

April 1987

NUCLEAR MATERIALS

Alternatives for Relocating Rocky Flats Plant's Plutonium Operations



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United States
General Accounting Office
Washington, D.C. 20548

Resources, Community, and
Economic Development Division

B-216376

April 14, 1987

The Honorable Timothy E. Wirth
United States Senate

Dear Senator Wirth:

This report responds to your request dated February 21, 1985. It includes information on alternative locations for plutonium processing and fabricating operations currently conducted at the Rocky Flats Plant near Denver, Colorado. A recommendation is included which is directed toward the decisionmaking process affecting the future of the Rocky Flats Plant.

As agreed with your office, unless you publicly announce its contents earlier, we will not distribute this report further until 14 days after its publication date. At that time, we will send copies to the Director, Office of Management and Budget; interested congressional committees; members of Congress; and the Department of Energy. Copies will be made available to others upon request.

Sincerely yours,

A handwritten signature in cursive script that reads "J. Dexter Peach".

J. Dexter Peach
Assistant Comptroller General

Executive Summary

Purpose

Major operational problems in a plutonium-processing building at the Department of Energy's (DOE) Rocky Flats Plant near Denver, Colorado, have existed since the building became operational in 1981

Because of the high estimated costs associated with repairing the building, and the potential risks associated with the plant's proximity to a major metropolitan center, Senator Timothy E. Wirth requested that GAO determine (1) whether relocating the plutonium-processing operations to other DOE sites is a viable alternative to correcting the problems in the building, (2) what effect such a relocation would have on public health and safety in the Denver area, and (3) if the costs associated with correcting the problems in the building justify reevaluating the total relocation of the plant's plutonium processing and fabrication operations—in effect, relocating the plant.

Background

One of DOE's primary missions is to provide the Department of Defense with nuclear weapons. In order to accomplish that mission, DOE maintains facilities throughout the United States that supply nuclear materials, weapons components, and weapons. Many of these facilities, including the Rocky Flats Plant, have buildings that were constructed in the 1950's and 1960's and are now aged and deteriorating.

The Rocky Flats Plant fabricates plutonium components for nuclear weapons and processes obsolete weapons to extract the plutonium. Residues which are produced from both operations are processed at Rocky Flats, and plutonium recovered during processing is used in the fabrication process.

Plutonium is radioactive and toxic to humans if inhaled, ingested, or absorbed into the body. Plutonium operations at the Rocky Flats Plant have been the subject of concern because the Rocky Flats Plant is located just 16 miles from downtown Denver.

Design, materials, and mechanical problems associated with the processing building (known as building 371) surfaced in 1981. DOE has not yet funded repairs for building 371 and has, instead, examined alternatives for processing plutonium. The alternatives include relocating all or part of the Rocky Flats Plant's processing operations to other locations, and relocating all plutonium operations, including fabrication and processing, now performed at Rocky Flats to one or more other locations. The DOE sites which could be involved in such relocations are at Savannah River, South Carolina; Hanford, Washington, and/or Los

Alamos, New Mexico. These sites were considered because they currently conduct operations similar to those at Rocky Flats. Factors influencing which of the alternatives is more desirable include relocation costs, transportation costs, pipeline quantities (the amount of plutonium which is not available for use in weapon production because the material is either being processed or is in transit), health and safety risks, and socioeconomic impacts.

Results in Brief

Relocating plutonium processing to other locations appears to be feasible. On the basis of information obtained from DOE, GAO identified four alternatives for relocating plutonium processing that would cost between about \$200 million and \$600 million (fiscal year 1986 dollars). These alternatives would require between 4 and 10 years to implement, including design, construction and/or alterations, and start-up. This is in comparison to an estimated cost of about \$300 million to repair building 371 at the Rocky Flats Plant and an implementation period of 8 years.

While DOE currently considers off-site safety and health risks to be low, studies required by the Environmental Protection Agency have revealed some potential environmental problems.

The major contributor to safety and health risks at the Rocky Flats Plant is not the plutonium-processing operations, but rather the fabrication operations. The alternative that addresses fabrication operations (a fifth alternative GAO analyzed) is to relocate all Rocky Flats plutonium operations. According to a DOE study, this alternative could cost over \$4 billion and take as long as 24 years for planning, site selection, design, construction, and start-up of the new facility and decontamination and decommissioning of the Rocky Flats Plant. On a cost basis alone, this alternative does not appear justified.

Principal Findings

Costs Vary for Different Alternatives

Costs for relocating Rocky Flats' plutonium-processing operations range from about \$200 million to partially relocate plutonium processing to over \$600 million for relocating all processing operations. Estimated costs for repairing building 371 are about \$300 million. Costs to relocate

the total plant exceed \$4 billion. Transportation costs and pipeline quantities also vary between the alternatives; however, the differences are not as dramatic as the differences in relocation costs. (See ch. 2.)

Risks Associated With Rocky Flats Operations Considered Low

Recent safety assessments by Rockwell International, the contractor operating the Rocky Flats Plant, have calculated that the overall safety and health risks are within DOE's acceptable limits. Studies have estimated that an individual living near Rocky Flats has a 1-in-900 million chance of contracting cancer due to an accident at the Rocky Flats Plant. However, the studies which originally calculated these risks are currently being redone to incorporate new risk analysis techniques. Preliminary results indicate that the primary hazard at Rocky Flats is now an earthquake whereas the primary hazard was previously thought to be wind. In addition, recent studies have indicated toxic chemical contamination in local groundwater. (See ch. 3.)

Fabrication, Not Processing, a Major Contributor to Risks

Studies show that fabrication operations contribute 48 percent of the total Rocky Flats risk to the off-site population; processing operations contribute approximately 12 percent. Thus, the overall risk at the Rocky Flats Plant would not drastically change if only plutonium-processing operations were relocated and fabrication operations remained at Rocky Flats. (See ch. 3.)

Small Socioeconomic Impacts Predicted

If a decision is made to move some or all plutonium operations from the Rocky Flats Plant, the time required for relocation may help minimize adverse socioeconomic effects. Relocating the processing operations would require 4-10 years to complete, and the number of positions to be eliminated would be spread out over this period. Further, if fabrication operations remained at the Rocky Flats Plant, an increase in jobs related to residue packaging and transportation would partially offset the loss of processing-related jobs to other locations. Relocating all plutonium operations would not affect employment until about 14 years into the project. (See ch. 3.)

No Decision on Plutonium Operations Appears Imminent

Despite more than 5 years of studies, DOE does not appear to be close to a decision on the future of plutonium processing at the Rocky Flats Plant. During those 5 years, DOE has incurred costs to transport residues to other DOE facilities for processing; public perceptions of the health

risks associated with Rocky Flats appear to be growing; the older, deteriorating processing buildings at Rocky Flats are still in use; and building 371 is largely unused.

GAO's review disclosed no processing alternative that was clearly superior to the rest when all factors are considered. The total plant relocation alternative, when evaluated on a cost basis alone, does not appear justified. The costs associated with repairing building 371 and maintaining, upgrading, or replacing other facilities at Rocky Flats to allow it to operate until a new facility is constructed elsewhere exceed the total costs of most of the processing relocation alternatives; and the total relocation costs exceed \$4 billion. For all alternatives, when other factors, such as environmental, safety, and health risks, are considered, the most attractive alternative depends on the emphasis placed on the various factors.

Recommendation

To make the best decision on the future of building 371, DOE needs to first address a broader issue—where does the Rocky Flats Plant fit in the overall, long-term plans, goals, objectives, and requirements for an aging DOE weapons production complex? Many of DOE's facilities are approaching or have passed their planned operating lives, and major investments will be required to replace or refurbish these facilities.

Before spending hundreds of millions of dollars to relocate or repair one building at Rocky Flats, DOE needs to take a broader look. In March 1987 testimony before the Senate Governmental Affairs Committee, GAO addressed this issue and called on DOE to make this broad, strategic analysis. For Rocky Flats, GAO recommends that the Secretary of Energy ensure the selection of the best solution be closely coordinated with this strategic analysis to assure that construction/modernization funding is used efficiently.

Agency Comments

GAO discussed the facts presented in this report with DOE and Rockwell International officials. These officials agreed with our overall observations and provided information to clarify data contained in the report. As requested, GAO did not obtain official agency comments on the report.

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Abbreviations

| | |
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| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act of 1980 |
| DOD | Department of Defense |
| DOE | Department of Energy |
| EPA | Environmental Protection Agency |
| GAO | General Accounting Office |

Introduction

The responsibility for making nuclear material for defense programs was first vested in the Atomic Energy Commission in 1946 and then in the Energy Research and Development Administration, which was established in 1974. This responsibility was, in turn, transferred to the Department of Energy (DOE) pursuant to the Department of Energy Organization Act of 1977 (42 U.S.C. 7151).

The basic missions of DOE's defense activities include weapons research, design, and fabrication and production of nuclear materials for nuclear weapons and naval fuel. DOE's defense mission is carried out at 18 weapons facilities around the nation. One of DOE's key weapons facilities is the Rocky Flats Plant. Located approximately 16 miles from Denver, Colorado, the plant is operated by a contractor—Rockwell International. The plant fabricates weapons components using plutonium¹ and other materials, and processes materials from retired nuclear weapons and residues and wastes from the fabrication process to extract plutonium for reuse.

Because the Rocky Flats Plant is situated near the Denver metropolitan area (population, 1.8 million), public concerns over the safety and health risks associated with the facility's operations were raised by a series of accidents and fires which released radioactive material off-site. These concerns, in turn, have led to a number of safety assessments of the Rocky Flats Plant. Two of these assessments concluded that moving the functions performed at the Rocky Flats Plant to another location would cost billions of dollars and would require an extensive period of time

In 1973, to reduce the safety and health risks from Rocky Flats operations, DOE began constructing a new plutonium-processing building (at an estimated cost of \$113 million) to replace several aging buildings at Rocky Flats. When the project was completed in 1981—at a final cost of approximately \$215 million—Rockwell International attempted to operate it, but encountered severe design, materials, and mechanical problems. DOE has conducted several studies since 1981 of how to fix building 371. However, the building is still not fully operational, and DOE will have to provide additional funding to either correct the problems or move the processing operations elsewhere. DOE has not yet requested such funding and, as a result, does not know when or if the building will become fully operational. Because of these problems, DOE is conducting studies on the future of plutonium processing at the Rocky Flats Plant.

¹Plutonium is a heavy, radioactive, man-made metallic element which is toxic if inhaled, ingested, or absorbed through an open wound.

Because of the potential costs to correct the problems and health and safety concerns to the public stemming from the plant's proximity to the Denver metropolitan area, Senator (then-Representative) Timothy E. Wirth asked us to look at alternatives for relocating all or part of the Rocky Flats plutonium operations.

DOE's Nuclear Materials Facilities Have Varied Responsibilities

DOE uses a variety of facilities to accomplish its nuclear weapons responsibilities. Two facilities—the Los Alamos National Laboratory in Los Alamos, New Mexico, and the Lawrence Livermore National Laboratory in Livermore, California—are responsible for research and development activities for nuclear weapons components. The following lists the major facilities that are responsible for producing nuclear materials and producing and assembling weapons components:

- Rocky Flats Plant, near Denver, Colorado, fabricates and assembles weapon components, primarily from plutonium, and recovers plutonium from wastes generated during the fabrication process and from returned weapons.
- Y-12 Plant in Oak Ridge, Tennessee, produces weapon components of uranium, uranium alloys, and lithium² and recovers these materials from wastes generated in the fabrication process and from returned nuclear weapons.
- Savannah River Plant near Aiken, South Carolina, has five production reactors to produce tritium³ and/or plutonium. The plant also recovers plutonium from residual materials.
- N-Reactor, at the Hanford site near Richland, Washington, is a dual-purpose reactor which produces plutonium for nuclear weapons and steam for a local public power supply. In addition, DOE recovers plutonium from residual materials generated on-site.
- Pinellas Plant near St. Petersburg, Florida, manufactures electrical systems such as neutron⁴ generators, and specialty capacitors and switches for weapons.
- Mound Plant, near Miamisburg, Ohio, produces detonators and related components.
- Kansas City Plant in Kansas City, Missouri, develops, produces, and procures electrical components.

²Lithium is a soft element of the alkali metal group used in nuclear reactions and metallurgy

³Tritium is a radioactive isotope of hydrogen

⁴A neutron is an uncharged elementary particle that is found in the nucleus of every atom heavier than hydrogen

- Pantex Plant in Amarillo, Texas, manufactures non-nuclear explosives and other weapon components and performs the final assembly of nuclear weapons. It disassembles retired weapons, and returns the disassembled parts to the plant of origin for further processing.

Age, Environmental, Safety, and Health Concerns Exist at DOE's Weapons Facilities

Many structures at these facilities were originally constructed in the 1950's and 1960's—before building codes and environmental, safety, and health requirements which are now in effect were established. As a result, buildings and equipment are aged and, in some cases, in need of repair or upgrading. Further, not all buildings meet current requirements for protection against natural phenomena such as earthquakes and tornadoes. Consequently, we and other groups, have expressed concerns related to the environmental, safety, and health risks posed by DOE's weapons production complex.

Examples of these conditions and concerns at the Rocky Flats Plant are contained in the remainder of this report. The same type of conditions were also discussed in our August 1986 report entitled Nuclear Safety Comparison of DOE's Hanford N-Reactor With the Chernobyl Reactor (GAO/RCED-86-213BR). That report was prepared in response to concerns about similarities between DOE's N-Reactor and the Soviet Union's ill-fated Chernobyl reactor. The report stated that DOE's N-Reactor initially began operating in 1963 and had an expected life of 20 years. DOE officials acknowledged that many N-Reactor systems and components have aged and are deteriorating. The N-Reactor was shut down on January 7, 1987, for at least 6 months to allow major safety-related upgrades to be implemented.

In addition, we are currently conducting a review of DOE's plutonium production reactors at Savannah River, South Carolina. Savannah River is the site of four reactors (a fifth reactor is on standby) which first began operating in 1953. Three of the reactors are operable, however, problems in meeting state requirements related to the temperature of one of the reactor's cooling ponds preclude its operation during the summer months. The fourth reactor has not operated since July 1985 because of cracks in the reactor vessel which allow leaks of radioactive water. Although DOE has spent about \$47 million on repairs, the problem still exists and DOE has established no date for restart. Our review, conducted at the request of the Chairman, Senate Committee on Governmental Affairs, focuses on operational and safety concerns related to Savannah River's reactors.

Several of our reports have specifically addressed environmental, safety, and health matters at DOE nuclear facilities. In a September 1986 report entitled Nuclear Energy: Environmental Issues at DOE's Nuclear Defense Facilities (GAO/RCED-86-192), we reviewed nine DOE defense facilities. We found that eight facilities had high levels of groundwater contamination; six facilities had soil contamination in unexpected areas, including locations beyond the facilities' boundaries; and four facilities were not in compliance with the Clean Water Act.

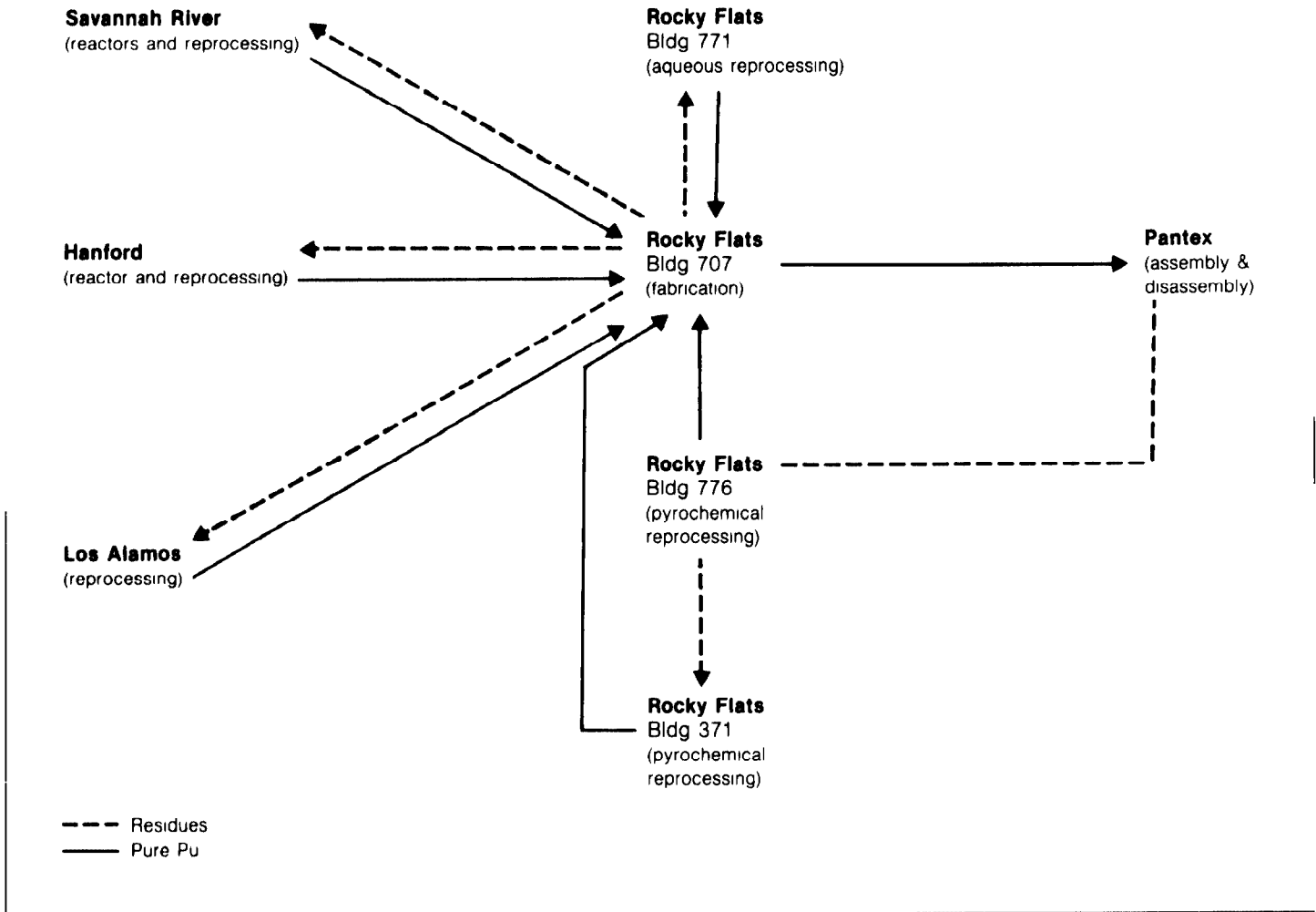
Two other reports⁵ dealt with safety and health problems at DOE nuclear facilities and the adequacy of DOE's environmental, safety, and health oversight. Both reports cited the need for independent environmental, safety, and health oversight of DOE's nuclear activities.

Rocky Flats Plant Is the Focal Point for Plutonium Operations

Each DOE facility provides materials, components, or services required to accomplish DOE's weapons production responsibilities. The Rocky Flats Plant is the focal point for fabricating nuclear components and processing plutonium materials. Figure 1.1 shows the production facilities at the Rocky Flats Plant and their relationship to DOE's other facilities.

⁵DOE's Safety and Health Oversight Program at Nuclear Facilities Could Be Strengthened (GAO/RCED-84-50, Nov 30, 1983) Better Oversight Needed for Safety and Health Activities at DOE's Nuclear Facilities (EMD-81-108, Aug 4, 1981)

Figure 1.1: Key Production Facilities



Source: Adapted from DOE diagrams

Fabrication of nuclear weapons components in building 707 makes use of weapons-grade plutonium (pure plutonium from reactors or plutonium that has been processed and purified). The finished products—known as triggers for nuclear weapons—are then shipped to the Pantex Plant in Amarillo, Texas, for final assembly in the weapons

Fabrication operations produce various residues which contain plutonium. Because of the high monetary value of even small quantities of plutonium, these residues must be processed to extract and purify the

plutonium. Certain residues are processed using pyrochemical techniques (use of dry, heated chemicals) in buildings 371 and 776; other residues are processed using acids in building 771.

Also processed at the Rocky Flats Plant are components from retired weapons (known as site returns) that contain plutonium. These components are removed from returned weapons at the Pantex Plant and are sent to the Rocky Flats Plant where the plutonium is extracted and purified in buildings 371 and 776.

Public Concerns and Studies Have Focused on Health and Safety at Rocky Flats Plant

When the present location was selected for the Rocky Flats Plant in 1951, it was generally hailed as good news for the surrounding area because of its economic implications. However, because attention in succeeding years has focused on the environmental, health, and safety effects attributed to nuclear energy, the public's overall attitude toward any type of nuclear plant has changed.

Public Concerns Have Led to Various Studies on Health and Safety

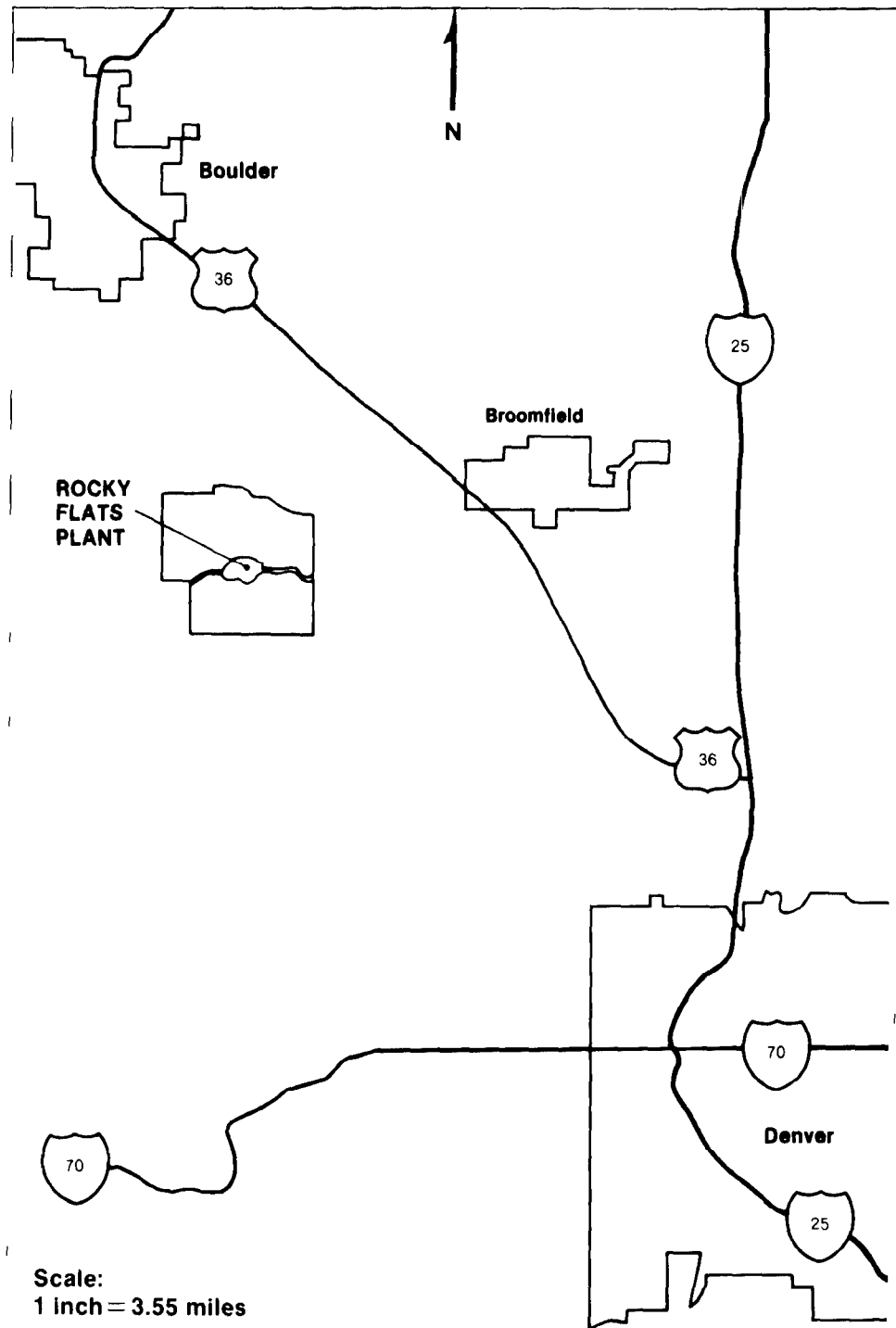
Concerns about the Rocky Flats Plant have developed from a number of incidents which have occurred since the late 1950's. In 1957 a fire in a glove-box line⁶ released a small amount of plutonium to the environment. From 1959 to 1969, storage drums containing plutonium-contaminated machine oil leaked and contaminated soil off-site. In 1969 a major fire occurred in one of the plutonium-processing buildings resulting in a minor release of plutonium to the off-site environment. Also, in 1973 a small quantity of tritium was accidentally released with waste water into the water supply for the nearby city of Broomfield, Colorado (population 17,000)

In 1974 public concerns related to the safety of the Rocky Flats Plant led to the establishment of a Rocky Flats Task Force by then Governor-elect Richard Lamm and Senator (then Representative-elect) Timothy Wirth. The task force, consisting of state and county officials, private citizens, and a state representative, was created to assess the effects of activities conducted at the Rocky Flats Plant. The Lamm-Wirth Task Force Report concluded that the Rocky Flats Plant should be reassessed as a nuclear weapons manufacturing facility, with consideration given to gradually phasing out its present operations, possibly transferring those operations to a more suitable site

⁶A glove-box line is a series of sealed boxes that workers use to handle radioactive materials

In 1976 the Administrator of the U.S. Energy Research and Development Administration (DOE's predecessor agency) disagreed with the Lamm-Wirth Task Force Report conclusion. Three years later, Senator Wirth formally requested that DOE conduct a major study of the Rocky Flats Plant. He stated that while the plant fulfilled a critical mission within the national defense structure, many arguments were being made concerning the advisability of such a plant in the midst of a major metropolitan area. (As shown in fig. 1.2, the plant is approximately 16 miles from downtown Denver—metropolitan area population of 1.8 million—and 8 miles from downtown Boulder—population of about 96,000)

Figure 1.2: The Rocky Flats Plant and Surrounding Area



Source: Final Environmental Impact Statement, Rocky Flats Plant Site (Apr. 1980)

Senator Wirth specifically requested that DOE (1) identify alternate sites for plutonium processing, (2) project potential losses of manpower at Rocky Flats if the plant were relocated, and (3) analyze alternate uses for the site. In 1979 he and Governor Lamm established an independent group—the Blue Ribbon Citizens Committee—to review the results of DOE's study.

DOE conducted the requested study and issued a report (Long-Range Rocky Flats Utilization Study) in February 1983. The Final Report on the Department of Energy Long-Range Rocky Flats Utilization Study, issued by the Blue Ribbon Citizens Committee, was released on March 21, 1984. Both reports agreed that any relocation alternative would require a considerable investment in terms of funding and time: \$2 billion to \$3 billion and 8 to 24 years. As a result, Governor Lamm and Senator Wirth concluded that a decision to relocate all operations at Rocky Flats should not be made in the immediate future. They also concluded, however, that future options for relocation must be kept open and active.

Problems With Building 371 Renewed Concerns With the Safety of Rocky Flats

Controversy over the future of the Rocky Flats Plant was renewed in 1984, when allegations were made by Rocky Flats employees that unsafe conditions existed in an aging plutonium reprocessing building, building 771, and in building 371. Construction for building 371, a new plutonium-processing building, began in 1973 to replace building 771. When building 371 was completed in 1981, the operating contractor encountered severe design, materials, and mechanical problems. Because of these problems, Rockwell could not conduct operations as originally planned and could not replace building 771. Building 771, which was built in 1953, is continuing operations with old and deteriorated equipment and, as a result, a processing backlog has been created.

In May 1984, Senator Timothy E. Wirth requested that we evaluate the problems associated with building 371, including an assessment of what would be necessary to bring the building on-line, and any related health and safety impacts in both buildings. Our report on building 371's problems and their impacts⁷ stated that the building had limited operational capability. The problems resulted from poor design, inappropriate construction materials, and changes in safety and safeguard requirements. We reported that rectifying the situation would require modifications.

⁷DOE's Plutonium Processing Facility at Rocky Flats—Operational Problems, Costly Resolutions, and Future Uncertainties (GAO/C-RCED-85-3, Sept. 11, 1985)

possibly costing more than \$300 million and that DOE would have to depend on other sites for plutonium-processing assistance in the interim.

DOE Has Studied Alternatives for Building 371

In October 1984, DOE's Albuquerque Operations Office, which has administrative control of the Rocky Flats Plant, initiated a study to determine the optimum utilization of building 371 as a plutonium-processing facility. The study evaluated a number of alternatives, including (1) using the building as originally intended, (2) using the building to a lesser extent by using capabilities at other DOE locations, and (3) not using the building at all—either a new facility would be constructed at the Rocky Flats Plant or the needed capability would be acquired at other locations. The Albuquerque study, completed in February 1986, concluded that building 371 should be repaired (involving a nearly complete reconstruction of the interior of building 371) and funding should be obtained as a fiscal year 1988 line item. Total cost of the repairs was estimated to be about \$300 million.

After the Albuquerque Operations Office submitted a funding request to DOE headquarters for repairing building 371, DOE headquarters began its review of the building's future. That study included a number of alternatives to funding the project as requested by the Albuquerque Operations Office. In July 1986, DOE headquarters decided to delay funding the project at least 1 year so that the project could be redesigned and additional information could be developed on possible alternatives.

DOE and Rockwell International personnel are currently reviewing the design of building 371 and reevaluating the condition of building 771. Recent processing operations changes have resulted in the generation of lower amounts of residues. The design of building 371 is being reviewed to determine if these lower generation rates will affect design decisions concerning the processing capacity of building 371. The review is evaluating the financial impacts of the reduced amounts of residues and is looking at the possibility of repairing building 371 in phases rather than as a single project.

The reevaluation of building 771 is being conducted to determine what the current problems are with the building, what the costs would be to correct the problems, and whether the building can be operated for an extended period of time if the repairs to building 371 are made in phases.

DOE Is Studying the Long-Range Use of Weapons Facilities

DOE headquarters is conducting an additional study that could affect the long-range utilization of the Rocky Flats Plant. DOE headquarters has initiated a study of all weapons facilities to determine what the DOE weapons complex should be in 30 years. The study was in its conceptual phase at the time of our review, and complete objectives and milestones had not been identified. DOE officials told us that the study would attempt to develop a strategic plan for all weapons facilities. The study will determine whether each site will be needed, and, if so, what each site will be doing, and what will be needed to perform that mission. Such information will enable DOE to have a long-range plan to repair or replace weapons facilities.

Objectives, Scope, and Methodology

On February 21, 1985, and in subsequent meetings, Senator Timothy E. Wirth requested that we review (1) the feasibility of relocating the Rocky Flats Plant's plutonium-processing operations and determine whether such relocation would alter the health and safety risks associated with the plant's operations and (2) whether the costs associated with rectifying the situation in building 371 were significant enough to warrant reconsidering the relocation of the entire plant. For the latter portion of the request, we agreed to update the cost and socioeconomic information contained in prior studies to the extent possible.

We discussed plutonium operations at Rocky Flats Plant with DOE and Rockwell officials to determine how plutonium is processed as well as to obtain data on quantities and types of residues that result from those processes. To determine what capabilities exist at other locations in the DOE weapons complex, we interviewed DOE and contractor officials at the Richland Operations Office and the Hanford site in Richland, Washington; DOE and contractor officials at the Savannah River Operations Office and Plant in Aiken, South Carolina; and DOE and contractor officials at the Albuquerque Operations Office and the Los Alamos National Laboratory in Los Alamos, New Mexico. We also obtained and reviewed 1985 and 1986 reports from DOE that addressed available plutonium-processing capabilities at those locations.

To determine what alternatives to plutonium processing at Rocky Flats Plant were available, we reviewed completed and ongoing DOE studies of potential alternatives and discussed the results of these studies with the participants. Alternatives identified based on the DOE studies included (1) totally relocating the Rocky Flats operations, (2) relocating the processing of all plutonium residues, (3) relocating the operations which

process plutonium oxides (one form of residue), (4) relocating the operations which process site returns (returned weapons), and (5) relocating operations which process both oxides and site returns. Possible alternative locations considered in our review were Hanford, Washington, Savannah River, South Carolina, and Los Alamos, New Mexico. These locations can presently process some plutonium materials, such as those generated at the Rocky Flats Plant.

We compared the estimated costs of the various alternatives with the estimated cost of repairing building 371. We selected this comparative approach because repairing building 371 was the course of action recommended by the Albuquerque Operations Office. Cost data were obtained from DOE and contractor officials, analyzed, and discussed at each location. As part of the Rocky Flats costs estimated for each alternative, we asked Rockwell to estimate the impacts on the plant's overall long-term construction plans. Although the cost estimates for the alternatives were not as detailed as the estimated costs for building 371, they were the only estimates available. We also obtained information on the quantities of plutonium in the DOE transportation and processing system ("pipeline").

To determine what effects the various relocation alternatives might have on public health and safety in the Denver area, we examined the risks calculated by DOE for current plant operations. We reviewed individual safety analysis reports as well as the safety analysis report prepared in support of the Long-Range Rocky Flats Utilization Study. We also reviewed available supporting documentation for these reports. Since DOE has building modification projects planned to reduce risks in certain buildings, we reviewed these projects and discussed each with DOE and Rockwell staff.

To understand what the environmental impacts of the plant's operations have been, we examined the 1980 Rocky Flats Environmental Impact Statement and the 1986 Comprehensive Environmental Assessment and Response Report. We discussed the findings and methodologies in these reports with Rockwell International personnel involved in their preparation, and with knowledgeable DOE officials responsible for reviewing and approving them.

In order to gain an understanding of the public's perception and attitudes toward the plant, we interviewed local civic leaders and health officials from Boulder, Broomfield, Westminster, and Jefferson County, Colorado. We also discussed the health and safety aspects of the plant

with Colorado Department of Health and Environmental Protection Agency officials. In addition, three reports have dealt with public concerns and issues surrounding the plant's operations. We reviewed these reports—the Blue Ribbon Citizen's Committee Report on the Long-Range Rocky Flats Utilization Study (1983), the Lamm-Wirth Task Force Report (1974), and the Rocky Flats Monitoring Committee's⁸ report, entitled An Assessment of Issues Concerning the Future of the Rocky Flats Plant (1979).

To assess what impacts plant relocation would have on the area's socioeconomics and the plant employees, we examined the section in the Long-Range Rocky Flats Utilization Study report dealing with socioeconomic impacts of changing missions at the Rocky Flats Plant. We examined economic and demographic forecasts for the Denver metropolitan area including annual reports on regional growth and development published by the Denver Regional Council of Governments, presentations by the state demographer, and DOE studies relating to growth projections in the area surrounding the Rocky Flats Plant. We also discussed future economic projections for the surrounding area with local community officials, and obtained their opinions on possible impacts that would result from relocating the plant. We discussed the relocation impacts on plant employees with Rockwell officials

All dollar figures contained in this report are expressed in fiscal year 1986 dollars. To change actual year dollars to fiscal year 1986 dollars, we used escalation rates contained in the Bureau of Labor Statistics Independent Cost Estimate Table. Although the time frames varied for each alternative, we did not discount the cost estimates because the DOE cost data was not sufficiently detailed to allow this calculation

As requested, we did not obtain formal, written comments on this report. We did, however, discuss the facts presented in a draft of this report with officials at DOE headquarters (Germantown, Maryland), the Albuquerque Operations Office, and the Rocky Flats Area Office. We also discussed the facts presented with Rockwell International officials. These officials agreed with our overall observations and provided information to clarify data contained in the report. Our review was conducted between July 1985 and December 1986 and was performed in accordance with generally accepted government auditing standards

⁸The Rocky Flats Monitoring Committee was established in 1976 to maintain oversight of the status of specific recommendations contained in the Lamm-Wirth Task Force Report

Chapter 2 discusses the estimated construction and transportation costs for the various alternatives and compares these costs with the estimated costs of repairing building 371. Chapter 2 also discusses pipeline quantities required for each of the alternatives. Chapter 3 discusses the risks that have been calculated for present operations at the Rocky Flats Plant and then explains factors related to risks for the relocation alternatives. It also presents data on the possible socioeconomic effects of the alternatives. Chapter 4 presents our conclusions and a recommendation to the Secretary of Energy.

Relocation Alternatives: A Comparison of Costs and Pipeline Quantities

Various alternatives exist to eliminate or reduce plutonium activities at the Rocky Flats Plant. These alternatives include relocating all activities performed at the Rocky Flats Plant (including fabrication, processing, and support services), relocating all plutonium-processing operations, and relocating only certain plutonium-processing operations. Based on DOE data, repairing building 371 and keeping all plutonium activities at the Rocky Flats Plant would cost about \$303 million. In comparison, total relocation of all Rocky Flats operations would cost about \$4 billion. If only a portion of Rocky Flats plutonium recovery operations were relocated, costs are estimated to range from \$206 million to \$617 million, depending on what operations were moved and where they were moved.

Our analysis of the alternatives also considered the cost of transporting residues to other DOE locations and the amount of plutonium tied up in plutonium shipments and in processing at alternate locations (“pipeline quantities”)

Other key factors such as risk to the off-site population and socioeconomic impacts are discussed in chapter 3.

Available Alternatives for Relocating Plutonium Operations and Factors Considered in Analysis

Because of Senator Wirth’s specific interest in (1) the processing operations and (2) the feasibility of totally relocating the Rocky Flats Plant, we compared the following alternatives with DOE’s most recent estimate of the cost to repair building 371

Relocating all Rocky Flats operations, including fabrication, processing, and support operations.

- Relocating the processing of residues, oxides, and site returns.
- Relocating the processing of site returns
- Relocating the processing of oxides.
- Relocating the processing of oxides and site returns

All of these alternatives would reduce the amount of plutonium handled at the Rocky Flats Plant, theoretically reducing the risk of a plutonium release to the Denver metropolitan area. Sites considered as potential recipients of these operations were Hanford, Washington; Savannah River, South Carolina, and Los Alamos, New Mexico. These locations were included because of their current involvement in the production of materials for nuclear weapons, and their potential capability and capacity to assume certain Rocky Flats processing responsibilities

In this chapter, we compare the alternatives listed above using the following factors:

- Costs of relocation, costs to upgrade or build new facilities at Rocky Flats and other locations and to acquire the necessary equipment and technology. The type of costs included in this category are costs which are generally appropriated through a line item budget request for a specific period of time. Cost impacts on facility-wide long-range construction plans for the plant were also included in the calculation of these costs.
- Transportation costs, operating costs required for the packaging, handling, and shipping of materials
- Pipeline quantities: the amount of plutonium which is not available for use in weapon production because the materials are either being processed or are in transit.

We did not consider potential increases in operating costs (other than transportation costs) which would occur if an alternate DOE facility were to assume Rocky Flats' plutonium responsibilities. Although operating costs at these locations would increase, these costs would generally be offset by reduced operating costs at the Rocky Flats Plant. It is assumed that the total operating costs for DOE would remain virtually the same regardless of which site undertakes these plutonium responsibilities.

Repairing Building 371: A Baseline for Cost Comparisons

Repairing building 371 would not eliminate any of the plutonium activities at the Rocky Flats Plant, however, these estimated costs can serve as a baseline for comparing the relocation alternatives. (A chart comparing costs associated with repairing building 371 to each of the alternatives is presented in app. II.) It is also important to note that repairing building 371 is currently being considered by DOE headquarters and was recommended by DOE's Albuquerque Operations Office and Rockwell International.

Costs Associated With Repairing Building 371

To avoid making a large investment in obsolete facilities, the DOE Rocky Flats Area Office and the Albuquerque Operations Office have proposed that building 371 be repaired at a total estimated cost of \$268 million. These funds would be spent during the project period (fiscal years 1988 through 1996) to correct the design, materials, and mechanical problems identified in building 371, and to enable Rocky Flats to meet DOE standards for health, safety, environment, security, and safeguarding of materials. However, according to a DOE Rocky Flats Area Office official,

if repairs of building 371 were approved, space may not be available to process special recoveries and to carry out research and development projects. An additional \$35 million may have to be spent to conduct those activities in building 771. Special recoveries involve the handling and processing of materials such as beryllium and aluminum found in the site returns. These materials cannot be handled in the existing processing lines in building 771 and require a separate processing system. Research and development projects would be required to develop technology for the relocated plutonium processing

**Transportation Costs
Associated With Repairing
Building 371**

If DOE approves the repair of building 371, Rocky Flats is expected to be able to process all of its residues and oxides and would not have to ship any of the materials off-site for processing. Until repairs are complete or alternate arrangements are implemented to process Rocky Flats' residues and oxides, other DOE facilities will continue to assist Rocky Flats in reducing the backlog.

The DOE Area Office Project Manager informed us that, as a result of this off-site assistance, the Rocky Flats residues and oxides are being transported 6.4 million kilogram miles annually¹ at annual costs of approximately \$2.9 million. This DOE official also stated that these costs will be experienced (1) until building 371 is repaired or an alternate site is available and (2) regardless of which alternative is chosen for the future processing of residues and oxides.

**Other Costs Associated
With Repairing Building
371**

Other related costs of approximately \$180 million have been estimated for repairing building 371. These include amounts for the project's design, management, research and development, operating expenses during construction, and small capital items such as laboratory equipment. These costs would be funded from annual operating funds and would not be included in the line-item budget request. It should be noted that while relocation alternatives may involve similar costs, estimates of those costs were not available. For comparability, we have not included these costs in the total cost of repairing building 371.

¹A kilogram mile is 1 kilogram of plutonium transported 1 mile

Pipeline Quantities
Associated With Repairing
Building 371

If building 371 is repaired, DOE Albuquerque Operations Office officials have computed that about 1,500 kilograms of plutonium would be contained in the processing system at any given time and would be unavailable for use in weapons production.

DOE headquarters and Albuquerque Operations Office officials disagree as to the significance of plutonium in the pipeline. DOE Albuquerque Operations Office officials told us that recovering plutonium from oxides, site returns, and residues is less costly than obtaining plutonium from nuclear reactors. Therefore, it is important to keep the amount of plutonium in the pipeline to a minimum, hence reducing the need for plutonium from reactors. Headquarters officials believe to the contrary that there would be no noticeable monetary impact, other than the cost of producing materials to fill the pipeline. Headquarters officials also stated that the quantity of plutonium in the pipeline does become significant when production is not sufficient to meet demand for the materials.

Alternative 1: Total
Relocation of Rocky
Flats' Operations

Under this alternative, DOE would relocate all of Rocky Flats Plant's fabrication, processing, and support activities to one or more of DOE's existing facilities or to an entirely new facility. According to the DOE Long-Range Rocky Flats Utilization Study, complete relocation and start-up of new operating facilities could take as long as 24 years

Because of the unique nature of plutonium operations carried out at the Rocky Flats Plant, new plutonium-processing and fabrication facilities would be required at any of the sites chosen for relocation. None of the other DOE facilities currently have the capability to fabricate plutonium weapons components. Other than Rocky Flats, only Los Alamos National Laboratory has capability to process site returns. This capability is limited. Additional processing capability would also be required at the other facilities to handle the quantities and varieties of residues resulting from the processing and fabrication operations. Once relocation occurred, the facilities at Rocky Flats would be decommissioned and decontaminated.

Costs Associated With Total
Relocation

The DOE Long-Range Rocky Flats Utilization Study stated that the total DOE cost for relocating, decommissioning, and decontaminating the Rocky Flats Plant site would be approximately \$3 billion (in fiscal year 1981 dollars). As shown in table 2.1, the costs for totally relocating the

plant would now be approximately \$4 billion (in fiscal year 1986 dollars). The increase is due primarily to inflation.

Table 2.1: Estimates of Costs for Total Relocation of Rocky Flats

| Dollars in millions | |
|--|------------------|
| Cost category | Cost |
| New facilities | \$2,800.0 |
| Additional labor costs to operate redundant processing and fabrication facilities during startup and testing of new facilities | 450.0 |
| Maintenance and replacement costs required to enable Rocky Flats to continue at present level of operation until new site is fully operational | 610.0 |
| Decommissioning & decontamination | 290.0 |
| Sub-total | 4,150.0 |
| Less Planned capital projects not required due to total relocation of Rocky Flats | 119.0 |
| Total estimated costs | \$4,031.0 |

While the new facilities would be under construction, DOE would be committed to meeting the demand for plutonium for weapons production. We assumed that the operations costs for DOE would remain virtually the same regardless of which site undertakes the processing operations. However, in the case of total relocation, DOE officials estimate that an additional \$450 million will be required for the additional labor necessary to operate both the new and existing facilities during the lengthy startup and testing period.

In addition, because of the obsolescence of existing Rocky Flats facilities, continued operations would require approximately \$610 million to maintain, up-grade, and possibly replace existing facilities during the time required for the new facilities to come on-line. These projects would include repairing building 371 to provide interim plutonium processing. It should be noted that the \$610 million required for existing facilities at the Rocky Flats Plant exceeds the entire cost of most of the alternatives discussed later in this chapter.

Approximately \$290 million would be required to decommission and decontaminate the Rocky Flats Plant. The Long-Range Rocky Flats Utilization Study estimates that it would take approximately 5 years for this activity to be accomplished. If this alternative were implemented, certain projects presently planned for Rocky Flats would be affected. Rockwell estimates that about \$1.1 billion will be spent for projects until the year 2001 if current responsibilities are continued. However, if DOE relocates all plutonium operations, projects costing about \$119 million

would not be required. The remaining projects would be necessary, according to DOE officials, to continue operations until the new location is in operation.

Transportation Costs
Associated With Total
Relocation

If all operations were relocated to a single site, this alternative should enable DOE to process plutonium without any additional transportation costs when compared with current operations.

Pipeline Quantities
Associated With Total
Relocation

DOE Albuquerque Operations Office officials assume that pipeline quantities of plutonium involved in a total relocation alternative would be about the same as the quantities involved if building 371 is repaired—about 1,500 kilograms

Alternative 2:
Relocation of the
Processing of Residues,
Oxides, and Site
Returns

With this alternative, the Rocky Flats Plant would continue to be the operating site primarily responsible for fabricating plutonium weapon components. As such, it would continue to be a major generator of residues (plutonium-laden byproducts from the fabrication operation), which would have to be shipped and processed

None of the other DOE facilities have existing capacity or capability to process all the various types and quantities of residues nor the capability to disassemble and process site returns. As a result, major investments would be necessary at the alternate DOE facilities for developing facilities, equipment, and technology required for plutonium recovery operations involving residues, oxides, and site returns.

If the processing of residues were shifted from Rocky Flats, the scope of recovery operations at the plant would change from plutonium recovery to preparing residues and oxides for shipment to other locations. New processes and techniques would be required to prepare the residues for shipment—possibly utilizing the available space in building 371. An incinerator would be used to burn and make transportable materials which are not shippable in their initial forms. Since the plutonium recovery operations at Rocky Flats would cease under this option, the existing processing facilities would be decommissioned and decontaminated

The alternate operating sites which could be involved—with modifications—in the processing of the residues and site returns include

Savannah River, South Carolina; Hanford, Washington, and Los Alamos National Laboratory, New Mexico. These sites either individually or as a group would be responsible for the annual processing of the following materials:

- Site returns and special recoveries shipped from the Pantex Plant in Amarillo, Texas.
- Oxides.
- Transportable residues generated by the Rocky Flats Plant's fabrication activity.
- Secondary residues generated by the alternate DOE facility's processing activities.

Implementation time for this alternative varies depending on the location chosen. According to a study (Decision Matrix for Plutonium Recovery Options) prepared by DOE's Albuquerque Operations Office, relocation to Hanford would require about 10 years, while relocation to Savannah River and Los Alamos would both require 9 years.

Costs Associated With Relocating Residues, Oxides, and Site Returns

For each of the sites having the potential to receive the materials to be processed, DOE has estimated the costs to either build or upgrade facilities to handle these materials. In addition, Rocky Flats Plant personnel have stated that even if all the materials were transported to alternate facilities, additional costs would still be incurred at Rocky Flats for an incinerator and packaging facility. The cost estimates for implementing this alternative are shown in table 2.2.

Table 2.2: Estimated Costs to Process Residues, Oxides, and Site Returns at Other DOE Facilities

| Location | Costs | | |
|-------------------------|------------------|-------------|------------------|
| | DOE facility | Rocky Flats | Total |
| Hanford | \$480 | \$9 | \$489 |
| Los Alamos National Lab | 436 | 9 | 445 |
| Savannah River | 600 ^a | 9 | 609 ^a |

^aCost estimates for Savannah River are based on processing twice as much plutonium as that assumed by Hanford and Los Alamos. Savannah River officials could not revise their cost estimates without further analysis and study.

All of the DOE facilities listed above would require construction of new processing facilities. In addition, Hanford would have to upgrade an existing facility to process site returns and construct storage and waste treatment facilities. Los Alamos National Laboratory would also require

a new analytical laboratory, waste treatment facility, support offices, utility building, and warehouse.

The costs shown for the Rocky Flats Plant are the net incremental costs for the Rocky Flats Plant. According to DOE and Rockwell International personnel, additional costs of \$185 million would be incurred, consisting of approximately \$15 million for an incinerator, \$70 million for the decommissioning and decontamination of the Rocky Flats' processing facilities, and \$100 million for the construction of a facility to handle the packaging and shipping of residue materials.

If this alternative is implemented, approximately \$176 million in projects currently planned would not be undertaken at Rocky Flats. (The cost of all planned construction projects at Rocky Flats total \$1.1 billion until the year 2001.) These projects include the construction of warehouses, laboratories, offices, and waste treatment facilities that would no longer be necessary if processing of residues, oxides, and site returns are relocated.

**Transportation Costs
Associated With Relocating
Residues, Oxides, and Site
Returns**

According to DOE officials, this alternative would incur approximately \$3.4 million in annual transportation costs. The transportation costs include the packaging, handling, health physics,² and measurement costs associated with shipping residues to another site.

**Pipeline Quantities
Associated With Relocating
Residues, Oxides, and Site
Returns**

According to DOE Albuquerque Operations Office, relocating the processing of residues, oxides, and site returns would result in about 3,200 kilograms of plutonium in the pipeline. This is approximately 1,700 kilograms more than would be in the pipeline if building 371 were repaired

**Alternative 3:
Relocation of
Processing Site Returns**

Under this alternative, the site return processing activities would be relocated to another operating site such as Hanford, Los Alamos National Laboratory, or Savannah River. Recovering plutonium from site returns involves receipt, assay, storage, disassembly, and processing of retired weapons components. Presently, Rocky Flats is the only DOE facility processing the plutonium parts of site returns. Site returns

²Health physics activities include recognition, evaluation, and control of health hazards from radiation

would be transported directly from Pantex to the selected DOE facility. The processed plutonium would then be packaged and shipped to the Rocky Flats Plant for the fabrication of nuclear weapon components. The Rocky Flats Plant would continue to process the plutonium residues and oxides generated from the remaining manufacturing and processing operations.

According to information provided by DOE's Albuquerque Operations Office, relocating site return processing to Hanford, Savannah River, and Los Alamos would require 4, 9, and 8 years, respectively.

Costs Associated With Relocating Site Returns

Since none of the other DOE facilities have the capability to process present quantities of site returns, each location would require substantial modifications to existing buildings or the construction of new ones to handle this operation. In addition, costs would be incurred for repairing building 371 or building 771 to enable the Rocky Flats Plant to continue processing oxides and residues. Table 2.3 shows that for this relocation alternative, estimated costs range from \$348 million to \$493 million.

Table 2.3: Estimated Costs to Process Site Returns at Other Locations

| Location | Costs | | | Total |
|-------------------------|---------------|-------------|---------------|-------|
| | DOE facility | Rocky Flats | | |
| Hanford | \$120 - \$260 | \$228 | \$348 - \$488 | |
| Los Alamos National Lab | 175 | 228 | 403 | |
| Savannah River | 265 | 228 | 493 | |

Cost estimates vary from site to site depending on whether or not existing plutonium-processing facilities can be reconfigured for processing site returns. For example, the Fuels and Materials Examination Facility at Hanford was originally constructed for an unrelated purpose. However, according to DOE officials, this facility could be reconfigured to handle and process site returns at an estimated cost of \$260 million. Another option at Hanford would be to utilize the existing Plutonium Finishing Plant for the processing of site returns. This option is estimated to cost \$120 million to \$166 million.

In order for Los Alamos or Savannah River to process site returns, new facilities would be needed at either site. These facilities are estimated to cost about \$175 million and \$265 million, respectively. Included in the

new facilities would be analytical laboratories as well as production, waste management, warehouse, and support areas.

Under this alternative, the Rocky Flats Plant would continue to have responsibility for processing oxides, residues, and special recoveries. Representatives from the DOE Rocky Flats Area Office estimate that approximately \$237 million would be needed to repair building 371 so that these materials could be processed. If site returns are relocated, approximately \$9 million of the facilitywide total of \$1.1 billion in other planned projects would not have to be undertaken, resulting in a net incremental cost of \$228 million

Transportation Costs
Associated With Relocating
Site Returns

Site returns are presently disassembled and plutonium components are packaged and transported from the Pantex Plant to the Rocky Flats Plant. After the Rocky Flats Plant has processed the site returns and fabricated the plutonium into weapon components, the finished product is then transported back to Pantex.

DOE estimates that there would be an additional annual transportation cost of approximately \$220,000 if site returns were to be processed at an alternate DOE facility. These costs would result from transporting the processed materials back to the Rocky Flats Plant for fabrication. The costs for the handling and packaging of the site returns would be roughly the same regardless of which DOE facility is responsible for the processing.

Pipeline Quantities
Associated With Relocating
Site Returns

According to DOE Albuquerque Operations Office officials, relocating site returns to another location would result in pipeline quantities of about 2,400 kilograms of plutonium. This amount would be more than the pipeline quantity for repairing building 371 and the total relocation alternative, but would be less than the quantity involved in relocating residues, oxides, and site returns.

Alternative 4:
Relocation of
Processing Plutonium
Oxides

This alternative would relocate the processing of plutonium oxides from the Rocky Flats Plant to another DOE facility. Processing of site returns, special recoveries, and residues, and fabrication of components would continue at the Rocky Flats Plant.

Since 1983, the DOE facilities at Los Alamos, Hanford, and Savannah River have assisted the Rocky Flats Plant by processing plutonium

oxides and residues. According to DOE officials, Hanford, Rocky Flats, and Savannah River were designed as plutonium production facilities. Los Alamos National Laboratory, on the other hand, was neither designed nor intended to be a plutonium production facility. By maximizing use of the processing facility originally designed to process plutonium for use in weapons research and development, Los Alamos assumed responsibility for processing oxides from the Rocky Flats Plant. This was intended to be a temporary measure to assist the Rocky Flats Plant in reducing its oxide- and residue-processing backlog.

Information provided by DOE's Albuquerque Operations Office states that relocating oxide processing to Hanford and Savannah River would require 7 and 9 years, respectively.

Costs Associated With Relocating Plutonium Oxide Processing

Some capacity currently exists at Savannah River, Hanford, and Los Alamos to process part of the oxides generated at the Rocky Flats Plant. However, additional investments would be required at two of these sites to upgrade or replace the existing processing facilities so that all of the Rocky Flats Plant's oxides could be processed.

In addition, expenditures would be required at the Rocky Flats Plant to repair building 371 to process site returns, special recoveries, and residues. The costs to relocate the processing of plutonium oxides range from \$206 million to \$316 million.

Table 2.4: Estimated Costs to Process Oxides at Other Locations

| Location | Costs | | Total |
|-------------------------|--------------|-------------|-------|
| | DOE facility | Rocky Flats | |
| Hanford | \$100 | \$206 | \$306 |
| Los Alamos National Lab | 0 | 206 | 206 |
| Savannah River | 110 | 206 | 316 |

Because enough capacity already exists at Los Alamos National Laboratory to process oxides produced at the Rocky Flats Plant, no additional expenditures would have to be made. According to DOE officials, if Los Alamos National Laboratory were to assume Rocky Flats Plant's processing responsibilities, it would have to be at the expense of weapons research and development activities—its current primary mission. If weapons research and development activities are then relocated, DOE may incur additional, currently unidentified, costs.

For Hanford, the cost estimate was based on restoring an existing facility known as the Plutonium Finishing Plant. Costs would include expanding the facility's waste treatment capabilities and nitrate feed storage space. Savannah River's costs would include the construction of a new building to be used as an analytical support laboratory, a solid-waste-handling facility, and other support facilities.

In addition to these construction costs, approximately \$214 million would be required to repair building 371 to conduct the remaining plutonium operations at the Rocky Flats Plant (handling site returns, special recoveries, and residues). The \$214 million cost includes expenditures for warehousing, storage, material movement, utilities, heating, ventilation, air-conditioning, and computers; removing the existing nonfunctioning equipment; and decontaminating building 371 before the new processes can be installed. Approximately \$8 million of the facility-wide total of \$1.1 billion in other construction projects currently planned would not be initiated because of the relocation of the oxide-processing operations, resulting in a net incremental cost of \$206 million

**Transportation Costs
Associated With Relocating
Plutonium Oxide Processing**

Transportation costs for moving oxides between the Rocky Flats Plant and the other DOE facilities includes packaging, handling, health physics, measurement costs, and shipping. Total annual transportation costs for this alternative are approximately \$1.6 million. Ninety-four percent of the total transportation costs is for handling and packaging the residues. The actual shipment of oxides comprise only 6 percent of the total costs

**Pipeline Quantities
Associated With Relocating
Plutonium Oxide Processing**

Albuquerque Operations Office officials estimate that relocating plutonium oxide processing would result in about 1,900 kilograms of plutonium in the pipeline. This amount is about 400 kilograms more than the amount resulting from repairing building 371 at the Rocky Flats Plant.

**Alternative 5:
Relocation of
Processing Oxides and
Site Returns**

Under this alternative, Rocky Flats' responsibility to recover plutonium from oxides and site returns would be transferred to one or more DOE facilities. If DOE were to implement this alternative, the oxides and site returns could be shipped to one DOE facility or oxides could be sent to one location and site returns to another. Rocky Flats' continuing responsibilities would include the fabrication of weapons components and the processing of certain residues generated from fabrication and from special recoveries

Implementation time, according to information provided by DOE's Albuquerque Operations Office, would be 7 years if oxides and site returns were relocated to Hanford and 9 years if relocated to Savannah River or Los Alamos.

Costs Associated With Relocating Oxides and Site Returns

Investments would be required to enable the other DOE facilities to obtain the necessary technology, equipment, and facilities to process site returns. Expenditures would also be required at either Hanford or Savannah River to expand and/or upgrade the existing oxide-processing facilities. As discussed under alternative 4, Los Alamos National Laboratory already has enough capacity and capability to process oxides generated at the Rocky Flats Plant

To allow Rocky Flats to continue its residue-processing operations, funds will be needed to repair building 371

Table 2.5 presents a summary of the estimated DOE cost requirements. Processing oxides and site returns at Los Alamos has the lowest costs. When added to Rocky Flats' costs, this option has a total estimated cost of approximately \$312 million.

Table 2.5: Estimated Costs for the Processing of Oxides and Site Returns at DOE Facilities

| Location | Costs | | |
|-------------------------|---------------|-------------|---------------|
| | DOE facility | Rocky Flats | Total |
| Savannah River | \$290 - \$480 | \$137 | \$427 - \$617 |
| Hanford | 220 - 360 | 137 | 357 - 497 |
| Los Alamos National Lab | 175 | 137 | 312 |

The cost estimates vary, depending on whether a new facility is to be built or an existing facility is modified to process the materials. If oxides and site returns are processed in modified existing facilities at Savannah River, the estimated costs would be \$290 million. If site returns are processed in new facilities and oxides in existing facilities, the estimated costs would be \$480 million.

At Hanford, the costs vary, depending on which existing facility at the site is used for processing the materials. Hanford could use the Plutonium Finishing Plant for processing oxides. For site returns, either the Plutonium Finishing Plant or the Fuels and Materials Examination Facility could be used. However, because of obsolescence, the Plutonium Finishing Plant would have to be renovated and upgraded. The Fuels

and Materials Examination Facility was originally built for a purpose not related to the recovery of plutonium. A major modification of this facility would be required if it is to be used for plutonium processing.

For the Los Alamos National Laboratory, the only cost would be for constructing a facility to handle and process site returns.

Rocky Flats would require approximately \$189 million in expenditures to continue processing residues and special recoveries and to prepare the oxides for transportation to other DOE facilities. Approximately \$99 million of these costs would be for repairs in building 371 such as storage, material movement systems, utilities, heating, ventilation, air conditioning systems, and computers. For processing special recoveries in building 371, DOE's Rocky Flats Area Office estimates that about \$31 million would be needed. The remaining costs of approximately \$59 million would be for an incinerator and for the specific technologies and equipment required in building 371 to carry out the residue-processing operations.

Approximately \$52 million of the facilitywide total of \$1.1 billion in planned costs for replacements and upgrading other facilities, equipment, and technology at the Rocky Flats Plant could be avoided if the materials were transported to another DOE facility for processing. If this amount were used to offset the \$189 million in new expenditures, the Rocky Flats' net incremental costs would be approximately \$137 million.

**Transportation Costs
Associated With Relocating
Oxides and Site Returns**

If this alternative were to be implemented, the annual costs to transport oxides and site returns would be \$1.7 million to \$2 million. Of this total, \$220,000 would be the additional amount required to transport site returns to a DOE facility other than Rocky Flats for processing. The remaining \$1.5 million to \$1.8 million would be for transporting oxides from Rocky Flats to another DOE facility.

**Pipeline Quantities
Associated With Relocating
Oxides and Site Returns**

According to DOE Albuquerque Operations Office officials, relocating oxide and site return processing would result in pipeline quantities of about 3,200 kilograms of plutonium. This alternative, along with the alternative which would relocate residues, oxides, and site returns, has the highest pipeline quantity of any of the alternatives.

Relocation Alternatives: Public Health and Socioeconomic Factors

DOE and Rockwell have conducted studies of the potential risk to public health that would result from an accident at the Rocky Flats Plant. The calculations in these studies show that the risk to public health is minimal. However, recent reviews of Rocky Flats which were conducted to evaluate compliance with environmental standards have disclosed potential problems. Further, various segments of the public perceive the risks from Rocky Flats to be substantial, a perception which may impact future decisions concerning the facility.

DOE has developed some information on the projected transportation risks associated with the relocation alternatives, but has not yet determined the potential future risks from the facilities for any relocation alternative. As such, sufficient information for making an informed selection of the most appropriate alternative is currently lacking.

In terms of socioeconomic impact, partial or total relocation would likely have a minimal effect on the Denver area. Given the extended period of time necessary to relocate Rocky Flats' operations and the projected economic growth of the area around the Rocky Flats Plant, local government officials believe that the effect would not be significant.

Studies Show Rocky Flats Operations Present Minimal Radiological Risks to the Public

In the event of a major accident, according to DOE, the Rocky Flats Plant could release radioactive material into the environment, exposing people living near the facility to radiation. Because of this potential hazard, DOE and Rockwell have conducted environmental impact statements and safety analysis reviews of the overall safety of the plant. To date (as discussed later in this chapter, safety analyses of the Rocky Flats Plant are being updated), the studies have concluded that the public health risks from plant operations as well as postulated accidents are minimal and are not expected to significantly impact the safety and health of inhabitants of the Denver metropolitan area

DOE Safety Analysis Program Has Concluded That Rocky Flats Presents Minimal Risks to the Public

Other than an Environmental Impact Statement, the only studies of safety and health risks due to Rocky Flats' operations are safety analyses which DOE requires of its facilities and operations to determine if the public, workers, and the environment are being adequately protected. In the area of public health, safety analysis reports have considered three issues for plutonium operations:

- The possibility that plutonium handled inside the buildings would not be contained if an accident occurred.

- How much plutonium could leak out, whether it would spread and to what extent, and whether the public would be exposed.
- What health effects to the general population might be expected.

Since 1976, Rockwell has prepared safety analysis reports for 11 plutonium handling and storage facilities and 4 nonplutonium facilities at Rocky Flats to address those issues. In 1982, Rockwell engineers also prepared a composite plant safety analysis report which summarized all previous plant safety analysis reports and provided overall risk information on the plant for inclusion in the 1983 Long-Range Rocky Flats Utilization Study.

That report concluded that

“ . . . the composite Rocky Flats risk provides a small contribution to the overall risk to which the public sector is routinely exposed ”

Given the 1.8 million population of the Denver metropolitan area at the time, it was estimated that an individual living within 50 miles of the plant had a 1-in-900 million chance per year of dying from a cancer induced by an accident at the Rocky Flats Plant. The study then compared this risk with “everyday” risks such as an individual’s chance of dying of cancer (1-in-550 chance per year), dying in an automobile accident (1-in-4,000 chance per year), or dying of heart disease (1-in-300 chance per year)

That report also contained the following conclusions:

- Measurable health effects to the public from radioactive material releases are difficult to predict precisely. The radiation exposure to the public from a Rocky Flats Plant accident would be extremely small compared with the existing natural background radiation¹ and would be masked by other conditions that produce the same effects
- Earthquake and high-wind events severe enough to cause substantial building damage contribute approximately 93 percent of the composite risk from the Rocky Flats Plant. (Structures built at the Rocky Flats Plant were designed to less stringent codes and standards in effect at the time. As a result, most of the older structures were built to withstand relatively low seismic and wind forces.)

¹Background radiation is radiation in the environment from naturally occurring radioactive elements and from fallout

- Modifications to upgrade the Rocky Flats Plant buildings to withstand severe natural phenomena events (i.e., earthquakes and high winds) for the area would reduce the risks posed by the plant.

Rocky Flats' Environmental Impact Statement Also Reported Minimal Public Risks

In 1980 DOE prepared an Environmental Impact Statement for Rocky Flats as required by the National Environmental Policy Act of 1969. The Environmental Impact Statement assessed the actual and potential environmental impacts associated with plant operations and contained the following conclusions:

- Normal plant operations have no significant impact on the environment.
- The radiological impact on people living within 50 miles of the plant, from routine operation, is not perceptible as an addition to that received from natural background sources
- For any type of Rocky Flats Plant accident, the risk of death is less than the risk of an average person's being killed in a common accident.²

DOE Is Reassessing Environmental and Radiological Risks at Rocky Flats Plant

DOE is presently reevaluating both environmental and radiological risks associated with operations at the Rocky Flats Plant. In response to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) (P.L. 96-510), DOE is investigating in more detail the environmental impacts from plant operations. Rockwell is also revising safety analysis reports utilizing state-of-the-art risk analysis techniques. The revised reports completed to date agree with the prior DOE safety analysis reports, concluding there are minimal public health risks from accidents at the Rocky Flats Plant, but showing that the primary risk is from earthquakes, not high winds as previously thought. DOE is currently planning construction and building design modifications that should reduce the risks that exist.

DOE Has Identified Possible Negative Environmental Impacts

In 1984, DOE's Albuquerque Operations Office implemented a multiphased program to identify, assess, and correct existing or potential environmental problems at the Rocky Flats Plant. This program was initiated in compliance with CERCLA, which requires federal agencies to identify to the Environmental Protection Agency (EPA) inactive waste storage sites that may be sources of environmental contaminants. The major thrust of the program is to determine whether waste—both

²Based on mortality risk to an individual receiving the maximum exposure at the plant boundary

nuclear and nonnuclear—disposal practices followed in the past require remedial action.

In April 1986, DOE released the findings based on its work to that date. Nine general areas were identified for further evaluation. Two of the more significant areas involved the need to (1) define the extent and movement of toxic chemicals in the groundwater and (2) develop a method of disposal for noncombustible, radioactive, PCB-contaminated materials (PCB's, polychlorinated biphenyl, are poisonous environmental pollutants which tend to accumulate in animal tissues). In addition, 45 locations at the Rocky Flats Plant were found to have possible contamination and the potential to release contaminants into the environment. These sites will be evaluated in subsequent phases of the program to determine whether environmental problems actually exist. Three of the 45 sites were found to meet the federal criteria for placement on EPA's National Priority List.³ Because these three sites exceeded the threshold value for placement on this list, the entire Rocky Flats facility may be designated as a priority site.

In addition, 21 other sites where remedial action had been taken in the past will undergo verification of the adequacy of the contamination removal or control. One additional site is currently undergoing removal of contaminated soil, and DOE has recently submitted to the EPA and the Colorado Department of Health a plan to clean up five radioactive and chemically contaminated waste ponds by 1991.

Revised Safety Analysis Reports Indicate Minimal Risks to the Public

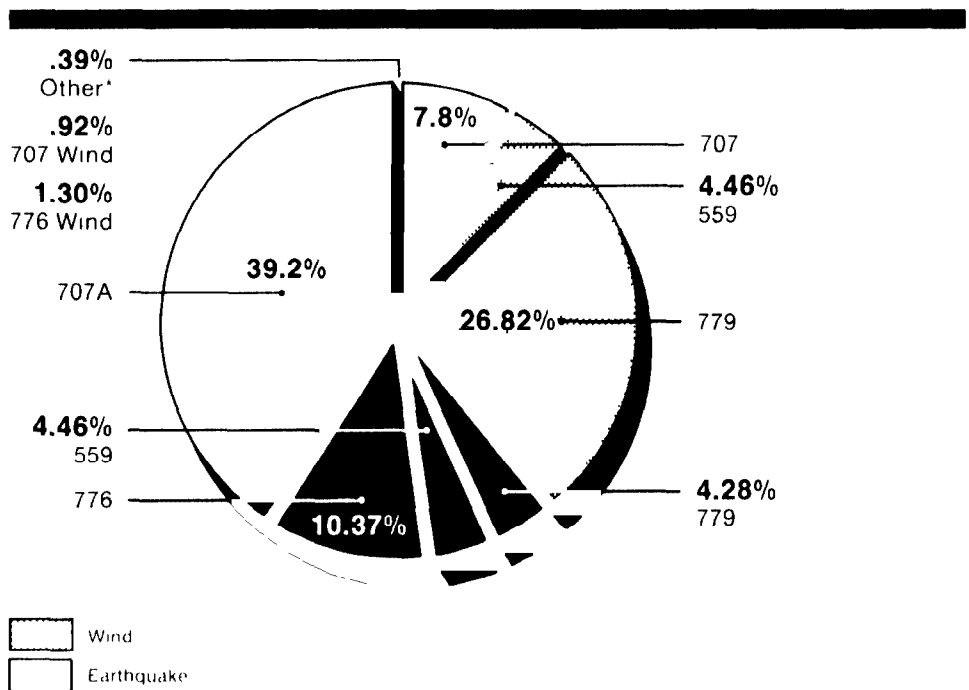
After completing the composite safety analysis for the Long-Range Rocky Flats Utilization Study in 1982, Rockwell's safety analysis engineers developed a more sophisticated risk analysis approach, which they have since incorporated into the safety analysis program. This new approach is patterned after the probabilistic risk assessment techniques widely used in the nuclear power industry and approved by the Nuclear Regulatory Commission. According to Rockwell's safety analysis branch manager, this new methodology provides a more detailed calculation of risks than previously provided, as well as risk figures that have a much greater degree of confidence.

As of March 1987, Rockwell had revised safety analysis reports for the six major Rocky Flats plutonium-handling facilities. DOE is currently

³EPA uses a "hazard ranking system" to establish the National Priorities List of facilities for initial attention under CERCLA.

reviewing these reports and hopes to approve them by the middle of 1987. These draft revised safety analysis reports indicate that while the overall plant risk to the public remains essentially the same as reported in the Long-Range Rocky Flats Utilization Study, the relative contributions to public risk that would result from plutonium dispersal due to earthquakes versus those due to high winds has been reversed. The site-wide safety analysis report prepared to support the Long-Range Rocky Flats Utilization Study showed that 87 percent of the risk to the public was due to extreme winds, while only 6 percent of the risk was due to severe earthquakes. The revised safety analysis reports show that seismic risks now dominate—66 percent of the public risk is due to severe earthquakes and only 33 percent is due to severe winds. Figure 3.1 illustrates the contribution to the composite risk, by building and natural phenomena event.

Figure 3 1: Contribution to Risk by Building and Natural Phenomena Event



*Other is 771 774 Natural Phenomena Tornado, Operational Accidents and Stack Emissions

Risk from wind-caused damage and resulting plutonium dispersal is greatest for building 779 followed by buildings 559, 776, and 707. Building 707 (plutonium-fabrication building) poses the highest seismic risk, followed by buildings 776 (plutonium-processing building), 559

(plutonium analytical laboratory), and 779 (plutonium research and development building). The other buildings at the Rocky Flats Plant contribute little to the overall seismic risk. According to Rockwell's safety engineers, the reversal in risk contribution is based on further research in a number of areas, such as plutonium particle size, the dispersion properties in an accidental release, and the structural strength and containment capabilities of the plutonium buildings.

It should be noted that we have recently completed a review of DOE's safety analysis report process.⁴ Eight of DOE's older defense facilities were reviewed, including the Rocky Flats Plant. We reported that an effective and well-accepted safety review process is a key to DOE's demonstration that its nuclear facilities can be safely operated. However, we found that

- the extent to which the facilities were compared against DOE's safety design criteria varied considerably between the facilities (the Rocky Flats safety analysis report which was reviewed did not contain a comparison of the facility against design criteria);
- different approaches and assumptions were used to identify and analyze potential accidents at the facilities; and
- all safety analysis reports were being reviewed and approved internally within DOE, which does not represent an independent review process.

We recommended that the Secretary of Energy (1) complete safety analysis reports for all high-hazard facilities, (2) require that the reports include a comparison of the facilities against current DOE design criteria, (3) develop more consistent requirements for preparing the reports, and (4) establish an arrangement so that DOE's safety analysis reports receive outside, independent reviews. On August 21, 1986, DOE responded to these recommendations. DOE stated that it would ensure that safety analysis reports for all high-hazard facilities are approved by the end of fiscal year 1987 and that it will require a comparison of its nuclear facilities to current DOE design criteria to be incorporated into each facility's safety analysis report. DOE also stated that it would provide additional guidance to ensure consistency in how accidents are analyzed in safety analysis reports. DOE disagreed with our fourth recommendation

⁴Nuclear Safety Safety Analysis Reviews for DOE's Defense Facilities Can Be Improved (GAO/RCED-86-175, June 16, 1986)

DOE Is Making Building Modifications to Decrease Public Risk

In a 1983 evaluation of the findings and conclusions in the Long-Range Rocky Flats Utilization Study, DOE's Albuquerque Operations Office concluded that while no upgrading of the plutonium-processing facilities at the Rocky Flats Plant was required given the present level of off-site risk, some facility upgrading was desirable because of health- and safety-related considerations. These considerations included uncertainties in the risk estimates, population growth around the Rocky Flats Plant, worker protection from nonradiologic risks, and DOE policy requiring that risks to the worker, public, and environment be minimized.

DOE initiated a construction project to strengthen three of the plutonium buildings (707, 776, and 779) to withstand extreme winds. DOE estimated that the structural upgrade would reduce the off-site risk by a factor of about 10. The project was subsequently funded for \$5.6 million and construction was to begin in 1986. However, DOE decided to redesign the construction project to provide for greater seismic strengthening in the buildings on the basis of its revised safety analysis reports. DOE is also considering ways to reduce the risk in building 559, as it is a relatively significant contributor to the overall risk. DOE plans to reassess the entire project in mid-1987, when engineering and cost estimates are refined, and then determine if additional funds will be necessary.

Perceived Risk May Be as Important as Calculated Risk

Similar to the negative perception of the risks attributed to nuclear power plants held by some individuals and groups and despite the conclusion of DOE's safety analysis reports that Rocky Flats is of minimal risk to the surrounding area, perception of more serious risks exists. Perceived risks at the Rocky Flats Plant may be more important to the public than any calculated risks. The Blue Ribbon Citizens' Committee review of DOE's Long-Range Rocky Flats Utilization Study, stated that a critical factor in determining both perceived risk and risk acceptability is an individual's personal opinion regarding national nuclear weapons policy and the mission of Rocky Flats. Deeply held feelings opposing the plant tend to increase perceived risk and reduce risk acceptability. Strong feelings in support of the plant and its mission tend to have the opposite effect.

Past plutonium releases, while found by DOE to contribute very little risk to the public compared with natural background radiation, have resulted in litigation against the plant. In addition, there was adverse public reaction to a recent discovery of contaminated groundwater at the plantsite, although not yet determined to be a public health problem.

The events surrounding this discovery have led to charges that DOE is attempting to hide crucial information.

Perceived Risks Result in Litigation Against DOE

In 1975 several land owners adjacent to the Rocky Flats Plant filed a lawsuit against the U.S. government contending that their property had been damaged by releases of plutonium and other radioactive materials from the plant. The property owners alleged that their lands had been rendered unfit for human habitation and the market value of their properties had diminished. They also alleged that the mere presence of the plant next to their properties was sufficient to diminish their property values.

The landowners' suit involved claims of almost \$140 million. In order to avoid the expense and the uncertainty of a jury trial, DOE entered into negotiations and a settlement agreement was finally reached in December 1984. The settlement agreement required the U.S. government to pay \$8.75 million to the property owners for certain parcels of land and convey these lands to a nearby city for open space use or reservoir expansion purposes only. In addition, Rockwell agreed to reduce the levels of contamination in the off-site soil where they exceeded state standards.

As part of the settlement agreement, the U.S. District Court for Colorado later held hearings. The hearings concluded that no scientific basis existed for believing that soil and air concentrations of plutonium and other radioactive materials on the subject properties would produce human health effects different from those resulting from naturally occurring background radiation. The court also concurred with a Colorado state epidemiologist that no measurable increases in cancer incidence resulting from operations at the Rocky Flats Plant have been scientifically demonstrated.

Public Concerns Increase Over Recent Discovery of Groundwater Contamination at Rocky Flats Plant

In 1985, Rockwell conducted a preliminary screening of plant drinking water, surface water, and groundwater in compliance with then-pending EPA regulations regarding allowable concentrations of certain organic chemicals in drinking water. Elevated levels of four highly toxic (nonradioactive) chemicals were found in eight on-site groundwater monitoring wells. While none of these chemicals were found in surface or drinking water, concentrations in groundwater were as much as 1,000 times EPA's proposed maximum concentration limits for these chemicals.

DOE is conducting an investigation to determine the extent of groundwater contamination and to determine the appropriate future actions

While no adverse public health effects have yet been demonstrated, further study has confirmed the possibility that some offsite groundwater users could be affected. Local civic and health officials have expressed concern over the extent to which this contamination might have spread into nearby community water supplies.

The events surrounding the discovery of groundwater contamination at the plant have led a number of local health officials and private citizens to question whether DOE has been withholding vital public health information. In a letter dated December 30, 1985, to the Colorado Department of Health, one county health department director stated that his department suspected that even more dangerous chemicals could possibly be contaminating the groundwater. In May 1986, the governor reestablished a citizen's oversight committee on the basis of his perception that environmental concerns, specifically waste cleanup and discovery of toxic chemicals in the plant's groundwater, deserved the committee's renewed attention.

Impacts on Public Health Resulting From Rocky Flats Relocation Alternatives Difficult to Determine

Relocating the entire Rocky Flats operation would benefit the local residents by reducing potential exposure from an accidental release and from normal operations. However, relocating the plant would require extensive operations to decommission and decontaminate existing facilities, which, in turn, would entail risks that are presently unknown. Risk analysts state, however, that these risks could be significant

Risk reduction gained from relocating the reprocessing operations is presently unknown. According to Rockwell officials, all of the detailed information necessary to perform a risk analysis has not been developed for the relocation alternatives now being considered.

Certain Impacts of a Total Rocky Flats Relocation Have Been Determined

DOE's 1980 Environmental Impact Statement stated that if the Rocky Flats Plant were to be totally relocated, the accident risk potential for the Denver area would be eliminated and a reduction in dose from normal emissions and soil contamination would occur. The dose to inhabitants in the Denver area from present operations would be almost entirely eliminated. This projected impact on public health, however, does not include possible risk associated with redispersal of plutonium

particles or accidental releases during decommissioning and decontamination of the Rocky Flats Plant. The Environmental Impact Statement also stated that completely relocating the Rocky Flats' plutonium operations would have little net risk reduction for the environment on a nationwide basis since the population surrounding the new site would then be subject to potentially increased operations' risks.

Impacts of Partially Relocating Plutonium Operations Have Not Been Determined

DOE has developed some information on transportation risks associated with the relocation alternatives (discussed in ch. 2); however, DOE has not calculated the risks that the relocated plutonium operations would have on public health and safety in the vicinity of their new location. In our opinion, such calculations would be quite useful in evaluating and comparing the net effect on safety and health risk resulting from the relocation alternatives. Although the effect on public health was originally to be a factor in DOE's evaluation of alternatives, sufficient detail has not been developed to facilitate analysis.

Transportation Risks

In a study entitled Long-Range Recovery of Plutonium Scrap in the DOE Defense Programs Complex (Sept. 1985), DOE identified several social and political issues associated with shipments of plutonium and plutonium-laden materials, which are listed below:

- Potential political problems from accidents (such as prohibiting transportation of plutonium in certain areas)
- Increased public (antinuclear) awareness of weapons material shipments and potential for demonstrations and public issue campaigns in the media.
- Concern by the state government of the receiving site that the additional plutonium represents more "nuclear waste" coming into the state

In April 1986, at the request of DOE, Sandia National Laboratories in Albuquerque, New Mexico, completed a risk analysis for the shipment of plutonium oxides from Rocky Flats to other DOE facilities. The analysis concluded that the greater level of plutonium transportation associated with plutonium processing at locations other than Rocky Flats would increase the probability of accidents, although health and safety risk would still be low. According to a Rockwell International safety engineer, the analysis shows that risks for shipments would be 4 to 24 times greater, depending on location, than if the processing operations were maintained at the Rocky Flats Plant.

Facility Risk

A thorough calculation of risk resulting from a plutonium facility requires complex data in a number of areas. Calculations of the risks presented by natural phenomena events, for example, must initially be based on the severity of such events in the area of the plutonium facility and the associated frequency of occurrence. Buildings and equipment must then be assessed as to the expected amount of damage from each event. Given this information, determinations must be made of how much radioactive material would be released from a given building, considering the operations in the building and the amount of material processed. How much material would then be available for release to the public would be calculated. Public consequences can subsequently be estimated through various models which involve population estimates, meteorological data, and projections of health effects from such releases. Because none of this detailed information has been developed for the various relocation alternatives, Rockwell officials stated that the associated risks are unknown.

According to DOE and Rockwell officials, relocating only the plutonium-processing operations to another site, for example, may not significantly reduce the overall risk to the public in the Denver metropolitan area. This occurs because the two dominant contributors to public health risk, building 707 where fabrication takes place and building 779 where plutonium development activities take place, are estimated to be responsible for 48 percent and 31 percent of the overall risk, respectively. By comparison, building 776, which processes returned weapons, contributes approximately 12 percent of the overall risk.

In fact, relocation could have the opposite effect. If fabrication remains at Rocky Flats, residues will still be generated. Risks associated with transporting these residues off-site, and decontamination and decommissioning procedures necessary to close down processing operations are presently unknown but could be significant, according to DOE and Rockwell safety officials. They believe that these risks could offset any reduction in risks gained by relocating the processing operations.

**Impact on Area's
Socioeconomics Likely
to Be Minimal**

Studies conducted in the early 1980's indicated that relocating the entire Rocky Flats Plant would have little socioeconomic impact on the Denver metropolitan area. Although population growth and employment factors have changed since those studies were conducted, relocating the Rocky Flats Plant is still likely to have only a small socioeconomic effect.

A 1982 study performed in support of the Long-Range Rocky Flats Utilization Study entitled The Social and Economic Impacts of Changing Missions at the Rocky Flats Plant concluded that the impacts of either a partial or total relocation of the Rocky Flats Plant would not be highly negative. The study also concluded that, with prior planning, most employees would be able to find new jobs if the plant were relocated. In its independent assessment of the study, the Blue Ribbon Citizen's Committee reported that the study's conclusions seemed sound, unless predictions of rapid future growth in the area proved invalid. But in the intervening years, the social and economic changes which have occurred in the area could affect the validity of the Long-Range Rocky Flats Utilization Study's conclusions. Some of these changes include the following:

- Population growth rates have decreased in the state. Recent reports from the Colorado State demographer have noted that the rate of population growth in the state (previously projected to be 2.4 percent to 2.6 percent) was only 1 percent from 1983 to 1984. These lower growth rates are predicted to remain for the foreseeable future.
- Personnel levels at Rocky Flats have increased, indicating possibly greater difficulty with reemployment. At the time of the Long-Range Rocky Flats Utilization Study, personnel levels hovered around 4,500. Rockwell officials expect the plant to remain at the current level of approximately 5,500 employees for the next few years.

Despite the lower population growth projections for the state, however, recent county and city studies suggest that vigorous growth will occur in the general area surrounding Rocky Flats. Also, plans are proceeding for the construction of a major highway, with a likely route near the plant's buffer zone. Disagreement exists among local officials as to the impact of the highway, but other locations within the Denver metropolitan area have experienced enormous growth around new highways.

Following a decision to relocate the entire plant, it is estimated that it would take about 14 years before any employee layoffs would begin. Such an extended period of time would allow for employee retraining and other mitigation strategies to ease Rocky Flats employees into the workforce.

Relatively few Rocky Flats employees would be affected by a partial relocation, according to a recent Rockwell study. For example, if all the plutonium-processing operations were moved, almost 1,100 employees would be affected, but only 878 would actually be laid off. The others would be needed for preparing residues for shipment off-site. Table 3.1

details Rockwell's estimate of the personnel decreases that might result from a number of relocation alternatives.

Table 3.1: Relocation Alternatives and Personnel Level Decreases

| Relocation alternatives | Personnel decreases |
|---|----------------------------|
| Relocate site returns | 96 |
| Relocate oxides | 56 |
| Relocate oxides and site returns | 152 |
| Relocate residues, oxides, and site returns | 878 |
| Relocate Rocky Flats Plant to new area | 5,500 |

Local government officials recently expressed the opinion that total relocation of the plant to a new site would definitely have some effect on the surrounding area, but given the extended time period necessary to implement such a move, the impact probably would not be significant. They also believed that the local workforce would be vigorous enough to absorb Rocky Flats' employees.

Conclusions and Recommendation

The future of building 371 has been debated and studied for more than 5 years. During that time, DOE has incurred costs to transport residues to other DOE facilities, public perception of the health risks associated with the Rocky Flats Plant appears to be growing, the older buildings at Rocky Flats—buildings 771 and 776, which building 371 was designed to replace—are still in use and growing older, while DOE's building 371—costing more than \$200 million—is largely unused. While these conditions appear to argue in favor of a quick resolution of this matter, we found that there is no easy solution to the dilemma facing DOE relative to the future of building 371 or the Rocky Flats Plant

Our comparison did not disclose any alternative that was clearly superior to the others when all factors were considered. On a cost basis only, several processing alternatives appeared to be competitive with repairing building 371 at the Rocky Flats Plant. Using the same criteria, we believe the cost of relocating the entire Rocky Flats Plant—about \$4 billion—is not justified. However, comparison of all alternatives using only cost as a criteria does not take into consideration other factors, such as environmental, safety, and health risk, which impact on the desirability of the alternatives. When these factors, or combinations of these factors, are considered, the most appropriate alternative would depend on the goals, objectives, perceptions, and subjective judgments of those making the comparison. For example, if one's objective were to limit transportation costs and related risks, the most appropriate alternative would be to have all residues processed at the location where they were created. Repairing building 371 or total relocation would achieve that objective. If one's objective were to minimize capital costs and reduce the amount of plutonium at the Rocky Flats Plant, relocating oxide processing to the Los Alamos National Laboratory would be the most appropriate alternative. Further, if one's primary objective were to eliminate the risk of a plutonium accident in the Denver metropolitan area, then total relocation would be the only suitable alternative. By altering the goals and objectives of a study, which would in turn alter the relative weights of the comparative factors, almost any of the alternatives could be made to appear as the best alternative.

The best decision concerning the future of plutonium operations at the Rocky Flats Plant should not only consider and weight the various factors related to Rocky Flats, but should also be made in the context of the future of the entire DOE weapons production complex. This complex consists of 18 interdependent sites with numerous buildings, some of which are becoming increasingly deteriorated with age. Various groups have

become concerned over the environmental, safety, and health risks associated with DOE's facilities, particularly since the Chernobyl disaster. Any consideration given to relocating parts of, or the entire Rocky Flats Plant to these locations, must include the environmental, safety, and health impacts such relocation would have on the receiving locations. Based on our review, we believe a decision on the future of Rocky Flats cannot be made until DOE completes studies of such impacts.

Also, any decision relative to relocating all or part of Rocky Flats plutonium operations must be made in the context of the long-term future use of the various facilities within DOE's weapons production complex. The future use of these facilities, in turn, will be dependent on the goals and objectives established for the program, the projected requirements for continued nuclear weapon production, and the physical condition of the various facilities. Such information is currently lacking, however, DOE is conducting a study which addresses the long-term future of its weapons facilities.

Recommendation to the Secretary of Energy

To make the best decision on the future of building 371, DOE needs to first address a broader issue—where does the Rocky Flats Plant fit in the overall, long-term plans, goals, objectives, and requirements for an aging DOE weapons production complex? Many of DOE's facilities are approaching or have passed their planned operating lives and major investments will be required to replace or refurbish these facilities

Before spending hundreds of millions of dollars to relocate or repair one building at Rocky Flats, DOE needs to take a broader look. In March 1987 testimony before the Senate Governmental Affairs Committee, we addressed this issue and called on DOE to make this broad, strategic analysis. For Rocky Flats, we recommend that the Secretary of Energy ensure the selection of the best solution be closely coordinated with this study to assure that construction/modernization funding is used efficiently.

Chronology of Events Related to Building 371

| | Date |
|--|-------------|
| Congressional approval of building 371 construction | 1970 |
| Project funded by the Congress | 1971 |
| Engineering started | 1971 |
| Construction started | 1973 |
| Project cost estimate revised to \$140 million | May 1974 |
| DOW Chemical Corporation replaced by Rockwell International as operating contractor | July 1975 |
| Full-time project manager appointed for building 371 | Nov 1976 |
| Project cost estimate revised to \$187 million | July 1977 |
| GAO report on building 371 construction problems | June 1978 |
| Project cost revised to \$202 million | Sept 1978 |
| Project cost revised to \$215 million | Dec 1978 |
| All systems transferred to Rockwell for testing | Sept 1980 |
| Construction completed | Mar 1981 |
| Testing began with acids | June 1981 |
| DOE approved start of plutonium operations | Aug 1981 |
| Incinerator tested and found not operable | Nov 1982 |
| Comprehensive DOE and Rockwell evaluation of building 371 completed | Sept 1983 |
| DOE prepared a special plan for shipping and processing plutonium | Oct 1983 |
| DOE initiated study of alternatives to building 371 | Oct 1984 |
| Rockwell submitted draft plan for repairing building 371 | Nov 1984 |
| Rockwell submitted final conceptual design for repairing building 371 | Mar 1985 |
| DOE Albuquerque Operations Office decided to delay funding request to fiscal year 1988 | May 1985 |
| GAO report on building 371's operational problems and costly resolutions | Sept 1985 |
| DOE's health and safety standard for allowable exposure of workers to radiation made more stringent | Sept 1985 |
| Revised conceptual design for building 371 completed, new technologies initiated to meet current standards | Jan 1986 |
| Report submitted by Independent Technical Review Group on the building 371 Conceptual Design Report | Mar 1986 |
| Albuquerque Operations Office Manager submitted budget request for building 371, but project completion date extended to fiscal year 1996 to accommodate Gramm Rudman-Hollings deficit reduction act | Mar 1986 |
| Two independent cost estimate analyses conducted on the proposed building 371 capital budget request | Apr 1986 |
| DOE headquarters established assessment team to reevaluate possible recovery relocation options | Apr 1986 |

Appendix I
Chronology of Events Related to Building 371

| | Date |
|---|-------------|
| Draft of Plutonium Recovery Assessment Team Report recommended that planned capacity of building 371 be reduced because of operational efficiencies and other factors | May 1986 |
| DOE headquarters' decision not to submit fiscal year 1988 budget request for building 371 | July 1986 |
| Rocky Flats Area Office and Rockwell International initiate actions to revise conceptual design for building 371 to reduce capacity and to study future potential use of building 771 | Aug 1986 |

Comparison of Costs Associated With Repairing Building 371 and the Relocation Alternatives

| Dollars in millions | | |
|----------------------------------|-------------------------|-----------------------------------|
| Cost Category | Cost^a | Annual transportation cost |
| Repair building 371 | \$303 | \$2.90 |
| Total relocation | 4,031 | 00 |
| Relocate all processing | 445 - 609 ^b | 3.40 |
| Relocate site returns | 348 - 493 | .22 |
| Relocate oxides | 206 - 316 | 1.60 |
| Relocate oxides and site returns | 312 - 617 | 1.70 - 2.00 |

^aTime frames for costs vary for different alternatives. Costs were not discounted because DOE data were not sufficiently detailed to allow this calculation.

^bSee footnote a to table 2.2.

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