Hill adjusted the baseline to accommodate this direction.
- **Addressing schedule insufficiencies.** DOE questioned whether Kaiser-Hill had included sufficient time in its schedule to respond to unanticipated problems, deal with uncertainties, and still meet the target closure date. Kaiser-Hill officials had a different view of whether its baseline schedule was realistic. They stated that because many of the scheduled activities have never been performed before, it is not known whether the time they have allotted to accomplish these activities is insufficient. Nevertheless, Kaiser-Hill officials acknowledged that slippage on any one of several key activities would delay subsequent activities and could ultimately delay the site's closure. Accordingly, they have been working to build in additional time without extending the schedule. For example, they are seeking more efficient ways to accomplish tasks and are considering alternatives to potentially troublesome systems and processes.

DOE Is Developing a Plan to Meet Its Contractual Responsibilities, but Issues Remain

In August 2000, DOE's Office of Site Closure began developing a detailed plan for carrying out the Department's responsibilities for Rocky Flats' closure. When completed, the plan is intended to formalize DOE's strategy to deliver services and items to Kaiser-Hill, such as transportation for nuclear materials and off-site locations for storage and disposal of those materials. DOE expects that this plan will increase the likelihood of DOE's meeting its responsibilities in a timely way and thus avoid adversely affecting the project's completion date and cost. Because Kaiser-Hill depends on DOE to deliver services and items critical to completing various aspects of the project, the contractor may not be able to complete the closure project as scheduled, should DOE fail to deliver on time.

DOE intends for its plan to identify each service or item for which DOE is responsible, the DOE organizations involved and their responsibilities, and a schedule for accomplishing the necessary activities. For example,

concerning the problem of finding off-site storage and disposal locations for all of the site's so called "orphan" wastes and materials, the Office of Site Closure is compiling a complete list of these orphans; examining possible storage, treatment, and disposal locations; determining the regulatory and other requirements that must be met; and establishing time frames for the necessary activities. Once DOE has a strategy for addressing these and other issues, it intends to obtain agreement from the responsible DOE organizations and sites that they will provide the necessary services and items within the specified time frames. In addition, DOE intends for its plan to improve the monitoring of the project to surface problems or challenges that need to be addressed. As designed, DOE's plan has many of the elements needed to serve as a useful tool to manage DOE's responsibilities; however, we are concerned that two issues may hamper the plan's implementation.

First, DOE has not designated an individual or organization with the requisite authority to make decisions and resolve conflicts that arise among the DOE organizations and sites over competing priorities or limited resources. The Office of Site Closure, which has spearheaded the plan's development, does not have the authority to resolve problems or conflicts as they arise between DOE organizations, such as Environmental Management and Defense Programs. Because of this lack of a recognized authority to make such decisions, some issues with the potential to adversely affect Rocky Flats' closure have not been resolved. For example, Rocky Flats has had difficulty obtaining assurance that sufficient transportation resources (trucks, trailers, and personnel) will be available when needed to ship its plutonium and uranium. These resources are managed by an organization within Defense Programs, which routinely gives priority to its own activities over the activities of Environmental Management—such as Rocky Flats' cleanup and closure. Most of Defense Programs' transportation resources are committed to shipments of nuclear materials from other sites, so the resources may not be available to ship Rocky Flats' materials when needed to meet its target closure date. Officials from Environmental Management have been trying to arrange for the transportation resources needed by Rocky Flats through informal discussions with officials from Defense Programs, but they have not been completely successful. According to a DOE official evaluating DOE's transportation needs and resources and another from the Office of Site Closure, this situation has remained unresolved for months because no individual or organization currently involved in the process has the recognized authority or is at a high enough management level to determine what trade-offs should occur across the DOE organizations or how the Department's limited transportation resources should be put to their most

effective use. If the transportation resources are not available when needed, Kaiser-Hill will have to continue to store the nuclear materials, potentially delaying the cleanup and removal of the storage buildings.

The second implementation problem is that DOE does not have a mechanism in place to limit the amount of time that an issue can languish unresolved before it is referred to the appropriate authority for resolution. Some issues that affect DOE's and Kaiser-Hill's ability to close Rocky Flats by 2006 have remained unresolved for long periods of time. For example, DOE has not been able to certify a transportation container needed for Rocky Flats to ship its plutonium off-site, although this container has been in various stages of the certification process since 1988. The certification process requires coordination among many DOE organizations, sites, and laboratories.⁴³ In a November 2000 report on nuclear material container issues,⁴⁴ DOE's Inspector General concluded that because DOE did not adequately coordinate among the various entities responsible for container activities, it failed to certify, in a timely manner, containers needed to ship plutonium materials from Rocky Flats to Savannah River. As of January 2001, this problem had not been resolved, and DOE expected additional delays in the certification of the transportation container for Rocky Flats' plutonium metals and oxides. Both Kaiser-Hill and DOE officials see the container certification delays as one of the major obstacles to getting the site's plutonium shipped to Savannah River. If DOE does not certify this container by the time the plutonium packaging system is operational, currently scheduled for March 2001, the subsequent cleanup and closure activities could be delayed.

These two features are not part of DOE's plan now because the Office of Site Closure has been focused on developing the plan and has focused little attention on the plan's implementation. In addition, to date, DOE's senior managers have not been significantly involved in the plan's development or its implementation. However, DOE cannot wait until the plan is complete to start implementing it. Instead, officials from the Office of Site Closure are implementing components of the plan as they are

⁴³Container certification is an iterative process of testing and addressing safety concerns and questions. The process involves one or more of DOE's laboratories, various DOE sites, and many DOE organizations, including the Office of Environmental Management and the National Nuclear Security Administration's Offices of Defense Programs and Defense Nuclear Nonproliferation.

⁴⁴See *Audit Report: Containers Suitable for Shipping Fissile Material* (DOE/IG-0490, Nov. 28, 2000).

developed. For example, they are already working to obtain agreement from various DOE entities to provide the services and items necessary to ship the site's special nuclear materials off-site. Because of the tight time frames for the cleanup and closure of Rocky Flats, key activities relating to the site's special nuclear materials must be completed on time or they will affect subsequent cleanup activities, ultimately delaying the site's closure and increasing its cost.

The need for high-level managers' awareness and oversight of DOE's activities in support of Rocky Flats' closure was also raised by DOE's Acting Deputy Director for Management and Administration in a January 2001 memorandum. After reviewing the closure project's administration, he recommended that DOE establish a special management control mechanism to ensure appropriate visibility and resolve problems that arise. However, as of February 2001, DOE was still considering these recommendations. An Office of Site Closure official stated that implementing DOE's plan will be challenging, especially without the requisite authority and a process in place to raise and resolve issues in a timely manner.

Conclusions

Closing the Rocky Flats Environmental Technology Site by December 2006 is a laudable goal and a formidable challenge, especially given the magnitude and complexity of the cleanup project. Kaiser-Hill has made significant progress in the cleanup of the site on several fronts. However, because of the scope and complexity of the remaining work, and the compressed schedule for completing it, there is little margin for resolving the many obstacles that could delay the completion date. Because we found no specific governmental action that would resolve the challenges Kaiser-Hill faces, the contractor needs to continue its efforts to address these challenges quickly and effectively, with diligent attention to safety. However, DOE can take actions to establish the decision-making authority and process for implementing its plan and thereby improve the likelihood of achieving the target closure date and cost. Doing so is important because it will be costly to DOE to keep the Rocky Flats site operating beyond 2006. Even with these actions, because of the many challenges that Kaiser-Hill must overcome, site closure by 2006 is unlikely. However, completing the cleanup and closure of Rocky Flats close to the target date represents the reduction of significant financial and environmental liabilities for DOE and the public.

Recommendations for Executive Action

To improve the chance of achieving the target closure date and cost, and to minimize schedule extensions and cost increases associated with any closure delays, we recommend that the Secretary of Energy develop an implementing strategy for DOE's plan at Rocky Flats that (1) clarifies the authority and responsibility for reconciling competing demands for DOE's resources needed to support Rocky Flats' closure and (2) specifies a process by which these differences between DOE organizations are identified and resolved within specified time frames.

Agency Comments and Our Evaluation

We provided the Department of Energy and Kaiser-Hill Company, L.L.C., with a draft of our report for their review and comment. DOE said that the report was a thorough and credible assessment of the challenges facing the Rocky Flats Closure Project and the Department's prospects of meeting very aggressive cost and schedule objectives for this complex project. DOE also agreed with our observations and recommendation concerning the need for a means to resolve conflicts that arise as part of the complexwide coordination of activities needed to support Rocky Flats' closure.

However, DOE raised two main issues about the content of the report. First, DOE noted that our 1999 report on this project included information that there was less than a 1-percent chance of meeting the target closure date, which was 2010 at that time. DOE said that the contractor's more recent assessment of a 15-percent chance of meeting the 2006 target closure date was a significant improvement that should be recognized in our draft report. We modified our final report to include this information. Second, DOE said that several of the challenges we discussed in our 1999 report, such as the recycling of uncontaminated building rubble and the delays in opening WIPP, had been resolved but that we did not explicitly mention this progress in our draft report. We modified our final report to include this information. DOE also provided several technical corrections, which we incorporated as appropriate.

DOE's comments are presented in appendix I.

Kaiser-Hill said that our draft report was accurate and indicated a strong understanding of the challenges and obstacles facing the Rocky Flats Closure Project. However, Kaiser-Hill raised several issues concerning the report. First, Kaiser-Hill mentioned the two concerns that DOE had raised above. As noted, we modified our final report to address those concerns. Second, Kaiser-Hill said that our draft report should acknowledge that the company had emphasized safety in its operations at the site since the first contract was signed in 1995 and had seen consistent improvement in some safety indicators until the recent development of a negative safety trend.

We clarified this information in our final report. Finally, Kaiser-Hill said that even if closure occurs 1 or 2 years after the 2006 target date, the public would still receive significant safety and financial benefits but that our draft report did not explicitly recognize this point. Although our draft report acknowledged the benefits of closing the site decades earlier than originally planned, we added information to our final report to emphasize these benefits.

Kaiser-Hill's comments are presented in appendix II.

Scope and Methodology

To obtain the necessary information on the closure project's status and cost, and the likelihood of meeting the target closure date, we visited Rocky Flats' facilities and observed cleanup activities, reviewed documents, and interviewed DOE and contractor officials. We also contacted officials and reviewed documents provided by DOE's headquarters and other DOE field locations. We analyzed Kaiser-Hill's baseline and various planning, budget, and cost documents and other records. We also reviewed DOE's draft plans for meeting its contractual cleanup commitments and other DOE records pertaining to DOE's responsibilities under the contract and its oversight of Kaiser-Hill's activities. In addition, we reviewed records and interviewed officials of the regulatory and oversight agencies with cognizance for the site's cleanup—EPA's Region VIII Office in Denver, the Colorado Department of Public Health and Environment in Denver, and site representatives of the Defense Nuclear Facilities Safety Board located at Rocky Flats. We also reviewed documents and attended meetings of various Rocky Flats stakeholder groups, including the Rocky Flats Citizens Advisory Board, Rocky Flats Coalition of Local Governments, and Rocky Flats Cleanup Agreement Stakeholder Focus Group.

To determine the management actions needed, if any, to improve the likelihood of the project's success, we compared the major challenges affecting the closure of the site with Kaiser-Hill's and DOE's plans for addressing them. We assessed whether the planned actions appeared to address the important aspects of these challenges. We also discussed the challenges and planned actions with DOE and Kaiser-Hill officials, regulatory and oversight agency officials, and stakeholders involved in the cleanup and closure of the Rocky Flats site.

We conducted our review from May 2000 through February 2001 in accordance with generally accepted government auditing standards.

We are sending copies of this report to the Honorable Spencer Abraham, Secretary of Energy; the Honorable Mitchell Daniels, Director, Office of Management and Budget; and Mr. Robert Card, President and Chief Executive Officer, Kaiser-Hill Company, L.L.C. We will make copies available to others upon request.

If you or your staff have any questions about this report, please call me at (202) 512-3841. Key contributors to this report are listed in appendix III.

A handwritten signature in black ink that reads "Gary L. Jones". The signature is written in a cursive style with a large, stylized "G" and "J".

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

Appendix I: Comments From the Department of Energy



Department of Energy

Washington, DC 20585

14 FEB 2001

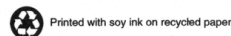
Gary L. Jones
Director, Natural Resources and Environment
General Accounting Office, Rm 2964
441 G. Street, NW
Washington, D.C. 20548

Dear Ms. Jones:

We are writing to provide the official Department of Energy (DOE) agency response to the General Accounting Office (GAO) Report GAO-01-284 "Nuclear Cleanup: Progress Made at Rocky Flats, but Closure by 2006 Is Unlikely, and Costs May Increase." As discussed with your office, technical comments are included in the enclosure to this letter, but will not be published with the report.

Overall, we find the report to be a thorough and credible assessment of the challenges facing the Rocky Flats Closure Project and DOE's prospects of meeting very aggressive cost and schedule objectives for this complex project. The DOE has always believed that the 2006-closure goal for Rocky Flats Environmental Technology Site (Site) is aggressive and ambitious. It nevertheless represents a compelling public policy objective, since the benefits in reducing risk to workers, the public, the environment and the value of reducing government costs and liabilities are obvious from accelerating the closure of this facility. The progress made since the mid-1990s – when DOE estimated closure would take until 2070 – reaffirm for us that DOE is on the right policy track in our efforts to close the Site. Nothing in this report in any way undermines this basic conviction. The DOE is reassured that GAO continues to agree with us that the goal of accelerated closure is laudable, and that this report, like the previous report, does not identify any issues or challenges not previously identified by DOE.

In fact, DOE is heartened by GAO's conclusions in this report. Although the title might lead a casual reader to believe GAO is pessimistic about DOE's prospects for success, we note with approval GAO's comments on the probability of achieving our schedule goals in this report compared with GAO's 1999 review of Rocky Flats closure (GAO/RCED-99-100). The 1999 report indicated that DOE had a 1 percent chance of success by the year 2010. This report, written less than eighteen months later, concludes that the project has a 15 percent chance of success by 2006 and a 97 percent chance of success by 2008. By any measure, this is a huge improvement, one that the public should find reassuring. Since any project of this size and complexity will have some variance in cost and schedule, we are pleased by GAO's conclusions about our prospects. By GAO's own estimate this is a \$7.5 billion project. An insignificant three-percent cost variance on this project represents \$225 million, more than enough money to cover the various regulatory and



**Appendix I: Comments From the Department
of Energy**

Ms. Gary L. Jones

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waste management uncertainties identified in this report. The Kaiser-Hill Company, L.L.C. estimate of a 97 percent probability of success by 2008 cited by GAO is in stark contrast to estimates only six years ago by DOE that closure would not take place until 2070. At the time of the last GAO report DOE was still working to a 2010 baseline. In this context, GAO's assessment is a powerful validation of the prospects for a substantial public policy victory at the Site.

Also, DOE is pleased that many of the specific issues cited by GAO in 1999 – such as the recycling of clean building rubble, the opening of the Waste Isolation Pilot Plant, the availability of receiver sites -- have, in fact, been resolved. This report's silence on these issues is eloquent testimony to our success, even as the report correctly analyzes the current challenges DOE is managing to achieve closure. As we have said in the past, there will always be challenges to completing this complex project. The DOE intends to continue to identify and resolve these challenges and barriers to the 2006 closure plan. A careful review of the two reports shows that DOE is resolving obstacles expeditiously. This analysis is not explicit in this report, even though the legislation authorizing this report specifically calls on GAO to assess "The developments, if any, since the April 1999 report of the Comptroller General that could alter the pace of closure at the Rocky Flats site."

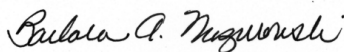
The DOE appreciates GAO's observations regarding our efforts to organize and coordinate complex-wide initiatives to support the closure of the Site. The GAO correctly observes that this process could be strengthened by greater clarity regarding how long issues can sit before they are resolved, and who has final authority to resolve issues among Departmental elements. This is a useful observation and recommendation, one the DOE will take very seriously.

The DOE also has specific, more detailed comments on the report. These are enclosed, and listed as issues of factual or technical inaccuracy and issues of policy.

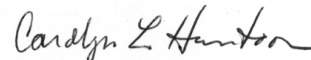
Thank you very much for the opportunity to comment on this report. The DOE remains committed to the safe, accelerated closure of the Site, and we appreciate the role of GAO in reviewing and commenting on our efforts.

Sincerely,

Sincerely,



Barbara A. Mazurowski
Manager
Rocky Flats Field Office



Carolyn Huntton
Acting Assistant Secretary
for Environmental Management

Enclosure

Appendix II: Comments From Kaiser-Hill Company, L.L.C.



February 13, 2001

01-RF-00304

Gary L. Jones
Director, Natural Resources and Environment
U.S. General Accounting Office
441 G Street, N.W.
Washington, D.C. 20548

GENERAL ACCOUNTING OFFICE RESPONSE – RGC-021-01

Dear Ms. Jones:

Thank you for the opportunity to provide comments on the General Accounting Office's (GAO's) draft report, Progress Made at Rocky Flats, but Closure by 2006 Is Unlikely, and Costs May Increase (GAO-01-284). Overall, the report is well written and accurate, and indicates a strong understanding by GAO's staff of the challenges and obstacles facing the Rocky Flats Closure Project.

First, we would like to expand on the report's discussion of safety at the Rocky Flats Environmental Technology Site (Site). We recognize that safety is the key to a successful closure of the Site. If we cannot perform safely and compliantly, we cannot perform at all. Safe conduct of operations is clearly a fundamental precursor to all other risk reduction activities at the Site. The fruits of this emphasis have been seen in our performance at the Site: each year since 1995, our overall safety performance has been better than each previous year. The results are impressive: measured against traditional safety indicators since 1995, the Site has seen an 80 percent improvement in radiological violations, an 80 percent improvement in nuclear criticality safety, and a 60 percent improvement in the employee injury rate.

GAO correctly points out that there was a particularly disturbing negative trend in safety performance over the last quarter of calendar year 2000 – a trend that precipitated the serious criticism of our safety performance by the Rocky Flats Field Office (RFFO). We agree that this trend is significant and, if left unchecked, could have a negative long-term impact on closure activities. The lesson is a simple one: we can never rest on our past performance, and must consistently and continually maintain our diligence on safety improvement. As the report points out, we have taken several significant steps to improve our focus on safety and work control issues, and are working closely with RFFO to ensure that these serious concerns are properly addressed.

Second, a somewhat disconcerting element of the report is the lack of recognition of obstacles already overcome and the marked improvement in the confidence of an accelerated closure since the GAO's last evaluation of the project's progress. In its April

Kaiser Hill Company, L.L.C.
Rocky Flats Environmental Technology Site, 10808 Hwy. 93 Unit B, Golden CO 80403-8200 • 303-966-7000

**Appendix II: Comments From Kaiser-Hill
Company, L.L.C.**

Gary L. Jones
February 13, 2001
RGC-021-00
Page 2

1999 report, Accelerated Closure of Rocky Flats: Status and Obstacles (GAO/RCED-99-100), GAO accurately pointed out that Kaiser-Hill's risk analysis concluded that it had a "1-percent chance of closing the Site by the end of fiscal year 2010." GAO's current report indicates that this same risk analysis, applied to the current state of the closure project, confirms that today the Site has a "15-percent chance of achieving site closure by December 15, 2006," and a "97-percent chance of achieving closure by December 2008."

This dramatic improvement would not be evident by a cursory comparison of the two reports; in fact, the February 2001 report initially seems more pessimistic about the potential for accelerated closure. The evidence clearly proves otherwise. While it may still be accurate to depict the December 15, 2006 closure as "unlikely," it is also accurate to state that impressive progress has been made over the past two years, and that the confidence in an accelerated closure has steadily increased as obstacles have been overcome.

From the unique perspective at the Site, the successful closure of this facility remains a significant national interest. As long as the Site stands, there will be a large, ongoing expenditure of Federal dollars to safeguard nuclear materials and safely maintain facilities. Only through cleanup and closure will this significant taxpayer liability be eliminated. Kaiser-Hill Company, through the unprecedented and innovative closure contract signed last year, also has a compelling interest in the closure of the Site. In a fairly unique arrangement with DOE, Kaiser-Hill's ability to earn fee on this project is directly tied to the savings and efficiencies we can generate for the Federal government. Our goal is to shut down the Site 64 years ahead of the original schedule. Regardless of whether the project is completed in 2006, 2007, or 2008, taxpayers are the ultimate beneficiaries of the Site cleanup and closure.

We agree that numerous challenges remain, and that the December 2006 closure date continues to be a difficult and demanding goal. GAO's report clearly and accurately points out several of these daunting challenges. The report is a valuable resource for highlighting current areas of concern for the project and independently confirming several areas in need of additional focus and attention. We are also confident that these remaining hurdles, like others before them, can and will be crossed on the way to a successful and timely closure of the Site.

Sincerely,



Robert G. Card
President and Chief Executive Officer
Kaiser-Hill Company, L.L.C.

Appendix III: GAO Contacts and Staff Acknowledgments

GAO Contacts

William R. Swick (206) 287-4800; Pamela J. Timmerman (303) 572-7306

Staff Acknowledgments

In addition to those named above, Lee H. Carroll, Amy Cram Helwich, Pamela K. Tumler, and Amy E. Webbink made key contributions to this report.

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