# 1.0 INTRODUCTION

This Final Environmental Impact Statement (EIS) identifies potential alternatives and impacts associated with the proposed action to process certain plutonium residues and all of the scrub alloy currently stored at the Rocky Flats Environmental Technology Site (Rocky Flats). While ongoing stabilization activities at Rocky Flats are addressing immediate health and safety concerns associated with existing storage conditions, the indefinite storage of these materials, even after stabilization, would continue to present health and safety concerns that could only be eliminated by disposal or other disposition of the materials. Thus, this EIS evaluates alternative processing technologies to prepare these materials for disposal as transuranic waste at the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico, or for other disposition.

*The DOE sites potentially affected by the proposed action are:*

- *Rocky Flats Environmental Technology Site, Colorado*
- *Savannah River Site, South Carolina*
- *Los Alamos National Laboratory, New Mexico*
- *Waste Isolation Pilot Plant, New Mexico*

This EIS identifies and evaluates alternative processing technologies at three Department of Energy (DOE) sites and identifies DOE's preferred alternative for the various materials. DOE has prepared this EIS in accordance with the National Environmental Policy Act (NEPA), as amended.

Four alternatives are analyzed in this EIS. They include:

- Alternative 1 (No Action - Stabilize and Store)
- Alternative 2 (Processing without Plutonium Separation)
- Alternative 3 (Processing with Plutonium Separation)
- Alternative 4 (Combination of Processing Technologies)

DOE's Notice of Intent to prepare this EIS was published on November 19, 1996 (61 *Federal Register* 58866). Following a public scoping process, the Draft EIS was issued for public comment on November 25, 1997 (62 *Federal Register* 62761). This Final EIS reflects DOE's consideration of public comments and further information DOE has gained about the nature of its residues as a result of continued characterization of the residues. Changes made since the Draft EIS are highlighted by sidebars in the margins of this Summary and of the Final EIS and are summarized in Section 1.4 of this Summary.

*The materials covered by this EIS include:*

- *Plutonium residues, primarily in the form of salts, ash, sludge, and contamination on rags, glass, and metal pieces; and*
- *Scrub alloy, a magnesium/aluminum/americium/plutonium metal mixture created as an interim step in plutonium recovery.*

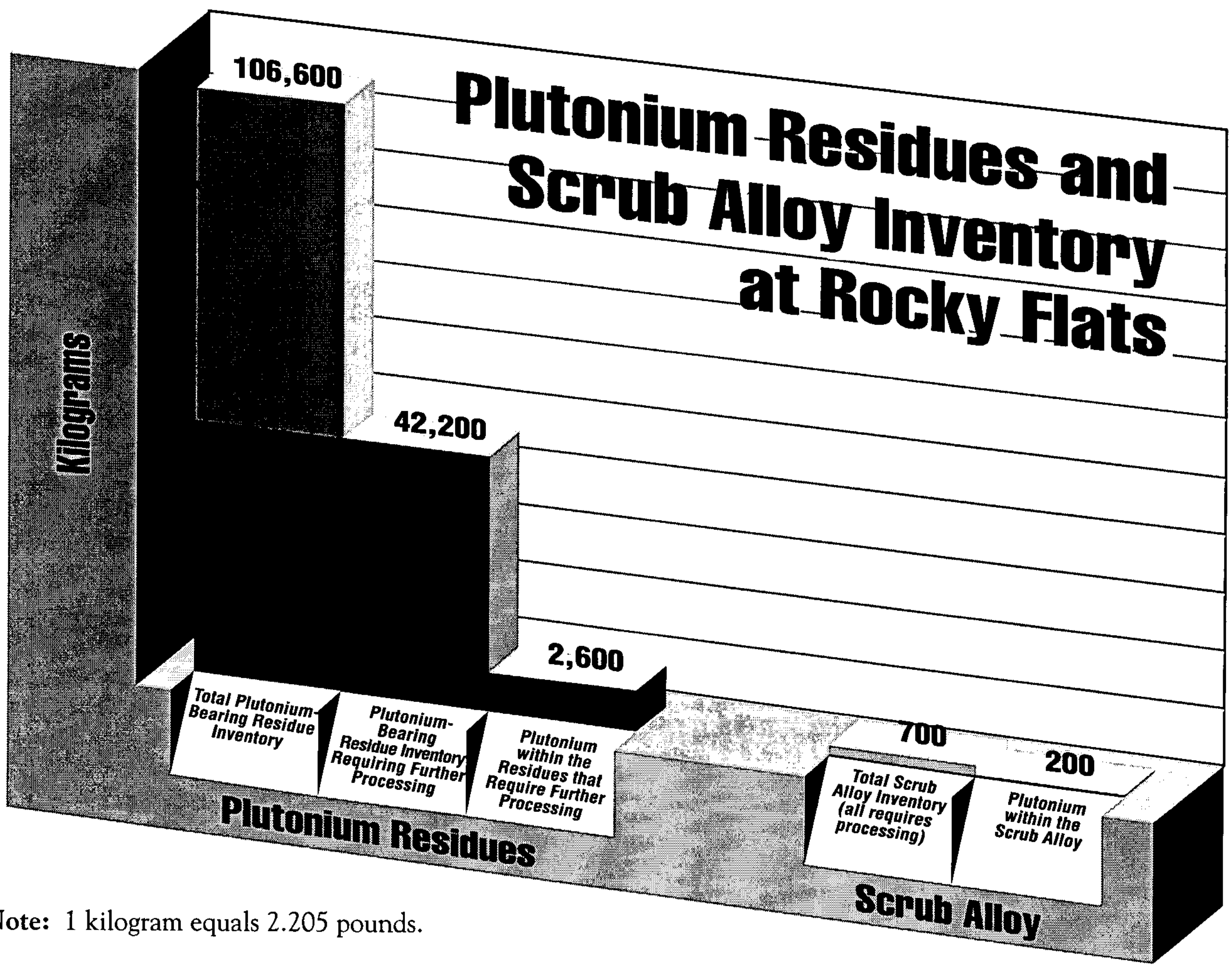
## 1.1 BACKGROUND

During the Cold War, DOE and its predecessor agencies conducted various activities associated with the production of materials for use in nuclear weapons. Several intermediate products and wastes were generated as a result of those operations, some of which are still in storage at various DOE sites. Now that the Cold War is over and the United States has ceased production of fissionable nuclear weapons materials, DOE is conducting activities to safely manage, clean up, and dispose of (where appropriate) those intermediate products and wastes. Among the intermediate products and wastes requiring proper management and preparation for disposal or other disposition are plutonium residues and scrub alloy currently stored at Rocky Flats near Golden, Colorado.

About 85 percent of DOE's plutonium residues and almost all of DOE's scrub alloy are currently stored at Rocky Flats. They are stored in various types of containers in six former plutonium production facilities. The amounts stored are about 106,600 kilograms (kg) (235,000 pounds [lb]) of residues containing about 3,000 kg (6,600 lb) of plutonium, and about 700 kg (1,540 lb) of scrub alloy containing about 200 kg (440 lb) of plutonium.

In order to address near-term health and safety concerns associated with the continued storage of these materials at Rocky Flats,[1] stabilization activities are already underway for the plutonium residues currently in storage at Rocky Flats. For the majority of these materials, these stabilization activities are sufficient to prepare the materials for ultimate disposition. These stabilization activities are being conducted in accordance with the Finding of No Significant Impact that was issued after completion of the Rocky Flats Solid Residue Environmental Assessment.[2] The stabilization of Rocky Flats scrub alloy was not addressed in that Environmental Assessment. (Stabilization activities for the remaining plutonium residues at other DOE sites are addressed in other NEPA documents identified in Section 1.7 of this Summary.)

Even with the stabilization contemplated under the Finding of No Significant Impact, a portion of the plutonium residues (42,200 kg [93,000 lb] out of 106,600 kg [235,000 lb]) and all of the scrub alloy (700 kg [1,540 lb]) would still continue to present health and safety concerns because they would not be in forms that would allow for their disposal or other disposition. This EIS addresses the processing of this subset of Rocky Flats' plutonium residues and all of the Rocky Flats scrub alloy not only to stabilize them but also to prepare them for disposal or other disposition, with the primary goal of eliminating the health and safety issues associated with continued storage of these materials.




**Note:** 1 kilogram equals 2.205 pounds.

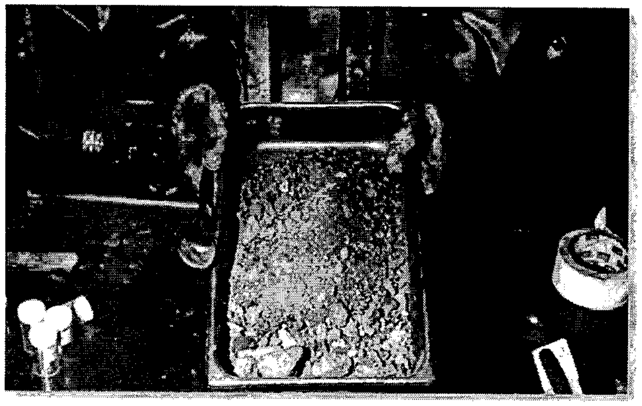
[1] *Health and safety concerns associated with the continued storage of plutonium residues at Rocky Flats were raised by the Defense Nuclear Facilities Safety Board in Recommendation 94-1, "Improved Schedule for Remediation in the Defense Nuclear Facilities Complex," June 1994.*

[2] *Solid Residue Treatment, Repackaging, and Storage Environmental Assessment/Finding of No Significant Impact, DOE/EA-1120, Rocky Flats Field Office, April 1996.*

The plutonium residues consist of four broad categories that were described in the Rocky Flats Solid Residue Environmental Assessment: ash, salts, wet residues, and direct repackaging residues. The residues were grouped into these categories due to chemical similarities or similarities in the manner in which they could be managed. The approximate quantities in each residue category and also the scrub alloy inventory requiring further processing to prepare them for disposal or other disposition are summarized in Table S-1. A more detailed break-out of these materials is contained in Table S-2 of Section 1.6.

Table S-1. Plutonium Residues (by Major Category) and Scrub Alloy Inventory Covered Under this EIS

| Category | Inventory, kg (lb) | Plutonium Content, kg (lb) |
|---|---|---|
| **Ash Residues** include incinerator ash and firebrick fines; sand, slag, and crucible; graphite fines; and inorganic ash residues. | 20,060 (44,200) | 1,160 (2,560) |
| **Salt Residues** include molten salt extraction salt residues, electrorefining salt residues, and direct oxide reduction salt residues. | 14,900 (32,800) | 1,000 (2,200) |
| **Wet Residues** include wet combustible residues, plutonium fluoride residues, filter media, Raschig rings, sludges, and greases/oily sludges. | 4,300 (9,500) | 290 (640) |
| **Direct Repackage Residues** include dry combustible residues, glass residues, miscellaneous residues, and graphite and firebrick. | 2,900 (6,400) | 130 (290) |
| **Scrub Alloy** | 700 (1,540) | 200 (440) |



Example of Residues in Raw Form

Packaged Residues

Storage in Drums

## 1.2 SCOPE OF THIS EIS

*1 kilogram (kg) equals 2.205 pounds (lb).*

This EIS evaluates technical alternatives for management of approximately 42,200 kg (93,000 lb) of plutonium residues containing approximately 2,600 kg (5,700 lb) of plutonium, and approximately 700 kg (1,540 lb) of scrub alloy containing about 200 kg [440 lb] of plutonium currently in storage at Rocky Flats to facilitate their disposal or other disposition. The four technical alternatives are:

(1) No Action (Stabilize and Store) — Under the No Action Alternative, the Rocky Flats plutonium residues and scrub alloy would be stabilized, if necessary, and stored there for an indefinite period of time pending disposal or other disposition. The materials processed under this alternative would not meet safeguards termination limits (see Section 1.3.1 of this Summary), and the health and safety risks associated with continued storage at Rocky Flats would not be eliminated.

(2) Processing without Plutonium Separation — Under this approach, materials covered by this EIS would be processed into forms that meet safeguards termination limits using processes such as immobilization[3] or blend down (without separating the plutonium), and would thus be ready for shipment to WIPP for disposal.

(3) Processing with Plutonium Separation — Under this approach, materials covered by this EIS would be processed using approaches that would separate the plutonium from the material. DOE would manage the separated weapons-usable surplus plutonium in accordance with decisions made under the *Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement* and the *Surplus Plutonium Disposition Environmental Impact Statement* (in preparation). Transuranic wastes resulting from this alternative would be disposed of in WIPP and low-level wastes would be disposed of in accordance with the processing site's low-level waste disposal practices.

(4) Combination of Processing Technologies — Under this approach, a combination alternative comprised of elements of the technologies analyzed under Alternatives 1 and 2 would be used.

The objective of the proposed agency action is to process the material, if necessary, into a form and concentration that is suitable for disposal or other disposition for the purpose of eliminating the health and safety impacts associated with continued storage of these materials. DOE would prefer to integrate management decisions regarding the materials within the scope of this EIS with stabilization decisions resulting from the Solid Residue Environmental Assessment. The intent of such integration would be to reduce the need to handle these materials, thereby reducing worker risk and costs associated with achieving a material form suitable for disposal or other disposition.

[3] *The immobilization technologies referred to here consist of processes such as cementation, vitrification and cold ceramification, and are not a part of the immobilization of weapons-usable plutonium as discussed in Section 1.3.2, Disposition of Waste and Separated plutonium.*

***Transuranic Waste*** *is contaminated with radioactive elements heavier than uranium (e.g., isotopes of plutonium) with half-lives longer than 20 years in concentrations greater than 100 nanocuries per gram of waste.*

*Most transuranic waste (about 97 percent by volume) is alpha-emitting and can be safely handled in its packaging (alpha particles can be stopped by shielding as thin as a sheet of paper).*

*A small percentage of transuranic waste emits sufficient penetrating radiation (gamma rays) to require more shielding (i.e., lead-shielded casks) if it is to be transported for processing or disposal.*

## 1.3 PURPOSE AND NEED FOR AGENCY ACTION

The purpose and need for agency action is to process certain plutonium residues and scrub alloy currently in storage at Rocky Flats (summarized in Table S-1) to address health and safety concerns regarding storage of the materials, as raised by the Defense Nuclear Facilities Safety Board (the Board) in Recommendation 94-1, *Improved Schedule for Remediation in the Defense Nuclear Facilities Complex*, and to prepare the materials for offsite disposal or other disposition. These actions would be taken in a manner that supports Rocky Flats site closure and limits worker exposure and waste production. Disposal or other disposition would eliminate health and safety concerns associated with indefinite storage of these materials.

The Rocky Flats Solid Residue Environmental Assessment addressed the potential environmental impacts associated with stabilizing the entire 106,600 kg (235,000 lb) inventory of Rocky Flats' plutonium residues to provide for safe storage until final disposition of the residues could be decided and implemented. Because of the need for expeditious action to resolve concerns with storage of the plutonium residues at Rocky Flats, the Solid Residue Environmental Assessment addressed neither disposal or other disposition of the residues after these materials were stabilized nor stabilization of the scrub alloy. Furthermore, although stabilization activities to mitigate the risks associated with the current storage condition of the plutonium residues are in progress at Rocky Flats, based on the Solid Residue Environmental Assessment, less than 10 percent of the Rocky Flats plutonium residues addressed in this EIS and none of the scrub alloy have been stabilized to date. Accordingly, DOE considers it prudent to consider in this EIS processing and other alternatives that not only would stabilize the remaining plutonium residues to address the health and safety concerns raised by Board Recommendation 94-1, if necessary, but also would convert them into forms that would allow for their disposal or other disposition. To that end, the materials must also have safeguards terminated.

### 1.3.1 Safeguards Termination Requirements

In the process of considering disposal options for the Rocky Flats plutonium residues and scrub alloy, DOE determined that the majority of the residues would be suitable for disposal at WIPP after stabilization. Approximately 42,200 kg (93,000 lb) out of the total 106,600 kg (235,000 lb) of plutonium residues currently stored at Rocky Flats, however, could not be sent to WIPP for disposal in their present forms because they contain plutonium concentrations exceeding DOE safeguards termination limits. Although these plutonium residues would not be directly usable in nuclear weapons, they currently contain plutonium concentrations too high to be transported to and staged for disposal at WIPP unless safeguards controls were maintained.[4] DOE does not plan to maintain such controls for materials transported to and staged at WIPP prior to disposal because WIPP is not designed to allow implementation of such controls. Thus, these materials in their present forms are effectively foreclosed from being disposed of at WIPP unless a variance to safeguards termination limits is applied (see discussion below).

*For the Rocky Flats plutonium-bearing materials to be disposed of as transuranic waste at WIPP, they must meet the following requirements:*

- *Performance-based requirements contained in the WIPP waste acceptance criteria and*
- *Safeguards termination requirements, either by having:*
  - *plutonium concentrations that are below the safeguards termination limits for those material forms, or*
  - *a variance to safeguards termination limits*

The term "safeguards" refers to those measures (e.g., recordkeeping, monitoring, and physical protection) that DOE and other organizations holding nuclear materials must take to ensure that the materials are not stolen or

[4] *Hereinafter, in this Summary, the terms "disposal" or "disposed of" at WIPP include the steps of transporting to and staging prior to disposal.*

diverted for illicit purposes. The safeguards requirements that are applicable to nuclear materials held by DOE are specified in DOE Order 5633.3B, "Control and Accountability of Nuclear Materials." The term "safeguards termination requirements" refers to those steps that must be taken, or conditions that must exist, before nuclear materials are rendered sufficiently unattractive as a source of fissile material for illicit purposes to allow them to be exempted from safeguards controls. These requirements include "safeguards termination limits" that define, for certain categories and forms of material, the maximum weight percentage of special nuclear material (plutonium and certain uranium isotopes) that can be present in materials without subjecting them to safeguards controls.

For certain materials that contain a concentration of plutonium or other special nuclear material above safeguards termination limits, special conditions, such as the combination of the processing method, the controls in place for normal handling of transuranic waste, and the limited quantity of special nuclear material present at any particular place and time, may preclude the need for the strict material control and accountability imposed by safeguards. If a DOE site identifies such a special condition, the site may request approval of a "variance" to safeguards termination limits from DOE's Office of Nonproliferation and National Security, Office of Safeguards and Security. If a variance to safeguards termination limits is granted, this does not necessarily mean that there are no longer any security controls in effect to protect the materials. In particular, in the case of materials such as those within the scope of this EIS, as part of the process of considering whether a variance should be granted, the Office of Safeguards and Security reviews the other DOE management practices and physical security procedures that would remain in effect in place of the strict safeguards requirements, as specified in the documentation explaining the basis for the variance. They would then approve a variance only if they determine that the controls that would remain in effect under the variance would be sufficient to adequately control access to the materials.

***WIPP** is designed to incorporate security provisions appropriate to its function (which includes disposal of materials containing small amounts of plutonium), but not to meet the more stringent nuclear material safeguards requirements. As a result, materials must meet safeguards termination requirements before they could be disposed of in WIPP. There are three approaches that could be taken to satisfy the safeguards termination requirements, as described below:*

- *The concentration of plutonium, or other fissile elements, in the material must be very low (e.g., 0.1 weight percent). Many of the Rocky Flats residues (i.e., approximately 64,400 kg [142,000 lb]) could be shipped to WIPP after completion of the stabilization processes analyzed in the Solid Residue Environmental Assessment because they contain so little plutonium that they already meet the safeguards termination limits. Other residue materials could be processed by either diluting the residues with materials that are similar, or by removing some or all of the plutonium.*
- *Materials with somewhat higher but still small (i.e., up to 5 weight percent) concentrations of plutonium or other fissile elements (e.g., U-233 and U-235) could be immobilized by converting them into a glass or ceramic form, from which it would be very difficult to extract the plutonium or other fissile elements.*
- *A variance to safeguards termination limits could be applied to some materials under special conditions (see text in Section 1.3.1 of this Summary) to allow for disposal at WIPP.*

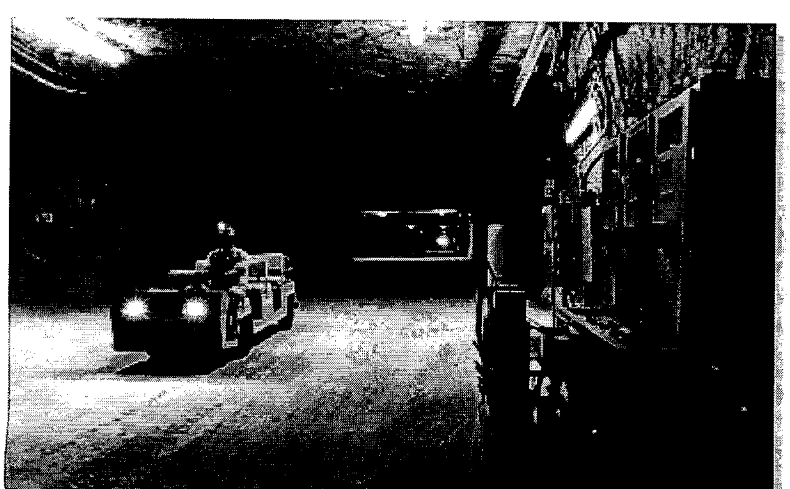
In addition, if a variance to safeguards termination limits is granted, it is recognized that the materials would no longer need to be subject to strict material control and accountability as special nuclear material. The materials would still be controlled and guarded in accordance with other DOE management practices and physical security procedures as specified in the documentation explaining the basis for the variance.

If a variance to safeguards termination limits is granted, the materials must still meet WIPP's waste acceptance criteria. WIPP's waste acceptance criteria are performance-based and are independent of safeguards termination requirements.

### 1.3.2 Disposition of Waste and Separated Plutonium

For approximately 64,400 kg (142,000 lb) of the plutonium-bearing residues currently being stabilized in accordance with the Finding of No Significant Impact issued after completion of the Solid Residue Environmental Assessment, there are no issues of safeguards controls and these materials may be disposed of at WIPP. Those residues are not addressed in this EIS.

The processing technologies for the materials being considered in this EIS could yield transuranic waste and/or plutonium metal or oxide, as well as low-level radioactive waste and other material managed as high-level waste, which are subject to different disposal/disposition options. Disposal of transuranic waste is planned at WIPP, in southeastern New Mexico. Therefore, the transuranic waste would be required to meet WIPP waste acceptance criteria. For plutonium metal or oxide that would result from processing technologies involving plutonium separation, disposition would be by immobilization in glass or ceramic material for disposal in a monitored geologic repository pursuant to the Nuclear Waste Policy Act (refer to Section 2.7 of this Summary). Low-level waste that would result from some of the processing technologies would be disposed of in accordance with the site's low-level waste disposal practices. Impacts from these disposal and other disposition options are addressed in other NEPA documents, as identified in Section 1.7 of this Summary. Additional NEPA review would be required if the scrub alloy is converted directly into transuranic waste (without plutonium separation) and disposed of in WIPP because this material was not included in the WIPP baseline estimates. This is discussed in Section 2.4.10 of the Final EIS.



The Waste Isolation Pilot Plant (WIPP), located near Carlsbad, New Mexico, is a geologic repository in ancient salt beds proposed to be used for disposal of DOE's transuranic waste. WIPP is currently scheduled to open in 1998.

## 1.4 CHANGES BETWEEN THE DRAFT AND FINAL VERSIONS OF THIS EIS

Changes between the draft and final versions of this EIS have been made as a result of comments received on the Draft EIS and further information DOE has gained as a result of continued characterization of the Rocky Flats residues. All revisions and changes made since the issuance of the Draft EIS are indicated by sidebars in this Summary and in the Final EIS. Key changes are discussed in this section.

*Variances to Safeguards Termination Limits*

The Draft EIS, issued in November 1997, identified certain residue categories for which variances to the safeguards termination limits had been approved by the DOE Office of Nonproliferation and National Security, Office of Safeguards and Security. These included combustible residues, glass and graphite residues, most inorganic residues, and some salt (direct oxide reduction) and filter residues. The Draft EIS also identified additional residue categories for which Rocky Flats was considering variance requests. These included ash and sludge residues, molten salt extraction and electrorefining salt residues, and high-efficiency particulate air filter residues.

As a result of further characterization of the residues since the Draft EIS was issued, Rocky Flats concluded that many residues would only need to be repackaged prior to disposal at WIPP because much of the residue inventory would not require stabilization prior to repackaging to meet WIPP waste acceptance criteria. For the remaining residues, where stabilization would be required, it could be accomplished by the alternative technologies analyzed in this EIS. Rocky Flats further concluded that, given the nature of the materials, their plutonium concentration, and the waste management controls that would be in effect during the transportation to and storage at WIPP, safeguards controls would not be needed to ensure the absence of proliferation risks. Therefore, Rocky Flats requested and obtained a variance to safeguards termination limits that covers all residues with plutonium concentrations below 10 percent. This includes all the material categories that were specified in the Draft EIS as being covered by a variance or for which DOE indicated that variances were being pursued. DOE chose 10 percent plutonium by weight as the upper limit for Rocky Flats residues being repackaged for direct disposal to WIPP because at that plutonium concentration the material would not be deemed suitable or attractive for use in an improvised nuclear device and would require extensive processing to be converted into a form usable in such a device. To achieve this concentration level, limited quantities of relatively higher plutonium concentration materials (i.e., residues containing in the range of about 20 percent to 50 percent plutonium) could be blended with low plutonium concentration materials having the same characteristics or with inert materials. Therefore, the Final EIS evaluates a new Alternative 4 (see below) to address materials that have an approved variance.

*Alternative 4 - Combination of Processing Technologies*

DOE has combined elements of processing technologies analyzed in Alternative 1 (stabilization and repackaging) and Alternative 2 (blending) into an additional Alternative 4 (Combination of Processing Technologies) in order to specifically address materials which have received a variance to safeguards termination limits. Specifically, Alternative 4 includes the following:

- stabilization, if necessary;
- blending with similar or inert materials, if necessary, to achieve a 10 percent plutonium concentration limit (up to 6,800 kg [15,000 lbs] of the residues, approximately 16 percent, contain more than 10 percent plutonium);
- repackaging for disposal at WIPP; and
- implementation of a variance to safeguards termination limits.

*Preferred Alternative*

The Draft EIS identified preferred processing technologies for all residues except filter media residues and sludge residues. Since issuance of the Draft EIS more has been learned about the materials, and because a variance to safeguards termination limits has been approved for many of the residues subsequent to issuance of the Draft EIS, the preferred processing technologies have changed for many material categories. The Final EIS now identifies preferred processing technologies for all residue categories and scrub alloy, collectively referred to as the "Preferred Alternative" (see Section 2.5 of this Summary and Section 2.5.2 of the Final EIS).

*New Processing Technologies*

This Final EIS also introduces two new candidate processing technologies. One is processing of direct oxide reduction salt residues at Los Alamos National Laboratory by acid dissolution. The other is processing of incinerator ash residues at Rocky Flats by cold ceramification. These are described in Section 2.4 of this Summary and Sections 2.4.1 and 2.4.2 of the Final EIS.

At the recommendation of Los Alamos National Laboratory, the acid dissolution process at Los Alamos National Laboratory was added to the Final EIS for processing direct oxide reduction salt residues. This process is similar to the acid dissolution process analyzed in the Draft EIS for implementation at Rocky Flats and would impose similar environmental impacts to workers and to the offsite public population. This process was previously used at Los Alamos National Laboratory to recover plutonium from direct oxide reduction salt residues and therefore is considered to have a low technical uncertainty. In the Draft EIS, the water leach process, which has a higher technical uncertainty, was analyzed for separating plutonium oxide from direct oxide reduction salt residues at Los Alamos National Laboratory.

Cold ceramification was suggested for inclusion in the EIS during public comments and has recently been successfully demonstrated for Rocky Flats incinerator ash residues. This technology produces a very stable waste form. The process steps for cold ceramification are similar to those used in cementation, which was analyzed for implementation at Rocky Flats in the Draft EIS. The major difference in these two processes is that they use different binding materials. Because these two processes have similar processing steps, environmental impacts to workers and to the offsite public population would be similar.

*Contingency Storage Analysis*

As a result of public comments, the risks associated with the storage of the plutonium residues and scrub alloy following processing and/or repackaging have been evaluated, and are discussed in Section 4.14 of the Final EIS. The evaluations consider a 20-year storage period for Alternative 1 (No Action - Stabilize and Store) and storage of the product for the other alternatives while waiting for transport of the transuranic waste to WIPP or for final disposition of separated plutonium.

*Modified Impact Assessments*

Refinements have been made to the impact analyses in the Final EIS. Some of the changes occurred because DOE re-evaluated many of the processing technologies and introduced some new processing technologies. DOE previously assumed a higher frequency of severe damage due to earthquakes at Building 707 and 707A at Rocky Flats because structural calculations were not completed until after the Draft EIS was published. Furthermore, the calculations of the potential for worker health impacts due to exposure to hazardous chemicals were refined to account for more realistic assumptions.

## 1.5 DECISIONS TO BE MADE BASED ON THIS EIS

### 1.5.1 Decisions

To ensure that the plutonium residues and scrub alloy addressed in this EIS are properly prepared for disposal or other disposition (which would eliminate the health and safety risks associated with further management of the materials, including continued, indefinite storage) and are stored safely before their disposal or other disposition, the following decisions must be made:

- Whether any repackaging or processing[5] of the plutonium residues and scrub alloy should occur, and if so:
  - How much of the plutonium residues and scrub alloy should be processed?
  - What processing approach should be used for each plutonium residue category and for the scrub alloy?
- Where processing and any subsequent management of the plutonium residues and scrub alloy should occur. Different sites could be chosen for management of different residues and the scrub alloy or for different portions of a single residue category (for example, if differences in the weight percent plutonium contained in a portion of a residue category, or other detailed differences in the residue chemistry, make such distinctions desirable). (This includes consideration of whether various portions of the plutonium residues and scrub alloy should be processed through DOE's existing chemical separation facilities at the Savannah River Site or Los Alamos National Laboratory in addition to Rocky Flats.)

These decisions will be announced in Records of Decision in accordance with the phased schedule identified in Section 1.5.2, below.

### 1.5.2 Process and Schedule for Decisions

With the exception of the two new candidate processing technologies identified in Section 1.4 of this Summary, all of the alternatives analyzed in the EIS for management of Rocky Flats plutonium residues and scrub alloy were either analyzed in the Draft EIS or are composed of elements of alternatives analyzed in the Draft EIS. Nevertheless, since certain alternatives were not presented to the public in the form in which they appear in this Final EIS, and in furtherance of public involvement in the NEPA process, DOE has decided to issue phased Records of Decision for this Final EIS.

The first Record of Decision will cover only those materials for which the preferred processing technology was analyzed in the Draft EIS, and for which any variances to safeguards termination limits discussed in the Draft EIS had already been granted. DOE plans to issue the first Record of Decision no sooner than 30 days after issuance of the Final EIS. The material categories to be covered by the first Record of Decision are as follows:

- Sand, slag, and crucible residues
- Direct oxide reduction salt residues (low plutonium concentration)
- Combustible residues
- Plutonium fluoride residues
- Ful Flo filter media residues
- Glass residues
- Graphite residues
- Inorganic (metal and other) residues
- Scrub alloy

The second Record of Decision will cover all of the remaining materials within the scope of the EIS. The material categories to be covered by the second Record of Decision are as follows:

- Incinerator ash residues
- Graphite fines residues
- Inorganic ash residues
- Molten salt extraction/electrorefining salt residues

[5] *The term "processing" as used in this EIS always includes repackaging. In some cases, repackaging may be the only operation conducted. These cases are specifically identified and described in Section 2.4 of the Final EIS.*

- Direct oxide reduction salt residues (high plutonium concentration)
- HEPA filter media residues
- Sludge residues

Prior to issuing the second Record of Decision, DOE will hold a 45-day comment period for the purpose of receiving written comments from the public on the management of these remaining material categories. The 45-day comment period will begin when the Environmental Protection Agency publishes the *Federal Register* notice that announces the availability of this Final EIS.

At the end of the 45-day comment period, DOE will determine whether any comments have been received that raise issues that require further analysis. If no comments are received which require further analysis, DOE will issue a second Record of Decision that identifies its management decisions for the material categories. The Record of Decision will include DOE's responses to comments received from the public. If comments are received which require further action by DOE, DOE will determine and implement appropriate actions to address the comments and inform the public of the Department's decisions.

## 1.6 CATEGORIES OF MATERIALS COVERED BY THE PROPOSED ACTION

Section 1.1 of this Summary identifies the five major categories of materials (residues and scrub alloy) that require further processing. These were the major categories identified in the November 1996 Notice of Intent to prepare this EIS (61 *Federal Register* 58866, November 19, 1996). The residue categories are the same as those identified in the Rocky Flats Solid Residue Environmental Assessment, which addresses the existing Rocky Flats stabilization and repackaging efforts. (Scrub alloy was not analyzed in the Solid Residue Environmental Assessment.)

For the purpose of calculating potential environmental impacts for this EIS, DOE has regrouped the plutonium residues and scrub alloy into new categories that require similar processing technologies. Descriptions of the processing technologies and the evaluation of impacts are presented according to these categories. The 10 categories of material are:

1. Ash Residues
2. Pyrochemical Salt Residues
3. Combustible Residues
4. Plutonium Fluoride Residues
5. Filter Media Residues
6. Sludge Residues
7. Glass Residues
8. Graphite Residues
9. Inorganic Residues
10. Scrub Alloy

Table S-2 compares categories presented in the Notice of Intent with those used in this environmental evaluation. The processing technologies are described in Section 2.4 of this Summary; the potential environmental impacts are presented in Chapter 4.

Table S-2. Material Categories and Subcategories

| Notice of Intent Categories | | EIS Categories |
|---|---|---|
| **Ash Residues**<br>- Incinerator Ash, Firebrick Heels and Fines, and Soot<br>- Sand, Slag, and Crucible<br>- Graphite Fines | (#1) | **Ash Residues (20,060 kg [44,200 lb] containing 1,160 kg [2,560 lb] of plutonium)**<br>- Incinerator Ash, and Ash Heels and Firebrick Fines[a]<br>- Sand, Slag, and Crucible[a]<br>- Graphite Fines[a]<br>- Inorganic Ash[a] |
| **Salt Residues**<br>- Electrorefining (ER) Salts<br>- Molten Salt Extraction (MSE) Salts<br>- Direct Oxide Reduction (DOR) Salts | (#2) | **Pyrochemical Salt Residues (14,900 kg [32,800 lb] containing 1,000 kg [2,200 lb] of plutonium)**<br>- Electrorefining Salts[a]<br>- Molten Salt Extraction Salts[a]<br>- Direct Oxide Reduction Salts[b] |
| **Wet Residues**<br>- Wet Combustibles (partial) | (#3) | **Combustible Residues (partial)[a]**<br>- Aqueous/Organic-Contaminated Combustibles (685 kg [1,500 lb] containing 12 kg [26 lb] of plutonium) |
| - Plutonium Fluoride | (#4) | **Plutonium Fluoride Residues (315 kg [690 lb] containing 142 kg [313 lb] of plutonium)** |
| - Wet Combustibles (partial) | (#5) | **Filter Media Residues[b] (2,630 kg [5,800 lb] containing 112 kg [250 lb] of plutonium)**<br>- High Efficiency Particulate Air (HEPA) and Ful-Flo filters |
| - Sludge<br>- Greases/Oily Sludge | (#6) | **Sludge Residues (620 kg [1,370 lb] containing 27 kg [60 lb] of plutonium)**<br>- Sludge[a]<br>- Greases/Oily Sludge[a] |
| - Raschig Rings | (#7) | **Glass Residues (partial)[a]**<br>- Raschig Rings (7.3 kg [16 lb] containing 1 kg [2.2 lb] of plutonium) |
| **Direct Repackage Residues**<br>- Glass | (#7) | **Glass Residues (partial)[a]**<br>- Other Glass (126 kg [280 lb] containing 4 kg [8.8 lb] of plutonium) |
| - Dry Combustibles | (#3) | **Combustibles Residues (partial)[a]**<br>- Dry Combustibles (455 kg [1,000 lb] containing 9 kg [20 lb] of plutonium) |
| - Graphite, Firebrick | (#8) | **Graphite Residues[a] (1,880 kg [4,150 lb] containing 97 kg [215 lb] of plutonium)**<br>- Graphite, Firebrick |
| - Miscellaneous | (#9) | **Inorganic Residues (Metal and Others)[a] (460 kg [1,000 lb] containing 18 kg [40 lb] of plutonium)**<br>- Miscellaneous |
| **Scrub Alloy** | (#10) | Scrub Alloy (700 kg [1,540 lb] containing 200 kg [440 lb] of plutonium) |

[a] *A variance to safeguards termination limits may be applied to these categories, which would allow for disposal at WIPP.*

[b] *A variance to safeguards termination limits may be applied to a portion of these categories, which would allow for disposal at WIPP.*

## 1.7 RELATIONSHIP TO RELATED NEPA DOCUMENTS AND OTHER REPORTS

Several NEPA documents and other reports have been or are being prepared that relate to DOE's management of plutonium-bearing materials. More detailed information describing the relationship of the NEPA documents and other reports listed below to this EIS can be found in Section 1.5 of the Final EIS.

- *Environmental Assessment, Finding of No Significant Impact,* and *Response to Comments — Solid Residue Treatment, Repackaging, and Storage* (DOE/EA-1120, April 1996)
- *Rocky Flats Site-Wide Environmental Impact Statement Notice of Intent* (59 FR 40011, August 5, 1994)
- *Interim Storage of Plutonium at the Rocky Flats Environmental Technology Site Environmental Impact Statement Notice of Intent* (61 FR 37247, July 17, 1996)
- *Rocky Flats Environmental Technology Site Cumulative Impacts Document* (June 1997)
- *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* (DOE/EIS-0026-S2, September 1997)
- *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (DOE/EIS-0200-F, May 1997)
- *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement (DOE/EIS-0229, December 1996)*
- *Surplus Plutonium Disposition Draft Environmental Impact Statement (DOE/EIS-0283-D, July 1998)*
- *Final Environmental Impact Statement for Continued Operation of Lawrence Livermore National Laboratory* (DOE/EIS-0157, August 1992)
- *Draft Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory* (DOE/EIS-0238, April 1998)
- *Plutonium Finishing Plant Stabilization Environmental Impact Statement (DOE/EIS-0244-F, May 1996)*
- *Final Interim Management of Nuclear Materials Environmental Impact Statement* (DOE/EIS-0220, October 1995)
- *Accelerating Cleanup: Paths to Closure* (DOE/EM-0362, June 1998)
- *DOE Nonproliferation Study* (pending - see Section 2.9 of this Summary)
- *Savannah River Site Chemical Separation Facilities Multi-Year Plan* (September 1997)
- Recommendation 94-1, *Improved Schedule for Remediation in the Defense Nuclear Facilities Complex*, Defense Nuclear Facilities Safety Board (59 FR 28848, May 1994)

**Chapter 2 of this Summary presents information on:**

*Description of Alternatives*

*DOE Sites Considered*

*Technology Screening Process*

*Description of Technologies*

*Preferred Processing Options*

*Interim Storage*

*Ultimate Disposition*

*Transportation*

*Proliferation Concerns*

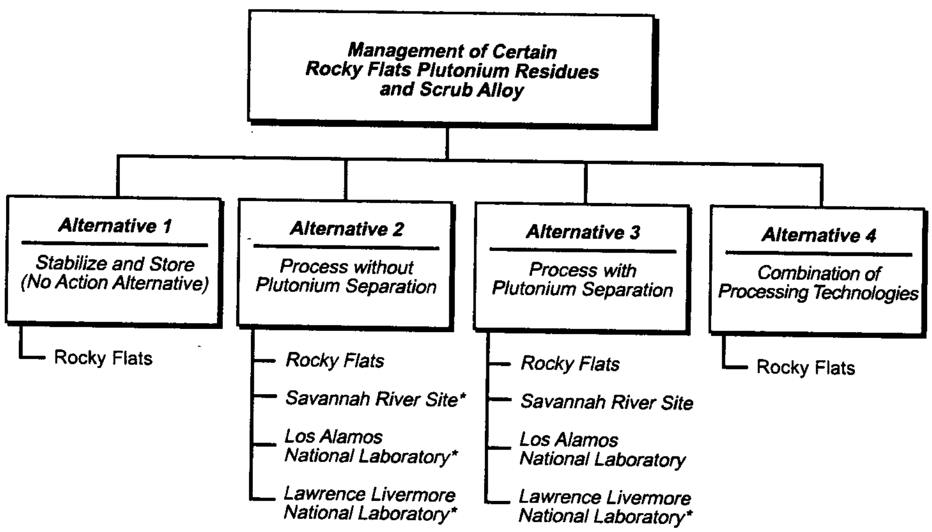
# 2.0 PROPOSED ACTION AND ALTERNATIVES

The "proposed action" is to process certain plutonium residues and scrub alloy currently stored at Rocky Flats, if necessary, when those plutonium residues and scrub alloy have plutonium concentrations above the safeguards termination limits. Processing is needed to address immediate health and safety concerns regarding storage of the plutonium residues and scrub alloy, as raised by the Defense Nuclear Facilities Safety Board in Recommendation 94-1, and to prepare these materials for offsite disposal as transuranic waste in WIPP or for other disposition. Disposal or other disposition would eliminate worker exposure and potential accident risks that would be associated with continued storage of these materials. The term "processing" as used in this EIS always includes repackaging. In some cases, repackaging may be the only operation conducted. These cases are specifically identified and described in Section 2.4 of the Final EIS.

The proposed action could be accomplished by using a mix of alternatives evaluated in this EIS for the different material categories. This chapter describes the alternatives evaluated under three action alternatives and the "No Action" Alternative. Included is a description of the alternatives, the sites being considered, the procedure used to screen and select alternative technologies for evaluation, and a summary of each processing technology evaluated. For each of the material types, a preferred processing technology has been identified and highlighted. Discussions of interim storage, transportation of the materials, and disposition are also presented, followed by a discussion of proliferation concerns.

## 2.1 DESCRIPTION OF ALTERNATIVES

The alternatives evaluated in this EIS, along with the DOE sites considered for implementing the alternatives, are presented in Figure S-1 and are discussed below.




** Sites for which processing was considered but not analyzed in detail (see Section 2.2 of this Summary)*

Figure S-1. Alternatives Evaluated in this EIS

The processing technologies for the No Action Alternative are as given in the Rocky Flats Solid Residue Environmental Assessment. In selecting the processing technologies for Alternatives 2, 3, and 4, DOE initially screened and selected candidate processing technologies for all the categories of residues (ash, pyrochemical salts, wet residues, and direct repackage residues) and for the scrub alloy. Only those processing technologies that are mature enough for implementation in the 1998-2004 timeframe were selected for detailed evaluation.

### Alternative 1 (No Action - Stabilize and Store)

This alternative consists of stabilization or repackaging to prepare the material for interim storage as described in the Rocky Flats Solid Residue Environmental Assessment. Under this alternative, further processing would not occur to prepare the material for disposal at WIPP or other disposition. This is referred to as the "No Action" Alternative. Scrub alloy was not addressed in the Environmental Assessment. The No Action Alternative for scrub alloy is defined as continued storage at Rocky Flats with repackaging, as necessary. Since there is no way to know what the length of the storage period would be, the annual impacts of storage have been determined. To illuminate the impacts of extended storage, DOE has also determined the impacts of a 20-year storage period for the residues and scrub alloy. Under this alternative, the stabilization process would leave approximately 40 percent of the Rocky Flats plutonium residues and all of the Rocky Flats scrub alloy in a form that would not meet safeguards termination limits and, therefore, would not be eligible for disposal. Thus, while implementation of this alternative would address immediate health and safety concerns associated with near-term storage conditions, the health and safety risks associated with potential long-term storage of these materials at Rocky Flats would remain unabated.

Depending on the material category, technologies under this alternative include calcination, cementation, pyro-oxidation, neutralization, thermal desorption, steam passivation, repackaging, acid dissolution/plutonium oxide recovery, and filtration. These technologies would be implemented onsite at Rocky Flats. The specific materials analyzed for technologies under Alternative 1 are identified in Figure S-3 in Section 2.4 of this Summary.

### Alternative 2 (Processing without Plutonium Separation)

Under this alternative, the materials would be processed to convert them into forms that would meet safeguards termination limits. The materials would be ready for shipment to WIPP for disposal.

Depending on the material category, technologies that could be used include immobilization (e.g., cementation, calcination/vitrification, and cold ceramification), blend down, catalytic chemical oxidation (digestion), and sonic wash. These technologies would be implemented onsite at Rocky Flats. The specific materials analyzed for technologies under Alternative 2 are identified in Figure S-3 in Section 2.4 of this Summary.

### Alternative 3 (Processing with Plutonium Separation)

Under this alternative, the material would be processed to separate plutonium from the material and concentrate it so that the secondary waste would meet safeguards termination limits and would be ready for shipment to WIPP, while the separated and concentrated plutonium would be placed in safe and secure storage pending disposition in accordance with decisions to be made under the Surplus Plutonium Disposition Environmental Impact Statement. DOE would not use this plutonium for nuclear explosive purposes.

Depending on the material category, processing technologies that could be used include acid dissolution/plutonium oxide recovery, Purex process/plutonium metal or oxide recovery, mediated electrochemical oxidation, salt distillation, salt scrub, and water leach. Processing and storage activities under Alternative 3 could be performed at Rocky Flats, the Savannah River Site, and Los Alamos National Laboratory. The specific materials analyzed for technologies under Alternative 3 are identified in Figure S-3 in Section 2.4 of this Summary.

### Alternative 4 (Combination of Processing Technologies)

DOE has combined certain elements of alternatives discussed in the Draft EIS, specifically elements of Alternative 1 (No Action - Stabilize and Store) and Alternative 2 (Process without Plutonium Separation) to form Alternative 4 (Combination of Processing Technologies). A separate Alternative 4 allows the Department to more clearly address management of residues that have received a variance to safeguards termination limits (see Section 1.3.1 of this Summary).

The need for this alternative became apparent to DOE after consideration of the results of further characterization that was performed on the residues after the Draft EIS was issued for public review. In particular, as Rocky Flats learned more about the nature of the plutonium residues, it became apparent that much of the residue inventory would not require further stabilization prior to repackaging (the final step of each processing option analyzed under Alternatives 1 and 2) to meet the WIPP waste acceptance criteria. Even where further stabilization might be required, the stabilization could be accomplished by rather straightforward means such as calcination, neutralization and drying, or filtration and drying (as analyzed under Alternatives 1 and 2 in the Draft EIS). Thus, if a means could be found to satisfy the safeguards termination limit requirements, affected residues could be prepared for disposal in WIPP with a minimum of exposure to the public and workers, generation of less transuranic waste, lower cost, and without separation of the plutonium in those residues.

Further consideration of the mechanisms available to protect the residues prior to the time when they could be disposed of in WIPP led DOE to the conclusion that the safeguards termination requirements need not be maintained in order to ensure that the residues are sufficiently protected to meet nuclear nonproliferation concerns. Thus, a variance to the safeguards termination limits was granted.

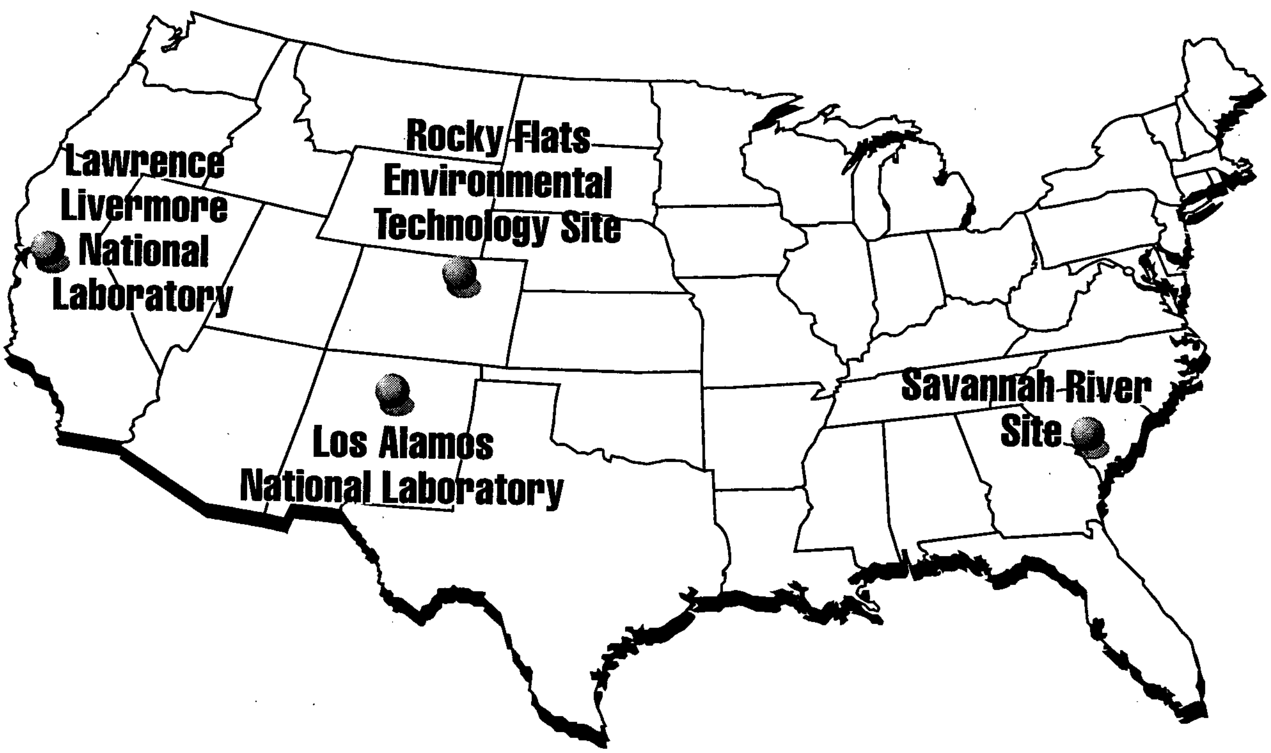
Alternative 4 allows analysis of alternatives for management of those categories of residues for which a variance to safeguards termination limits has been granted, as described in Section 1.3.1 of this Summary. Certain residues, such as plutonium fluorides, Ful Flo filter media, and scrub alloy, are not analyzed under this alternative because they had not been identified in the Draft EIS as a material for which a variance to the safeguards termination limits had been requested. Accordingly, application of a variance was not considered for the Final EIS.

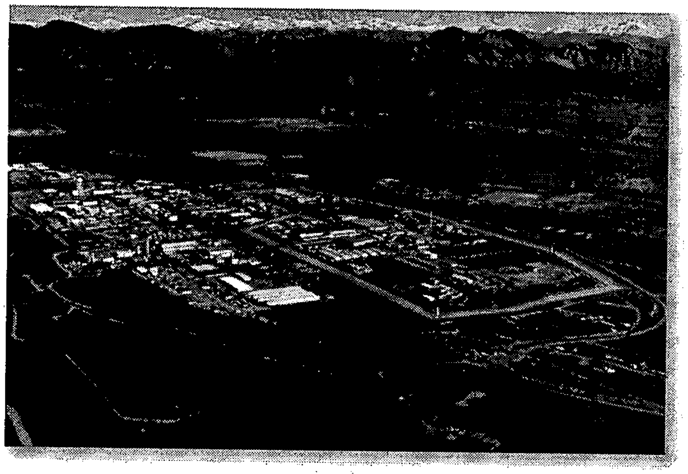
The processing technologies for each of these alternatives are described in more detail in Section 2.4 of this Summary.

## 2.2 DOE SITES CONSIDERED FOR IMPLEMENTING THE ALTERNATIVES

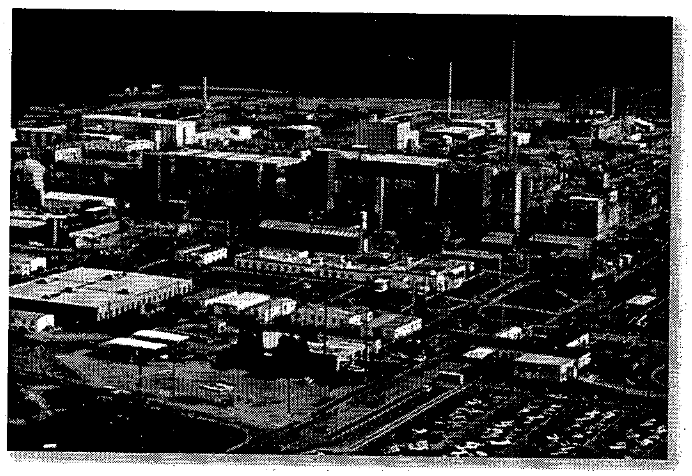
Processing and storage activities under Alternative 1 (No Action - Stabilize and Store) would be performed at Rocky Flats as part of existing activities. Processing activities under Alternative 2 (Processing without Plutonium Separation) and Alternative 4 (Combination of Processing Technologies) would also be performed at Rocky Flats. For processing activities under Alternative 3 (Processing with Plutonium Separation), DOE is considering three DOE sites for implementation: Rocky Flats, the Savannah River Site, and Los Alamos National Laboratory.

Based on the screening and evaluation process implemented for this EIS, DOE is considering Rocky Flats for 15 processes with and without plutonium separation, the Savannah River Site for two processes with plutonium separation, and Los Alamos National Laboratory for three processes with plutonium separation. These sites were selected as potential processing sites because they currently manage, or have managed in the past, plutonium residues and scrub alloy. Lawrence Livermore National Laboratory was initially considered a potential processing site under Alternatives 2 and 3, but is subject to operational constraints that precluded it from further consideration. DOE's rationale for consideration of each of these sites is further discussed below.

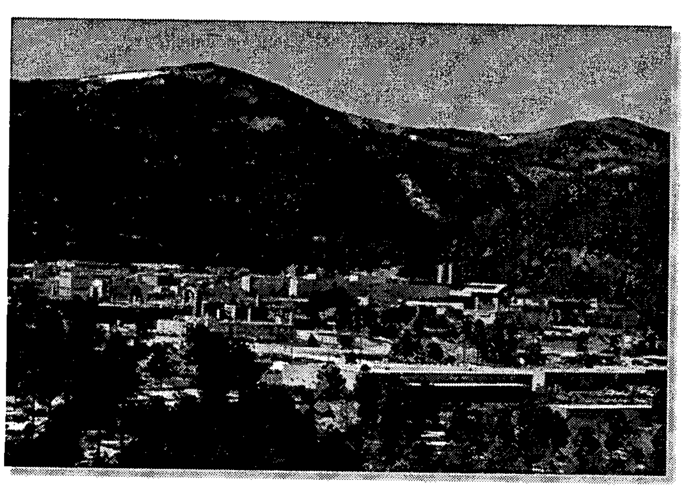




Rocky Flats
Environmental Technology Site



Savannah River Site's
F-Canyon



Los Alamos
National Laboratory

### Rocky Flats Environmental Technology Site

For Alternative 2 (Processing without Plutonium Separation), DOE eliminated all sites from consideration except Rocky Flats. The transport of the materials to another site for processing would involve preprocessing at Rocky Flats, which would entail risks to the public and workers of essentially the same magnitude as the risks from doing all of the processing at Rocky Flats. Furthermore, transportation of the materials to a different processing site would impose additional, although small, risks to the public and transportation workers. Finally, processing the material at another site could entail risks to the public and workers at that site. The sum of the costs and risks of preprocessing, transportation, and final processing would exceed that of final processing at Rocky Flats without providing any tangible benefits. Accordingly, all processing of the plutonium residues and scrub alloy that does not involve plutonium separation would be accomplished at Rocky Flats. This includes processing under Alternative 4 (Combination of Processing Technologies). Rocky Flats is also being considered for processing under Alternative 3 (Processing with Plutonium Separation).

Processing of plutonium residues and scrub alloy at Rocky Flats would be conducted in Buildings 371 and 707. Building 371 is a four-level facility that currently stores special nuclear material, plutonium residues and wastes. It was built to nuclear design standards. Building 707 is a two-story structure that currently stores smaller amounts of plutonium residues and wastes. It was built to industrial standards.

### Savannah River Site

For Alternative 3 (Processing with Plutonium Separation), the Savannah River Site has unique operational facilities for the separation of plutonium. The F-Canyon, FB-Line, H-Canyon, and HB-Line were designed to separate plutonium and uranium from other materials. Because these facilities would already be in operation to stabilize and/or process corroding spent fuel and targets, it would be efficient to also use them to process materials from Rocky Flats.

### Los Alamos National Laboratory

Because Los Alamos National Laboratory is the site at which much of the technology used in the production of the Nation's nuclear weapons stockpile was developed, it has the capability to implement essentially all of the technologies considered in this EIS. However, much of this capability is limited to laboratory bench-scale operations suitable for initial development of the technology, but not for use as a production operation. Furthermore, Los Alamos National Laboratory's processing capability has been committed, for the most part, to other programs (e.g., to process the backlog of residues from Los Alamos' previous operations and to manage wastes from manufacture of plutonium components for nuclear weapons). As a result, DOE determined that much of the processing that might be performed on the Rocky Flats plutonium residues and scrub alloy could not reasonably be conducted at Los Alamos National Laboratory. Nevertheless, DOE concluded that Los Alamos National Laboratory should be considered for three processing technologies considered in this EIS (under Alternative 3). Scientists at the site developed the salt distillation technology being considered for separation of plutonium oxide from certain pyrochemical salts. The site has the experience needed to apply this processing technology and, therefore, is considered in this EIS for salt distillation. Los Alamos National Laboratory is also being considered for acid dissolution and water leach of direct oxide reduction salts because of its experience with salt processing and Rocky Flats' limited capability for processing aqueous waste.

Processing of salt residues at Los Alamos National Laboratory would be conducted in Plutonium Facility-4 in Technical Area 55. This facility is a two-story laboratory, designated as a nonreactor nuclear facility. It was built to comply with seismic standards for Safeguards Category-I buildings.

### Lawrence Livermore National Laboratory

Lawrence Livermore National Laboratory has also developed technologies for use in the production of nuclear weapons, but the site has facility capacity and capability limitations similar to those discussed above for Los Alamos National Laboratory. In addition, Lawrence Livermore National Laboratory is subject to constraints imposed by an existing agreement with the State of California that limits the amount of plutonium that may be present at the site at any one time. This limitation would require that most, if not all, of any residues processed at Lawrence Livermore National Laboratory be shipped to another DOE site for storage prior to disposal. This requirement would result in additional shipment preparation and transportation impacts, without any advantage to offset such effects. As a result, DOE has eliminated Lawrence Livermore National Laboratory from further consideration as a site for the processing of Rocky Flats plutonium residues or scrub alloy.

The maximum amounts of materials that could be processed under this EIS at each of the sites are given in Figure S-2. The breakdown by material category is given in Table S-3.

## 2.3 PROCESS USED TO SCREEN AND SELECT PROCESSING TECHNOLOGIES FOR EVALUATION

DOE used a screening process to identify a reasonable set of processing technologies for detailed evaluation in this EIS. The screening process assessed a wide range of potential processing technologies identified in several DOE studies, including the following:

- *Environmental Assessment, Finding of No Significant Impact, and Response to Comments - Solid Residue Treatment, Repackaging, and Storage*, DOE/EA-1120, (April 1996)
- *Rocky Flats Environmental Technology Site: Direct Disposal Trade Study for Plutonium-Bearing Residues* (November 1995)
- A series of trade studies on specific material categories prepared by the DOE Nuclear Material Stabilization Task Group. These are technical studies which evaluate "trade offs" of variables such as health impacts, amounts of wastes generated, and costs. The studies include:

  *Plutonium Combustibles Trade Study* (December 1996)

  *Plutonium Salts Trade Study* (February 1996)

  *Plutonium Sand, Slag, and Crucible Trade Study* (January 1997)

  *Ash Residues End-State Trade Study* (October 1996)

  *Plutonium Scrub Alloy Trade Study* (February 1996)
- *Residue Program Rebaselining: Phase I Recommendation for Rebaselining Salts, SS&C, and Graphite Fines* (the Rocky Flats Rebaselining Study) (December 1996)
- *Residue Program Rebaselining: Phase II Recommendation for Rebaselining Ash, Combustibles, Fluorides, Sludges, Glass, and Firebrick and Inorganics* (January 1997)

After identifying a preliminary set of processing technologies from these studies, DOE screened the technologies further, using a set of criteria that included the following:

- direct applicability of the technology to the particular material type,
- maturity and timing of the technology so that processing could be accomplished in the 1998-2004 timeframe within reasonable cost,
- experience of the DOE site in employing the technology and availability of facilities and equipment,
- minimization of the number of process steps to minimize worker exposures, and
- amount of secondary wastes generated and appropriate secondary waste disposition methods.

Next, several working sessions were held between DOE Headquarters and site technical and management representatives to better understand the suitability of the technologies to be applied to each material type, the experience of the sites with the technologies, and the capability of the sites to implement the technologies within

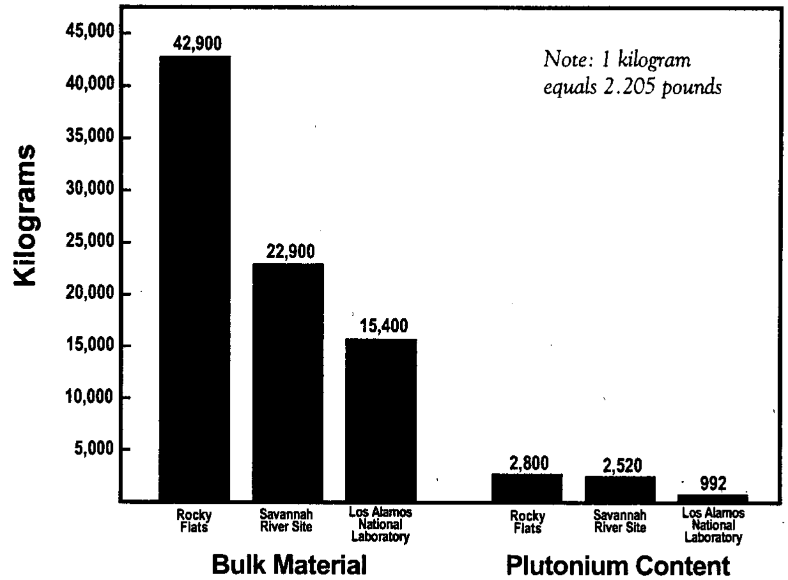
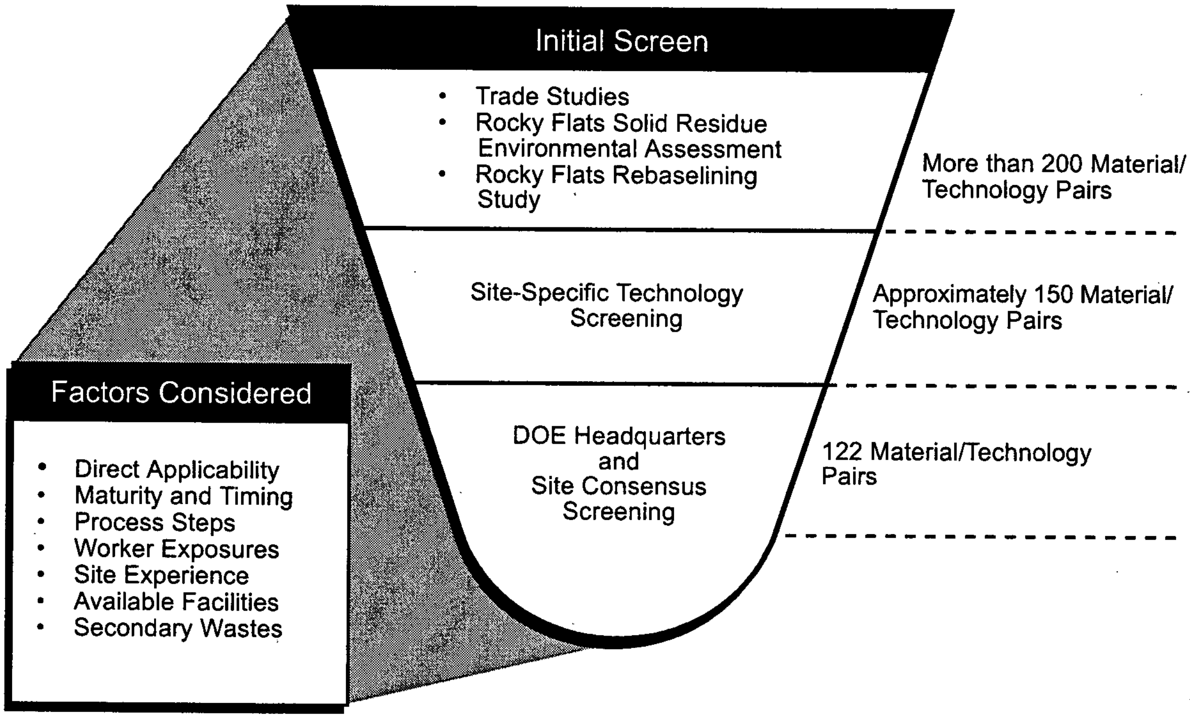



Figure S-2. Maximum Amounts of Plutonium Residues and Scrub Alloy That Could Be Processed at Each Site

| Rocky Flats | Bulk (kg) | Plutonium (kg) |
|---|---|---|
| Ash | 20,060 | 1,160 |
| Salts | 14,900 | 1,000 |
| Combustibles | 1,140 | 21 |
| Fluorides | 315 | 142 |
| Filters | 2,630 | 112 |
| Sludge | 620 | 27 |
| Glass | 133 | 5 |
| Graphite | 1,880 | 97 |
| Inorganic | 460 | 18 |
| Scrub Alloy | 700 | 200 |
| Total | ~ 42,900 | ~ 2,800 |
| **Savannah River Site** | **Bulk (kg)** | **Plutonium (kg)** |
| Ash | 16,400 | 1,100 |
| Salts (after scrub) | 3,210 | 964 |
| Fluorides | 312 | 141 |
| Graphite | 1,860 | 96.4 |
| Inorganic | 444 | 17.5 |
| Scrub Alloy | 700 | 200 |
| Total | ~ 22,900 | ~ 2,520 |
| **Los Alamos National Laboratory** | **Bulk (kg)** | **Plutonium (kg)** |
| Salts | 15,400 | 992 |

*Notes: 1 kg equals 2.205 pounds*
*Preprocessing at Rocky Flats generally reduces the amounts of material that would be sent to the Savannah River Site or to Los Alamos National Laboratory for processing.*

Table S-3. Maximum Amounts of Material (by Category) That Could Be Processed at Each Site the desired timeframe. An attempt was made to select processes for evaluation in this EIS that included at least one process that did not involve plutonium separation and one that involved plutonium separation for each material category. These discussions, plus considerations of public comments received on the Draft EIS and additional information obtained as the result of further characterization of the residues and scrub alloy, were the bases for selecting the technologies included in this EIS.




## 2.4 DESCRIPTION OF PROCESSING TECHNOLOGIES (OPTIONS)

This section presents a summary description of processing technologies evaluated in this EIS for the various material categories. With a few exceptions, material categories were evaluated using the processes included in the No Action Alternative (i.e., those processes included in the Solid Residue Environmental Assessment), one or more processes that do not include separation of plutonium from the material, one or more processes that include separation of plutonium from the material, and a combination of processes (as described in Alternative 4). Materials that were not evaluated for processes with plutonium separation were inorganic ash residues and certain sludge residues. Materials that were not considered for the combination of processing technologies were plutonium fluoride residues, Ful Flo filter media residues, and scrub alloy. Processing technologies that are applicable to each of the material categories and subcategories and DOE's preferred alternative are identified in Figure S-3. A brief overview of each of the technologies is presented in Figures S-4, S-5, S-6, and S-7. Figures S-8 through S-17 identify, for each material type, the paths from processing to ultimate disposition for the applicable processing technologies. Detailed descriptions of the processing technologies are contained in Chapter 2 and Appendix C of the Final EIS.

# Figure S-3. Processing Technologies by Material Category

*This figure should be reviewed in conjuction with Figures S-4 through S-17.*

| | Processing Technologies | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Alternative 1 NO ACTION (All Stabilizations Would Occur at Rocky Flats) | | | | | | | Alternative 2 PROCESS WITHOUT PLUTONIUM SEPARATION (All Processing Would Occur at Rocky Flats) | | | | | | Alternative 3 PROCESS WITH PLUTONIUM SEPARATION | | | | | | | | | | Alternative 4[b] Combination of Processing Technologies (All Processing Would Occur at Rocky Flats) | | | | |
| MATERIAL CATEGORIES | Calcination/Cementation | Pyro-Oxidation | Neutralization/Dry | Thermal Desorption/Steam Passivation | Repackaging | Acid Dissolution/Plutonium Oxide Recovery | Filtration/Dry | Cementation | Calcination/Vitrification | Cold Ceramification | Blend Down | Catalytic Chemical Oxidation | Sonic Wash | Acid Dissolution/Plutonium Oxide Recovery at Rocky Flats | Acid Dissolution/Plutonium Oxide Recovery at Los Alamos National Laboratory | Purex Process at the Savannah River Site | Mediated Electrochemical Oxidation at Rocky Flats | Mediated Electrochemical Oxidation at the Savannah River Site | Salt Distillation at Rocky Flats | Salt Distillation at Los Alamos National Laboratory | Salt Scrub at Rocky Flats and Purex Process at Savannah River Site | Water Leach at Rocky Flats | Water Leach at Los Alamos National Laboratory | Calcination/Cementation | Neutralization/Dry | Thermal Desorption/Steam Passivation | Repackaging | Filtration/Dry |
| ASH RESIDUES | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Incinerator Ash Residues | ● | | | | | | | | ● | ● | ● | | | | | ● | | ● | | | | | | ● | | | ■ | |
| Sand, Slag, and Crucible Residues | ● | | | | | | | | ● | | ● | | | | | ■ | | | | | | | | ● | | | ● | |
| Graphite Fines Residues | ● | | | | | | | | ● | | ● | | | | | | | ● | | | | | | ● | | | ■ | |
| Inorganic Ash Residues | ● | | | | | | | | ● | | ● | | | | | | | | | | | | | ● | | | ■ | |
| PYROCHEMICAL SALT RESIDUES | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MSE Salt Residues (IDC 409) | | ● | | | | | | | | | ● | | | | | | | | ● | ● | ● | ● | | | | | ■ | |
| MSE/ER Salt Residues (All Others) | | ● | | | | | | | | | ● | | | | | | | | ● | ● | ● | ● | | | | | ■ | |
| DOR Salt Residues (IDCs 365, 413, 417, 427)[a] | | ● | | | | | | | | | ● | | | | ■ | | | | | | ● | ● | ● | | | | ■ | |
| DOR Salts (All Others) | | ● | | | | | | | | | ● | | | | ● | | | | | | ● | ● | ● | | | | ■ | |
| COMBUSTIBLE RESIDUES | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Aqueous-Contaminated | | | ● | | | | | | | | ● | ● | ● | | | | ● | | | | | | | | ■ | | | |
| Organic-Contaminated | | | | ● | | | | | | | ● | ● | ● | | | | ● | | | | | | | | | ■ | | |
| Dry | | | | | ● | | | | | | ● | ● | ● | | | | ● | | | | | | | | | | ■ | |
| PLUTONIUM FLUORIDE RESIDUES | | | | | | ● | | | | | ● | | | ● | | ■ | | | | | | | | | | | | |
| FILTER MEDIA RESIDUES | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ful Flo Filters (IDC 331) | | | ● | | | | | | | | ■ | | ● | | | | ● | | | | | | | | | | | |
| HEPA Filters (IDC 338 only) | | | ● | | | | | | ● | | ● | | ● | | | | ● | | | | | | | | ■ | | | |
| HEPA Filters (All Others) | | | ● | | | | | | ● | | ● | | ● | | | | ● | | | | | | | | | | ■ | |
| SLUDGE RESIDUES | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| IDCs 089,099, and 332 | | | | | | | ● | | ● | | ● | | | | | | | | | | | | | | | | ■ | |
| All Other Sludge Residues | | | | | | | ● | | ● | | ● | | | ● | | | | | | | | | | | | | | ■ |
| GLASS RESIDUES | | | ● | | | | | | ● | | ● | | ● | | | | ● | | | | | | | | ■ | | | |
| GRAPHITE RESIDUES | | | | | ● | | | ● | ● | | ● | | | | | | ● | ● | | | | | | | | | ■ | |
| INORGANIC (Metal & Other) RESIDUES | | | | | ● | | | | ● | | ● | | | | | | ● | ● | | | | | | | | | ■ | |
| SCRUB ALLOY | | | | | ● | | | | ● | | | | | | | ■ | | | | | | | | | | | | |

■ = Preferred processing option ● = Other processing options analyzed **Notes:** IDC = Item Description Code; MSE = molten salt extraction; ER = electrorefining; DOR = direct oxide reduction; HEPA = high-efficiency particulate air

[a] *There are two preferred processing technologies for processing high plutonium concentration DOR salt residues. The rationale for having two preferred processing technologies is given in Section 2.5 of this Summary.*

[b] *Alternative 4 may require blending high plutonium concentration materials with similar low plutonium concentration materials or with inert materials to achieve plutonium concentrations below 10 percent.*

## Figure S-4. Processing Technologies for Alternative 1 — No Action (Stabilize and Store)

***Calcination*** – To provide a more chemically stable form of ash residues, calcination involves heating the ash residues in a furnace at 500°C (930°F) to convert reactive metals, carbon, and organics to oxides. This step would be necessary to place ash residues into a form suitable for cementation and subsequent packaging and storage. It would also be a first step in preparing ash residues for processing without plutonium separation (vitrification) or for shipment to the Savannah River Site for processing with plutonium separation.

***Cementation*** – An adaptation of the immobilization process widely used within DOE and the commercial industry and approved by the Environmental Protection Agency as a Best Demonstrated Available Technology for waste stabilization. After calcining the ash residues and crushing any oversize pieces (creating stabilized residue fines), the cementation process blends Portland cement and water with the ash residues, creating a solid material for packaging and storage.

***Pyro-Oxidation*** – A process that converts reactive metals in salt residues to oxides for a more chemically stable waste form. Pyrochemical salt residues and an oxidant would be placed in a crucible and heated in a furnace to about 800°C (1,470°F). The result would be a stabilized, solidified salt form ready for packaging and storage. This process would also be a first step in preparing pyrochemical salt residues for processing without plutonium separation (e.g., blending down) or for processing with plutonium separation, if necessary.

***Neutralization/Dry*** – A washing and drying process for combustible, filter media, and glass residues to remove nitrate contamination, neutralize any residual nitric acid and eliminate the potential flammability hazard. The residues would be washed in potassium hydroxide to convert the acid to potassium nitrate and water. Combustible solids would be separated from the nitrate solution, decanted, filtered, transferred to a drying pan, and dried under a vacuum at 80°C (176°F) for 2 hours. The result would be a neutralized dry solid ready for packaging and storage. The spent neutralization solution would go to the site's wastewater treatment process.

***Thermal Desorption/Steam Passivation*** – A heating process that removes the organic solvent contaminants from combustible residues and converts plutonium fines in the residues to plutonium oxide. Batches of combustible residues would be heated to 80°C (176°F) for 2 hours under reduced pressure to volatilize the organic solvent contaminants. Offgases would be collected on granulated activated charcoal. Then, low temperature steam would be injected for 1 hour to oxidize any plutonium fines present in the residue. Upon cooling, dry absorbent would be added to dry the wet matrix, and the result would be a shredded combustible waste and absorbent ready for packaging and storage.

***Repackaging*** – The transferring of residues or scrub alloy into more sturdy containers. Under Alternative 1, this includes the direct repackaging of the dry combustible residues, graphite residues, inorganic residues, and scrub alloy that are presently in a physical or chemical form that requires repackaging, but no additional processing, to meet interim safe storage criteria. Repackaging would be conducted in gloveboxes and consists of unpacking the existing storage drums and the plastic bags inside the drums, sorting the residues, and repackaging them into metal containers. After packaging and nondestructive assay, the metal containers would be staged inside 208-liter (55-gallon) drums, for safe interim storage.

***Acid Dissolution/Plutonium Oxide Recovery*** – Conducted in a glovebox, this process dissolves plutonium fluorides into a slurry, followed by precipitation and filtration of plutonium oxalate. That precipitate would be calcined and packaged as plutonium oxide. The filtrate from the oxalate precipitation is processed with magnesium hydroxide to precipitate the plutonium remaining in the solution. The magnesium hydroxide contaminated with plutonium would then be removed and calcined, resulting in a stabilized form for packaging and storage.

***Filtration/Dry*** – A process used on sludge residues to remove any excess liquid and dry the remaining material by mixing with an absorbent. First, unwanted materials in the sludge (plastics, metals, or free liquids) would be removed and managed appropriately. After decanting, the sludge would be packed, along with absorbent for drying, into metal containers and sealed for packaging into pipe components and drums for storage.

## Figure S-5. Processing Technologies for Alternative 2 — Processing without Plutonium Separation

*Cementation* – As a processing technology for graphite residues, this would be the same process used in Alternative 1 (No Action - Stabilize and Store) for ash residues. In this case, cementation would result in an acceptable waste form for WIPP disposal for graphite molds, scarfed graphite molds, coarse graphite, and coarse firebrick.

*Calcination/Vitrification* – An immobilization process similar in concept to calcination in which the residues would be heated in a furnace to produce a vitrified solid material. The process would be conducted in gloveboxes, where a siliceous material called "frit" would be added to the residues, and the material would be heated in a muffle furnace at temperatures between 700°C and 1,300°C (1,290°F - 2,370°F) for about 4 hours. The result would be a stable, glassified (vitrified) monolith that fits into an 8 x 10 inch metal can. This process could be applied to several categories of residues (ash, filter media, sludge, glass, graphite, and inorganic) and the scrub alloy. Scrub alloy would be first converted to an oxide by burning and calcining at 600°C (1,110°F) and 1,000°C (1,830°F), respectively. Then the calcined material would be blended with sufficient glass frit to make a product that would satisfy the safeguards termination limits, and heated in a furnace to a temperature of 700°C - 1,300°C (1,290°F - 2,370°F). The end product would consist of a vitrified monolith containing less than 5 percent plutonium.

*Blend Down* – A process for diluting the concentration of plutonium in all categories of plutonium residues (but not scrub alloy) so that each container would meet safeguards termination limits. An inert material, such as uranium oxide, salt, or magnesium oxide, would be added to create a mixture of materials with a smaller weight percentage of plutonium. Residues with a plutonium concentration below the safeguards termination limit may also be used. The dilution would initially create a larger waste mixture, which would then be reduced into smaller batches and calcined at 900°C (1,650°F). Calcination would eliminate water and oxidize any carbon or organic compounds into carbon dioxide.

*Cold Ceramification* – A process that stabilizes incinerator ash residues by converting them into chemically bonded phosphate ceramics. The process would result in an acceptable waste form for disposal at WIPP after repackaging.

*Digestion (Catalytic Chemical Oxidation or Detox Process)* – A process used to digest organic materials in combustible residues. The process uses catalysts, dissolved in acid, to oxidize organic materials and to dissolve metals associated with the residues. The metals, including plutonium, would be converted to metal oxides by boiling down the solution. The residual metal oxides would be placed in containers for storage pending disposal at the WIPP.

*Sonic Wash* – A process to physically separate plutonium from combustible, filter media, and glass residues using sound waves. The materials would be shredded, lowered into a sonic wash unit containing a weak caustic solution, and agitated by sound waves. The sonic agitation would dislodge a portion of the transuranic oxides and other higher-density materials from the surfaces of the matrix. The dislodged materials would settle to the bottom, and the washed matrix would be dried and repackaged for shipment to WIPP for disposal. The settled transuranic-laden materials or sludges would be filtered from the wash, dried and stored until they could be batched for immobilization (vitrification for combustible and filter media residues and calcining for glass residues). The immobilized settlings would be packaged for ultimate disposal. The effluent streams from the filtration and rinsing steps would be evaporated and recycled back to the sonic wash unit.

## Figure S-6. Processing Technologies for Alternative 3 — Processing with Plutonium Separation

***Acid Dissolution/Plutonium Oxide Recovery at Rocky Flats*** – A process to recover plutonium from plutonium fluoride residues and sludge residues by dissolving them in nitric acid and precipitating the plutonium with oxalic acid. The resulting plutonium oxalate slurry would be filtered to separate plutonium oxalate and a filtrate. Magnesium hydroxide would be added to the filtrate to precipitate any remaining plutonium. The magnesium hydroxide would be filtered, calcined at 450°C (840°F), and packaged for interim storage and ultimate disposal at WIPP. The plutonium oxalate filter cake would be calcined at 450°C (840°F) until it results in a dry plutonium oxide cake, which would be packaged and temporarily stored until it could be calcined at 1,000°C (1,830°F) to remove volatile constituents. The recalcined plutonium oxide would then be repackaged to meet DOE standards for interim storage pending disposition in accordance with decisions to be reached under the Surplus Plutonium Disposition Environmental Impact Statement.

***Acid Dissolution/Plutonium Oxide Recovery at Los Alamos National Laboratory*** – A process to recover plutonium from direct oxide reduction salt residues. The residue would be first dissolved in concentrated hydrochloric acid and then the plutonium and americium would be separated from the salt matrix by solvent extraction using tributylphosphate in dodecane. After separation of the aqueous and organic layers, the organic phase would be stripped of plutonium using dilute hydrochloric acid and the aqueous phase would be stored pending further processing. Addition of oxalic acid to the plutonium-bearing solution would cause plutonium to precipitate as plutonium oxalate. The resulting plutonium oxalate slurry would be filtered and calcined at 400°C (750°F) to decompose plutonium oxalate to plutonium oxide, which would be packaged and temporarily stored until it could be calcined at 1,000°C (1,830°F) to remove volatile constituents. The recalcined plutonium oxide would then be repackaged to meet DOE standards for interim storage pending disposition in accordance with decisions to be reached under the Surplus Plutonium Disposition Environmental Impact Statement. Magnesium hydroxide would be added to the filtrate from oxalate precipitation and the aqueous phase from solvent extraction to precipitate any remaining plutonium in those solutions. This material would be filtered, calcined at 450°C (840°F), packaged, and stored for shipment to WIPP as transuranic waste.

***Purex Process/Plutonium Metal or Oxide Recovery*** – A process developed for plutonium extraction and recovery. It would use a Canyon facility at the Savannah River Site to process ash residues (except for graphite fines and inorganic ash), plutonium fluoride, and scrub alloy. These materials would be dissolved in nitric acid and separated into a waste fraction and a plutonium-bearing fraction. The waste fraction would be added to the Site's high-level waste storage system, where solids would be vitrified with other high-level wastes at the Defense Waste Processing Facility, and residual liquids would be solidified as saltstone. The plutonium-bearing fraction would be transferred to a finishing line (FB/HB), precipitated and converted to stable oxide or metal, and packaged to meet DOE standards for interim storage pending disposition in accordance with decisions to be reached under the Surplus Plutonium Disposition Environmental Impact Statement.

***Mediated Electrochemical Oxidation*** – Similar to the Purex and acid dissolution/plutonium oxide recovery processes described above, but would also use oxidized silver ions generated in an electrochemical cell to catalyze the dissolution of normally unreactive plutonium compounds. Undissolved materials remaining after mediated electrochemical oxidation processing would be removed by filtration, dried, and packaged for shipment to WIPP for disposal as transuranic wastes. Plutonium dissolved in the nitric acid/silver nitrate solution would be processed differently, however, depending on the nature of the materials and the facilities available for processing it.

Plutonium from mediated electrochemical oxidation dissolution of graphite and inorganic residues at the Savannah River Site and from mediated electrochemical oxidation processing of all ash residues would be processed through the Purex system. Here the plutonium would be reduced to metallic or oxide form and packaged to meet DOE standards for interim storage pending disposition in accordance with decisions to be reached under the Surplus Plutonium Disposition Environmental Impact Statement. Plutonium-bearing solutions from mediated electrochemical oxidation-treated glass and inorganic residues at Rocky Flats, as well as from mediated electrochemical oxidation-treated combustible waste, filter media, and graphite residues, would be treated with oxalic acid to precipitate the plutonium as an oxalate. This oxalate would then be calcined, recalcined, and packaged for long-term storage using the same plutonium oxide recovery process described above under the acid dissolution alternative.

***Salt Distillation*** – A process that separates transuranic materials from a potassium chloride or sodium chloride salt matrix by using a special furnace to distill these salts away from any metal oxides in the matrix. The salt matrix would first be pyro-oxidized, as described in Alternative 1 (No Action - Stabilize and Store), and then heated under vacuum in the distillation furnace to about 950°C (1,740°F) for about 6 hours. The distilled salts would be stored for ultimate disposition at WIPP. The metal oxides and undistilled salts, such as calcium chloride, would be calcined at 1,000°C (1,830°F) for 4 hours and packaged for interim storage pending disposition in accordance with decisions to be reached under the Surplus Plutonium Disposition Environmental Impact Statement. Salt distillation would be used only for salt residues from pyrochemical processing, such as electrorefining and molten salt extraction.

(continued)

Figure S-6. Processing Technologies for Alternative 3 — Processing with Plutonium Separation (continued)

***Salt Scrub*** – A process that recovers plutonium from salt residues by heating them in a crucible with magnesium and aluminum, or gallium and calcium, inside a glovebox furnace. The magnesium or calcium would reduce any plutonium and americium chlorides in these residues to metallic form, allowing the metals to be extracted in an alloy with the aluminum or gallium. Heated to 800°C (1,470°F) for 2 hours, this alloy (called scrub alloy) would separate from the salts and form a metallic button at the bottom of the crucible. After cooling, the scrub alloy button would be sent to the Savannah River Site for Purex processing, as described above, to reduce the plutonium to metal or oxide, and packaged to meet DOE standards for interim storage pending disposition in accordance with decisions to be reached under the Surplus Plutonium Disposition Environmental Impact Statement. The residual salts removed from the crucible would be batched to meet safeguards termination limits and pyro-oxidized as described above to stabilize any reactive metals before packaging and shipment to WIPP for disposal. Salt scrubbing would remove plutonium from calcium chloride, as well as sodium chloride/potassium residues.

***Water Leach*** – A dissolution process to recover plutonium from pyrochemical salts using water leach. The salt would be first pyro-oxidized, if necessary, as discussed under Alternative 1 (No Action - Stabilize and Store), then placed in a leaching vessel with water added. Because the pyro-oxidation process produces an excess of sodium oxide, the resulting solution would be alkaline. The alkaline slurry would then be vacuum-filtered, leaving a damp solid filter cake of plutonium/americium oxide, which would then be calcined at 1,000°C (1,830°F) for 4 hours to remove any remaining volatile materials. The oxide material would be packaged for interim storage pending disposition in accordance with decisions to be reached under the Surplus Plutonium Disposition Environmental Impact Statement. The filtrate would be evaporated, leaving a lean salt that would be packaged according to WIPP waste acceptance criteria and placed in interim storage pending disposal at WIPP.

## Figure S-7. Processing Technologies for Alternative 4 — Combination of Processing Technologies[a]

***Calcination*** – To provide a more chemically stable form of ash residues, calcination involves heating the ash residues in a furnace at 500°C (930°F) to convert reactive metals, carbon, and organics to oxides. This step would be necessary to place ash residues into a form suitable for cementation and subsequent packaging and shipment to WIPP.

***Cementation*** – An adaptation of the immobilization process widely used within DOE and the commercial industry and approved by the Environmental Protection Agency as a Best Demonstrated Available Technology for waste stabilization. After calcining the ash residues and crushing any oversize pieces (creating stabilized residue fines), the cementation process blends Portland cement and water with the ash residues, creating a solid material for packaging and shipment to WIPP.

***Neutralization/Dry*** – A washing and drying process for combustible, filter media, and glass residues to remove nitrate contamination, neutralize any residual nitric acid and eliminate the potential flammability hazard. The residues would be washed in potassium hydroxide to convert the acid to potassium nitrate and water. Combustible solids would be separated from the nitrate solution, decanted, filtered, transferred to a drying pan, and dried under a vacuum at 80°C (176°F) for 2 hours. The result would be a neutralized dry solid ready for packaging and shipment to WIPP. The spent neutralization solution would go through the site's wastewater treatment process.

***Thermal Desorption/Steam Passivation*** – A heating process that removes the organic solvent contaminants from combustible residues and converts plutonium fines in the residues to plutonium oxide. Batches of combustible residues would be heated to 80°C (176°F) for 2 hours under reduced pressure to volatilize the organic solvent contaminants. Offgases would be collected on granulated activated charcoal. Then, low temperature steam would be injected for 1 hour to oxidize any plutonium fines present in the residue. Upon cooling, dry absorbent would be added to dry the wet matrix, and the result would be a shredded combustible waste and absorbent ready for packaging and shipment to WIPP.

***Repackaging*** – The transferring of residues into more sturdy containers. Under Alternative 4, this includes, if necessary, the combining of above-10-percent-plutonium material with below-10-percent-plutonium material or inert material to reach a mixture containing no higher than 10 percent plutonium and subsequent repackaging of the ash, pyrochemical salts, combustibles, filter media, sludges, graphite, and inorganics, with no additional processing, to meet shipping requirements for WIPP disposal. Pyrochemical salts will be pyro-oxidized (as necessary) prior to blending. Blending and repackaging would be conducted in gloveboxes and consist of unpacking the existing storage containers, sorting and combining the residues, one waste stream at a time, as described above, and repackaging them either in metal containers or plastic bags, as appropriate. After packaging and non-destructive assay, the metal containers would be placed inside pipe components (with the exception of certain residues, such as combustibles) and loaded into drums. The plastic bags would be loaded into drums and then non-destructively assayed. Both sets of drums would then be ready for shipment to WIPP.

***Filtration/Dry*** – A process used on sludge residues to remove any excess liquid and dry the remaining material by mixing with an absorbent. First, unwanted materials in the sludge (plastics, metals, or free liquids) would be removed and managed appropriately. After decanting, the sludge would be packed, along with absorbent for drying, into metal containers and sealed for packaging into pipe components and drums for shipment to WIPP.

[a] *In order to receive a variance to safeguards termination limits, materials would be blended down, as necessary, to reduce their plutonium concentrations to less than 10 percent.*

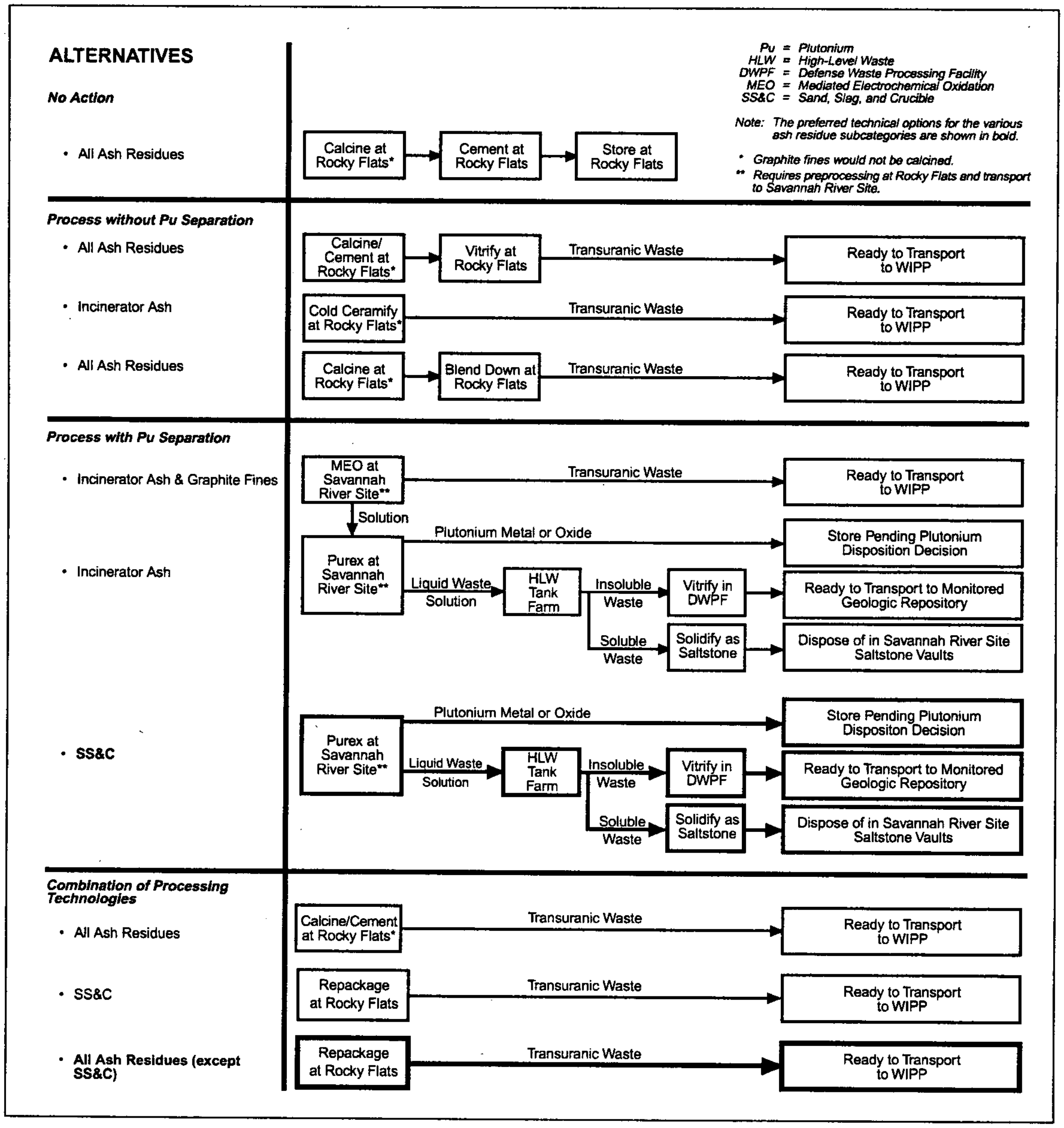



Figure S-8. Processing Technologies for Ash Residues

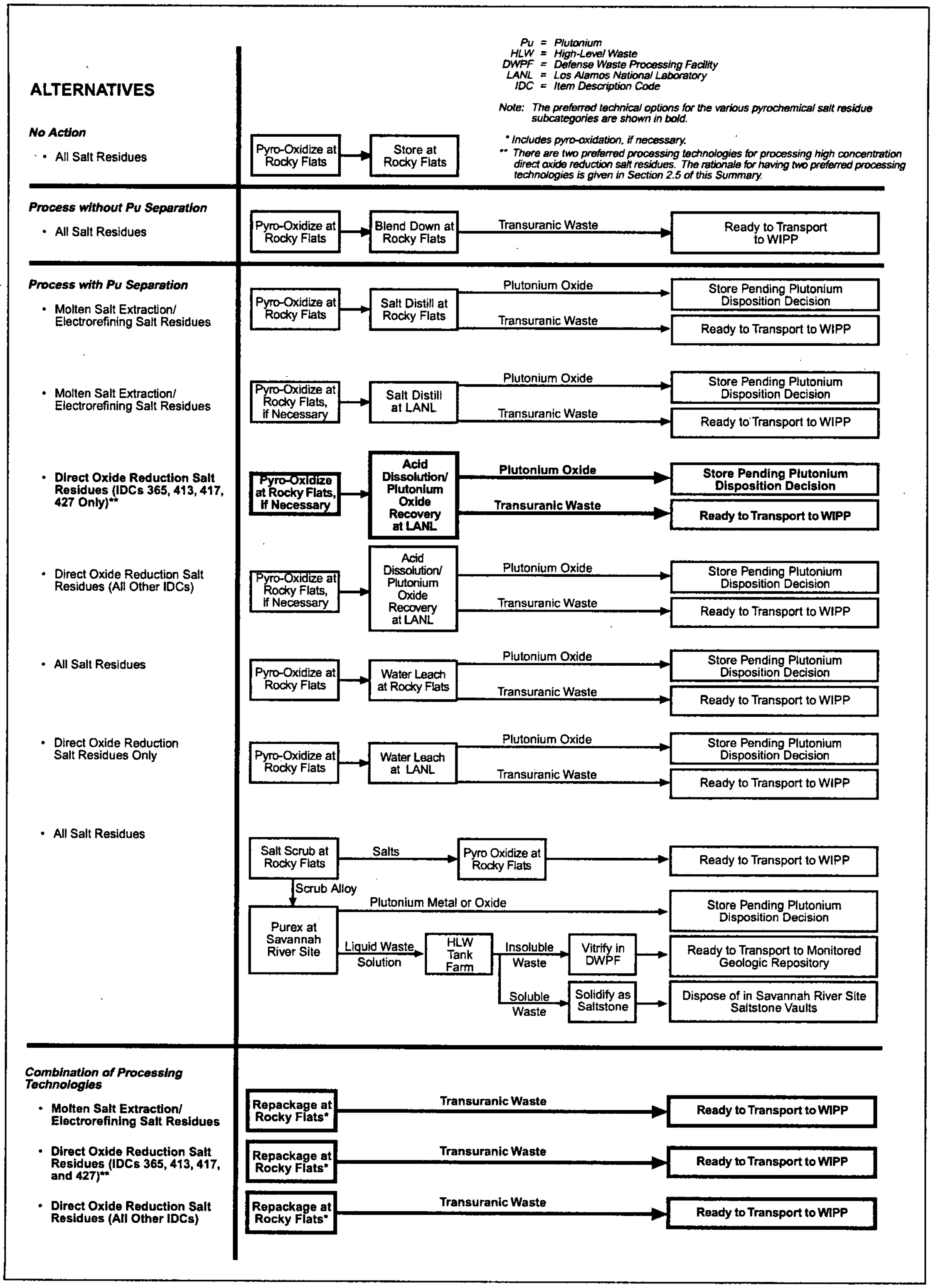



Figure S-9. Processing Technologies for Pyrochemical Salt Residues

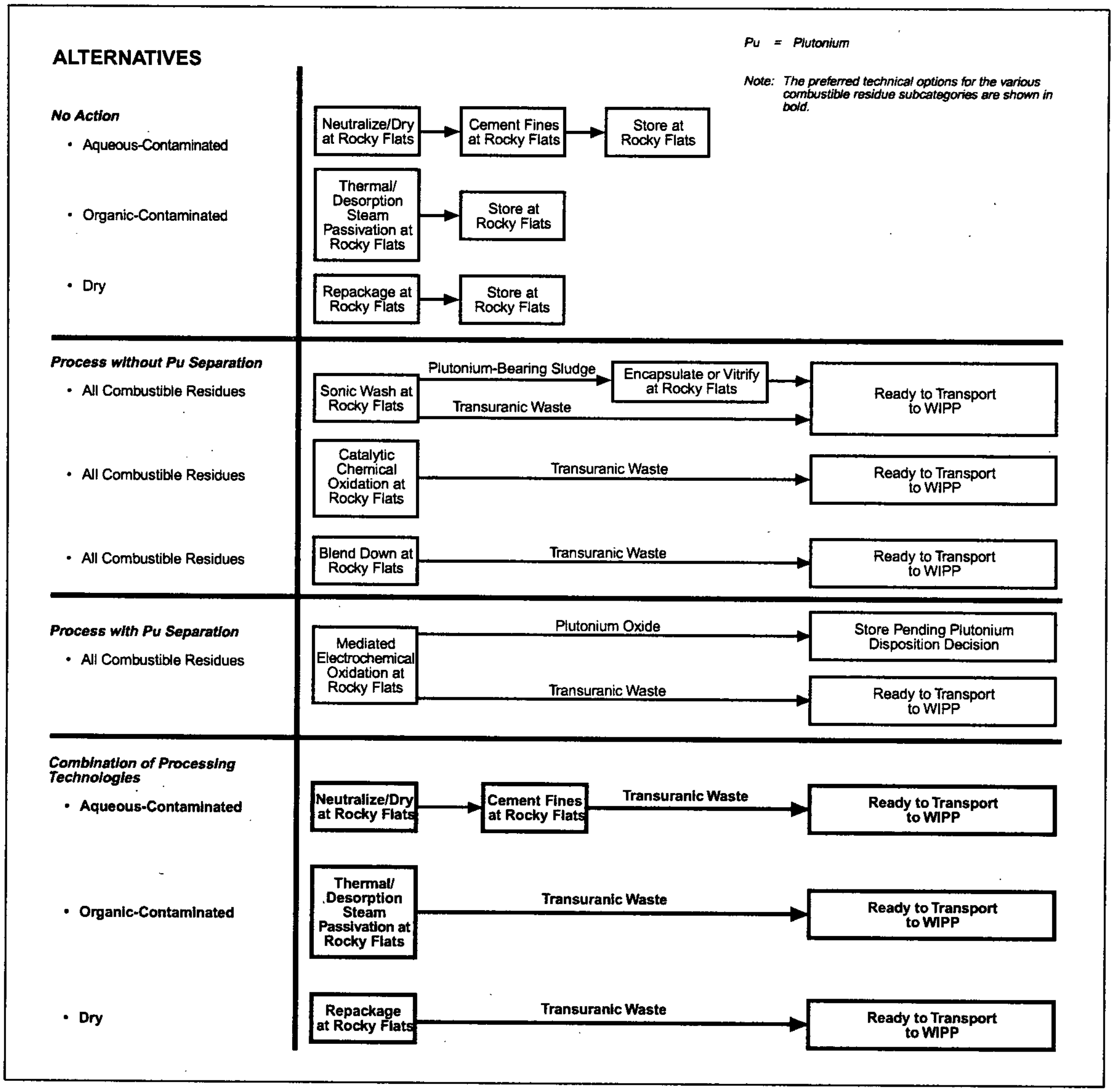



Figure S-10. Processing Technologies for Combustible Residues

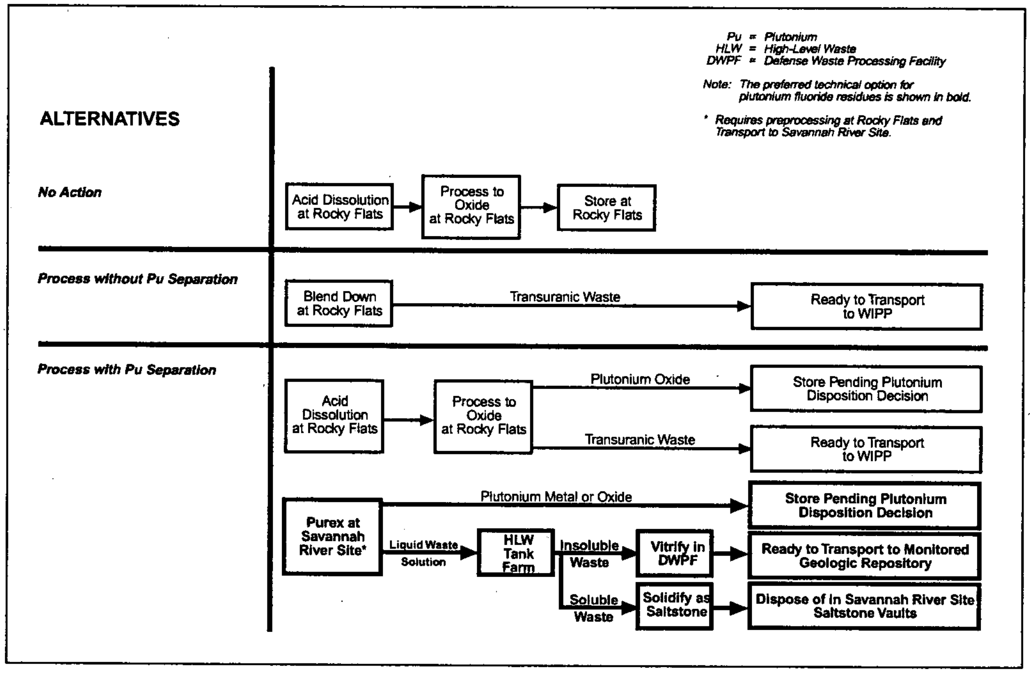



Figure S-11. Processing Technologies for Plutonium Fluoride Residues

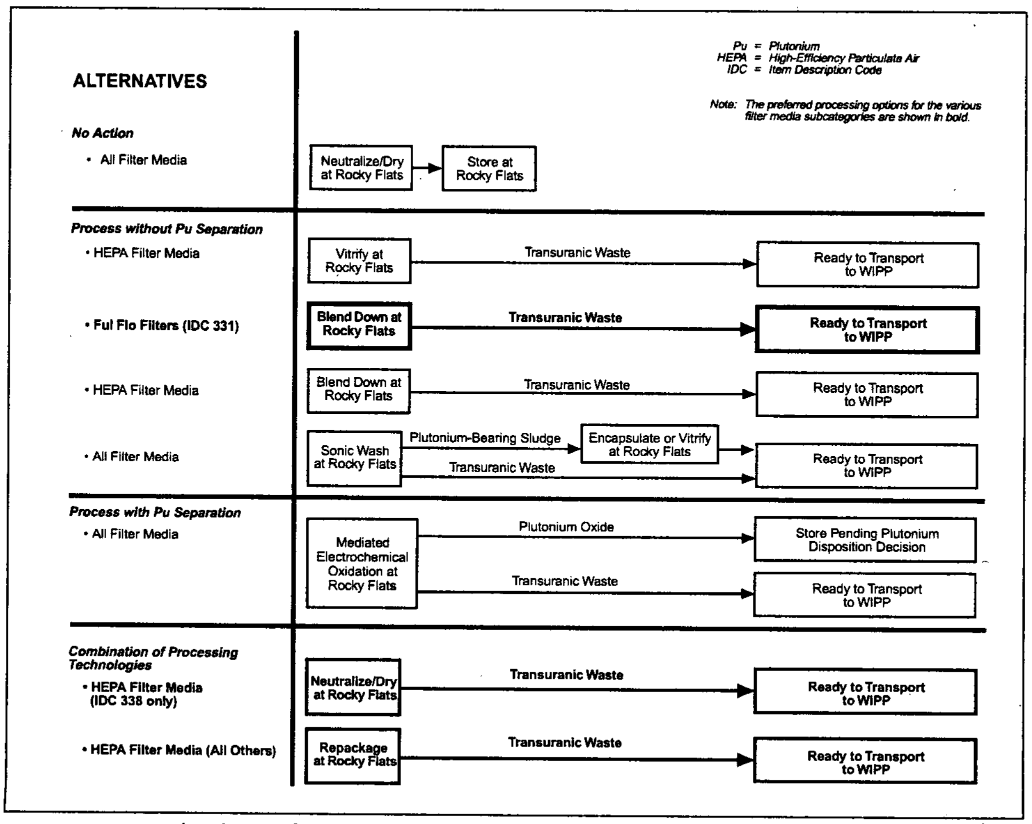



Figure S-12. Processing Technologies for Filter Media Residues

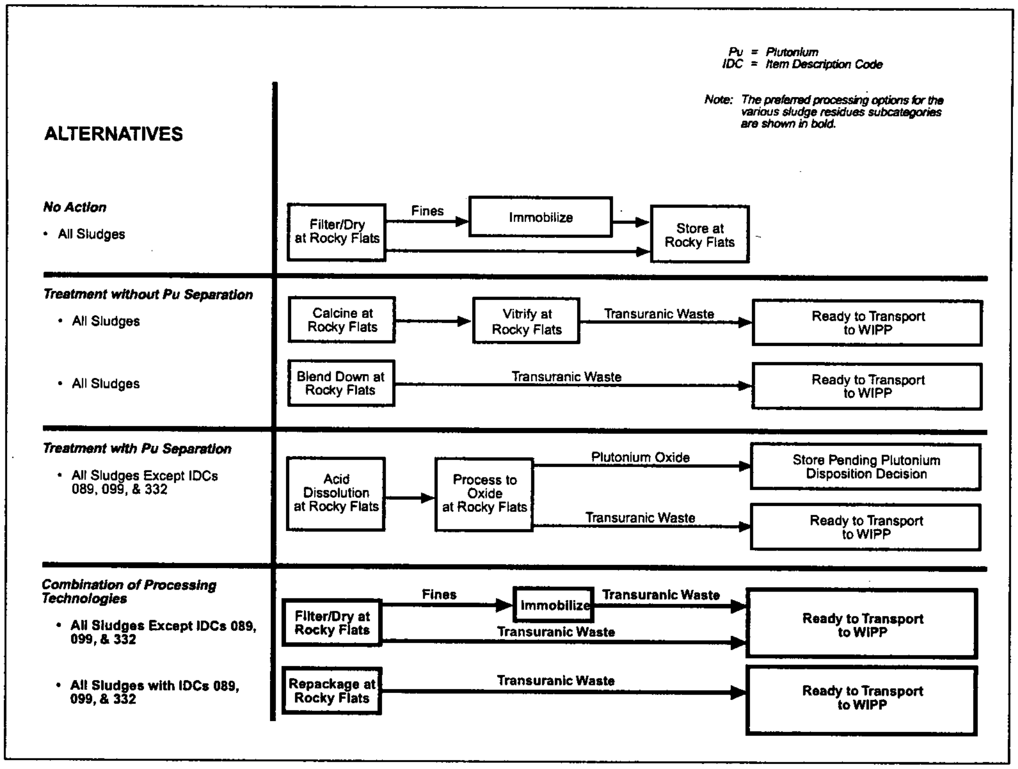



Figure S-13. Processing Technologies for Sludge Residues

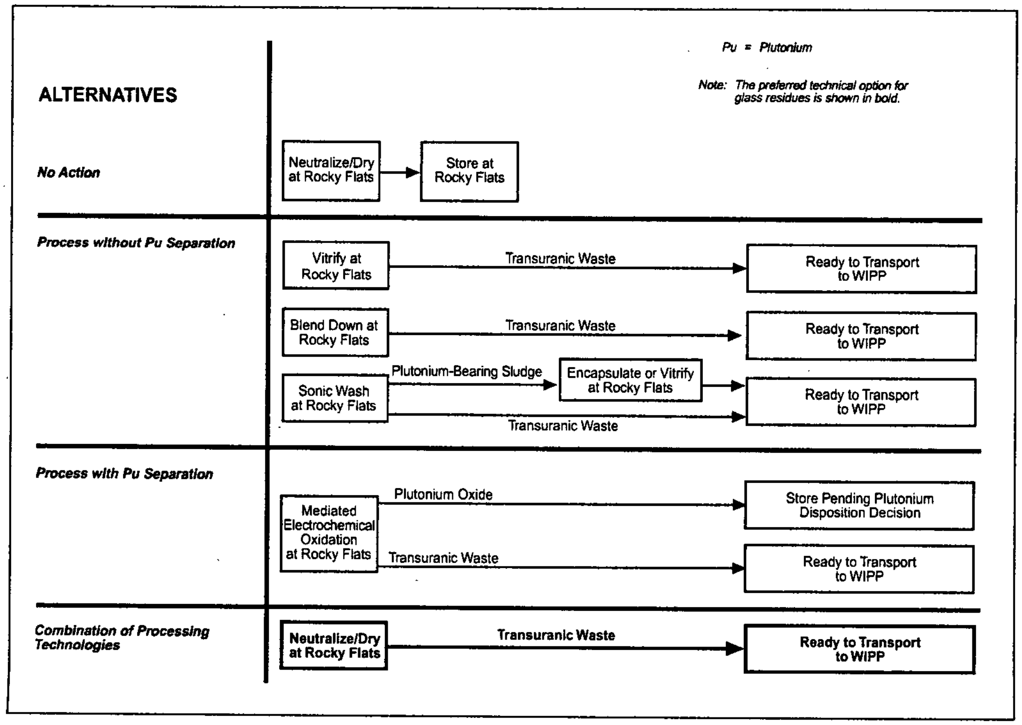



Figure S-14. Processing Technologies for Glass Residues

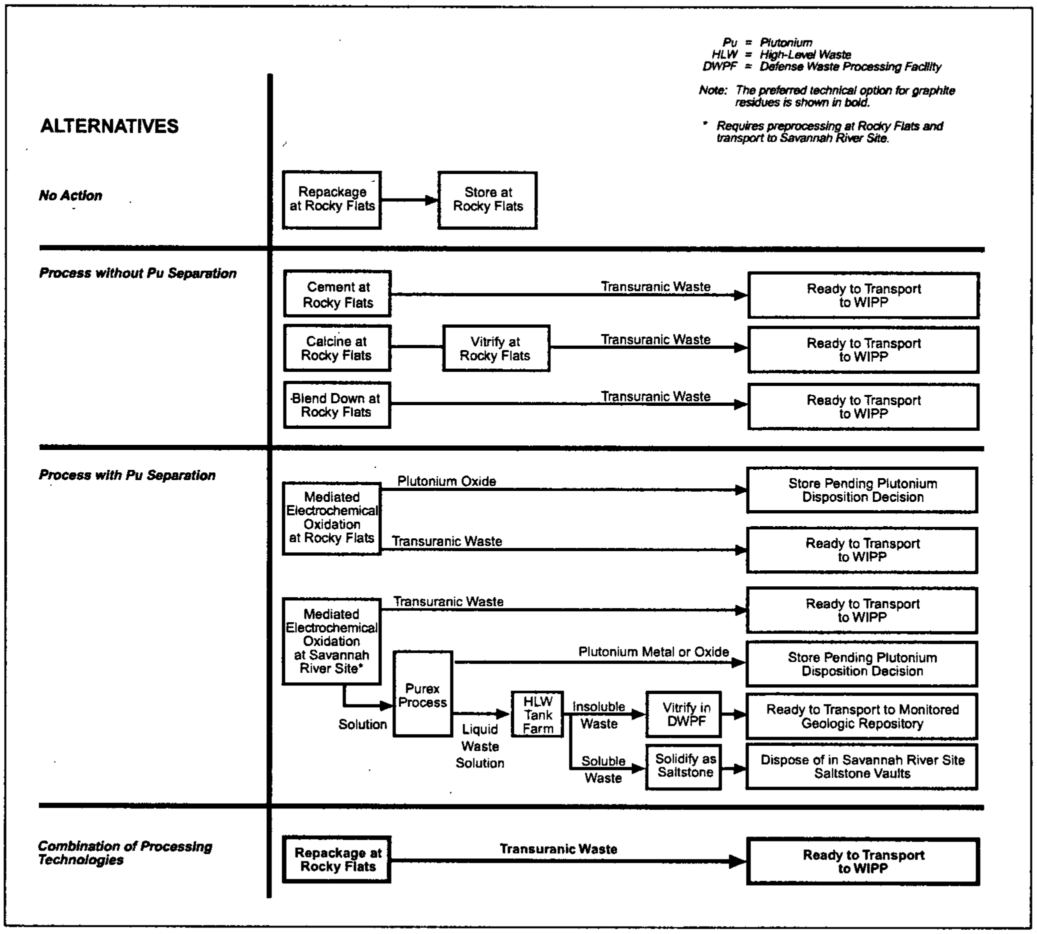



Figure S-15. Processing Technologies for Graphite Residues

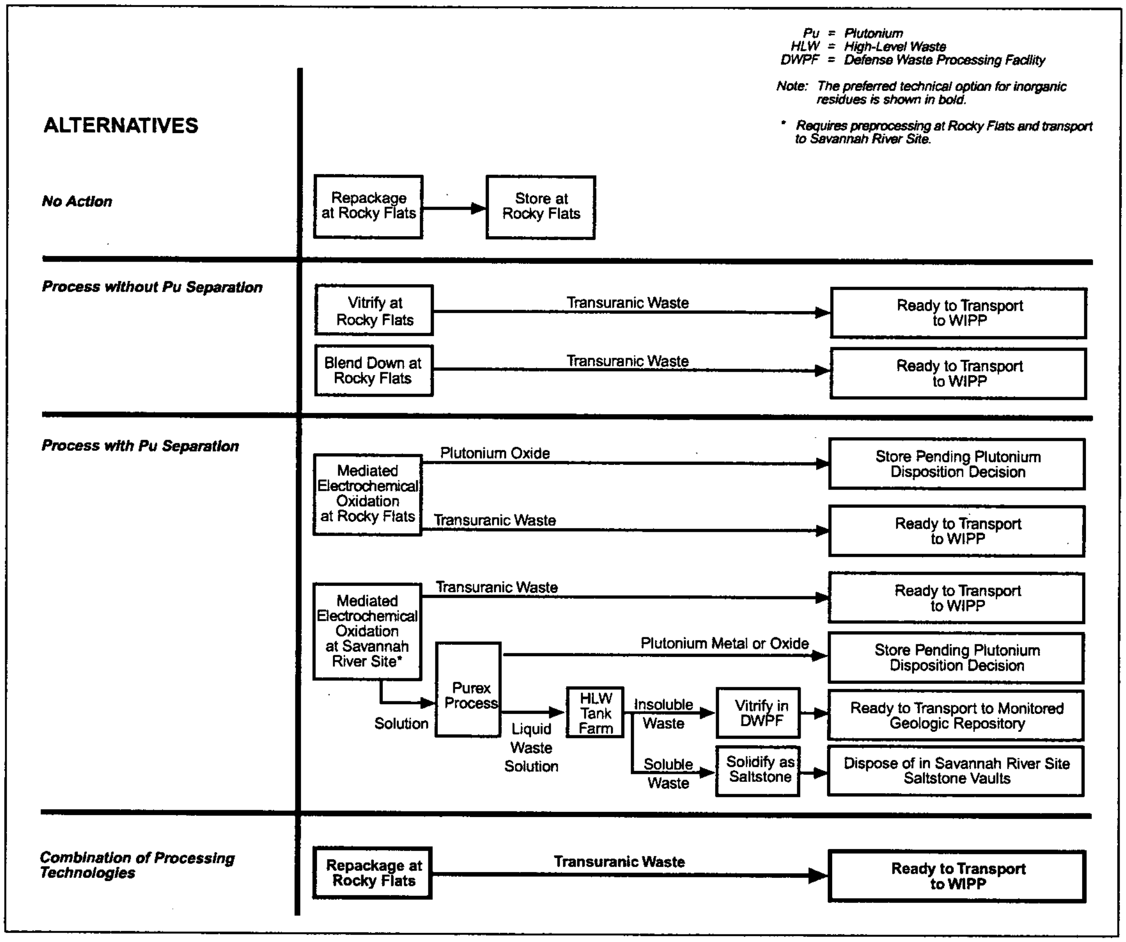



Figure S-16. Processing Technologies for Inorganic Residues

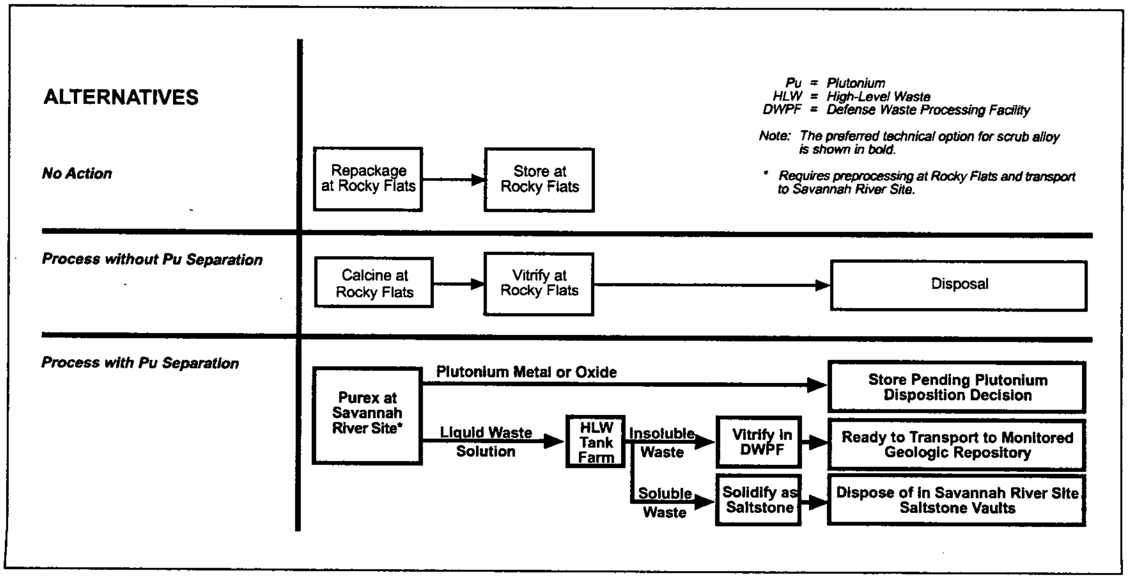



Figure S-17. Processing Technologies for Scrub Alloy

## 2.5 PREFERRED ALTERNATIVE

DOE has identified a preferred technology/site option for processing each category of Rocky Flats plutonium residues and the scrub alloy addressed in this EIS. The material categories and preferred processing technologies are listed in Table S-4. Taken as a group, the compilation of the preferred technology/site processing technologies constitutes the Preferred Alternative for this EIS. The detailed rationale for selecting each of the preferred technologies is provided in Section 2.4 of the Final EIS.

Under the Preferred Alternative, all materials would be processed at Rocky Flats except for sand, slag, and crucible; certain direct oxide reduction salts; fluoride residues; and scrub alloy. The salts would be processed at Los Alamos National Laboratory (up to 727 kg [1,603 lb] of bulk, containing 139 kg [306 lb] of plutonium). The other materials would be processed at the Savannah River Site (4,077 kg [8,988 lb] of bulk containing 470 kg [1,036 lb] of plutonium).

As shown in Table S-4, DOE's Preferred Alternative includes processing technologies for several material categories that would involve separation of plutonium from the materials as plutonium metal or oxide at either the Savannah River Site or Los Alamos National Laboratory. These sites have unique facilities and processing expertise for separating plutonium from certain categories of the residues and scrub alloy that are not available at Rocky Flats. The processing technologies involving separation are preferred not only because they would allow DOE to stabilize the residues and scrub alloy (to address near-term health and safety issues associated with storage of the materials), and would convert the materials into forms that would allow their disposal or other disposition (thus eliminating the continuing health and safety risks that would be associated with their continued storage), but would also address health and safety concerns related to the increased worker radiation doses associated with the non-separation processing technologies for these categories of residues and scrub alloy. The Savannah River Site facilities for the separation of plutonium include the F-Canyon, FB-Line, H-Canyon, and the HB-Line. Use of these facilities, some of which are designed for remote operation, would result in lower worker radiation exposure than use of the glove box facilities at Rocky Flats, low technical uncertainty, or low cost. Separation of plutonium from pyrochemical salt residues at Los Alamos National Laboratory would not be remote-handled, but would involve much shorter periods of exposure to the residues than would the nonseparation technology.

Also as shown in Table S-4, there are two preferred processing technologies for the direct oxide reduction salt residues with Item Description Codes (IDCs) 365, 413, 417, and 427. This is because these IDCs contain salt residues with high concentrations of plutonium and others with lower plutonium concentrations. The two preferred processing technologies for these IDCs are: (1) preprocessing at Rocky Flats followed by acid dissolution/plutonium oxide recovery at the Los Alamos National Laboratory for the high plutonium concentration salts and (2) pyro-oxidation (if necessary) followed by repackaging (with blending, if necessary) at Rocky Flats for the remaining salts in these IDCs.

DOE believes that there are only about 306 kg (675 lb) of high plutonium concentration salt residues from IDCs 365, 413, 417, and 427 that would need to be processed at Los Alamos National Laboratory. Material that would need to be processed at Los Alamos National Laboratory would include material that was not granular or would not easily be finely ground (e.g., material in solid clumps). There is the possibility that additional material beyond the 306 kg might be identified upon physical inspection of the containers, and a small quantity of additional material could also come from other direct oxide reduction salt IDCs. Given this uncertainty, DOE has analyzed the environmental impacts of processing up to 727 kg (1,603 lb) of direct oxide reduction salts at the Los Alamos National Laboratory using the acid dissolution/plutonium oxide recovery process. After processing, the plutonium oxides would be stored at Los Alamos National Laboratory in accordance with the Record of Decision that was issued after completion of the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement* until it would be disposed of in accordance with decisions to be made after completion of the *Surplus Plutonium Disposition Environmental Impact Statement*. The transuranic waste generated during processing would be shipped to WIPP for disposal.

Direct oxide reduction salts from IDCs 365, 413, 417, and 427 that would not be processed at Los Alamos National Laboratory using acid dissolution/plutonium oxide recovery would be processed at Rocky Flats using pyro-oxidation/repackaging and prepared for shipment to WIPP for disposal.

Table S-4. Preferred Processing Technology for Each Material Category

| MATERIAL | PREFERRED PROCESSING TECHNOLOGY |
|---|---|
| ASH RESIDUES | |
| Incinerator Ash Residues | Repackage at Rocky Flats under Alternative 4 (See Section 2.4.1 of the EIS) |
| Sand, Slag, and Crucible Residues | Purex Process at the Savannah River Site under Alternative 3 (See Section 2.4.1 of the EIS) |
| Graphite Fines Residues | Repackage at Rocky Flats under Alternative 4 (See Section 2.4.1 of the EIS) |
| Inorganic Ash Residues | Repackage at Rocky Flats under Alternative 4 (See Section 2.4.1 of the EIS) |
| PYROCHEMICAL SALT RESIDUES | |
| Molten Salt Extraction/Electrorefining (IDC 409) | Repackage at Rocky Flats under Alternative 4 (See Section 2.4.2 of the EIS) |
| Molten Salt Extraction/Electrorefining (all others) | Repackage at Rocky Flats under Alternative 4 (See Section 2.4.2 of the EIS) |
| Direct Oxide Reduction Salt Residues (IDCs 365, 413, 417, and 427)[a] | Repackage at Rocky Flats under Alternative 4 and Acid Dissolution/Plutonium Oxide Recovery at Los Alamos National Laboratory under Alternative 3 (See Section 2.4.2 of the EIS) |
| Direct Oxide Reduction Salts (all others) | Repackage at Rocky Flats under Alternative 4 (See Section 2.4.2 of the EIS) |
| COMBUSTIBLE RESIDUES | |
| Aqueous-Contaminated | Neutralize/Dry at Rocky Flats under Alternative 4 (See Section 2.4.3 of the EIS) |
| Organic-Contaminated (See Section 2.4.3 of the EIS) | Thermal Desorption/Steam Passivation at Rocky Flats under Alternative 4 |
| Dry | Repackage at Rocky Flats under Alternative 4 (See Section 2.4.3 of the EIS) |
| PLUTONIUM FLUORIDE RESIDUES | Purex Process at the Savannah River Site under Alternative 3 (See Section 2.4.4 of the EIS) |
| FILTER MEDIA RESIDUES | |
| Ful Flo Filter (IDC 331) | Blend Down at Rocky Flats under Alternative 2 (See Section 2.4.5 of the EIS) |
| HEPA Filters (IDC 338 only) | Neutralize/Dry at Rocky Flats under Alternative 4 (See Section 2.4.5 of the EIS) |
| HEPA Filters (all others) | Repackage at Rocky Flats under Alternative 4 (See Section 2.4.5 of the EIS) |
| SLUDGE RESIDUES | |
| IDCs 089, 099, and 332 | Repackage at Rocky Flats under Alternative 4 (See Section 2.4.6 of the EIS) |
| All Other Sludge Residues | Filter/Dry at Rocky Flats under Alternative 4 (See Section 2.4.6 of the EIS) |
| GLASS RESIDUES | Neutralize/Dry at Rocky Flats under Alternative 4 (See Section 2.4.7 of the EIS) |
| GRAPHITE RESIDUES | Repackage at Rocky Flats under Alternative 4 (See Section 2.4.8 of the EIS) |
| INORGANIC (Metal & Other) RESIDUES | Repackaging at Rocky Flats under Alternative 4 (See Section 2.4.9 of the EIS) |
| SCRUB ALLOY | Purex Process at the Savannah River Site under Alternative 3 (See Section 2.4.10 of the EIS) |

[a] *There are two preferred processing technologies for processing these high plutonium concentration direct oxide reduction salt residues (IDCs 365, 413, 417, and 427). The rationale for having two preferred processing technologies is given in the text of this section.*

## 2.6 STORAGE METHODS

This EIS discusses storage of two categories of materials: (1) plutonium residues and scrub alloy and (2) plutonium metal and oxides. The storage methods for these materials are described below.

### 2.6.1 Storage of Plutonium Residues and Scrub Alloy

Plutonium residues and scrub alloy are stored in accordance with DOE guidance contained in *Criteria for Interim Safe Storage of Plutonium-Bearing Solid Material.* This guidance is included as an addendum to the DOE Implementation Plan for the Defense Nuclear Facilities Safety Board's Recommendation 94-1, dated February 28, 1995, which addresses remediation in the defense nuclear facilities complex.

Processed residues and scrub alloy, containing less than 50 percent plutonium by weight, are packaged in storage containers that provide multiple barriers. While in the glovebox, the material is placed into "produce cans," which are small sealed cans similar to those used for storage of food products. The "produce cans" are then sealed inside plastic "bagout bags" as they are removed from the glovebox. The next layer of containment is the "pipe component" (with the exception of certain residues such as combustibles), which is a flanged stainless-steel pipe measuring 15 - 30 centimeters (6 - 12 inches) in diameter. A lid bolted to the flange allows the residue material to be sealed within the pipe, which is then placed inside a 208-liter (55-gallon) storage drum. (See figure below.) Processes from Alternatives 2, 3, and 4 would produce stabilized residues and transuranic waste that may be packaged in this way. When ready for transport to WIPP, the drums would then be placed into the TRUPACT-II container, which is the Nuclear Regulatory Commission-certified and Department of Transportation-approved shipping container. (Section 2.8.1 of the Final EIS provides more details.) The TRUPACT-II loading limit for transport to WIPP is 2,800 fissile gram equivalents of plutonium-239.

Residues and scrub alloy awaiting transfer to another onsite facility or an offsite facility (Savannah River Site or Los Alamos National Laboratory) for further processing would be stored temporarily in one of a number of double-containment, intrasite packagings. Prior to shipment offsite, the double-contained packages would be placed into shielded containers authorized by DOE and the Department of Transportation for shipment. (See Section 2.8 of this Summary.)

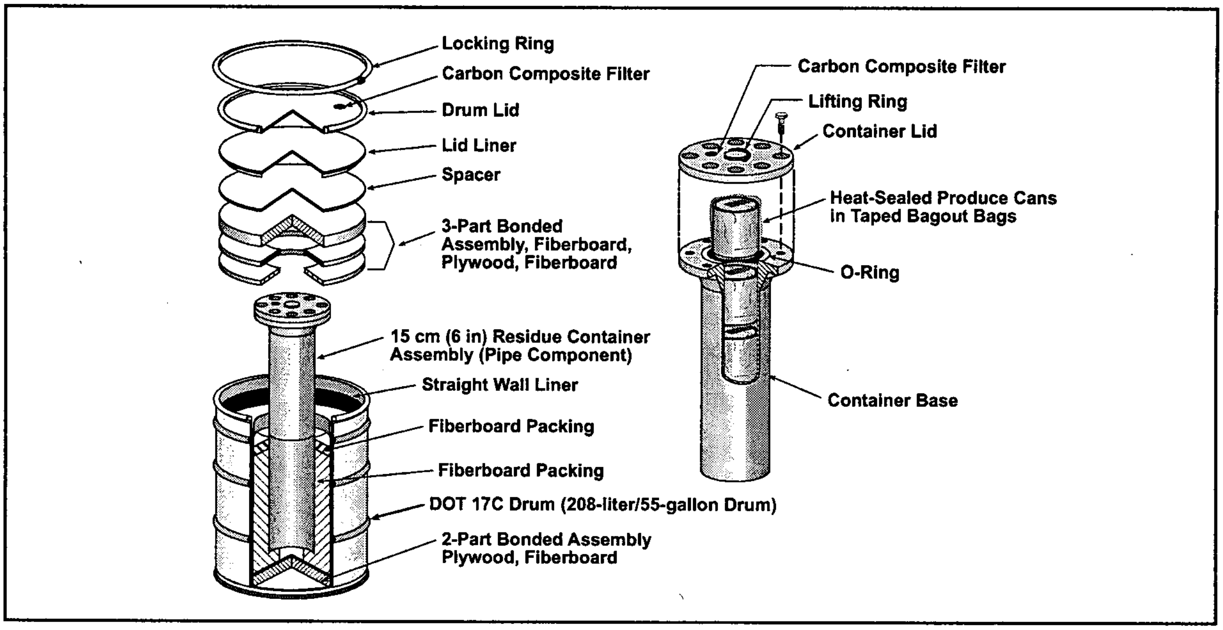
### 2.6.2 Storage of Plutonium Metal and Oxides

Processing the residues and scrub alloy under Alternative 3 would result in stabilized plutonium metal or oxide, which would be placed into safe and secure storage pending disposition in accordance with decisions to be reached under the Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement and the Surplus Plutonium Disposition Environmental Impact Statement.

Safe long-term storage of plutonium metal and oxide is addressed by DOE-STD-3013-96, *DOE Standard: Criteria for Preparing and Packaging Plutonium Metals and Oxides for Long-Term Storage* (September 1996). This standard establishes criteria for packaging plutonium metals and stabilized plutonium oxides to ensure safe storage for at least 50 years. The standard applies to packaging for storage of plutonium metals, alloys, and oxides that contain at least 50 percent plutonium by mass. To meet the standard, materials containing plutonium must be in stable forms and must be packaged in containers designed to maintain their integrity both under normal storage conditions and during handling accidents.

To ensure safe storage conditions, DOE has issued guidance that plutonium should not be stored in the form of plutonium solutions, metal turnings, or particles with a specific surface area greater than one square centimeter per gram. Plutonium metal items should be free of hazardous or pyrophoric materials or corrosion products. Plutonium oxides should be stabilized at 1,000°C (1,830°F) for 1 hour. In packaging, no plastic should contact plutonium metal or oxide, and metal should be packaged in as dry and inert an atmosphere as possible. Existing metal packages should be inspected for external corrosion, and packages containing more than 0.5 kg (1.1 lb) plutonium metal should be weighed annually.

Department of Transportation 17C Drum with 15 cm (6 in) Residue Container




## 2.7 DISPOSAL OR OTHER DISPOSITION

This section provides an overview of the disposition paths for the processed residues and scrub alloy covered by this EIS and for any separated plutonium that would occur under Alternative 3. The impacts of disposition are evaluated in other EISs that address the disposal of transuranic waste at WIPP and disposition of surplus plutonium and, thus, are not evaluated in this EIS. However, disposal in WIPP of scrub alloy (from which the plutonium has not been separated) would require additional NEPA review because the transuranic waste generated during its processing was not analyzed in the WIPP Disposal Phase Final Supplemental EIS. Such disposal may also require changes to current legal limitations on WIPP.

Under the No Action Alternative, no material would be prepared sufficiently to allow its disposition, as discussed in more detail in Section 1 of this Summary. Under the other alternatives, materials processing would result in transuranic waste that could be transported to WIPP for disposal. The environmental impacts of shipping transuranic waste to WIPP and the impacts of disposal at that site are covered in the *Waste Isolation Pilot Plant Disposal Phase, Final Supplemental Environmental Impact Statement* (DOE/EIS-0026-S-2, September 1997). Transportation impacts are summarized and are incorporated by reference in this EIS (see Appendix E, Section E.6.1).

Alternative 3 (Process with Plutonium Separation) analyzes processing that separates the plutonium from the waste material and concentrates it so residual material meets the safeguards termination limits for disposal at WIPP, while the separated and concentrated plutonium is placed in safe and secure storage pending ultimate disposition. In the Record of Decision for the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement* (DOE/EIS-0229) described in Section 1.5.6 of the Final EIS, DOE decided to pursue a twofold strategy for disposition of surplus weapons usable plutonium: (1) immobilization of some (and potentially all) of the plutonium in a glass or ceramic material for disposal in a monitored geologic repository pursuant to the Nuclear Waste Policy Act; and (2) burning of some of the plutonium as mixed oxide (MOX) fuel in existing, domestic, commercial reactors, with subsequent disposal of the spent fuel in a monitored geologic repository pursuant to the Nuclear Waste Policy Act. In July 1998, DOE published a Draft EIS on Surplus Plutonium Disposition, described in Section 1.5.7 of the Final EIS, that analyzes the impacts of implementing this plutonium strategy. Any plutonium separated under any alternative analyzed in this EIS would be disposed of using the immobilization process.

During the process to separate plutonium, some low-level waste and other material managed as high-level waste may be produced. These wastes would be managed according to the waste management practices for these waste types at the processing site.

## 2.8 TRANSPORTATION FOR OFFSITE PROCESSING

Transportation of plutonium residues or scrub alloy to other sites for processing would not occur under Alternative 1 (No Action - Stabilize and Store), Alternative 2 (Processing without Plutonium Separation) or Alternative 4 (Combination of Processing Technologies) because all processing would occur at Rocky Flats. Under Alternative 3 (Processing with Plutonium Separation), however, some plutonium residues and scrub alloy would be transported to other DOE sites for processing that involves plutonium separation.

The number of inter-site shipments that could potentially be sent to the Savannah River Site or Los Alamos National Laboratory under Alternative 3 for each processing technology is shown in Table S-5. These shipments cannot be added to obtain the total shipments because that would lead to double counting of some shipments. Incinerator ash may be processed using either the Purex process or the mediated electrochemical oxidation process at the Savannah River Site. Accordingly, the number of shipments of this material is given for both processes. In addition, processing of direct oxide reduction salts may result in shipments to Los Alamos National Laboratory (as residues) or to the Savannah River Site (as scrub alloy, following salt scrub at Rocky Flats). Table S-5 also shows the number of shipments under the Preferred Alternative. Under the Preferred Alternative, Rocky Flats would make only 39 shipments to the Savannah River Site (26 for sand, slag, and crucible residues; 7 for plutonium fluoride residues; and 6 for scrub alloy) and 3 shipments to Los Alamos National Laboratory (for high plutonium concentration direct oxide reduction salt residues).

DOE provides a level of safety and health for DOE transportation operations that is equivalent to or greater than that provided by compliance with applicable Federal, State, Tribal, and local regulations. In addition to meeting applicable shipping containment and confinement requirements in 10 Code of Federal Regulations (CFR) Part 71 and 49 CFR, packaging for transport of this material must be certified separately by DOE.

Plutonium residues and scrub alloy have been shipped safely for 25 years. During the weapons production years (1960s to 1989), about 70 truck shipments (3,800 kg or 8,400 lb) were made from Rocky Flats to the Savannah River Site. These shipments were made using the same Transportation Safeguards System used for transporting nuclear weapons and weapon components. This same transportation system could be used in shipments of Rocky Flats plutonium residues and scrub alloy. DOE is also evaluating the possible use of a commercial transportation system for transporting a portion of these materials. The analyses in this EIS are based on a set of assumptions that conservatively bound the impacts that would result from use of either the Transportation Safeguards System or commercial carriers. Experience has shown that typical radiation levels for these shipments are below regulatory limits. This is due to several factors: (1) most of the radiation emitted from plutonium is alpha radiation, which cannot penetrate the container walls; (2) plutonium residues would be preprocessed/repackaged prior to shipment, and (3) the transport system, which includes containers, transportation packaging, and special transporter, provides multiple layers of containment.

Four aspects of ground transportation are discussed in the following sections: (1) transportation packaging system, (2) the "Safe Secure Trailer" system, (3) route selection process for offsite shipments, and (4) emergency management considerations.

Table S-5. Number of Inter-Site Shipments Under Alternative 3 and Under the Preferred Alternative

| MATERIAL CATEGORY | PROCESS/SITE | POTENTIAL SHIPMENTS UNDER ALTERNATIVE 3 | SHIPMENTS UNDER THE PREFERRED ALTERNATIVE |
|---|---|---|---|
| Incinerator Ash and Firebrick Fines* Residues | Purex at Savannah River Site<br>Mediated Electrochemical Oxidation at Savannah River Site | 116<br>86 | 0<br>0 |
| Sand, Slag, and Crucible Residues | Purex at Savannah River Site | 26 | 26 |
| Graphite Fines Residues | Mediated Electrochemical Oxidation at Savannah River Site | 7 | 0 |
| Molten Salt Extraction/ Electrorefining Salt Residues | Salt Distillation at LANL - IDC 409<br>Salt Distillation at LANL - All Other IDCs<br>Purex at Savannah River Site (following scrub) - IDC 409<br>Purex at Savannah River Site (following scrub) - All Other IDCs | 6<br>44<br>7<br>15 | 0<br>0<br>0<br>0 |
| Direct Oxide Reduction Salt Residues | Acid Dissolution or Water Leach at LANL - IDCs 365, 413, 417, and 427<br>Acid Dissolution or Water Leach at LANL - All Other IDCs<br>Purex at Savannah River Site (following scrub) - IDCs 365, 413, 417, and 427<br>Purex at Savannah River Site (following scrub) - All Other IDCs | 3<br>10<br>3<br>1 | 3<br>0<br>0<br>0 |
| Combustible Residues | Not Shipped | 0 | 0 |
| Plutonium Fluoride Residues | Purex at Savannah River Site | 7 | 7 |
| Filter Media Residues | Not Shipped | 0 | 0 |
| Sludge Residues | Not Shipped | 0 | 0 |
| Glass Residues | Not Shipped | 0 | 0 |
| Graphite Residues | Mediated Electrochemical Oxidation at Savannah River Site | 16 | 0 |
| Inorganic (Metal and Others) Residues | Mediated Electrochemical Oxidation at Savannah River Site | 4 | 0 |
| Existing Scrub Alloy | Purex at Savannah River Site | 6 | 6 |

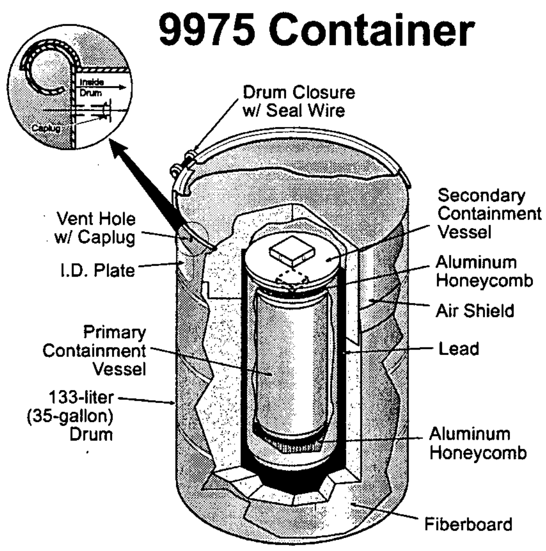
* Firebrick fines would not be processed by the Purex process
LANL = Los Alamos National Laboratory
IDC = Item Description Code

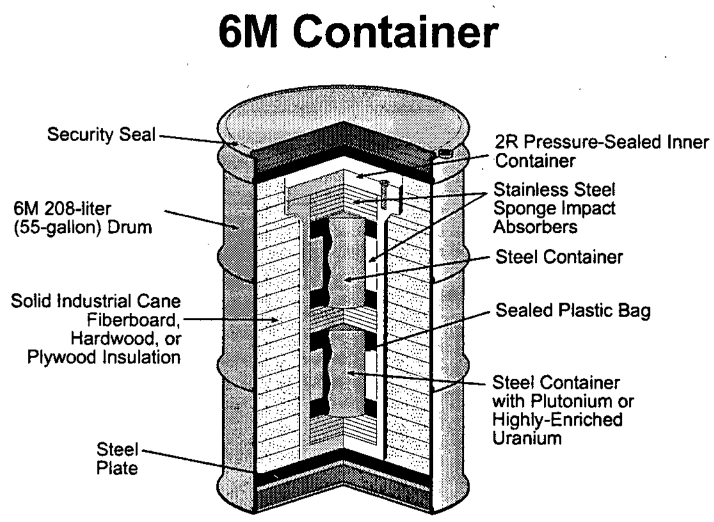
## 2.8.1 TRANSPORTATION PACKAGING

The containers that would be used by DOE for shipping residues and scrub alloy for offsite processing are authorized or certified by the Department of Transportation, the Department of Energy, or the Nuclear Regulatory Commission. They are known by regulation as "Type B" packaging. In general, scrub alloy and plutonium-bearing residues would be shipped in packaging such as 9968, 9975, or 6M containers (see the schematic diagrams). Two typical Type B designs that would be used for shipments under this EIS are illustrated below.

Type B packaging is made up of several components and is designed to reduce the risk of material dispersal, radiation exposure, or criticality. In addition to meeting Nuclear Regulatory Commission-specified standards demonstrating it can withstand normal conditions of transport without loss or dispersal of its radioactive contents, the Type B container used for DOE shipments must also be designed to survive certain severe hypothetical accident conditions that demonstrate by testing or analysis resistance to impact, puncture, fire, and water submersion. These hypothetical accident conditions do not duplicate accident environments but, rather, are defined so that they produce damage equivalent to extreme and unlikely accidents. The sequence of tests is described in more detail in Appendix E of the EIS. The Type B designs considered in this EIS have been tested under normal and accident conditions.

Shipments of plutonium residues and scrub alloy that meet requirements for disposal at WIPP would be transported to WIPP in TRUPACT-II containers. This container could also be used to transport materials for offsite processing.




Two Type B Packagings that Could be Used to Ship Plutonium Residues and Scrub Alloy.

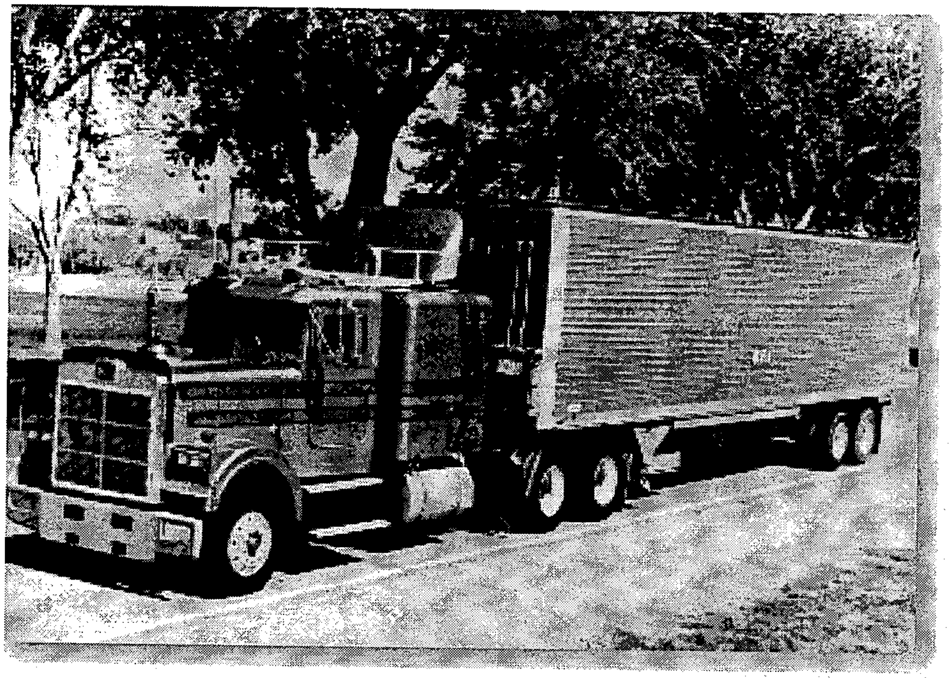
## 2.8.2 THE "SAFE SECURE TRAILER" SYSTEM

The Safe Secure Trailer System would be used to transport plutonium residues and scrub alloy for processing at the Savannah River Site or at Los Alamos National Laboratory. The Safe Secure Trailer System is an integral part of the Transportation Safeguards System operated by DOE. The Transportation Safeguards System is normally used to transport nuclear weapons, nuclear weapon components, and special nuclear materials. Since its establishment in 1975, the Transportation Safeguards Division has accumulated more than 110 million kilometers (70 million miles) of over-the-road experience transporting cargo without a fatality or radioactive release.

The Safe Secure Trailer System uses specially designed 18-wheel tractor trailers, which incorporate deterrents to prevent unauthorized removal of cargo. Key features of the system include:

- superior structural characteristics and a highly reliable cargo tiedown system;
- communications, electronic, and other equipment that further enhance in-transit safety and security;
- specially trained and equipped personnel accompanying the shipment, driving the truck and escort vehicles, and operating the communications and other equipment;
- a comprehensive maintenance program, including compliance with maintenance standards significantly more stringent than those applied to similar commercial transport vehicles; and
- periodic and unannounced audits/surveys during transport operations to ensure compliance with approved procedures.

Safe Secure Trailer System



### 2.8.3 ROUTE SELECTION PROCESS FOR OFFSITE TRANSPORTATION

Highway routing of nuclear material is governed by Department of Transportation Regulations at 49 CFR Parts 171-179 and 49 CFR Part 397. The regulations require that shipment of a "highway route controlled quantity" of radioactive material be transported over a preferred highway network. The network includes interstate highways, with preference toward interstate system bypasses around cities, and State-designated preferred routes.

A computer code called HIGHWAY was used to select representative routes for conducting the risk assessment in this EIS. The HIGHWAY code is a computerized road atlas that provides selection of routes in compliance with the Department of Transportation preferred highway network.

For security reasons associated with Safe Secure Trailer shipments, details about routes for such shipments would not be publicized before shipment.

### 2.8.4 EMERGENCY MANAGEMENT CONSIDERATIONS

DOE's Transportation Safeguards Division is responsible for the safety and security of special nuclear material shipments. Most, if not all, plutonium residues and scrub alloy shipments would be treated as special nuclear material shipments and would be accompanied by armed special agents who would be in constant communication with the Transportation Safeguards Division Control Center.

In the event of an incident or accident, the Transportation Safeguards Division convoy commander would notify Security Communications (SECOM), which is a nationwide communications system operated 24 hours per day by the Transportation Safeguards Division. SECOM would then notify the State's emergency point of contact and would interface with emergency responders. The Transportation Safeguards Division would maintain control over the immediate scene of any accident, called a "National Security Area." Beyond that, State or local officials would be in command of the scene. First on-scene responders would receive a briefing from the Transportation Safeguards Division Special Agents. The incident commander would be apprised of the security requirements and of the hazardous nature of the shipment in advance of directing the responders to begin their response.

DOE has eight regional Radiological Assistance Program teams available to respond to incidents involving plutonium residue or scrub alloy shipments.

The DOE Transportation Emergency Preparedness Program provides Federal, Tribal, State, and local responders with access to training and technical assistance necessary to safely, efficiently, and effectively respond to DOE transportation incidents involving radioactive materials.

## 2.9 NUCLEAR NONPROLIFERATION CONSIDERATIONS

For over 40 years, the United States has supported international efforts to prevent the spread of nuclear weapons to states that do not already have them. Although the cold war has ended, national support for the nonproliferation of nuclear weapons remains undiminished. As one of its fundamental nonproliferation strategies, the United States seeks to prevent the unauthorized acquisition of materials, such as plutonium, that could be used to manufacture nuclear weapons. United States efforts to prevent unauthorized access to plutonium are based on longstanding national policies, as well as on our obligations under the Nuclear Nonproliferation Treaty and the Treaty on the Physical Protection of Nuclear Material.

The current framework for U.S. nonproliferation policy was issued by the President on September 27, 1993. Several key elements of this framework dealt with plutonium policy. The policies most directly pertinent to this EIS stated that the United States would:

- Seek to eliminate where possible the accumulation of stockpiles of highly enriched uranium or plutonium, and to ensure that where these materials already exist they are subject to the highest standards of safety, security, and international accountability;
- Submit U.S. fissile material no longer needed for our deterrent to inspection by the International Atomic Energy Agency; and
- Initiate a comprehensive review of long-term options for plutonium disposition, taking into account technical, nonproliferation, environmental, budgetary, and other economic considerations.

The framework document also stated that the "United States does not encourage the civil use of plutonium and, accordingly, does not itself engage in plutonium reprocessing for either nuclear power or nuclear explosive purposes."

The materials covered by this EIS (approximately 40 percent of the plutonium residues and all of the scrub alloy stored at Rocky Flats) contain nearly 2,800 kg (6,200 lb) of plutonium that could be used in nuclear weapons, if diverted. The proliferation consequences of each alternative must be considered in conjunction with considerations of the health and safety benefits (both near-term and long-term) that would be associated with implementation of the proposed action. The proliferation consequences of each alternative for management of these materials are discussed below.

***Alternative 1 (No Action - Stabilize and Store)***

Under the No Action Alternative, the entire Rocky Flats inventory of plutonium residues and scrub alloy would be stabilized and stored there pending disposition. Materials containing nearly 2,800 kg (6,200 lb) of plutonium would remain an attractive target for theft by those interested in the manufacture of nuclear weapons. Theft would be prevented by continued operation of the physical security system at Rocky Flats. From the viewpoint of nuclear weapons nonproliferation, the No Action Alternative has no clearly defined endpoint. The stabilization efforts under the No Action Alternative would result in a very small reduction in proliferation risk.

***Alternative 2 (Process without Plutonium Separation)***

Implementation of Alternative 2 would render the Rocky Flats plutonium residues and scrub alloy unattractive as source of plutonium for the manufacture of nuclear weapons. From the viewpoint of nuclear weapons nonproliferation, the endpoint is clearly defined as completion of processing for the entire inventory, at which time the resulting materials would pose a greatly reduced proliferation risk. Under this alternative, the high level of physical security required under Alternatives 1 and 3 would no longer be required for the processed plutonium residues and scrub alloy. This alternative would cause the largest reduction in the risk of proliferation, and this risk reduction would occur in the near term.

***Alternative 3 (Process with Plutonium Separation)***

Under this alternative, the chemical separation of the plutonium from the residues and scrub alloy would be conducted while processing the materials to address near-term health and safety issues raised by the Defense Nuclear Facilities Safety Board in its Recommendation 94-1. This processing would also prepare the residues and scrub alloy for disposal or other disposition, thus allowing the elimination of the health and safety risks associated with further storage of these materials. The separated plutonium would be converted into a form that would be more attractive as a potential target for theft or diversion until its disposition if it were left unprotected. However, in the interim, prior to its disposition, this plutonium would be stored at the separation site(s) under the protection of the safeguards and security systems already in operation at those sites to provide protection for the plutonium already in storage at those sites. The separated plutonium would be disposed of in accordance with decisions to be made under the *Surplus Plutonium Disposition Environmental Impact Statement*. The ultimate disposition of this plutonium would be in a monitored geologic repository either as a glass or ceramic waste form embedded in canisters of vitrified high-level radioactive waste. As a result, while there would be a slight and manageable increase in proliferation concerns in the near-term until the plutonium is dispositioned, implementation of this alternative would ultimately result in a reduction in the risk of proliferation. The waste resulting from the separation processes would not pose a proliferation risk because only minute quantities of plutonium would be present in this waste.

***Alternative 4 (Combination of Processing Technologies)***

This alternative is a combination alternative comprised of elements of the technologies analyzed under Alternatives 1 and 2. Materials subject to processes under Alternative 4 have been granted a variance to safeguards termination limits subject to their plutonium concentration levels being below 10 percent. The variance was approved by the DOE Office of Safeguards and Security for many of the residues only after it was determined that these residues would not be in a form that is attractive for theft as a source of plutonium for use in nuclear weapons or terrorist activities. The proliferation risk would, therefore, be very low under this alternative.

The Department of Energy is preparing a report on the nuclear nonproliferation implications that under certain circumstances could be associated with chemical separation (a process that chemically extracts plutonium and uranium from other elements or compounds) of spent nuclear fuel of both domestic and foreign origin. This report, which DOE announced it would prepare in the *Record of Decision on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel* (61 Federal Register 25092, May 17, 1996), is intended to assist the Department of Energy in its ongoing efforts to manage nuclear materials under its jurisdiction in a manner consistent with broad United States nonproliferation and arms control objectives. These policies have been laid down by successive Presidents in a series of Presidential Decision Directives.

DOE believed at the time the Draft EIS was issued for public comment that the report would be completed in time to allow it to be considered, if appropriate, in conjunction with this EIS in deciding on the stabilization and disposition options for materials within the scope of this EIS. The current schedule for completion of the report, however, makes it clear that the report will not be completed in time to be available for consideration as intended.

The report focuses on potential nuclear nonproliferation benefits and vulnerabilities associated with various nuclear material handling technologies, including chemical separation, in instances other than to address health and safety vulnerabilities. All of the materials being considered in this EIS are covered by Defense Nuclear Facilities Safety Board Recommendation 94-1 and must be stabilized to address health and safety concerns. Any chemical separation operations performed on these materials would be conducted in the process of accomplishing this health and safety related stabilization, and to allow the materials to be disposed of, thus ending ongoing health and safety risks associated with their continued storage. Thus, although the results of the report will not be available for consideration in making decisions under this EIS, DOE believes that the concerns that led to the decision to prepare the report are being appropriately addressed by this EIS.

# 3.0 THE AFFECTED ENVIRONMENT

The alternatives assessed in this EIS would potentially affect the environment surrounding Rocky Flats, the Savannah River Site, and Los Alamos National Laboratory. Chapter 3 of the Final EIS describes potentially affected environments around each of these sites. The resources that could potentially be affected are grouped into the following categories: site infrastructure, air quality, socioeconomics, public and occupational health and safety, and waste management.

The resources described above are presented in detail in Chapter 3 of the Final EIS due to their potential to be impacted by the alternatives assessed in this EIS. Several other resources are not expected to be impacted by these alternatives, and are presented in less detail in Chapter 3. These resources are: land resources, noise, water resources, geology and soils, ecology, and cultural and paleontological resources.

**Chapter 4 of this Summary Presents:**

- *Overview of Methodology for Calculating Impacts*
- *Overview of Impacts*

# 4.0 ENVIRONMENTAL CONSEQUENCES

Chapter 4 of this Summary presents an overview of the methodology used to evaluate environmental impacts and presents a summary of the environmental impacts associated with the No Action Alternative and the Action Alternatives. As described in Chapter 2, the alternatives evaluated for the 10 material categories (some with further subcategories) are as follows:

- The *No Action Alternative* is a set of processing options that prepare the Rocky Flats plutonium residues and scrub alloy for indefinite storage.
- The *Action Alternatives* consist of a set of technology options for processing of these materials so that they meet requirements for disposal or other disposition. (Several options were evaluated for each material category and subcategory.) The Proposed Action could be accomplished by either Alternatives 2, 3, or 4 (identified in Section 2.1 of this Summary) or by some combination of these alternatives for different material categories or portions of one or more material categories.
- The *Preferred Alternative* is a specific selection of preferred processing technologies from the list of processing technologies applicable to each material category and subcategory.

**PRIMARY FOCUS OF IMPACTS**

**Products & Wastes**

**Radiological**

**Chemical**

## 4.1 METHODOLOGY FOR EVALUATING AND PRESENTING ENVIRONMENTAL IMPACTS

Each material category and subcategory was analyzed independently. For each one, every combination of material and processing option specified in Chapter 2 of this Summary was analyzed. For each combination of material and processing option, a set of impacts was assessed, including:

- Amounts of products and wastes
- Radiological health effects due to:
  - Incident-free operations and transportation
  - Accidents
- Chemical health effects due to:
  - Incident-free operations and transportation
  - Accidents

DOE then calculated the total impacts of processing all the plutonium residues and scrub alloy under the No Action Alternative and for alternatives accomplishing the Proposed Action. DOE also calculated the range of potential impacts at each site from the processing technologies.

The focus of the impacts is on public and occupational health and safety associated with the processing technologies and any associated transportation. The following sections provide an overview of how the radiological and chemical health effects were calculated for members of the public and workers.

### 4.1.1 INCIDENT-FREE OPERATIONS AND ACCIDENT CONDITIONS

Radiological and chemical health effects were calculated for processing options under incident-free operations and accident conditions.

- For *incident-free operations*, the impacts are those that are anticipated to occur as a result of process operations and transportation over whatever time period is necessary to process the entire inventory of residues and scrub alloy covered under this EIS.
- For *accident conditions*, DOE analyzed a wide spectrum of potential accident scenarios, including fire, explosion, spill, criticality, earthquake, and aircraft crash. Accident scenarios with the highest consequences and risks are used in the EIS for the purpose of bounding consequences and identifying the largest contributor to total risk. The risks associated with accidents for each processing option with each residue and scrub alloy category were also computed.

The methods used for calculating the consequences from incident-free operations and accident conditions are described in the sections that follow.

### 4.1.2 CALCULATING RADIOLOGICAL HEALTH EFFECTS

For each material type and processing option, radiological health effects are presented in terms of the potential radiation *dose* that a person or population would receive (based on standard computer codes used for estimating doses from releases). A risk factor is applied to the estimated dose to a *maximally exposed individual* (a worker or a member of the offsite public) to derive a *probability of a latent cancer fatality*. For the potentially exposed population (workers and the offsite public), the dose received by the receptor group is converted to the *number of estimated excess latent cancer fatalities*.


Estimated doses from incident-free operations are based on anticipated releases and direct exposures. Estimated doses from accident conditions take into account the estimated frequency of the accident, the duration of the process, and the magnitude of any potential release.

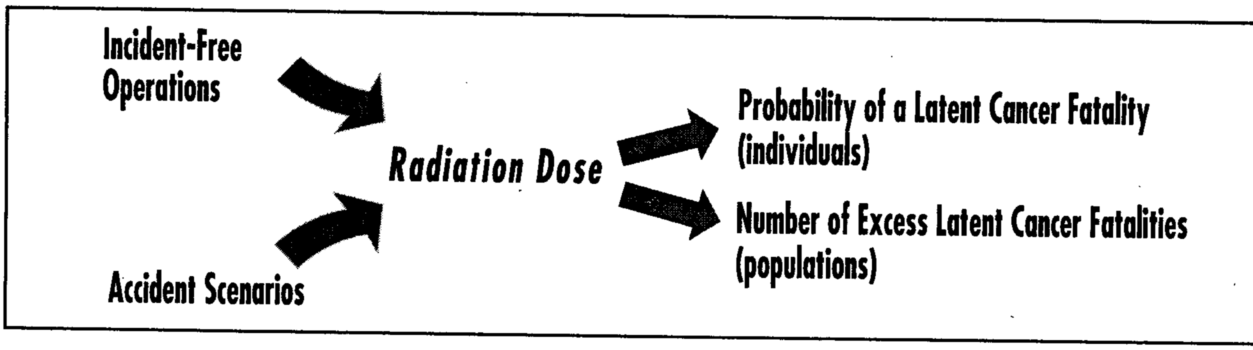
Health effects associated with these doses are presented for the *maximally exposed individual* (worker and member of the public), the *worker population*, the *offsite public population* living within a radius of 80 kilometers (50 miles) from the site, and the public population living and traveling along transportation routes.

For those processing options that involve transportation from Rocky Flats to the Savannah River Site and Los Alamos National Laboratory, the estimated doses and associated health effects from transportation are factored into the results for those processes. DOE uses the RADTRAN code to determine the doses potentially received by populations.

### 4.1.3 CALCULATING CHEMICAL HEALTH EFFECTS

The potential impacts of exposure to hazardous chemicals released to the atmosphere as a result of the processing of plutonium residues and scrub alloy were evaluated for the routine operation of processing facilities.

Impacts for incident-free operation are presented for the maximally exposed individual worker, the maximally exposed offsite member of the public, the offsite population in an 80-kilometer (50-mile) radius, and the worker




**The Maximally Exposed Individual**
*The maximally exposed individual is an individual who receives the highest dose in a given situation. For incident-free processing operations, the dose is calculated for the hypothetical individual (member of the public) who resides at the site boundary in a downwind direction. For incident-free transportation, the dose is calculated for a hypothetical individual stuck in traffic next to a shipment for 30 minutes. The maximally exposed worker during incident-free operations is assumed to receive an annual dose equal to the DOE Administrative Control Level. Under accident conditions, the dose is calculated for the individual worker located 100 meters (328 feet) or more downwind from the release point when an accidental release of radioactive material occurs. The dose is also calculated for a hypothetical member of the public located at the site boundary downwind from the release point when an accidental release of radioactive material occurs.*

**Population Within 50 Miles**
*For both incident-free processing operations and accident conditions, doses (and associated health effects) are determined for the general populations that reside within an 80-kilometer (50 mile) radius of each of the three candidate sites. Several types of data are used in the assessment of these values, namely: meteorological data, agricultural production and consumption data, and demographic data. Meteorological data assist in the calculation of doses to populations that are downwind from a release; agricultural data help determine the doses that people receive by the amount of contaminated food they eat; demographic data help define how many people are situated at a given distance and direction, relative to a release location.*

**Conservatism in Estimating Health Effects**
*This EIS uses a conservative approach in estimating health effects to individuals and populations. Estimates are based on the linear no-threshold theory of radiation carcinogenesis, which postulates that all radiation doses, even those close to zero, are harmful. It is stated in a recent report issued by the National Council of Radiation Protection and Measurements that there is no proof or direct support for this theory. DOE uses the conservative approach to provide an upper bound on the potential health effects.*

**Accident Risk**
*Under the realm of accident conditions, for each applicable scenario type (e.g., fire, explosion) a radiological "risk" is determined for the maximally exposed offsite individual, general population within 80 kilometers (50 miles), and onsite noninvolved worker. This risk is attained by multiplying a scenario's probability of occurrence by its associated consequences. For example, if a given accident has a one-in-a-one-million ($10^{-6}$) probability of occurrence per year and its consequence is 10 rem to the maximally exposed offsite individual, then the total annual risk to this individual is [($10^{-6}$/yr)(10 rem)], which is equal to $10^{-5}$ rem/yr. Associated health effects (i.e., latent fatal cancer risks) are then determined by the application of risk factors discussed in Appendix D of this final EIS.*

population. Health effects evaluated include excess incidences of latent cancers and potential for chemical-specific noncancer health effects.

Accident analyses for hazardous chemicals were not conducted for this EIS. However, chemical accident analyses have been conducted in other safety analyses and NEPA analyses for Rocky Flats, the Savannah River Site, and Los Alamos National Laboratory (see Section 4.1.3 of the Final EIS). These analyses are relevant to the proposed action because they address similar types of facilities using similar types of chemicals and are, therefore, incorporated by reference. As discussed more fully in Section 4.1.3 of the Final EIS, prior analyses estimate that the chemical accident risks for the offsite public and onsite workers not involved in the facility processes would be low and could be limited by emergency response actions. Workers involved in the facility processes, however, could experience serious injury or fatalities due to their closeness to the source of the accident. Only very severe accidents, that are not likey to occur, could cause such severe impacts.

### 4.1.4 Plutonium and Americium Toxicity

The adverse health effects experienced following exposure to plutonium result predominantly from its radiological toxicity rather than its chemical toxicity. Plutonium is not readily absorbed from the gastrointestinal tract following ingestion or through the intact skin following dermal exposure; inhalation is the most common route of human exposure. Once inhaled, the rate of clearance from the lungs is influenced by particle size, specific isotope, and chemical form. Following inhalation exposure, plutonium partitions to the lungs, liver, and bone. The radiotoxicity of plutonium results from its emissions of ionizing radiation, primarily in the form of alpha particles, although low-energy gamma radiation and low-energy neutrons are also released. In studies with laboratory animals, exposure to high radiation doses of plutonium isotopes has resulted in decreases in lifespans, diseases of the respiratory tract, and cancer. Plutonium residues and scrub alloy contain a number of different isotopes of plutonium.

In addition to plutonium isotopes, scrub alloy and some plutonium residues contain substantial amounts of americium-241, which is formed by the decay of plutonium-241. Americium-241 is radiotoxic because it produces high gamma radiation doses and also emits alpha particles and neutrons. Like plutonium, the radiotoxicity of americium is of much greater concern than its chemical toxicity.

## 4.2 SUMMARY OF IMPACTS

This section summarizes the impacts associated with the processing options evaluated in this EIS. The following subsections cover:

- Comparison of Health and Safety Risks with Common Risks to the Public
- Impacts of the Strategic Management Approaches
- Range of Impacts at Each Site
- Range of Intersite Transportation Impacts
- Environmental Justice
- Cumulative Impacts

*Radiation dose is expressed in terms of rem or millirem. One rem is 1,000 millirem. One millirem may also be expressed as 0.001 rem. The average individual in the United States receives a dose of about 300 millirem per year (or 0.3 rem per year) from natural background radiation. Millirem is abbreviated as "mrem."*

### 4.2.1 COMPARISON OF HEALTH AND SAFETY RISKS WITH COMMON RISKS TO THE PUBLIC

This section compares the increased risks to the public associated with the management of plutonium residues and scrub alloy to those of common activities, such as smoking, flying, receiving a medical x-ray, and so forth.

- ***Risks in the Proposed Action*** — Below are highlights of the highest risks from any combination of processing activities evaluated in the EIS.

  The highest increase in the incident-free population risk to the general public living near any of the DOE management sites due to radiation exposure would be 0.00019 latent cancer fatalities. This risk occurs at the Savannah River Site. The risk would be spread among the 755,000 people who are expected to live within 80 kilometers (50 miles) of the site when processing would take place. The risk of a latent cancer fatality to the maximally exposed individual in this population would be increased by less than one chance in one hundred million ($1.7 \times 10^{-9}$).

  The highest increase in the accident population risk to the general public living near any of the DOE management sites would be 0.66 latent cancer fatalities. This risk occurs at the Rocky Flats site. The risk would be spread among the 2.4 million people who are expected to live within 80 kilometers (50 miles) of the site when processing would take place. The risk of a latent cancer fatality to the maximally exposed individual in this population would be increased by less than one chance in ten thousand (0.000042).

  The highest increase in the population risk to the general public along any of the transportation routes due to radiation exposure during ground transport would be 0.010 latent cancer fatalities, if the maximum number of shipments is assumed (208 from Rocky Flats to the Savannah River Site). The risk from radiation exposure to the maximally exposed individual along any transportation route would be increased by less than one chance in one hundred thousand ($5.5 \times 10^{-6}$).

  Nonradiological fatalities are also unlikely. The highest increases in the risk of nonradiological fatalities to the public is through a traffic accident involving a truck transporting plutonium residues or scrub alloy. Assuming the same number of shipments (208 to the Savannah River Site), the increase in the population risk to the general public along the transportation routes would be 0.021 fatalities.

- ***Risks from Common Activities*** — Every activity carries some risk. Table S-6 shows activities estimated to increase an individual's chance of death in any year by one in one million. Most of these activities would not be considered unusually risky actions, and they can be compared to the risks presented in this chapter for perspective only.

### 4.2.2 IMPACTS OF THE STRATEGIC MANAGEMENT APPROACHES

Selection of the future steps to be taken in the management of the plutonium residues and scrub alloy must be made separately for each material category and subcategory since chemical and physical differences between the material categories require that each category be handled using different methods, and possibly different management sites. Nevertheless, in an attempt to simplify presentation of this large group of processing options, DOE has assembled the separate processing options for the individual material categories into eight groups that allow the impacts of processing the plutonium residues and scrub alloy to be compared.

Table S-6. Risks Estimated to Increase Chance of Death in Any Year by One Chance in a Million

| Activity | Cause of Death |
|---|---|
| Smoking 1.4 cigarettes | Cancer; heart disease |
| Living 2 days in New York or Boston | Air pollution |
| Traveling 16 km (10 mi) by bicycle | Accident |
| Flying 1,600 km (1,000 mi) by jet | Accident |
| Living 2 months in Denver on vacation from New York | Cancer caused by cosmic radiation |
| One chest x-ray | Cancer caused by radiation |

These groupings of processing options are referred to as Strategic Management Approaches. They include the No Action Alternative and the Preferred Alternative discussed previously. They also include six illustrative groupings of processing options that would have the following overall effects:

- Minimization of Process Duration at Rocky Flats
- Minimization of the Cost
- All Actions Taken at Rocky Flats
- Conduct Fewest Actions at Rocky Flats
- Process with Maximum Separation of Plutonium
- Process with No Separation of Plutonium

The Strategic Management Approaches and the groupings of processing options that comprise them are shown in Table S-7.

The impacts of these various management approaches are compared in Section 4.2.2.1 of this Summary. It should be recognized that the Strategic Management Approaches, other than No Action and the Preferred Alternative, are illustrative cases generated to assist the public in understanding the relative impacts that could occur from various methods of managing the plutonium residues and scrub alloy. However, the material category-specific processing options that make up the illustrative Strategic Management Approaches do not necessarily represent optimum ways in which to manage the individual material categories.

Table S-7. Strategic Management Approaches for Processing Rocky Flats Plutonium Residues and Scrub Alloy

| | MANAGEMENT APPROACHES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Material Category* | *No Action* | *Preferred Alternative* | *Minimize Total Process Duration at Rocky Flats*[a] | *Minimize Cost* | *Conduct All Processes at Rocky Flats* | *Conduct Fewest Actions at Rocky Flats*[b] | *Process With Maximum Plutonium Separation* | *Process Without Plutonium Separation* |
| Incinerator Ash Residues | Calcination/ Cementation at Rocky Flats (Alternative 1) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Preprocess at Rocky Flats and MEO at SRS (Alternative 3) | Repackage at Rocky Flats (Alternative 4) |
| Sand, Slag, and Crucible Ash Residues | Calcination/ Cementation at Rocky Flats (Alternative 1) | Preprocess at Rocky Flats and Purex at SRS (Alternative 3) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Preprocess at Rocky Flats and Purex at SRS (Alternative 3) | Preprocess at Rocky Flats and Purex at SRS (Alternative 3) | Repackage at Rocky Flats (Alternative 4) |
| Graphite Fines Ash Residues | Calcination/ Cementation at Rocky Flats (Alternative 1) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Preprocess at Rocky Flats and MEO at SRS (Alternative 3) | Repackage at Rocky Flats (Alternative 4) |
| Inorganic Ash Residues | Calcination/ Cementation at Rocky Flats (Alternative 1) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4)[c] | Repackage at Rocky Flats (Alternative 4) |
| Molten Salt Extraction/ Electrorefining Salt Residues (IDC 409 only) | Pyro-oxidation at Rocky Flats (Alternative 1) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Salt Distill at Rocky Flats (Alternative 3) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Preprocess at Rocky Flats and Salt Distill at LANL (Alternative 3) | Repackage at Rocky Flats (Alternative 4) |
| Molten Salt Extraction/ Electrorefining Salt Residues (All Others) | Pyro-oxidation at Rocky Flats (Alternative 1) | Repackage at Rocky Flats (Alternative 4) | Salt Scrub at Rocky Flats and Purex at SRS (Alternative 3) | Salt Distill at Rocky Flats (Alternative 3) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Salt Distill at Rocky Flats (Alternative 3) | Repackage at Rocky Flats (Alternative 4) |
| Direct Oxide Reduction Salt Residues (IDCs 365, 413, 417, and 427) | Pyro-oxidation at Rocky Flats (Alternative 1) | Preprocess at Rocky Flats and Acid Dissolution/ Plutonium Oxide Recovery at LANL (Alternative 3) and Repackage at Rocky Flats (Alternative 4)[d] | Preprocess at Rocky Flats and Acid Dissolution/Plutonium Oxide Recovery at LANL (Alternative 3) | Salt Scrub at Rocky Flats and Purex at SRS (Alternative 3) | Repackage at Rocky Flats (Alternative 4) | Preprocess at Rocky Flats and Acid Dissolution/Plutonium Oxide Recovery at LANL (Alternative 3) | Preprocess at Rocky Flats and Acid Dissolution/Plutonium Oxide Recovery at LANL (Alternative 3) | Repackage at Rocky Flats (Alternative 4) |
| Direct Oxide Reduction Salt Residues (All Others) | Pyro-oxidation at Rocky Flats (Alternative 1) | Repackage at Rocky Flats (Alternative 4) | Preprocess at Rocky Flats and Acid Dissolution/Plutonium Oxide Recovery at LANL (Alternative 3) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Preprocess at Rocky Flats and Water Leach at LANL (Alternative 3) | Repackage at Rocky Flats (Alternative 4) |
| Aqueous-Contaminated Combustible Residues | Neutralize/Dry at Rocky Flats (Alternative 1) | Neutralize/Dry at Rocky Flats (Alternative 4) | Blend Down at Rocky Flats (Alternative 2) | Blend Down at Rocky Flats (Alternative 2) | Neutralize/Dry at Rocky Flats (Alternative 4) | Neutralize/Dry at Rocky Flats (Alternative 4) | MEO at Rocky Flats (Alternative 3) | Neutralize/Dry at Rocky Flats (Alternative 4) |
| Organic-Contaminated Combustible Residues | Thermal Desorption/ Steam Passivation at Rocky Flats (Alternative 1) | Thermal Desorption/ Steam Passivation at Rocky Flats (Alternative 4) | Blend Down at Rocky Flats (Alternative 2) | Blend Down at Rocky Flats (Alternative 2) | Thermal Desorption/ Steam Passivation at Rocky Flats (Alternative 4) | Thermal Desorption/ Steam Passivation at Rocky Flats (Alternative 4) | MEO at Rocky Flats (Alternative 3) | Thermal Desorption/ Steam Passivation at Rocky Flats (Alternative 4) |
| Dry Combustible Residues | Repackage at Rocky Flats (Alternative 1) | Repackage at Rocky Flats (Alternative 4) | Blend Down at Rocky Flats (Alternative 2) | Blend Down at Rocky Flats (Alternative 2) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | MEO at Rocky Flats (Alternative 3) | Repackage at Rocky Flats (Alternative 4) |

Continued on next page.

Table S-7 (continued). Strategic Management Approaches for Processing Rocky Flats Plutonium Residues and Scrub Alloy

| | MANAGEMENT APPROACHES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Material Category* | *No Action* | *Preferred Alternative* | *Minimize Total Process Duration at Rocky Flats* [a] | *Minimize Cost* | *Conduct All Processes at Rocky Flats* | *Conduct Fewest Actions at Rocky Flats*[b] | *Process With Maximum Plutonium Separation* | *Process Without Plutonium Separation* |
| Plutonium Fluoride Residues | Acid Dissolution/ Plutonium Oxide Recovery at Rocky Flats (Alternative 1) | Preprocess at Rocky Flats and Purex at SRS (Alternative 3) | Preprocess at Rocky Flats and Purex at SRS (Alternative 3) | Preprocess at Rocky Flats and Purex at SRS (Alternative 3) | Acid Dissolution/ Plutonium Oxide Recovery at Rocky Flats (Alternative 3) | Preprocess at Rocky Flats and Purex at SRS (Alternative 3) | Preprocess at Rocky Flats and Purex at SRS (Alternative 3) | Blend Down at Rocky Flats (Alternative 2) |
| Fúl Flo Filter Media Residues (IDC 331) | Neutralize/Dry at Rocky Flats (Alternative 1) | Blend Down at Rocky Flats (Alternative 2) | Blend Down at Rocky Flats (Alternative 2) | Blend Down at Rocky Flats (Alternative 2) | Blend Down at Rocky Flats (Alternative 2) | Blend Down at Rocky Flats (Alternative 2) | MEO at Rocky Flats (Alternative 3) | Blend Down at Rocky Flats (Alternative 2) |
| HEPA Filter Media Residues (IDC 338 only) | Neutralize/Dry at Rocky Flats (Alternative 1) | Neutralize/Dry at Rocky Flats (Alternative 4) | Vitrify at Rocky Flats (Alternative 2) | Blend Down at Rocky Flats (Alternative 2) | Neutralize/Dry at Rocky Flats (Alternative 4) | Neutralize/Dry at Rocky Flats (Alternative 4) | MEO at Rocky Flats (Alternative 3) | Neutralize/Dry at Rocky Flats (Alternative 4) |
| HEPA Filter Media Residues (All Others) | Neutralize/Dry at Rocky Flats (Alternative 1) | Repackage at Rocky Flats (Alternative 4) | Vitrify at Rocky Flats (Alternative 2) | Vitrify at Rocky Flats (Alternative 2) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | MEO at Rocky Flats (Alternative 3) | Repackage at Rocky Flats (Alternative 4) |
| Sludge Residues (IDCs 089, 099 and 332) | Filter/Dry at Rocky Flats (Alternative 1) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Vitrify at Rocky Flats (Alternative 2) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4)[c] | Repackage at Rocky Flats (Alternative 4) |
| Sludge Residues (All Others) | Filter/Dry at Rocky Flats (Alternative 1) | Filter/Dry at Rocky Flats (Alternative 4) | Blend Down at Rocky Flats (Alternative 2) | Blend Down at Rocky Flats (Alternative 2) | Filter/Dry at Rocky Flats (Alternative 4) | Filter/Dry at Rocky Flats (Alternative 4) | Acid Dissolution/ Plutonium Oxide Recovery at Rocky Flats (Alternative 4) | Filter/Dry at Rocky Flats (Alternative 4) |
| Glass Residues | Neutralize/Dry at Rocky Flats (Alternative 1) | Neutralize/Dry at Rocky Flats (Alternative 4) | Vitrify at Rocky Flats (Alternative 2) | Neutralize/Dry at Rocky Flats (Alternative 4) | Neutralize/Dry at Rocky Flats (Alternative 4) | Neutralize/Dry at Rocky Flats (Alternative 4) | MEO at Rocky Flats (Alternative 3) | Neutralize/Dry at Rocky Flats (Alternative 4) |
| Graphite Residues | Repackage at Rocky Flats (Alternative 1) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Preprocess at Rocky Flats and MEO at SRS (Alternative 3) | Repackage at Rocky Flats (Alternative 4) |
| Inorganic Residues | Repackage at Rocky Flats (Alternative 1) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Repackage at Rocky Flats (Alternative 4) | Preprocess at Rocky Flats and MEO at SRS (Alternative 3) | Repackage at Rocky Flats (Alternative 4) |
| Scrub Alloy | Repackage at Rocky Flats (Alternative 1) | Preprocess at Rocky Flats and Purex at SRS (Alternative 3) | Preprocess at Rocky Flats and Purex at SRS (Alternative 3) | Preprocess at Rocky Flats and Purex at SRS (Alternative 3) | Calcine and Vitrify at Rocky Flats (Alternative 2)[e] | Preprocess at Rocky Flats and Purex at SRS (Alternative 3) | Preprocess at Rocky Flats and Purex at SRS (Alternative 3) | Calcine/ Vitrify at Rocky Flats (Alternative 2)[f] |

[a] *Minimum time to process residues and scrub alloy at Rocky Flats for shipment to Savannah River Site, Los Alamos National Laboratory, or WIPP.*
[b] *Repackaging for some of the materials would result in fewer actions at Rocky Flats than would processing at SRS or LANL. This is the result of necessary preprocessing operations that would have to be performed at Rocky Flats prior to transport to SRS or LANL.*
[c] *No process with plutonium separation is available.*
[d] *There are two preferred processing technologies for the high plutonium concentration DOR salts. The rationale for having two preferred processing technologies is given in Section 2.5 of this Summary.*
[e] *Calcination/vitrification is the only processing technology for scrub alloy analyzed at Rocky Flats.*
[f] *Calcination/vitrification is the only processing technology without plutonium separation analyzed for scrub alloy.*

*HEPA = High-efficiency particulate air*
*IDC = Item description code (for residue designation)*
*LANL = Los Alamos National Laboratory*
*MEO = Mediated electrochemical oxidation*
*SRS = Savannah River Site*

### 4.2.2.1 COMPARISON OF THE STRATEGIC MANAGEMENT APPROACHES

The primary impacts of the eight management approaches are presented in Table S-8. These impacts have been derived by summing the impacts for each material category.

Table S-8. Comparison of Certain Impacts of the Strategic Management Approaches

| | MANAGEMENT APPROACHES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Impact* | No Action | *Preferred Alternative* | *Minimize Total Process Duration at Rocky Flats* | *Minimize Cost* | *Conduct all Processes at Rocky Flats* | *Conduct Fewest Actions at Rocky Flats* | *Process with Maximum Plutonium Separation* | *Process without Plutonium Separation* |
| Products and Wastes | | | | | | | | |
| Stabilized Residues (drums)[a] | 20,300 | **18,400** | 8,900 | 7,800 | 19,200 | 17,600 | 700 | 19,200 |
| Transuranic Waste (drums)[b] | 3,500 | **3,200** | 6,600 | 3,400 | 5,600 | 3,200 | 9,300 | 9,200 |
| High-Level Waste (canisters) | 0 | **5** | 2 | 1 | 0 | 5 | 42 | 0 |
| Separated Plutonium (kg)[c] | 0 | **607** | 1,082 | 1,279 | 141 | 607 | 2,709 | 0 |
| Low-Level Waste (drums) | 7,500 | **6,400** | 10,400 | 4,900 | 5,500 | 6,400 | 19,900 | 4,800 |
| Public and Occupational Health and Safety | | | | | | | | |
| Incident-Free Radiological Risk to the Public Maximally Exposed Individual (Probability of a Latent Cancer Fatality) | $2.4 \times 10^{-10}$ | $\mathbf{5.5 \times 10^{-6}}$ | $5.5 \times 10^{-6}$ | $5.5 \times 10^{-6}$ | $1.2 \times 10^{-10}$ | $5.5 \times 10^{-6}$ | $5.5 \times 10^{-6}$ | $9.4 \times 10^{-11}$ |
| Incident-Free Radiological Risk to the Public Population (Latent Cancer Fatalities) | $6.0 \times 10^{-6}$ | **0.0020** | 0.0016 | 0.00083 | $4.0 \times 10^{-6}$ | 0.0020 | 0.0079 | $3.5 \times 10^{-6}$ |
| Incident-Free Radiological Risk to the Maximally Exposed Individual Involved Worker (Probability of a Latent Cancer Fatality per Year) | 0.00080 | **0.00080** | 0.00080 | 0.00080 | 0.00080 | 0.00080 | 0.00080 | 0.00080 |
| Incident-Free Radiological Risk to the Involved Worker Population (Latent Cancer Fatalities) | 0.48 | **0.27** | 0.25 | 0.24 | 0.28 | 0.27 | 0.34 | 0.40 |
| Incident-Free Chemical Risk to an Individual Member of the Public (Probability of a Latent Cancer) | $6 \times 10^{-11}$ | $\mathbf{6 \times 10^{-11}}$ | 0 | 0 | $6 \times 10^{-11}$ | $6 \times 10^{-11}$ | 0 | $6 \times 10^{-11}$ |
| Incident-Free Hazard Index (Individual Member of the Public) | 0 | $\mathbf{5 \times 10^{-9}}$ | $4 \times 10^{-9}$ | $3 \times 10^{-9}$ | 0 | $5 \times 10^{-9}$ | $1 \times 10^{-8}$ | 0 |
| Incident-Free Chemical Risk to the Public Population (Number of Cancers) | <1 | **<1** | <1 | <1 | <1 | <1 | <1 | <1 |

Continued on next page.

Table S-8 (continued). Comparison of Certain Impacts of the Strategic Management Approaches

| | MANAGEMENT APPROACHES | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Impact* | *No Action* | *Preferred Alternative* | *Minimize Total Process Duration at Rocky Flats* | *Minimize Cost* | *Conduct all Processes at Rocky Flats* | *Conduct Fewest Actions at Rocky Flats* | *Process with Maximum Plutonium Separation* | *Process without Plutonium Separation* |
| Other Impacts | | | | | | | | |
| Incident-Free Chemical Risk to an Individual Noninvolved Worker (Probability of a Latent Cancer) | $3 \times 10^{-9}$ | **$3 \times 10^{-9}$** | 0 | 0 | $3 \times 10^{-9}$ | $3 \times 10^{-9}$ | 0 | $3 \times 10^{-9}$ |
| Incident-Free Hazard Index (Individual Worker) | 0 | **$6 \times 10^{-8}$** | $5 \times 10^{-8}$ | $4 \times 10^{-8}$ | 0 | $6 \times 10^{-8}$ | $1 \times 10^{-7}$ | 0 |
| Incident-Free Chemical Risk to the Noninvolved Worker Population (Number of Cancers) | <1 | **<1** | <1 | <1 | <1 | <1 | <1 | <1 |
| Accident Risk to the Public Maximally Exposed Individual (Probability of a Latent Cancer Fatality) | 0.000035 | **0.000038** | 0.000032 | 0.000035 | 0.000036 | 0.000038 | 0.000046 | 0.000036 |
| Accident Risk to the Public Population (Latent Cancer or Traffic Fatalities) | 0.62 | **0.64** | 0.53 | 0.62 | 0.64 | 0.64 | 0.67 | 0.65 |
| Accident Risk to the Onsite Noninvolved Worker (Probability of a Latent Cancer Fatality) | 0.00061 | **0.00070** | 0.00062 | 0.00065 | 0.00067 | 0.00070 | 0.00085 | 0.00067 |
| Intersite Round-Trip Transportation (1,000 km)[d] | 0 | **208** | 166 | 84 | 0 | 208 | 823 | 0 |
| Cost (millions $)[e,f] | 1,129[g,h] | **524**[i] | 482[i] | 428[i] | 510[h] | 668[h] | 814[j] | 539[i] |
| Processing Duration at Rocky Flats (years)[k] | 7.2 | **5.5**[l,m] | 2.6[l,n] | 3.2[l] | 5.1 | 2.8[l,o] | 3.4[l,n] | 10.2 |
| Proliferation Risk | See Note p | **See Note q** | See Note q | See Note q | See Note q | See Note q | See Note q | See Note q |
| Air Quality Impacts[r] | No exceedances of air quality standards | **No exceedances of air quality standards** | No exceedances of air quality standards | No exceedances of air quality standards | No exceedances of air quality standards | No exceedances of air quality standards | No exceedances of air quality standards | No exceedances of air quality standards |

*Note: kg = kilograms; km = kilometers*

[a] *All the stabilized residues, except those generated under the No Action Alternative, are transuranic wastes that would go to WIPP.*

[b] *Includes secondary waste generated during the processing of residues and scrub alloy such as contaminated gloves and equipment.*

[c] *To convert to pounds, multiply by 2.205.*

[d] *To convert thousands of kilometers to thousands of miles, multiply by 0.62.*

[e] *Decisional costs for labor, site overheads, itemized equipment, residue and waste processing, waste shipment and disposal, and fissile materials disposition, plus non-decisional costs for facilities upgrades, equipment, operational readiness reviews, start-up testing, and technology and development work. Excludes adjustments for technical or schedule uncertainties.*

[f] *Undiscounted 1997 dollars.*

[g] *Includes $460 million for 20 years of interim storage at Rocky Flats.*

[h] *Includes $220 million for facilities upgrades, equipment, operational readiness reviews, start-up testing, and technology and development work that is allocable to the clean-up of plutonium residues at Rocky Flats.*

[i] *Includes $190 million for facilities upgrades, equipment, operational readiness reviews, start-up testing, and technology and development work that is allocable to the clean-up of plutonium residues at Rocky Flats.*

[j] *Includes $250 million for facilities upgrades, equipment, operational readiness reviews, start-up testing, and technology and development work that is allocable to the clean-up of plutonium residues at Rocky Flats.*

[k] *Sum of durations for processing options with the shortest individual processing time at Rocky Flats. All processes at different buildings or modules at Rocky Flats are conducted concurrently. The sum of the shortest individual processing times does not necessarily equal the shortest processing time at the site since longer duration processing options at one facility may shorten the total duration at the site. Processing duration does not reflect technical or schedule uncertainties, deferred start-up due to technology demonstration and testing, or schedule interactions among processing options, facilities, or sites.*

[l] *Includes processing at the Savannah River Site F-Canyon. Processing durations at the Savannah River Site depend on schedules for materials in programs outside the scope of this EIS.*

[m] *Processing duration at Los Alamos National Laboratory is about four months.*

[n] *Processing duration at Los Alamos National Laboratory is about six months.*

[o] *Processing duration at Los Alamos National Laboratory depends on the type of new salt distillation equipment and the timing of its installation. The duration therefore depends on schedules for materials in programs outside the scope of this EIS.*

[p] *The plutonium residues and scrub alloy would be left in a form that cannot be disposed of due to proliferation concerns.*

[q] *The plutonium residues and scrub alloy would be managed and placed in a form that can be disposed of in a manner that supports United States nuclear weapons nonproliferation policy.*

[r] *All concentrations of pollutants in air are below Federal and State air quality standards. See Sections 4.12 and 4.25 of the EIS for additional information.*

### 4.2.2.1.1 PRODUCTS AND WASTES

The amounts of primary solid plutonium-bearing products and wastes that would be generated under the Strategic Management Approaches are compared in Figures S-18, S-19, S-20, S-21, and S-22.

For each Strategic Management Approach, except for No Action, the quantity of waste that could be sent to WIPP for disposal as transuranic waste is the sum of the quantities of drums shown in Figures S-18 and S-19. Under the Preferred Alternative, DOE would generate about 21,600 drums of processed residues and secondary waste that would be sent to WIPP for disposal. Under the No Action alternative, no processed residues would be disposed of.

The processed residues and secondary transuranic wastes that would be generated under the alternatives in this EIS are broken down into the two groupings shown in Figures S-18 and S-19 to distinguish between processed materials that would be below the safeguards termination limits and could thus be sent to WIPP, and those materials that would be above the safeguards termination limits and could only be sent to WIPP under a variance to safeguards termination limits:

- The term "Stabilized Residues," as used in the title of Figure S-18, is used to refer to processed materials that would still be above the safeguards termination limits even after processing under the action alternatives. The "stabilized residues" produced under the No Action alternative would be stored onsite and would not be sent to WIPP for disposal because their plutonium content would exceed the safeguards termination limits. The other "stabilized residues" that could be produced under this EIS would result from Alternative 4 and would be subject to a variance. As a result, they could be disposed of in WIPP.
- The term "Transuranic Waste," as used in the title of Figure S-19, is used to refer to those materials that would be below the safeguards termination limits after processing under the alternatives of this EIS. It includes both the processed residues and secondary transuranic waste that would be produced during the processing operation.

To reiterate, for the action alternatives of this EIS, the quantities in Figures S-18 and S-19 must be summed to determine the amount of transuranic waste that could be sent to WIPP.

Figure S-20 shows the amounts of plutonium that could be separated from the plutonium residues and scrub alloy. Two of the management approaches (No Action and Process without Plutonium Separation) do not involve any plutonium separation. Under the Preferred Alternative, DOE would separate roughly one-quarter of the plutonium that could be separated under the Maximum Plutonium Separation Management Approach. If any plutonium is separated, it would be placed in safe, secure storage until DOE makes decisions on its disposal or other disposition. DOE would not use this plutonium for nuclear explosive purposes.

The amounts of material to be managed as high-level waste and of low-level radioactive wastes that would be generated under each management approach are shown in Figures S-21 and S-22. The Process with Maximum Plutonium Separation Management Approach would generate the most material to be managed as high-level waste and also the most low-level waste. The Preferred Alternative would generate significantly smaller quantities of these wastes than this approach.

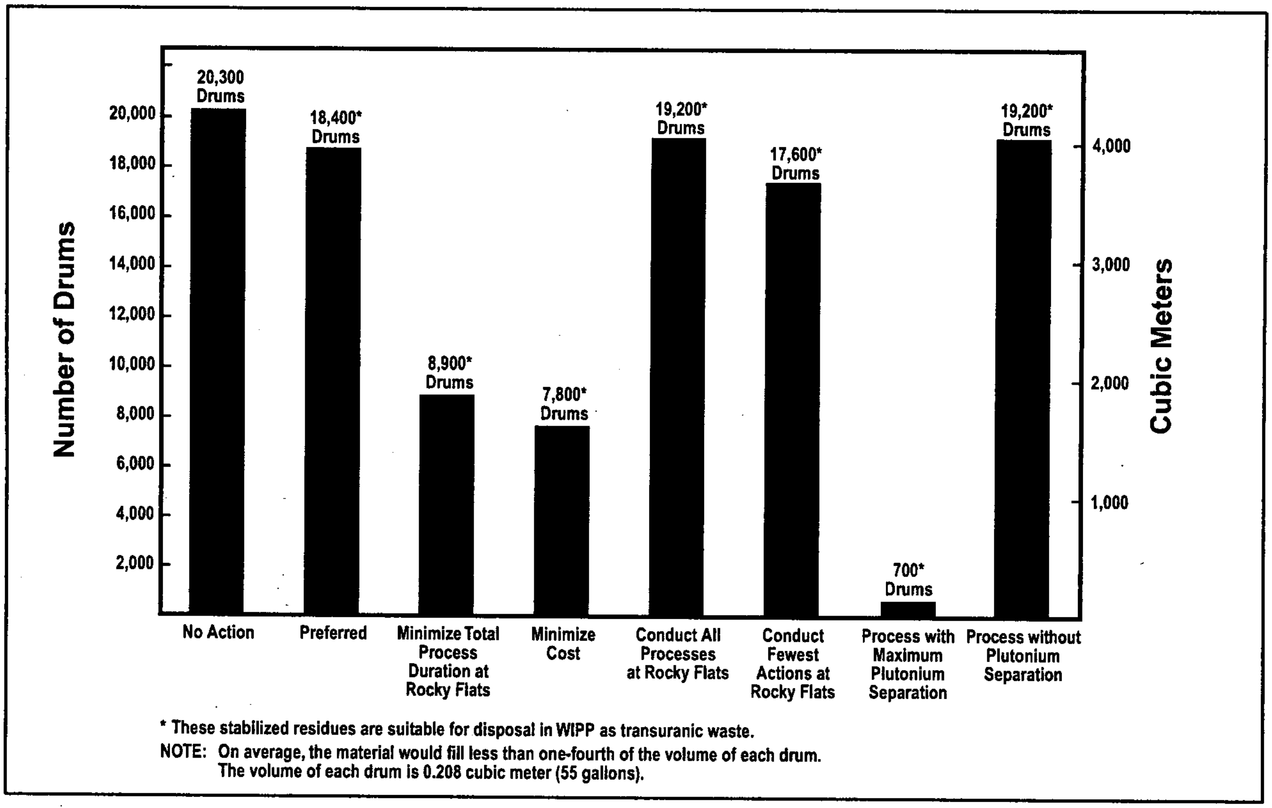



Figure S-18. Stabilized Residues Generated Under Each Management Approach

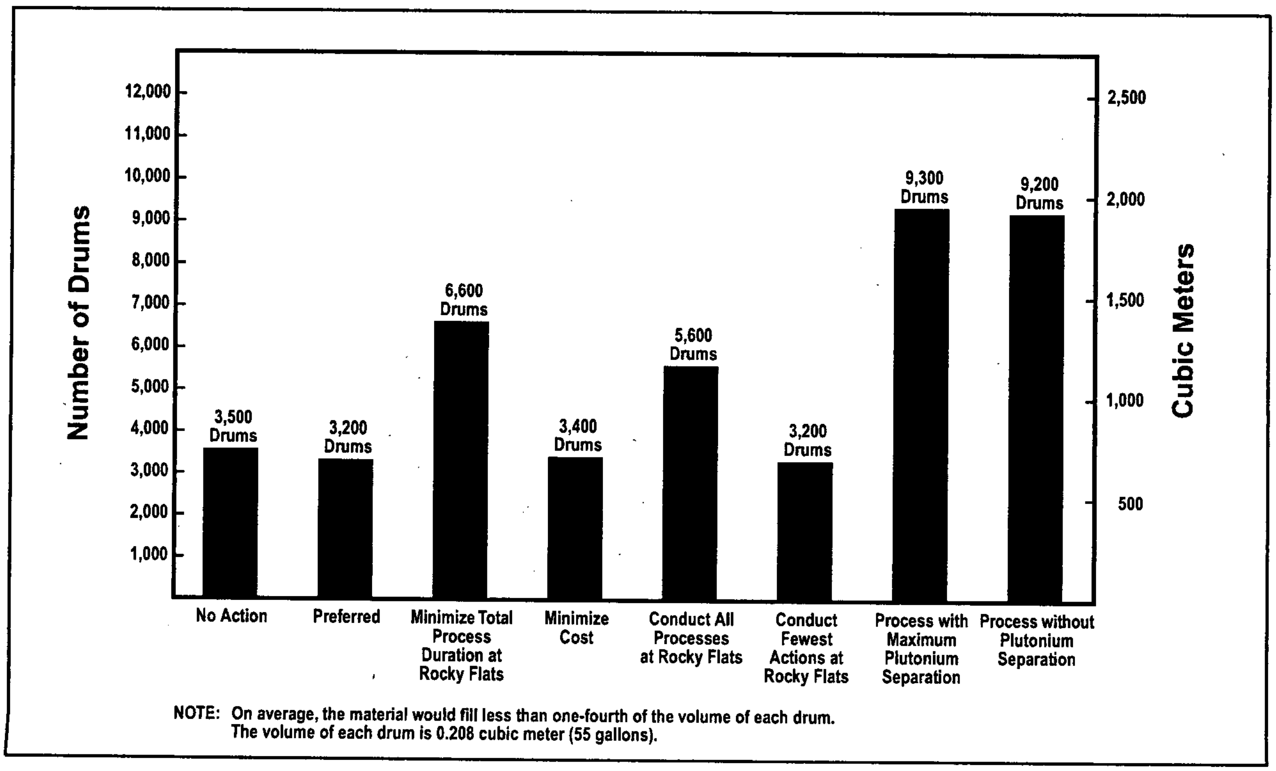



Figure S-19. Transuranic Waste Generated Under Each Management Approach

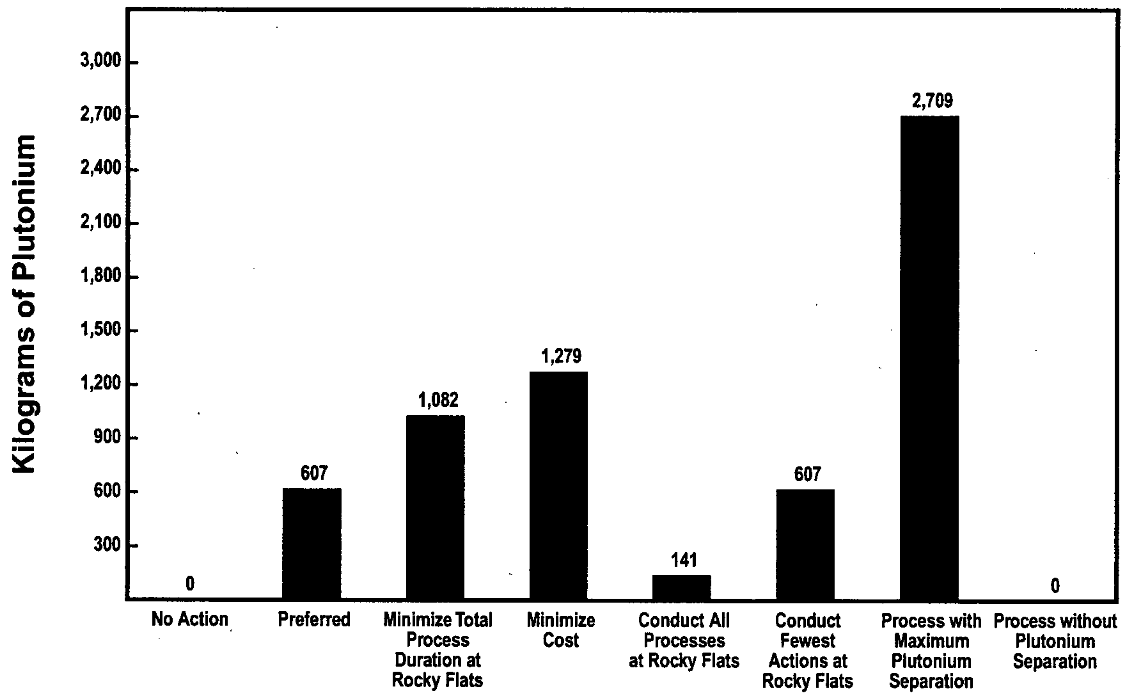
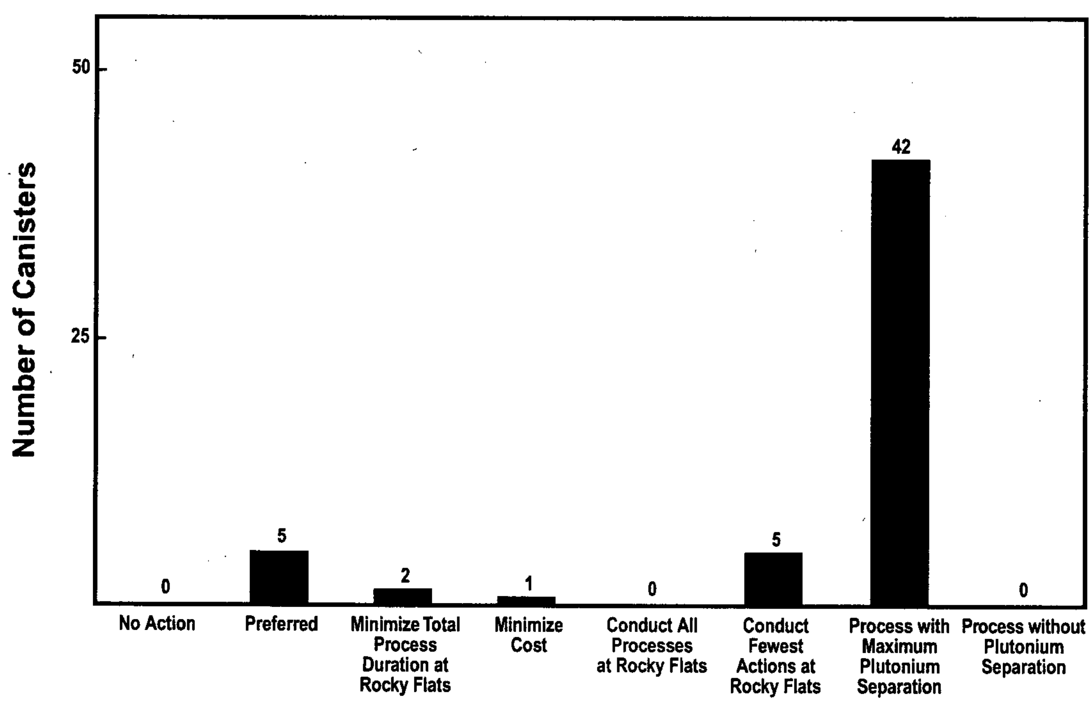



Figure S-20. Plutonium Separated Under Each Management Approach




**NOTE:** *One canister contains approximately 1,680 kilograms (3,700 pounds) of high-level waste glass*

Figure S-21. Material Managed as High-Level Radioactive Waste That is Generated Under Each Management Approach

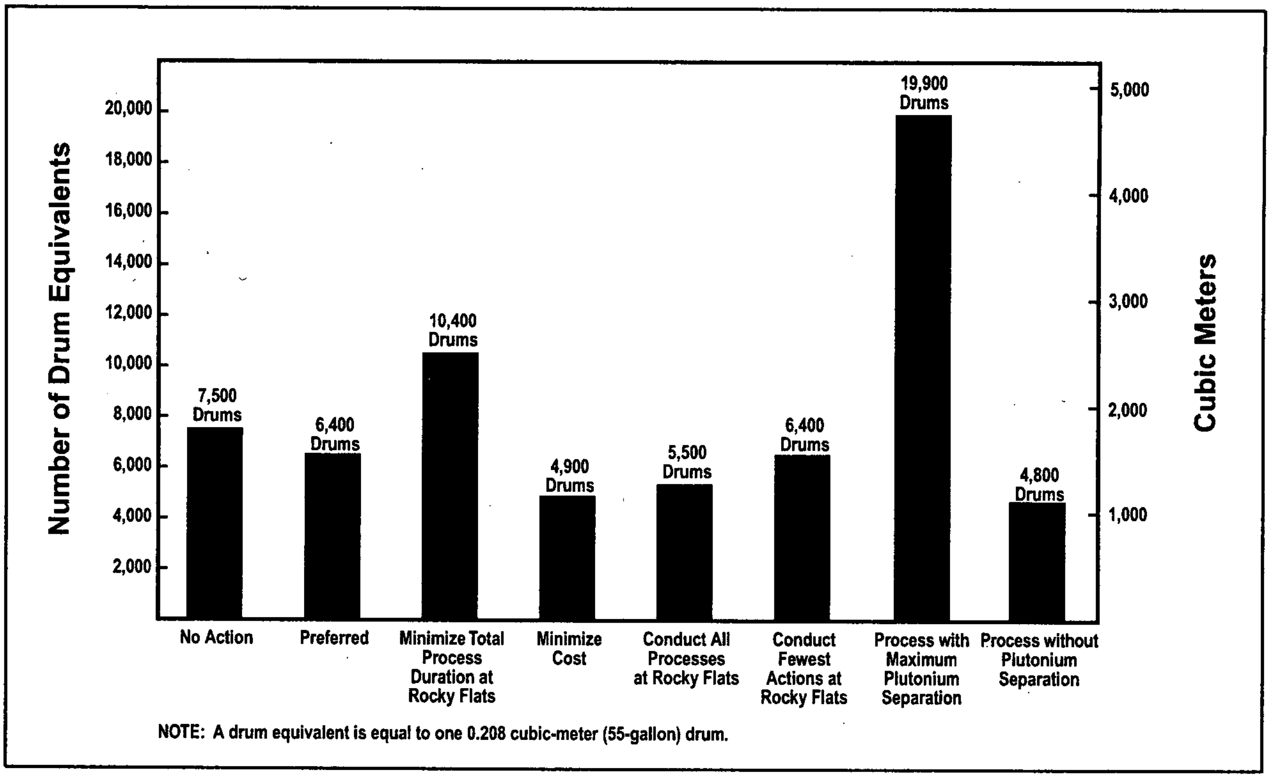



Figure S-22. Low-Level Radioactive Waste Generated Under Each Management Approach

## 4.2.2.1.2 PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY IMPACTS

All of the management approaches present low risks to the public and to workers. DOE estimates less than one additional latent cancer incidence in the general public as a result of exposure to radiation or hazardous chemicals, no matter which management approach is selected. Nevertheless, differences exist between the risks presented by the eight management approaches. Figures S-23 through S-27 display the risk comparisons for the public and workers under both incident-free and accident conditions.

The management approaches with intersite transportation would involve greater radiological risk to the public maximally exposed individual than the management approaches without intersite transportation because of the additional transportation involved. For the management approaches with intersite transportation (all approaches except No Action, Conduct All Processes at Rocky Flats, and Process Without Plutonium Separation), a conservative upper-bound estimate of the chance that this hypothetical individual would incur a latent cancer fatality would be about $5.5 \times 10^{-6}$, or less than one chance in 100,000. As shown in Figure S-23, the Maximum Plutonium Separation management approach presents a radiological risk of 0.0079 additional cancer fatalities among the public population, while the Preferred Alternative presents a risk of 0.0020 additional latent cancer fatalities. In all cases the estimated risks are low; no member of the public would be likely to incur a latent cancer fatality due to incident-free operations.

All the management approaches are equal in terms of the radiological risk to the maximally exposed individual worker (0.0008 cancer fatality per year). This is because DOE applied the same conservative assumption across the board for this part of the analysis — that the maximally exposed individual worker would be limited to DOE's Administrative Control Level of 2000 mrem per year. As shown in Figure S-24, all of the management approaches would cause less than 0.5 additional latent cancer fatalities among the worker population from exposure to radiation. DOE would not expect any additional latent cancer fatalities among workers under any of these approaches.

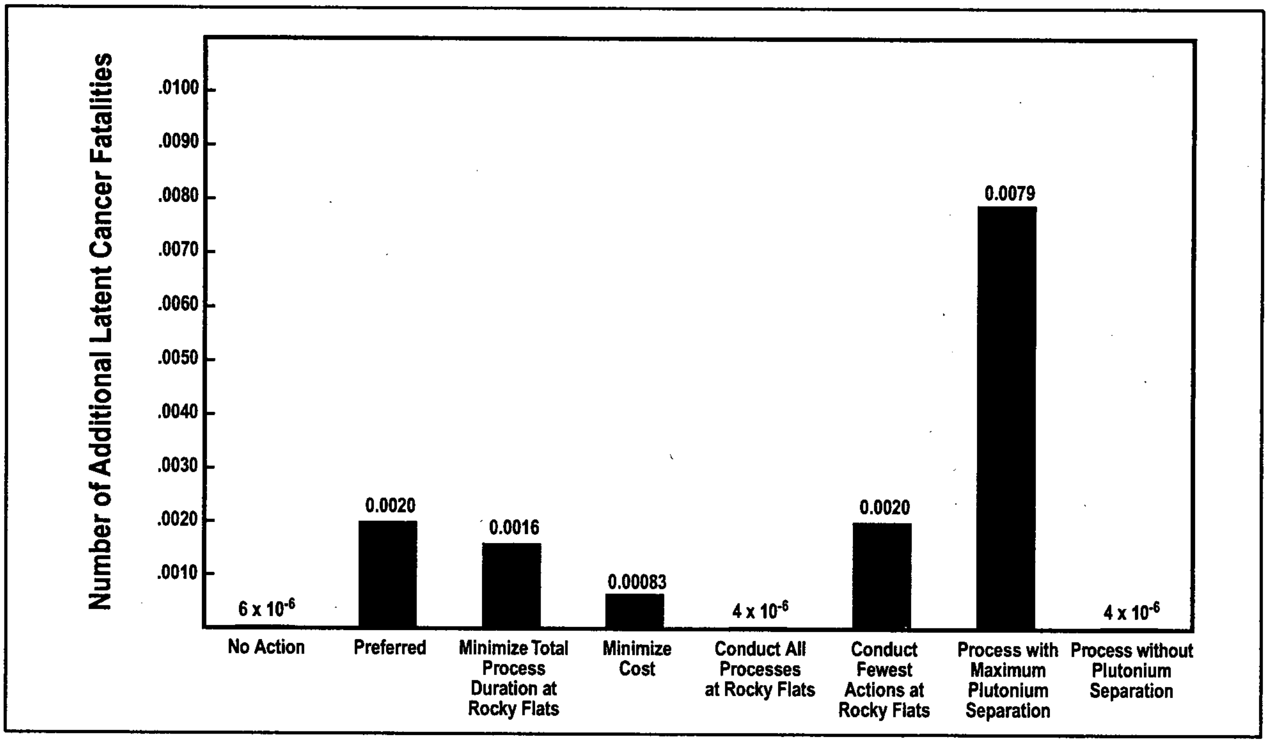



Figure S-23. Incident-Free Radiological Risk to the Public Population Under Each Management Approach

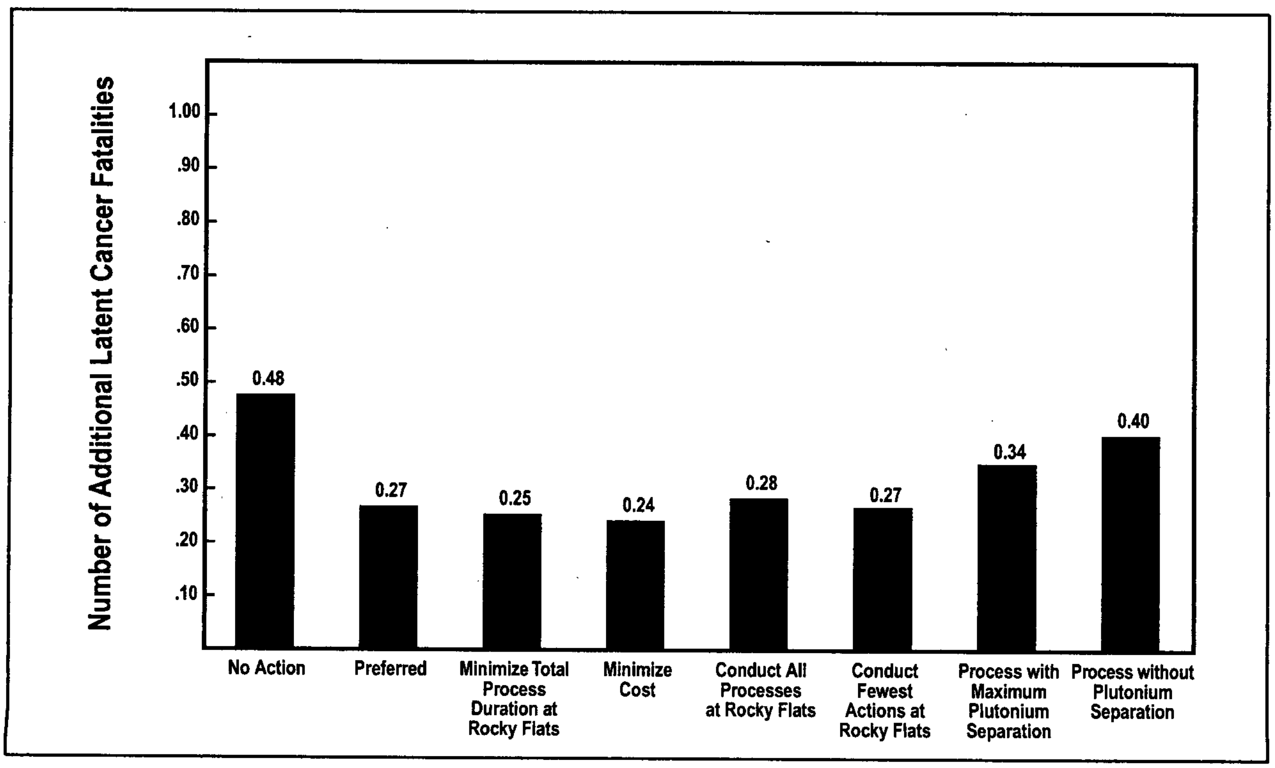



Figure S-24. Incident-Free Radiological Risk to the Involved Worker Population Under Each Management Approach

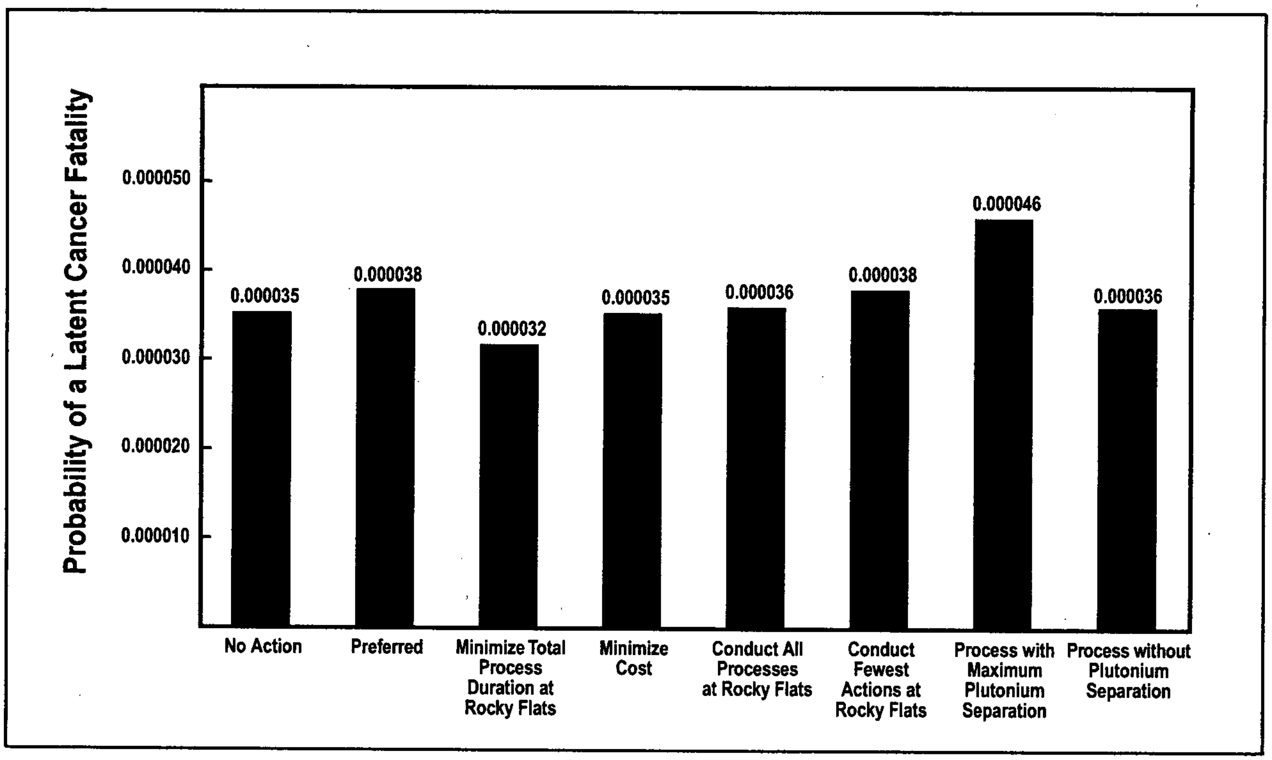



Figure S-25. Accident Risk to the Public Maximally Exposed Individual Under Each Management Approach

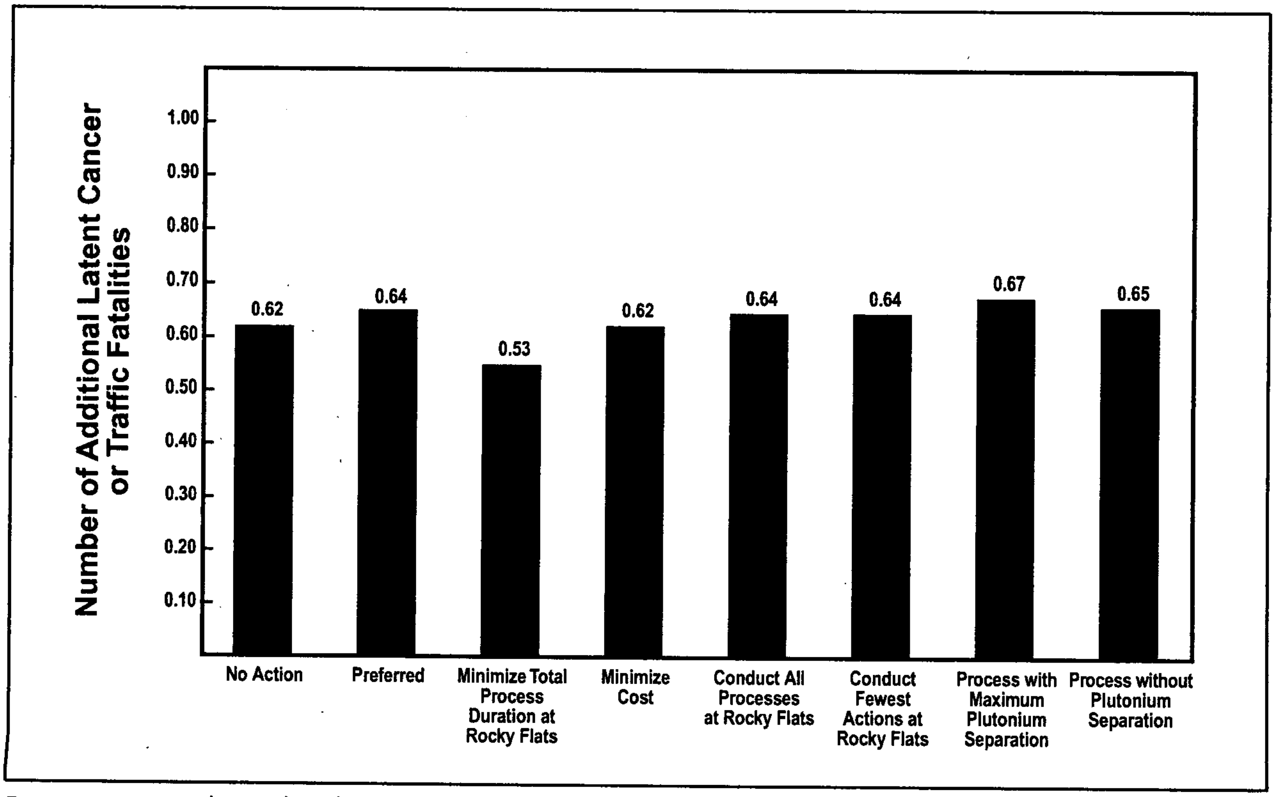



Figure S-26. Accident Risk to the Public Population Under Each Management Approach

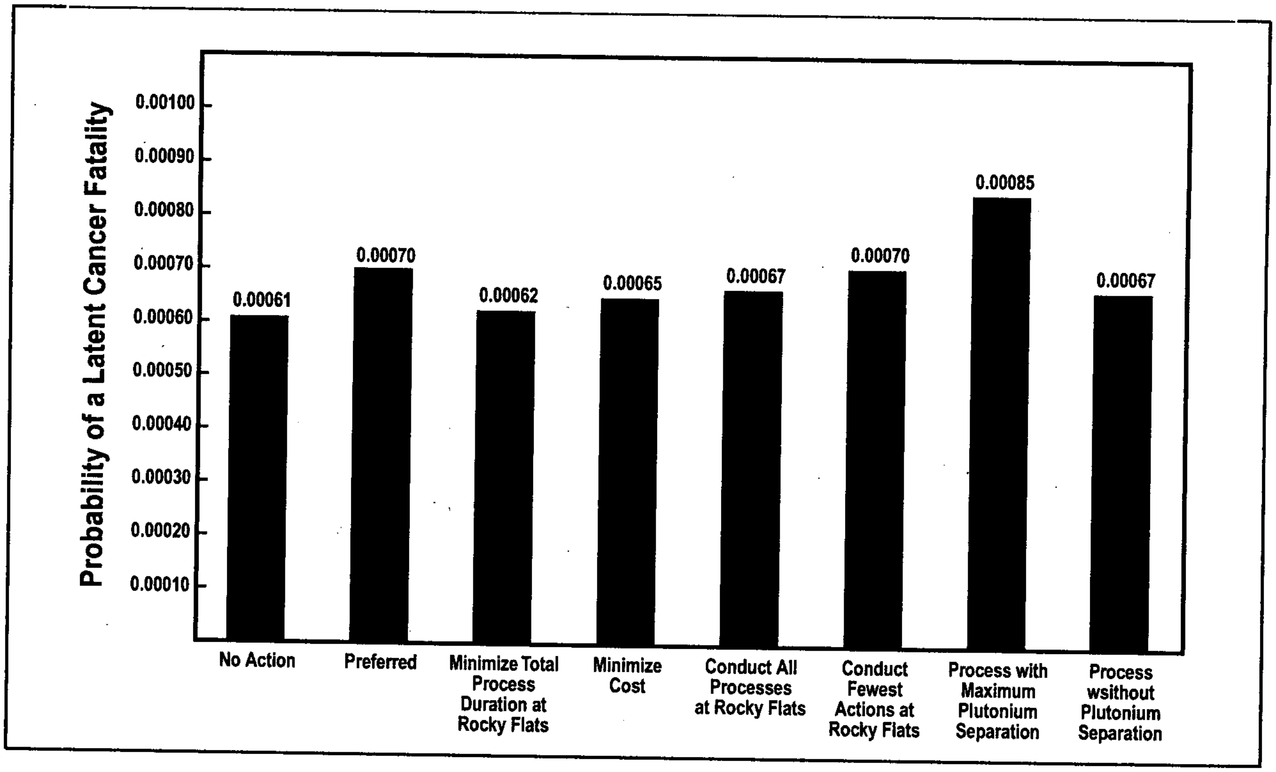



Figure S-27. Accident Risk to the Onsite Noninvolved Worker Under Each Management Approach

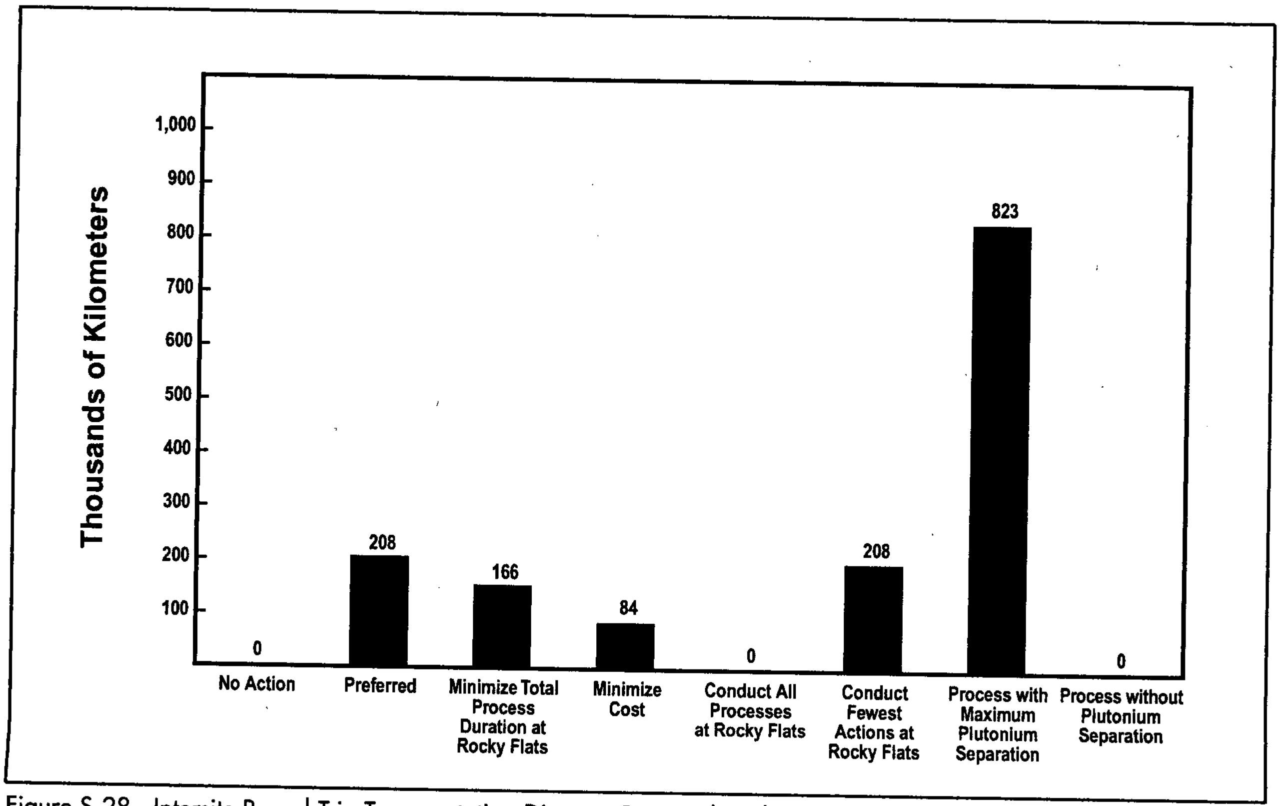



Figure S-28. Intersite Round-Trip Transportation Distance Required Under Each Management Approach

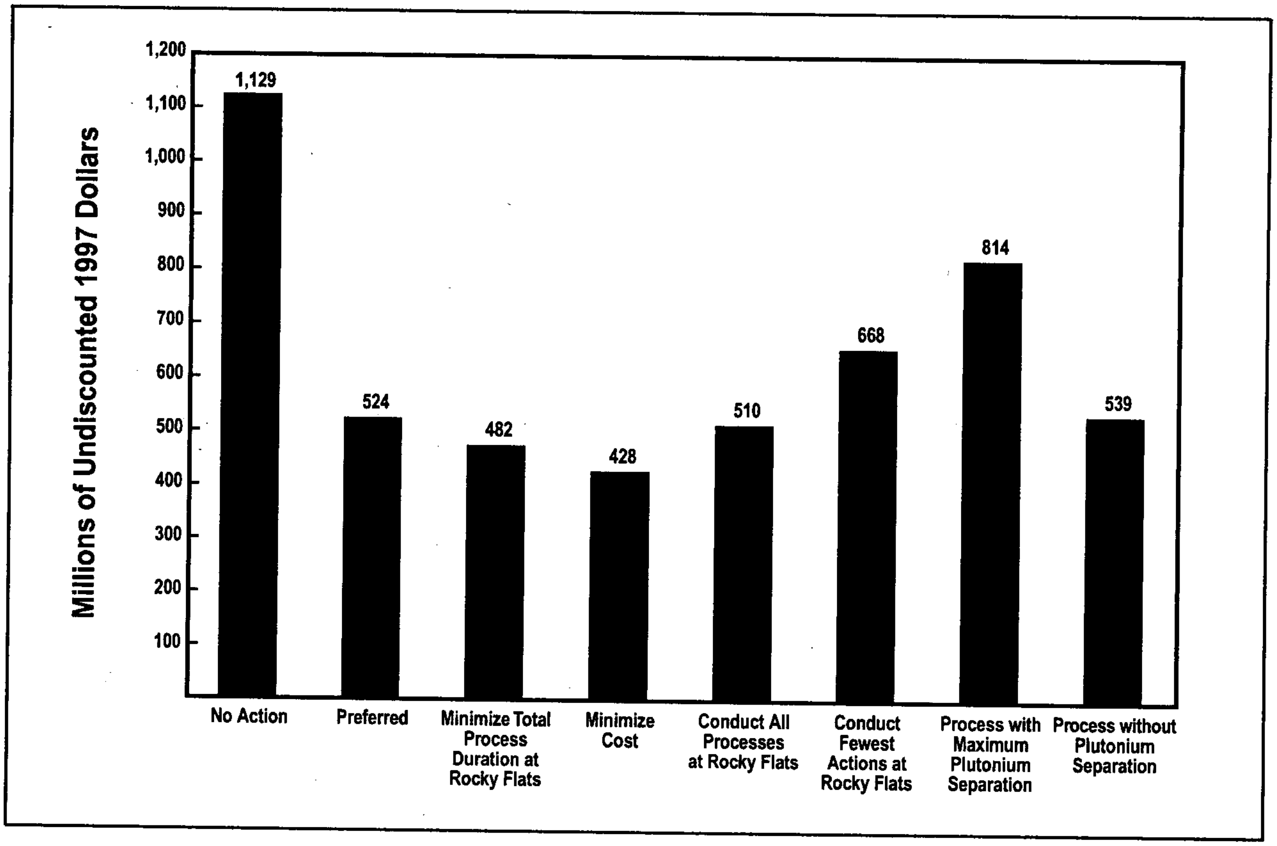



Figure S-29. Cost of Each Management Approach

All of the management approaches also present low risks to the public and to workers from exposure to hazardous chemicals. The probability of an excess latent cancer incidence for the member of the public and the worker expected to receive the highest exposure is less than 1 in one hundred million (0 to $3x10^{-9}$). Noncancer adverse health effects for the public and workers are also not expected since the Hazard Index values for all of the management approaches are much less than one, ranging from 0 to $1x10^{-7}$. The number of latent cancers resulting from exposure to facility emissions and transportation vehicle exhaust is estimated to be much less than one in the public and worker population for all management approaches.

As shown in Figures S-25, S-26, and S-27, the risks due to onsite and transportation accidents do not vary greatly among any of the management approaches. In general, the Minimize Total Process Duration at Rocky Flats approach, the Minimize Cost Management Approach, and the No Action Alternative present somewhat lower accident risks than the rest of the management approaches, but all the accident risks are very low.

#### 4.2.2.1.3 OTHER IMPACTS

Five of the management approaches involve intersite transportation of plutonium residues and/or scrub alloy. Figure S-28 compares the total intersite transportation distances that would be required under each management approach. The Process with Maximum Plutonium Separation Management Approach would require about 823,000 km (511,000 mi) of intersite transportation, while the Preferred Alternative would require about 208,000 km (129,000 mi).

The cost comparison is presented in Figure S-29. Cost estimates range from $428 million for the Minimize Cost Management Approach to $1,129 million for the No Action Alternative. The Preferred Alternative has an estimated cost of $524 million.

### 4.2.3 RANGE OF RADIOLOGICAL AND CHEMICAL IMPACTS AT EACH SITE

All the residues could be processed at Rocky Flats, and portions of the residues could be processed at the Savannah River Site or Los Alamos National Laboratory. This section presents the range of radiological and chemical impacts which could result from the processing technologies at Rocky Flats, the Savannah River Site, and Los Alamos National Laboratory.

#### 4.2.3.1 ROCKY FLATS

- ***Incident-Free Radiological Impacts*** — The range of radiological impacts to the public and the workers associated with incident-free implementation of various processing technologies at Rocky Flats is presented in Table S-9.

Table S-9. Range of Radiological Impacts Due to Incident-Free Operations at Rocky Flats

| Offsite Public Maximally Exposed Individual | | Offsite Public Population | |
|---|---|---|---|
| *Dose (mrem)* | *Probability of a Latent Cancer Fatality* | *Dose (person-rem)* | *Number of Latent Cancer Fatalities* |
| 0.00012 to 0.00105 | $6.0 \times 10^{-11}$ to $5.3 \times 10^{-10}$ | 0.0046 to 0.024 | $2.3 \times 10^{-6}$ to 0.000012 |
| **Maximally Exposed Individual Worker** | | **Worker Population** | |
| *Dose (mrem per year)* | *Probability of a Latent Cancer Fatality Per Year* | *Dose (person-rem)* | *Number of Latent Cancer Fatalities* |
| 2,000 | 0.00080 | 425 to 2,040 | 0.17 to 0.82 |

The public maximally exposed individual at Rocky Flats would be a hypothetical individual who lives downwind at the site boundary. The estimated total dose for this maximally exposed individual could range from 0.00012 mrem to 0.00105 mrem. This individual's chance of incurring a latent cancer fatality due to process operations would be less than one in one billion ($6.0 \times 10^{-11}$ to $5.3 \times 10^{-10}$).

The total public population radiation dose would range from 0.0046 person-rem to 0.024 person-rem. These doses would cause far less than one additional latent cancer fatality among the people living near the Rocky Flats site ($2.3 \times 10^{-6}$ to 0.000012). During incident-free storage, there would be no release of radioactive material, so the impact on the public would be equal to zero.

The maximally exposed individual worker dose assumes that an individual worker receives a dose below the DOE Administrative Control Level of 2,000 mrem per year to reflect DOE's commitment to maintain doses as low as reasonably achievable.

The total worker population radiation dose would be from 425 person-rem to 2,040 person-rem, which would cause 0.17 to 0.82 additional latent cancer fatalities among the workers directly involved in the operations. Onsite workers who are not involved with the actual processing of the residues are designated as noninvolved workers. The impacts to these workers would be much smaller than the impacts to the involved workers. During the post-processing storage period, inspections of the storage facility would expose the worker population to very small incremental additions.

- ***Incident-Free Hazardous Chemical Impacts*** — The range of impacts of hazardous chemical releases (e.g., carbon tetrachloride and hydrochloric acid) associated with incident-free implementation of the various processing technologies at Rocky Flats is presented in Table S-10. The probability of excess latent cancer incidence for the offsite population maximally exposed individual resulting from release ranges from 0 to $6 \times 10^{-11}$. From zero to less than one latent cancer incidence is expected to occur in the offsite population of 2.4 million individuals living within an 80-kilometer radius of Rocky Flats. The Hazard Index Value is much less than 1, indicating that noncancer adverse health effects would not be expected in the offsite population.

Table S-10. Range of Chemical Impacts Due to Incident-Free Operations at Rocky Flats

| **Offsite Public Maximally Exposed Individual** | | **Offsite Public Population** |
|---|---|---|
| *Probability of a Cancer Incidence* | *Hazard Index* | *Number of Cancer Incidences* |
| 0 to $6 \times 10^{-11}$ | 0 to $5 \times 10^{-11}$ | 0 to <1 |
| **Maximally Exposed Individual Worker** | | **Worker Population** |
| *Probability of a Cancer Incidence* | *Hazard Index* | *Number of Cancer Incidences* |
| 0 to $3 \times 10^{-9}$ | 0 to $3 \times 10^{-9}$ | 0 to <1 |

The maximally exposed individual worker probability of excess latent cancer incidence ranges from 0 to $3 \times 10^{-9}$. If all site workers were exposed to the maximally exposed individual concentration of carbon tetrachloride, which is an extremely conservative and unrealistic assumption, less than 1 excess latent cancer would be expected to occur in the workforce population. The Hazard Index value is much less than 1, which suggests that noncancer adverse health effects are not expected in the worker population.

- ***Radiological Impacts Due to Accidents*** — The range of radiological impacts to the public and the workers due to accidents during the implementation of the various processing technologies for plutonium residues and scrub alloy at Rocky Flats is presented in Table S-11.

Table S-11. Range of Radiological Impacts[a] Due to Accidents at Rocky Flats

| **Offsite Public Maximally Exposed Individual Risk** | **Offsite Public Population Risk** | **Noninvolved Onsite Worker Maximally Exposed Individual Risk** |
|---|---|---|
| *Probability of a Latent Cancer Fatality* | *Number of Latent Cancer Fatalities* | *Probability of a Latent Cancer Fatality* |
| $2.7 \times 10^{-6}$ to 0.000042 | 0.031 to 0.66 | 0.000027 to 0.00067[b] |

[a] *The impacts are given as risks, which are additive, rather than consequences, which are not additive for accidents.*

[b] *If an earthquake strong enough to collapse Building 707 and damage Building 371 occurs, 200 involved workers would be at risk of death or injury.*

The public maximally exposed individual at Rocky Flats would be a hypothetical individual who lives downwind at the site boundary. The public population is defined as the residential population within a radius of 80 km (50 mi). An onsite worker is defined as an individual worker who is located 100 m (328 ft) or more downwind from the release point when an accidental release of radioactive material occurs. (This is the same for all three sites evaluated.)

The estimated risk of a latent cancer fatality for the maximally exposed individual at Rocky Flats could range from $2.7 \times 10^{-6}$ to 0.000042. This individual's chance of incurring a latent cancer fatality due to an accident during process operations would be increased by less than 1 in 10,000. The estimated risk of latent cancer fatalities for the general population would be in the range of 0.031 to 0.66. The fatal cancer risk to the onsite worker is in the range of 0.000027 to 0.00067. This onsite worker's chance of incurring a latent cancer fatality due to an accident during process operations would be increased by less than 1 in 1,000.

In any accident scenario, the individuals most likely to be injured are the involved workers. The risk to these workers would be due to both radiological and nonradiological effects. In a fire, the involved workers could be exposed to airborne radioactive material, in addition to the smoke and heat of the fire. In an explosion, there could be flying debris and containment barriers could be broken, exposing workers to airborne radioactive material. Most spills would not have a major effect on involved workers because they would clean up the spill wearing protective clothing and respirators as necessary. An accidental criticality could expose involved workers to large doses of prompt penetrating radiation, which could cause death in a short period of time. The earthquake and aircraft crash accident scenarios present very severe nonradiological effects to the involved workers. In these scenarios, the workers are likely to be hurt or killed from the collapse of the building or the impact of the aircraft crash before they could be evacuated.

The maximum number of involved workers at risk is estimated to be equal to the number of workers who would be working on plutonium residues or scrub alloy at any one time in each of the processing buildings at each of the three sites. Buildings 707 and 371 at Rocky Flats would each have about 100 involved workers inside, which is more involved workers than any facility at either of the other two sites. Thus, if an earthquake strong enough to collapse Building 707 and damage Building 371 hits Rocky Flats, approximately 200 involved workers would be at risk of death or injury due to activities associated with plutonium residues and scrub alloy. It is estimated that an earthquake strong enough to collapse Building 707 would occur once every 385 years. It is also estimated that an earthquake strong enough to collapse Building 371 would occur once every 10,700 years.

### 4.2.3.2 SAVANNAH RIVER SITE

- ***Incident-Free Radiological Impacts*** — The range of radiological impacts to the public and the workers associated with incident-free implementation of various processing technologies at the Savannah River Site is presented in Table S-12.

Table S-12. Range of Radiological Impacts Due to Incident-Free Operations at the Savannah River Site

| Offsite Public Maximally Exposed Individual | | Offsite Public Population | |
|---|---|---|---|
| *Dose (mrem)* | *Probability of a Latent Cancer Fatality* | *Dose (person-rem)* | *Number of Latent Cancer Fatalities* |
| 0 to 0.0034 | 0 to $1.7 \times 10^{-9}$ | 0 to 0.38 | 0 to 0.00019 |
| **Maximally Exposed Individual Worker** | | **Worker Population** | |
| *Dose (mrem per year)* | *Probability of a Latent Cancer Fatality Per Year* | *Dose (person-rem)* | *Number of Latent Cancer Fatalities* |
| 0 to 2,000 | 0 to 0.00080 | 0 to 469 | 0 to 0.19 |

*Note: The lower value of each range is zero because it is possible that no processing would take place at the Savannah River Site.*

The public maximally exposed individual at the Savannah River Site would be a hypothetical individual who lives downwind at the site boundary. The estimated total dose for this maximally exposed individual would range from 0 mrem to 0.0034 mrem. This individual's chance of incurring a latent cancer fatality due to process operations would be less than one in one-hundred million (0 to $1.7 \times 10^{-9}$).

The total public population radiation dose would range from 0 person-rem to 0.38 person-rem. The dose is estimated to result in less than one additional latent cancer fatality among the people living near the Savannah River Site (0 to 0.00019). During incident-free storage, there would be no release of radioactive material, so the impact on the public would be equal to zero.

The maximally exposed individual worker dose range assumes that an individual worker receives a dose below the DOE Administrative Control Level of 2,000 mrem per year to reflect DOE's commitment to maintain doses as low as reasonably achievable.

The total worker population radiation dose would range from 0 person-rem to 469 person-rem, which would cause 0 to 0.19 additional latent cancer fatalities among the workers directly involved in the operations. Onsite workers who are not involved with the actual processing of the residues are designated as noninvolved workers. The impacts to these workers would be much smaller than the impacts to the involved workers. During the post-processing storage period, inspections of the storage facility would expose the worker population to small incremental additions.

- ***Incident-Free Hazardous Chemical Impacts*** — The range of impacts of hazardous chemical releases associated with incident-free implementation of the various processing technologies at the Savannah River Site is presented in Table S-13. No carcinogenic chemicals are expected to be released from the processing of plutonium residues and scrub alloy at the Savannah River Site; therefore, maximally exposed individual cancer probability and population cancer incidences were not evaluated for the offsite population or workers. The Hazard Index value is much less than 1, which suggests that noncancer adverse health effects are not expected for the offsite maximally exposed individual as a result of releases of phosphoric acid and ammonium nitrate. The Hazard Index value for the maximally exposed worker is also much less than 1. Therefore, noncancer adverse health effects are not expected among the worker population.

Table S-13. Range of Chemical Impacts Due to Incident-Free Operations at the Savannah River Site

| **Offsite Public Maximally Exposed Individual** | | **Offsite Public Population** |
|---|---|---|
| *Probability of a Cancer Incidence* | *Hazard Index* | *Number of Cancer Incidences* |
| N/A | 0 to $2 \times 10^{-9}$ | N/A |
| **Maximally Exposed Individual Worker** | | **Worker Population** |
| *Probability of a Cancer Incidence* | *Hazard Index* | *Number of Cancer Incidences* |
| N/A | 0 to $2 \times 10^{-8}$ | N/A |

*N/A = not applicable*

- ***Radiological Impacts Due to Accidents*** — The range of radiological impacts to the public and the workers due to accidents during the implementation of the various processing technologies for the processing of plutonium residues and scrub alloy at the Savannah River Site is presented in Table S-14.

The estimated risk of a latent cancer fatality for the maximally exposed individual could range from 0 to $2.5 \times 10^{-7}$. This individual's chance of incurring a latent cancer fatality due to an accident during processing operations would be increased by less than one in one million. The estimated risk of latent cancer fatalities for the general population could be in the range of 0 to 0.011. The onsite worker risk is in the range of 0 to

0.000078. This onsite worker's chance of incurring a latent cancer fatality due to an accident during processing operations would be increased by less than 1 in 10,000.

Table S-14. Range of Radiological Impacts[a] Due to Accidents at the Savannah River Site

| Offsite Public Maximally Exposed Individual Risk | Offsite Public Population Risk | Noninvolved Onsite Worker Maximally Exposed Individual Risk |
|---|---|---|
| *Probability of a Latent Cancer Fatality* | *Number of Latent Cancer Fatalities* | *Probability of a Latent Cancer Fatality* |
| 0 to $2.5 \times 10^{-7}$ | 0 to 0.011 | 0 to 0.000078[b] |

[a] *The impacts are given as risks, which are additive, rather than consequences, which are not additive for accidents.*

[b] *If an earthquake strong enough to damage H-Canyon and H-B Line occurs, 54 involved workers could be at risk of death or injury.*

Note: *The lower value of each range is zero since it is possible that no processing will take place at the Savannah River Site.*

### 4.2.3.3 LOS ALAMOS NATIONAL LABORATORY

- ***Incident-Free Radiological Impacts*** — The range of radiological impacts to the public and the workers associated with incident-free implementation of various processing technologies at Los Alamos National Laboratory is presented in Table S-15.

Table S-15. Range of Radiological Impacts Due to Incident-Free Operations at Los Alamos National Laboratory

| Offsite Public Maximally Exposed Individual | | Offsite Public Population | |
|---|---|---|---|
| *Dose (mrem)* | *Probability of a Latent Cancer Fatality* | *Dose (person-rem)* | *Number of Latent Cancer Fatalities* |
| 0 to 0.00080 | 0 to $4.0 \times 10^{-10}$ | 0 to 0.0024 | 0 to $1.2 \times 10^{-6}$ |
| **Maximally Exposed Individual Worker** | | **Worker Population** | |
| *Dose (mrem per year)* | *Probability of a Latent Cancer Fatality Per Year* | *Dose (person-rem)* | *Number of Latent Cancer Fatalities* |
| 0 to 2,000 | 0 to 0.00080 | 0 to 160 | 0 to 0.064 |

Note: *The lower value of each range is zero because it is possible that no processing would take place at Los Alamos National Laboratory.*

The public maximally exposed individual at Los Alamos National Laboratory would be a hypothetical individual who lives downwind of anticipated releases. As shown in Table S-15, the estimated total dose for this maximally exposed individual would range from 0 mrem to 0.00080 mrem. This individual's chance of incurring a latent cancer fatality due to processing operations would be less than one in one billion (0 to $4.0\times10^{-10}$).

The total public population radiation dose would range from 0 person-rem to 0.0024 person-rem. The dose is small and would cause far less than one additional latent fatal cancer among the people living near Los Alamos National Laboratory (0 to $1.2\times10^{-6}$). During incident-free storage, there would be no release of radioactive material, so the impact on the public would be equal to zero.

The maximally exposed individual worker dose range assumes that an individual worker receives a dose below the DOE Administrative Control Level of 2,000 mrem per year to reflect DOE's commitment to maintain doses as low as reasonably achievable.

The total worker population radiation dose would range from 0 person-rem to approximately 160 person-rem, which would cause 0 to 0.064 additional latent cancer fatalities among the workers directly involved in the operations. Onsite workers who are not involved with the actual processing of the residues are designated as noninvolved workers. The impacts to these workers would be much smaller than the impacts to the involved workers. During the post-processing storage period, inspections of the storage facility would expose the worker populations to very small incremental additions.

- ***Incident-Free Hazardous Chemical Impacts*** — No hazardous chemicals are expected to be released from the proposed processing of plutonium residues at Los Alamos National Laboratory under the various processing technologies evaluated in this EIS.

- ***Radiological Impacts Due to Accidents*** — The range of radiological impacts to the public and the workers due to accidents during the implementation of the various processing technologies for plutonium residues at Los Alamos National Laboratory is presented in Table S-16.

Table S-16. Range of Radiological Impacts[a] Due to Accidents at Los Alamos National Laboratory

| Offsite Public Maximally Exposed Individual Risk | Offsite Public Population Risk | Noninvolved Onsite Worker Maximally Exposed Individual Risk |
|---|---|---|
| *Probability of a Latent Cancer Fatality* | *Number of Latent Cancer Fatalities* | *Probability of a Latent Cancer Fatality* |
| 0 to 0.000028 | 0 to 0.037 | 0 to 0.00048[b] |

[a] *The impacts are given as risks, which are additive, rather than consequences, which are not additive for accidents.*

[b] *If an earthquake occurs at TA-55 strong enough to damage Building PF-4, 30 involved workers would be at risk of death or injury.*

Note: *The lower value of each range is zero since it is possible that no processing will take place at Los Alamos National Laboratory.*

The estimated risk of a latent cancer fatality for the maximally exposed individual at Los Alamos National Laboratory would range from 0 to 0.000028. This individual's chance of incurring a latent cancer fatality due to an accident during processing operations would be increased by less than 1 in 10,000. The estimated risk of latent cancer fatalities for the general population would be in the range of 0 to 0.037. The fatal cancer risk to the onsite worker is in the range of 0 to 0.00048. This onsite worker's chance of incurring a latent cancer fatality due to an accident during processing operations would be increased by less than 1 in 1,000.

## 4.2.4 RANGE OF WASTES GENERATED AT EACH SITE

The minimum and maximum amounts of wastes generated from processing the plutonium residues and scrub alloy addressed in this EIS are included in Table S-19 (for Rocky Flats), S-21 (for the Savannah River Site), and S-23 (for Los Alamos National Laboratory). The types of wastes included in these tables are stabilized residues (only at Rocky Flats), transuranic waste, low-level waste, low-level mixed waste, material managed as high-level waste (only at the Savannah River Site) and saltstone (only at the Savannah River Site).

As an example, from Table S-19, the range of low-level waste from processing at Rocky Flats would range from 900 $m^3$ (31,800 $ft^3$) to 12,100 $m^3$ (427,000 $ft^3$).

## 4.2.5 RANGE OF INTERSITE TRANSPORTATION IMPACTS

Some of the processing options would require transporting plutonium residues or scrub alloy from Rocky Flats to either the Savannah River Site or Los Alamos National Laboratory. Considering all the options, the number of truck shipments from Rocky Flats to the Savannah River Site could range from 0 to 208, and the number of truck shipments from Rocky Flats to Los Alamos National Laboratory could range from 0 to 63. (Refer to section 2.8 of this Summary.) This section describes the estimated radiation dose rate near the transport containers and the range of radiological and chemical impacts which could result from intersite transportation. The detailed analysis of the intersite transportation impacts are presented in Appendix E of the EIS.

The regulatory external radiation dose limit for ground transport is 10 mrem per hour at 2 m (6.6 ft) from the vehicle (49 CFR 173.441). Historical data from actual plutonium residue and scrub alloy handling experience have shown dose rates below this regulatory limit. Dose rates at 2 m (6.6 ft) from the Type 9975 and Type 6M containers have often been between 0.15 and 0.6 mrem per hour, depending on the age and type of residue. Because Safe Secure Trailers carry up to 30 Type 9975 and 38 Type 6M containers, dose rates around the vehicle could be higher than around a single container, but would be lower than the regulatory limit.

To be conservative, the analyses in this EIS assume that dose rates around the vehicle would equal the regulatory limit of 10 mrem per hour at 2 m (6.6 ft) from the side of the transport vehicle. This conservative value was used in the calculation of incident-free doses to members of the public and ground transport workers. For radiation workers handling containers at the DOE sites, the dose rate to the maximally exposed worker was conservatively assumed to be 2,000 mrem per year, which is equal to the DOE Administrative Control Level.

The range of radiological impacts due to incident-free transportation is presented in Table S-17. For every impact, the low end of the range is always zero because there are options that involve no transportation. The high end of each range is always low, which indicates that DOE would expect no latent cancer fatalities among the public or workers (0 to 0.025) from any combination of transportation options.

The only chemical impact would be latent cancer fatalities due to vehicle exhaust. The vehicle exhaust gases from the maximum number of truck shipments (round trip) from Rocky Flats to the Savannah River Site and to Los Alamos National Laboratory could cause 0.003 and 0.0003 latent cancer fatalities, respectively.

The potential impacts due to transportation accidents are presented in Table S-18. For every impact, the low end of the range is always zero because there are options that involve no transportation. The table shows that the risk of prompt death due to the trauma of a traffic accident is much greater than the risk due to radiological exposure following an accident. The highest risk is 0.021, which means that there would be about a 2 percent chance of one traffic fatality if DOE decides to make all 208 possible truck shipments to the Savannah River Site.

Table S-17. Range of Radiological Impacts Due to Incident-Free Transportation

| | Offsite Public Maximally Exposed Individual | | Offsite Public Population | |
|---|---|---|---|---|
| *Origin/Destination* | *Dose (mrem)* | *Probability of a Latent Cancer Fatality* | *Dose (person-rem)* | *Number of Latent Cancer Fatalities* |
| Rocky Flats/Savannah River Site | 0 to 11 | 0 to $5.5 \times 10^{-6}$ | 0 to 21 | 0 to 0.010 |
| Rocky Flats/Los Alamos National Laboratory | 0 to 11 | 0 to $5.5 \times 10^{-6}$ | 0 to 1.7 | 0 to 0.00085 |
| | **Maximally Exposed Individual Transport Worker** | | **Transport Worker Population** | |
| *Origin/Destination* | *Dose (mrem per yr)* | *Probability of a Latent Cancer Fatality Per Year* | *Dose (person-rem)* | *Number of Latent Cancer Fatalities* |
| Rocky Flats/Savannah River Site | 0 to 100 | 0 to 0.000040 | 0 to 32 | 0 to 0.013 |
| Rocky Flats/Los Alamos National Laboratory | 0 to 100 | 0 to 0.000040 | 0 to 2.6 | 0 to 0.0010 |

Table S-18. Range of Impacts[a] Due to Transportation Accidents

| | Offsite Public Population Radiological Risk | Offsite Public Population and Worker Trauma Risk |
|---|---|---|
| *Origin/Destination* | *Number of Latent Cancer Fatalities* | *Probability of One Traffic Fatality*[b] |
| Rocky Flats/Savannah River Site | 0 to 6.0 x $10^{-6}$ | 0 to 0.021 |
| Rocky Flats/Los Alamos National Laboratory | 0 to 3.6 x $10^{-7}$ | 0 to 0.0018 |

[a] *The impacts are given as risks, which are additive, rather than consequences, which are not additive for accidents.*

[b] *These probabilities are associated with traveling round-trip.*

## 4.2.6 ENVIRONMENTAL JUSTICE

Executive Order 12898 directs Federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of agency actions on minority populations and low-income populations. Analyses of the alternatives evaluated in this EIS to manage the plutonium residues and scrub alloy predict only minimal risks to health and safety. Because none of the alternatives would be expected to cause high and adverse consequences to the public at large, no minority or low-income populations would be expected to experience disproportionately high and adverse consequences. A more detailed discussion of the analysis of Environmental Justice is included in Appendix F of the Final EIS.

## 4.2.7 CUMULATIVE IMPACTS

The cumulative impacts from the management of plutonium residues and scrub alloy for each site are identified in Tables S-19, S-21, and S-23. The cumulative impacts include impacts from current and future activities at each site, along with the impacts from this EIS. The minimum and maximum impacts are based on the range of possible impacts at each site. The ranges of impacts are presented in Section 4.23 of the Final EIS. The cumulative impacts do not directly correlate to the management approaches presented in Section 4.2.2 of the Summary and Section 4.22 of the EIS.

Processing of residues and scrub alloy would contribute small additions to the amounts of products and wastes generated from other existing or planned activities at each of the three sites. In addition, the radiological and chemical releases associated with normal operations of any of the processing alternatives evaluated in this EIS would result in less than one cancer fatality to the offsite populations around each site. The contribution to existing and projected impacts associated with all other site activities would be small.

### 4.2.7.1 Rocky Flats

Tables S-19 and S-20 identify the cumulative waste, radiological and air quality impacts resulting from the management of the plutonium residues and scrub alloy addressed in this EIS, other future actions, and current activities.

Table S-19. Rocky Flats Cumulative Radiological Impacts

| *Impact Category* | *Impacts of Existing Operations*[b] | Plutonium Residue and Scrub Alloy Impacts | | | *Impacts of Other Reasonably Foreseeable Future Actions*[b] | Cumulative Impacts[a] | | |
|---|---|---|---|---|---|---|---|---|
| | | *Min.* | *Max.* | *Preferred* | | *Min.*[c] | *Max.*[d] | *Preferred*[e] |
| ***Waste Generation*** | | | | | | | | |
| Stabilized Residues (drums)[f] | 0 | 0 | 21,300 | 17,600 | 0 | 0 | 21,300 | 17,600 |
| Transuranic Waste (cubic meters) | 6,300 | 400 | 8,200 | 500 | 4,900 | 11,600 | 19,400 | 11,700 |
| Low-Level Waste (cubic meters) | 41,000 | 900 | 12,100 | 900 | 96,000 | 138,000 | 149,000 | 138,000 |
| Low-Level Mixed Waste (cubic meters) | 21,000 | 0 | 0 | 0 | 192,000 | 213,000 | 213,000 | 213,000 |
| ***Offsite Population*** | | | | | | | | |
| Collective Dose, 10 years (person-rem) | 1.6 | 0.0046 | 0.024 | 0.0057 | 228 | 230 | 230 | 230 |
| Number of latent cancer fatalities from collective dose | 0.00080 | $2.3 \times 10^{-6}$ | 0.000012 | $2.9 \times 10^{-6}$ | 0.11 | 0.11 | 0.11 | 0.11 |
| ***Offsite Maximally Exposed Individual*** | | | | | | | | |
| Annual Dose, Atmospheric Releases (mrem) | 0.00047 | 0.00012 | 0.00105 | 0.00019 | 0.23 | 0.23 | 0.23 | 0.23 |
| Probability of a Latent Cancer Fatality | $2.3 \times 10^{-10}$ | $6.0 \times 10^{-11}$ | $5.3 \times 10^{-10}$ | $9.5 \times 10^{-11}$ | $1.2 \times 10^{-7}$ | $1.2 \times 10^{-7}$ | $1.2 \times 10^{-7}$ | $1.2 \times 10^{-7}$ |
| ***Worker Population*** | | | | | | | | |
| Collective Dose, 10 years (person-rem) | 2,630 | 425 | 2,040 | 582 | 1,723 | 4,778 | 6,393 | 4,935 |
| Number of latent cancer fatalities from collective dose | 1.1 | 0.17 | 0.82 | 0.23 | 0.69 | 2.0 | 2.6 | 2.0 |

[a] *Impacts of existing operations, combined impacts from processing Rocky Flats plutonium residues and scrub alloy, and impacts of other reasonably foreseeable future actions.*

[b] *These are described in the Final Waste Management Programmatic Environmental Impact Statement and in Section 4.25 of the Final EIS.*

[c] *Cumulative impacts, including minimum combined impacts from processing Rocky Flats plutonium residues and scrub alloy.*

[d] *Cumulative impacts, including maximum combined impacts from processing Rocky Flats plutonium residues and scrub alloy.*

[e] *Cumulative impacts, including combined impacts from processing Rocky Flats plutonium residues and scrub alloy under the Preferred Alternative.*

[f] *Standard 55-gallon (208-liter) drums.*

Table S-20. Cumulative Air Quality Impacts at Rocky Flats

| *Pollutant* | *Baseline Concentration (μg/m³)* | *Modeled Concentration (μg/m³)* | *Concentration from Other Onsite Sources[a] (μg/m³)* | *Total Concentration (μg/m³)* | *Averaging Time* | *Most Stringent Regulation or Guideline (μg/m³)[b]* |
|---|---|---|---|---|---|---|
| Nitrogen Dioxide | 1.4 | 0.00014 | 0.0 | 1.4 | Annual | 100 |
| Hydrochloric Acid | 0.0052 | $4.2 \times 10^{-7}$ | 0.001 | 0.0062 | Annual | N/A |
| Carbon Tetrachloride | 0.0024 | 0.000031 | 0.002 | 0.0044 | Annual | N/A |

N/A = Not Applicable

[a] *Other approved onsite sources that would be operating at the same time as the plutonium residues and scrub alloy processing at Rocky Flats.*

[b] *Federal and State standards.*

- ***Wastes*** — Existing operations and other reasonably foreseeable future actions would not generate any stabilized residues that have plutonium concentrations above the safeguards termination limits. The minimum amount of stabilized residues that could be generated under this EIS is also zero because for every material category there is at least one processing technology that would not generate any. Alternatives 1 and 4 would generate stabilized residues, while Alternatives 2 and 3 would not. Existing and future operations at Rocky Flats (other than processing residues and scrub alloy) will generate approximately 6,300 m³ (222,000 ft³) and 4,900 m³ (173,000 ft³), respectively, of transuranic waste with plutonium concentrations below the safeguards termination limits. This will result in a total of 11,200 m³ (395,500 ft³) of transuranic waste. The maximum estimated volume of transuranic waste from plutonium residues and scrub alloy is 8,200 m³ (290,000 ft³), which would represent a major increase over the 11,200 m³ (395,500 ft³) from existing and future operations. The minimum amount of transuranic waste that could be generated at Rocky Flats would be about 400 m³ (14,100 ft³), which would occur if most of the plutonium residues and scrub alloy are simply repackaged at Rocky Flats. Existing and future operations at Rocky Flats will generate approximately 41,000 m³ (1,448,000 ft³) and 96,000 m³ (3,390,000 ft³), respectively, of low-level waste. This will result in a total of 137,000 m³ (4,840,000 ft³) of low-level waste. The maximum estimated volume from plutonium residues and scrub alloy is 12,100 m³ (427,000 ft³), which would represent an increase of less than 10 percent of the 137,000 m³ (4,840,000 ft³) from existing and future operations. Table S-19 also shows that the largest volume of waste at Rocky Flats is low-level mixed waste. DOE has estimated that existing and future operations will generate approximately 213,000 m³ (7,520,000 ft³) of low-level mixed waste, while the processing of plutonium residues and scrub alloy is not expected to generate any low-level mixed waste.

- ***Radiological Impacts*** — As identified in Table S-19, the radioactive releases that would result from processing the Rocky Flats plutonium residues and scrub alloy would not noticeably increase the radiation dose or the associated number of latent cancer fatalities in the offsite population. In addition, the radiation dose to the maximally exposed individual would remain well below the DOE regulatory limit of 10 mrem per year from atmospheric releases (DOE Order 5400.5). The radiation dose to the involved worker population could increase by about 47 percent over the dose from existing operations and other reasonably foreseeable future actions over the 10-year processing period. However, doses to individual involved workers will be kept below the regulatory limit of 5,000 mrem per year (10 CFR Part 835). Furthermore, as low as reasonably achievable principles will be exercised to maintain individual worker doses below the DOE Administrative Control Level of 2,000 mrem per year. Each DOE site also maintains its own Administrative Control Level, but for the sake of consistency, DOE used the 2,000 mrem per year throughout this EIS. Transportation workers (e.g., drivers) will be held to an annual limit of 100 mrem per year because they are not certified radiation workers. All worker doses are routinely monitored, and if any individual worker's dose approaches the annual limit, he or she would be rotated into another job.

- ***Air Quality Impacts*** — The processing of plutonium residues and scrub alloy at Rocky Flats would involve potential releases of nitrogen dioxide, hydrochloric acid, and carbon tetrachloride. The modeled offsite concentrations of these pollutants are presented in Table S-20, along with the existing concentrations and concentrations from other onsite sources that would be operating at the same time as the plutonium residues and scrub alloy processing.

  Because the total concentrations are small compared to the standards or guidelines, the cumulative impacts of the Proposed Action and the existing baseline should not be of concern with respect to these pollutants at Rocky Flats.

  Rocky Flats is in a nonattainment area where standards for criteria air pollutants are exceeded for particulates, carbon monoxide, and ozone. Section 176c of the 1990 Clean Air Act, as amended, requires that all Federal actions conform with the applicable State Implementation Plan. EPA has implemented rules that establish the criteria and procedures governing the determination of conformity for all Federal actions in nonattainment and maintenance areas (40 CFR 93.153). Since the area in which Rocky Flats is located is in nonattainment for particulates, carbon monoxide, and ozone, proposed actions at this site have been evaluated, and it has been determined that the total of direct and indirect emissions associated with the proposed actions are below the emissions level for which a conformity determination is required.

### 4.2.7.2 Savannah River Site

Tables S-21 and S-22 identify the cumulative radiological and chemical impacts at the Savannah River Site resulting from the management of the plutonium residues and scrub alloy addressed in this EIS, other future actions, and current activities.

Table S-21. Savannah River Site Cumulative Radiological Impacts

| Impact Category | Impacts of Existing Operations[b] | Plutonium Residue and Scrub Alloy Impacts | | | Impacts of Other Reasonably Foreseeable Future Actions[b] | Cumulative Impacts[a] | | |
|---|---|---|---|---|---|---|---|---|
| | | Min. | Max. | Preferred | | Min.[c] | Max.[d] | Preferred[e] |
| *Waste Generation* | | | | | | | | |
| High-Level Waste (canisters)[f] | 4,600 | 0 | 43[g] | 5[g] | (h) | 4,600 | 4,643 | 4,605 |
| Transuranic Waste (cubic meters) | 17,100 | 0 | 100 | 10 | 65,000 | 82,100 | 82,200 | 82,110 |
| Low-Level Waste (cubic meters) | 500,000 | 0 | 200 | 42 | 2,500,000 | 3,000,000 | 3,000,000 | 3,000,000 |
| Low-Level Mixed Waste (cubic meters) | 13,000 | 0 | 0 | 0 | 11,000,000 | 11,000,000 | 11,000,000 | 11,000,000 |
| Saltstone (cubic meters)[i] | 627,000 | 0 | 2,500 | 500 | (h) | 627,000 | 630,000 | 628,000 |
| *Offsite Population* | | | | | | | | |
| Collective Dose, 10 years (person-rem) | 68 | 0 | 0.38 | 0.062 | 686 | 754 | 754 | 754 |
| Number of latent cancer fatalities from collective dose | 0.034 | 0 | 0.00019 | 0.000031 | 0.34 | 0.37 | 0.37 | 0.37 |
| *Offsite Maximally Exposed Individual* | | | | | | | | |
| Annual Dose, Atmospheric Releases (mrem) | 0.14 | 0 | 0.0034 | 0.00057 | 9.8 | 9.9 | 9.9 | 9.9 |
| Probability of a Latent Cancer Fatality | $7.0 \times 10^{-8}$ | 0 | $1.7 \times 10^{-9}$ | $2.9 \times 10^{-10}$ | $4.9 \times 10^{-6}$ | $5.0 \times 10^{-6}$ | $5.0 \times 10^{-6}$ | $5.0 \times 10^{-6}$ |
| *Worker Population* | | | | | | | | |
| Collective Dose, 10 years (person-rem) | 8,400 | 0 | 469 | 76 | 8,309 | 16,700 | 17,200 | 16,800 |
| Number of latent cancer fatalities from collective dose | 3.4 | 0 | 0.19 | 0.030 | 3.3 | 6.7 | 6.9 | 6.7 |

[a] *Impacts of existing operations, combined impacts from processing Rocky Flats plutonium residues and scrub alloy, and impacts of other reasonably foreseeable future actions.*
[b] *These are described in the Final Waste Management Programmatic Environmental Impact Statement and in Section 4.25 of the Final EIS.*
[c] *Cumulative impacts, including minimum combined impacts from processing Rocky Flats plutonium residues and scrub alloy.*
[d] *Cumulative impacts, including maximum combined impacts from processing Rocky Flats plutonium residues and scrub alloy.*
[e] *Cumulative impacts, including combined impacts from processing Rocky Flats plutonium residues and scrub alloy under the Preferred Alternative.*
[f] *Each canister is 61 centimeters (2 feet) in diameter, 300 centimeters (10 feet) tall, and contains approximately 1,680 kilograms (3,700 pounds) of high-level waste glass.*
[g] *Material managed as high-level waste.*
[h] *The waste generation due to other reasonably foreseeable future actions (20 years) is included in the column of waste generation due to existing operations.*
[i] *Although saltstone is a low-level waste, it is managed independently from other low-level waste.*

- ***Wastes*** — As shown in Table S-21, existing and future operations at the Savannah River Site will generate large volumes of high-level waste, transuranic waste, low-level waste, low-level mixed waste, and saltstone. Table S-21 also lists the volumes of these wastes that could be generated from the processing of plutonium residues and scrub alloy. The limited processing of plutonium residues and scrub alloy at the Savannah River Site would cause very small increases in the wastes to be managed at this site.

- ***Radiological Impacts*** — As identified in Table S-21, the radioactive releases that would result from processing the Rocky Flats plutonium residues and scrub alloy at the Savannah River Site would not noticeably increase the radiation dose or the associated number of latent fatal cancers in the offsite population. In addition, the radiation dose to the maximally exposed offsite individual would remain below the DOE regulatory limit of 10 mrem per year. The radiation dose to the involved worker population could increase by about 3 percent over the dose from existing operations and other reasonably foreseeable future actions over the 10-year processing period. Doses to individual involved workers would be maintained below the limits, given above in the Rocky Flats cumulative impacts discussion.

- ***Air Quality Impacts*** — The processing of plutonium residues and scrub alloy at the Savannah River Site would involve potential releases of nitrogen dioxide, nitric acid, hydrogen fluoride, and phosphoric acid. The modeled offsite concentrations of these pollutants are presented in Table S-22, along with baseline concentrations and concentrations from other onsite sources that would be operating at the same time as the plutonium residues and scrub alloy processing at SRS.

  Because the total concentrations are lower than the applicable standards, the cumulative impacts of the Proposed Action and the existing baseline should not be of concern with respect to air quality at the Savannah River Site.

Table S-22. Cumulative Air Quality Impacts at the Savannah River Site

| *Pollutant* | *Baseline Concentration* ($\mu g/m^3$) | *Modeled Concentration* ($\mu g/m^3$) | *Concentration from Other Onsite Sources*[a] ($\mu g/m^3$) | *Total Concentration* ($\mu g/m^3$) | *Averaging Time* | *Most Stringent Regulation or Guideline* ($\mu g/m^3$)[b] |
|---|---|---|---|---|---|---|
| Nitrogen Dioxide | 8.8 | 0.039 | 3.6 | 12.4 | Annual | 100 |
| Nitric Acid | 50.96 | 0.65 | 4.76 | 56.37 | 24-Hour | 125 |
| Hydrogen Fluoride | 0.09 | 0.00036 | 0.019 | 0.11 | 30-Day | 0.8 |
| | 0.39 | 0.0032 | 0.067 | 0.46 | 7-Day | 1.6 |
| | 1.04 | 0.0032 | 0.175 | 1.22 | 24-Hour | 2.9 |
| | 1.99 | 0.0051 | 0.327 | 2.32 | 12-Hour | 3.7 |
| Phosphoric Acid | 0.462 | 0.0016 | 0.0 | 0.464 | 24-Hour | 25 |

[a] *Other approved onsite sources which would be operating at the same time as the plutonium residues and scrub alloy processing at the Savannah River Site.*

[b] *Federal and State standards.*

### 4.2.7.3 Los Alamos National Laboratory

Table S-23 identifies the cumulative radiological impacts at Los Alamos National Laboratory resulting from the activities addressed in this EIS (limited to processing pyrochemical salts), other future actions, and current activities.

- *Wastes* — As shown in Table S-23, existing and future operations at Los Alamos National Laboratory will generate large volumes of transuranic waste, low-level waste, and low-level mixed waste. Table S-23 also lists the volumes of these wastes that could be generated from the processing of pyrochemical salts. The limited processing of plutonium residues at Los Alamos National Laboratory would cause very small increases in the wastes to be managed at this site.

Table S-23. Los Alamos National Laboratory Cumulative Radiological Impacts

| Impact Category | Impacts of Existing Operations[b] | Plutonium Residue and Scrub Alloy Impacts | | | Impacts of Other Reasonably Foreseeable Future Actions[b] | Cumulative Impacts[a] | | |
|---|---|---|---|---|---|---|---|---|
| | | Min. | Max. | Preferred | | Min.[c] | Max.[d] | Preferred[e] |
| ***Waste Generation*** | | | | | | | | |
| Transuranic Waste (cubic meters) | 10,800 | 0 | 600 | 200 | 4,400 | 15,200 | 15,800 | 15,400 |
| Low-Level Waste (cubic meters) | 150,000 | 0 | 1,300 | 400 | 325,000 | 475,000 | 476,000 | 475,000 |
| Low-Level Mixed Waste (cubic meters) | 2,770 | 0 | 0 | 0 | 980 | 3,750 | 3,750 | 3,750 |
| ***Offsite Population*** | | | | | | | | |
| Collective Dose, 10 years (person-rem) | 16 | 0 | 0.0024 | 0.00079 | 16.9 | 33 | 33 | 33 |
| Number of latent cancer fatalities from collective dose | 0.0079 | 0 | $1.2 \times 10^{-6}$ | $4.0 \times 10^{-7}$ | 0.0085 | 0.016 | 0.016 | 0.016 |
| ***Offsite Maximally Exposed Individual*** | | | | | | | | |
| Annual Dose, Atmospheric Releases (mrem) | 7.9 | 0 | 0.00080 | 0.00027 | 0.37 | 8.3 | 8.3 | 8.3 |
| Probability of a Latent Cancer Fatality | $4.0 \times 10^{-6}$ | 0 | $4.0 \times 10^{-10}$ | $1.4 \times 10^{-10}$ | $1.9 \times 10^{-7}$ | $4.2 \times 10^{-6}$ | $4.2 \times 10^{-6}$ | $4.2 \times 10^{-6}$ |
| ***Worker Population*** | | | | | | | | |
| Collective Dose, 10 years (person-rem) | 4,580 | 0 | 160 | 8.8 | 763 | 5,340 | 5,500 | 5,350 |
| Number of latent cancer fatalities from collective dose | 1.8 | 0 | 0.064 | 0.0035 | 0.31 | 2.1 | 2.2 | 2.1 |

[a] *Impacts of existing operations, combined impacts from processing Rocky Flats pyrochemical salts and impacts of other reasonably foreseeable future actions.*

[b] *These are described in the Final Waste Management Programmatic Environmental Impact Statement and in Section 4.25 of the Final EIS.*

[c] *Cumulative impacts, including minimum combined impacts from processing Rocky Flats pyrochemical salts.*

[d] *Cumulative impacts, including maximum combined impacts from processing Rocky Flats pyrochemical salts.*

[e] *Cumulative impacts, including combined impacts from processing Rocky Flats pyrochemical salts under the Preferred Alternative.*

- *Radiological Impacts* — As identified in Table S-23, the radioactive releases that would result from processing the Rocky Flats pyrochemical salts in Los Alamos National Laboratory would cause very small increases in the radiation dose or the associated number of latent fatal cancers in the offsite population. In addition, the radiation dose to the maximally exposed offsite individual would remain below the DOE regulatory limit of 10 mrem per year. The radiation dose to the involved worker population could increase by 3 percent over the dose from existing operations and other reasonably foreseeable future actions over the 10-year processing period. Doses to individual involved workers would be maintained below the limits given in the Rocky Flats cumulative impacts discussion.

- *Air Quality Impacts* — For the Los Alamos National Laboratory, the emissions of air pollutants from the processing of pyrochemical salts would be very small because only limited processing would take place at this site. In addition, the baseline concentrations of criteria air pollutants and hazardous air pollutants are much smaller than the applicable standards.

### 4.2.7.4 Intersite Transportation

The cumulative impacts from transportation of plutonium residues and scrub alloy from Rocky Flats to the Savannah River Site and to Los Alamos National Laboratory are identified in Appendix E of the EIS. Since likely transportation routes cross about nine states, cumulative impacts are computed on a national basis. Occupational radiation exposure to transportation workers and exposure to the public would each increase by about 0.01 percent from the estimated cumulative exposure between 1943 and 2035 and would represent an estimated 0.1 percent of the cumulative exposure over the 10-year processing period. An additional traffic fatality is not expected and the incremental increase in traffic fatalities would be less than 0.0001 percent per year.

# 5.0 APPLICABLE LAWS, REGULATIONS, AND OTHER REQUIREMENTS

Numerous laws, regulations, and other requirements apply to the proposed action and alternatives. These include Federal regulations; Executive Orders; DOE Orders, Notices, and Standards; agreements between the States and DOE; and those Federal statutes, Executive Orders, and Federal regulations applicable to emergency management and response. A detailed description of these requirements is contained in Chapter 5 of the EIS.

# 6.0 OVERVIEW OF THE PUBLIC PARTICIPATION PROCESS

This chapter summarizes the public comments received on this EIS. The sub-chapters address the following:

- Public Scoping for this EIS
- Workshops for State and Local Officials along Potential Transportation Routes
- Public Comments on the Draft EIS
  - Public Hearings
  - Written Comments

Public comments are addressed in detail in Chapter 9 of the Final EIS. Chapter 9 also includes a reproduction of all of the written comments, a summary of oral comments from public comment hearings, and DOE's responses to all of the comments.

## 6.1 Public Scoping for This EIS

On November 19, 1996, DOE published in the *Federal Register* a Notice of Intent to prepare this EIS ("Notice of Intent to Prepare an Environmental Impact Statement on Management of Certain Plutonium Residues and Scrub Alloy Stored at the Rocky Flats Environmental Technology Site," 61 *Federal Register* 58866). This notice identified the preliminary scope of the EIS and invited public comments on the preliminary alternatives identified for preparing certain Rocky Flats plutonium residues and scrub alloy for disposal or other disposition.

The alternatives in the Notice of Intent were identified as follows:

Alternative 1 – No Action (same as in this Final EIS),
Alternative 2 – Onsite Treatment (with and without plutonium separation) and
Alternative 3 – Offsite Treatment (with and without plutonium separation).

DOE conducted the public scoping process from November 19, 1996, to December 19, 1996, but continued to accept all comments received beyond the closing date. During the scoping period, two public scoping meetings were held – one at Rocky Flats on December 3, 1996, and one near the Savannah River Site (in North Augusta, South Carolina) on December 12, 1996. Comments were received from individuals at these scoping meetings. In addition, DOE received written comments from 30 organizations and individuals. Copies of all written comments and summaries of comments made at the public scoping meetings are kept on file at DOE Headquarters in Washington, D.C., and in public reading rooms identified on the map in Figure S-30 and in Chapter 7 of this Summary.

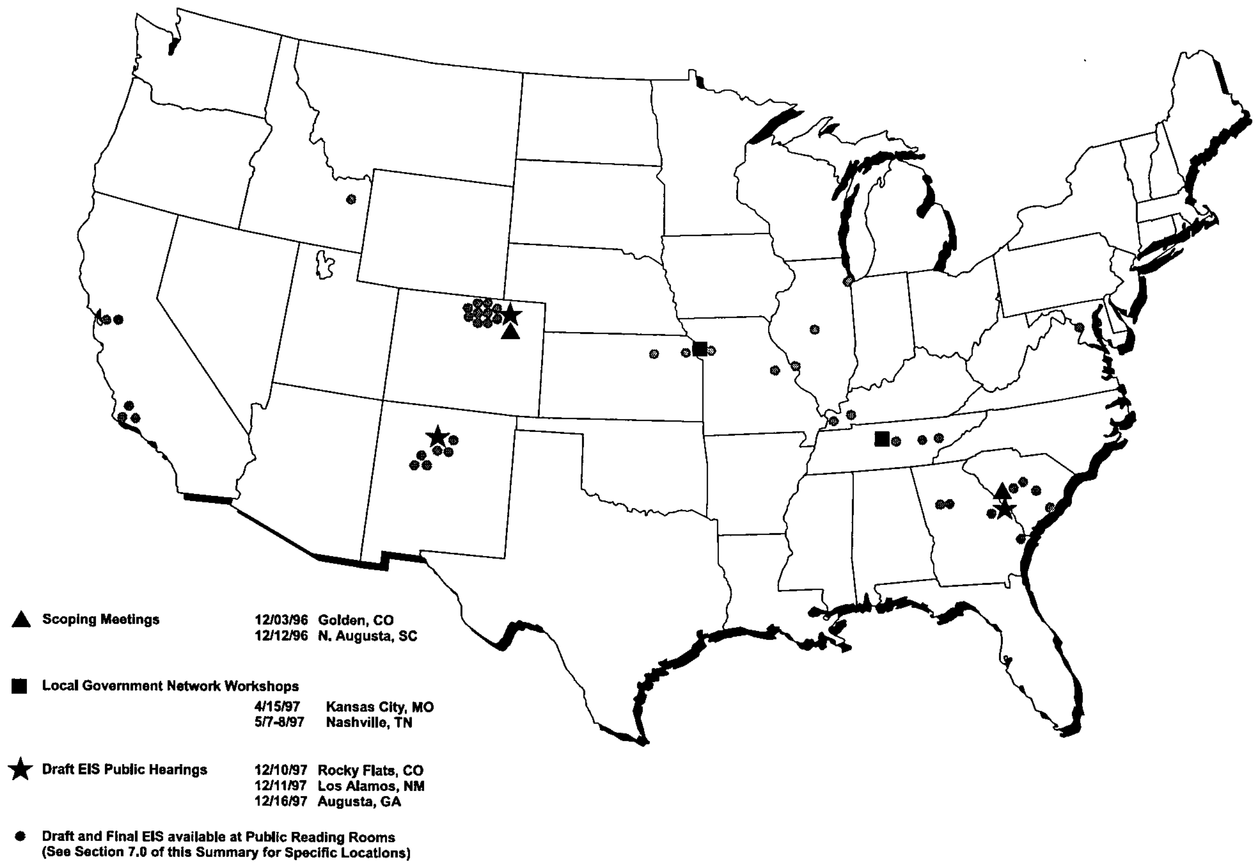
Almost half of the public scoping comments were from individuals and organizations in the Rocky Flats area (including a coalition of organizations with a specific interest in Rocky Flats activities), and most of the remainder were from individuals and organizations in the Savannah River Site area (including the Savannah River Site's Citizens Advisory Board). A few were from national organizations.

Most of the scoping comments included positions for or against the management alternatives presented in the Notice of Intent. No scoping comments were received on processing at Los Alamos National Laboratory or Lawrence Livermore National Laboratory, which were sites also considered in Alternative 3 (the latter site has since been dropped from consideration as an alternative). In providing these comments on the alternatives, specific comments were provided on related issues dealing with the following:

- Storage of the stabilized or processed materials
- Ultimate disposition of the stabilized or processed materials (e.g., WIPP disposal, mixed oxide fuel)
- Proliferation
- Transportation
- Environment, safety, and health risks
- Costs

A more detailed summary of the public scoping comments is presented in Section 1.3 of the Draft EIS, which is discussed in Section 6.3 below.

Figure S-30. Location of Hearings, Workshops, and Public Reading Rooms




## 6.2 Workshops for State and Local Officials Along Potential Transportation Routes

Prior to publication of the Draft EIS, DOE held workshops with the Local Government Network (composed of emergency response personnel and State and local officials along DOE transportation corridors). The workshops took place as follows:

- Kansas City, MO, April 16-17, 1997
- Nashville, TN, May 7-8, 1997

About 80 individuals participated in these workshops, during which DOE provided an overview of the upcoming Draft EIS, identified the potential shipments that could take place if a decision were reached to process the materials offsite, discussed the nature of the materials that could be shipped and the transport system that would be used for the shipments (e.g., the Safe Secure Trailer and the Type B shipping containers), and obtained feedback from the workshop attendees on their issues of concern. In addition to the question/answer sessions, the workshops included smaller break-out sessions that allowed participants to focus more in-depth on particular areas of interest. Meeting summaries from these two workshops are available in the DOE Reading Rooms identified in Chapter 7 of this Summary. Key suggestions and comments from those workshops include the following:

- Improve methods for making local citizens and officials more aware of the upcoming shipments (i.e., improve the distribution of information, such as widening the distribution list, using local PBS affiliates or radio stations to advertise and moderate public meetings, making the EIS available on a web page, distributing an information package, etc.).

- Provide more information on the shipment casks and Safe Secure Trailer (SST) system, including ongoing research, past history of shipments, amounts and nature of material inside the casks, truck and trailer sizes, and radiological monitoring.
- Share SST procedures with local government officials and emergency response personnel.
- Involve state and local government officials in developing the transportation plans for these shipments, including working out details ahead of time on issues such as safe parking and bad weather protocols; provide advance notifications.
- Improve coordination and funding for training of states and local officials in emergency response and provide the necessary equipment; enhance use of mutual aid agreements.

Following these workshops, DOE prepared a fact sheet on the potential plutonium residue shipments, which included information on the shipping casks and the SST, and distributed several copies of the fact sheet to the attendees at this meeting. The attendees volunteered at the workshops to distribute the fact sheets within their communities (e.g., media outlets and libraries). An updated version of this fact sheet is included in Appendix A of the Final EIS. In addition, DOE provided updates on this EIS at subsequent Local Government Network meetings.

## 6.3 Issuance of the Draft EIS

In developing the Draft EIS, DOE considered the various scoping comments and presented analyses that addressed many of the concerns or questions. DOE also identified the criteria used to screen the various alternatives considered since scoping. The presentation of the alternatives in the Draft EIS was modified from the Notice of Intent as follows: Alternative 2 was modified to include only processing without plutonium separation, which would be conducted at Rocky Flats. Alternative 3 was modified to include Rocky Flats as a candidate site for processing with plutonium separation and to eliminate Lawrence Livermore National Laboratory as a candidate processing site. Alternative 3 was also modified to only consider processing with plutonium separation. Preferred processing technologies were identified for most of the material categories and subcategories in the Draft EIS.

The Environmental Protection Agency announced the availability of the Draft EIS in the *Federal Register* on November 21, 1997 (62 FR 62303). In addition, DOE mailed copies of the full Draft EIS and/or the Summary to over 1,000 individuals and organizations who were on DOE's mailing list (from previous requests) or who specifically requested copies during or after the comment period. The public had access to a toll-free number (1-800-736-3282) directed to the DOE Office of Environmental Management's Center for Environmental Management Information in order to request copies of the Summary or full EIS.

The public comment period was held from November 25, 1997, to January 5, 1998. However, DOE continued to accept and consider comments received after the closing date.

## 6.4 Summary of Public Comments on the Draft EIS

This section summarizes the key comments DOE received on the Draft EIS, both in writing and orally (at public meetings). Key changes made to this EIS since publication of the Draft EIS, in response to public comments and further evaluations, are summarized in Chapter 1 of this Summary and of the EIS. The comments and DOE responses are presented in Chapter 9 of the Final EIS.

### 6.4.1 Summary of Written Comments on the Draft EIS

Written submissions were received from 39 individuals and organizations. Of those

- 15 were from representatives of environmental, citizen, or business organizations.
- 10 were from State agencies.

- 5 were from Federal agencies.
- 7 were from individuals.
- 2 were from Cities.

The localities represented by the written submissions were as follows:

- 13 were from individuals or organizations in the Savannah River Site area; however, 7 of them were acknowledgments of receipt/no comment from South Carolina state agencies.
- 11 were from the Rocky Flats area.
- 8 were from the Los Alamos area.
- 4 were from those along transportation corridors.
- 3 were national in representation.

Most commentors provided their positions on the alternatives or processes (many of which addressed plutonium separation processes), provided specific comments on the analyses presented in the EIS, and identified concerns regarding associated issues such as storage; ultimate disposition; proliferation risks; transportation; environmental, safety and health risks; and costs.

Of the 39 written submissions (received by U.S. mail and email), close to 200 specific comments were delineated. Chapter 9 of the Final EIS presents each of the written submissions, the delineation of comments, and DOE's response to each comment. Key comments are summarized below (with DOE responses summarized) and are organized according to the following key issue areas:

- Alternatives or Processes
- Storage
- Ultimate Disposition
- Proliferation Risks
- Transportation
- Environmental, Safety and Health Risks
- Costs
- Other (miscellaneous).

## Comments on Alternatives and Processes

Most of those who provided comments indicated their support for or opposition to a particular alternative or process, along with their reasons. Reasons dealt with issues such as proliferation risk, worker exposures, transportation, storage, ultimate disposition, increase in waste volume, and cost (these are further summarized in the sections following).

***Alternative 1 - No Action -- Stabilize and Store*** (Rocky Flats)

Very few commentors stated a preference for the No Action Alternative, which would stabilize the plutonium residues and scrub alloy for interim storage at Rocky Flats. Those who did suggested that the materials be stabilized and stored at Rocky Flats until safer treatment and disposal methods can be developed. While not stated explicitly, most of the commentors did not support this alternative. Instead, they advocated one of the other alternatives or variations to those alternatives (e.g., other processing technologies).

*In response to these comments, DOE has expanded Sections 1.1, 1.2, and 1.3 of the Final EIS to better clarify that the alternatives evaluated under the Proposed Action would not only stabilize the plutonium residues and scrub alloy to address immediate health and safety concerns raised by the Defense Nuclear Facilities Safety Board, but would also convert them into forms that would allow for their disposal or other disposition, thus eliminating health and safety concerns associated with indefinite storage of these materials. The No Action Alternative would not eliminate the long-term health and safety concerns. Nevertheless, DOE is required by the regulations implementing the National Environmental Policy Act to include evaluation of a No Action Alternative in the EIS. DOE has also responded individually to each comment related to the No Action Alternative in Section 9.5 of the Final EIS.*

***Alternative 2 - Processing Without Plutonium Separation*** (Rocky Flats)

Commentors were split on their positions regarding the implementation of this alternative at Rocky Flats. Comments supporting processing at Rocky Flats included the following reasons and suggestions:

- Alternative 2 is preferred because of opposition to plutonium separation and transportation of such materials.
- Rocky Flats has the capabilities to do all of the required stabilization and processing.
- DOE should minimize the number of processes, or use "one-step" processes.
- DOE should use only those technologies that are mature and have been demonstrated.

Comments against processing at Rocky Flats included the following reasons and suggestions:

- DOE has committed to clean up and close Rocky Flats.
- Rocky Flats has old and unsafe facilities, which lack an "authorization basis" to process.
- Any process that would result in airborne releases at Rocky Flats is not acceptable.
- DOE has better facilities at the Savannah River Site.
- It is more cost-effective to use large-scale and proven facilities at the Savannah River Site.
- DOE should evaluate sites, other than those identified, that have vitrification capabilities.

*In response to these comments, DOE notes that Section 2.9 of the Final EIS provides DOE's rationale for selecting processing technologies (for each material category) for evaluation in this EIS and for the Preferred Alternative. The Preferred Alternative is described in Section 2.5 of the Final EIS. The only processing technology at Rocky Flats identified under Alternative 2 for the Preferred Alternative is blend-down of certain filter media residues (Ful-Flo filters).*

*In selecting processing technologies for evaluation under Alternative 2, DOE eliminated all sites from consideration except Rocky Flats. The costs and risks of preprocessing (which would be required prior to transport of the materials to another site for processing), transportation, and final processing would exceed that of final processing at Rocky Flats without providing any tangible benefits.*

*As described in Section 1.3.1 of the Final EIS, DOE has added Alternative 4, Combination of Processing Technologies, to specifically address those materials for which a variance from safeguards termination limits has been granted. The Preferred Alternative described in Section 2.5 of the Final EIS identifies those materials for which Alternative 4 is part of the Preferred Alternative.*

*DOE has also responded individually to each comment related to processing technologies without plutonium separation in Section 9.5 of the Final EIS.*

***Alternative 3 - Processing With Plutonium Separation*** (Rocky Flats, Savannah River Site, and Los Alamos National Laboratory).

About one-third of the commentors expressed strong opposition to shipment of the Rocky Flats residues and scrub alloy to either the Savannah River Site or Los Alamos National Laboratory for plutonium separation processes. Comments included the following reasons and suggestions:

- The proliferation risk would be greater if plutonium is separated during processing.
- Due to risks of accidents, these materials should not be transported.
- It is unnecessary to ship offsite — processing can be done at Rocky Flats.
- The separation process would result in a larger volume of waste than from nonseparation processes.
- DOE would be extending the life of the already aging canyons if processing with plutonium separation were to be chosen at Savannah River Site.
- DOE underestimated the costs of using the canyons.
- Separated plutonium should not be used as mixed oxide fuel in civilian nuclear powerplants.

Other commentors supported plutonium separation (some were directed specifically to plutonium separation at the Savannah River Site) because of the following reasons:

- The Savannah River Site has proven capabilities and is the only large-scale processing facility in the country.
- There is better security at the Savannah River Site and Los Alamos National Laboratory than at Rocky Flats.
- There is urgency to get the materials out of Rocky Flats so that the site can be closed.
- Processing at Savannah River Site would be more cost-effective.
- Plutonium has economic value (as an energy source).
- Separating plutonium and its disposition constitutes waste minimization.

Some commentors expressed concern about the feasibility of the salt distillation process at Los Alamos, stating that:

- The salt distillation process is not mature enough to be considered a preferred alternative.
- Los Alamos does not have capability to store the resulting americium-contaminated plutonium materials.

*In response to these comments, DOE notes that Section 2.4 of the Final EIS provides DOE's rationale for selecting processing technologies (for each material category) for evaluation in this EIS and for the Preferred Alternative. The Preferred Alternative is described in Section 2.5 of the Final EIS. The only processing technologies under Alternative 3 identified for the Preferred Alternative are the Purex process at the Savannah River Site for certain ash residues (sand, slag and crucible), plutonium fluoride residues, and scrub alloy; and acid dissolution/plutonium oxide recovery at Los Alamos National Laboratory for certain (high assay) direct oxide reduction salts (these salts have two processing technologies under the Preferred Alternative — the other is repackaging at Rocky Flats).*

*A major consideration in evaluating the potential use of the Savannah River Site canyons for processing a limited quantity of plutonium residues and scrub alloy is that the materials would be handled remotely, resulting in low worker radiation exposures. The canyons have been maintained and upgraded during their life cycle to ensure continued operability. Furthermore, they are currently operating, demonstrating their ability to safely process nuclear materials. Processing the materials under the*

*Preferred Alternative, described in Section 2.5.2 of the Final EIS, would not require extending the operating life of the canyons as these facilities would be processing other previously-scheduled materials. As described in Section 2.5.2 of the Final EIS, salt distillation is no longer part of the preferred alternative. DOE has also responded individually to each comment related to processing technologies involving plutonium separation in Section 9.5 of the Final EIS.*

***Other Processing Options Not in Draft EIS.***

Some commentors expressed their beliefs that none of the processing options identified in the Draft EIS were reasonable and offered suggestions for additional options. These included:

- DOE should vitrify to meet the "spent fuel standard" in small "cans-in-canisters" or a "large monolith" at Rocky Flats.
- Small, mobile units should be used to conduct immobilization activities — they could be used at multiple sites.

Other commentors suggested that the EIS be delayed in order to more thoroughly evaluate other alternatives or the EIS should provide more rationale on why these are not being considered. Specific suggestions include the following:

- DOE should delay this EIS until more evaluation is done on innovative technologies, such as the Glass Material Oxidation and Dissolution System being developed at Oak Ridge National Laboratory or the cold ceramification immobilization process being developed at the Idaho National Engineering and Environmental Laboratory. These innovative technologies could be demonstrated on a small scale at Rocky Flats.
- DOE should include more sites in the EIS evaluation.

*In response to these comments, DOE notes that the technology and site screening process is described in Section 2.9.2 of this Final EIS. Issues raised during the public scoping process that are not analyzed in the EIS are described in Section 2.9.3 of the Final EIS. DOE has also responded individually to each comment related to other processing options not in the Draft EIS in Section 9.5 of the Final EIS.*

## Comments Related to Storage

A number of commentors addressed storage in their comments. Comments included the following:

- Continued storage at Rocky Flats is unacceptable (health and safety risks).
- DOE should evaluate contingency storage in the event of delays in opening the Waste Isolation Pilot Plant (WIPP).
- DOE did not adequately address impacts of long-term storage under the No Action alternative in the EIS.
- The materials should stay in storage (following stabilization or processing) at Rocky Flats "for the time being" and not be transported to another site.
- Stored plutonium resulting from plutonium separation poses proliferation risks.
- DOE should address the amount of americium-contaminated wastes that would result from the salt distillation process, as well as low-level waste, at Los Alamos National Laboratory and how these wastes would be stored or disposed.
- The public needs to be ensured that the processed materials at Los Alamos will not be stored indefinitely at that site.

- Separated plutonium from processes at the Savannah River Site canyons could be adequately accommodated in the new Actinide Packaging and Storage Facility.

*In response to these comments, DOE has revised its evaluation of the No Action Alternative (Alternative 1) to explicitly analyze the impacts from continued storage of the stabilized residues and scrub alloy at Rocky Flats until a decision is made concerning their ultimate disposition. A storage period of 20 years was used for the purpose of analysis. A discussion of storage has been added to Section 2.3, 2.4, and 2.5.1 of this Final EIS, and the associated impacts have been added to Sections 4.2 through 4.11. For the other alternatives, a discussion of storage of processed material has been added to Section 4.14 of the Final EIS to address the possibility of WIPP not opening in the near future.*

*The analysis of storing any plutonium that would be separated during processing of salts at Los Alamos National Laboratory is contained in Sections 2.4.2.3 and 4.14 of the Final EIS. Under the Preferred Alternative, described in Section 2.5 of the Final EIS, the plutonium that would be separated during the processing of salts would not be contaminated with americium. The americium would go into the transuranic waste. DOE has also responded individually to each comment related to storage in Section 9.5 of the Final EIS.*

## Comments Related to Ultimate Disposition

A number of commentors expressed concern about DOE's reliance on WIPP to dispose of the processed or stabilized residues. Key comments included the following:

- DOE is relying too heavily on WIPP, which is unlikely to open on schedule or may never open (some commentors cited specific problems with WIPP as a safe disposal facility).
- WIPP's compliance certification application with the Environmental Protection Agency (EPA) (and EPA's certification authority) does not cover the amounts and concentrations of plutonium in the materials covered by this EIS that would be shipped to WIPP. DOE should clearly address the number of shipments, amounts of processed residues and scrub alloy, and plutonium/americium concentrations that would be going to WIPP under this EIS and whether variances would be required.

Some of the commentors who opposed plutonium separation also provided the following comment:

- Separated plutonium should not be used in making mixed oxide fuel for civilian nuclear power plants due to proliferation risks.

*In response to these comments, DOE notes that, in January 1998, DOE issued a Record of Decision regarding alternatives evaluated in DOE's Waste Isolation Pilot Plant Disposal Phase Final Supplemental EIS (discussed in Section 1.5.4 of the Final EIS) to dispose of transuranic waste at WIPP. Nevertheless, the decision to open WIPP is outside the scope of this EIS. Section 4.14 of the Final EIS addresses the impacts from storing processed residues in the event that WIPP does not open on schedule.*

*In addition, in July 1998, DOE published a Draft EIS on Surplus Plutonium Disposition (discussed in Section 1.5.7 of the Final EIS). The disposition of any plutonium separated from Rocky Flats plutonium residues and scrub alloy would be determined in accordance with decisions to be reached under the Surplus Plutonium Disposition EIS. Any plutonium that would be separated under any alternative evaluated in this EIS would be immobilized. DOE has also responded individually to each comment related to ultimate disposition in Section 9.5 of the Final EIS.*

## Comments Related to Proliferation Risks

Perceived proliferation risks were the primary reasons commentors did not support Alternative 3 — Processing with Plutonium Separation. Comments included the following:

- DOE did not adequately address the issue of proliferation risk in the EIS.

- None of the alternatives were favorable to nonproliferation efforts and, thus, further evaluation should be conducted of innovative immobilization technologies (see "Other Processing Options Not in Draft EIS" above).

Several commentors expressed views concerning DOE's approach in seeking safeguards termination limit variances. These included:

- DOE's approach to seek a variance to safeguards termination limits is acceptable for those materials whose evaluations concluded that the materials presented minimal risk of proliferation.
- Variances to the safeguards termination limits presents an invitation to terrorists and, as such, the granting of variances is opposed.
- The EIS should include more discussion on the variances, including the rationale for variances and a clear path for materials that do or do not receive variances.
- State technical agencies should be involved in DOE's variance decisions.
- DOE should delay the EIS until variance decisions were made for all of the categories and subcategories.

*In response to these comments, DOE agrees that nonproliferation goals should be an important factor in deciding the processing technology for each of the Rocky Flats plutonium residues and scrub alloy. Nuclear nonproliferation considerations, including long-term proliferation risks, are discussed in Section 4.1.9 of this EIS. None of the actions evaluated in this EIS, including those that involve plutonium separation, would result in a substantial increase in proliferation risk.*

*In addition, the discussion of variances to safeguards termination limits has been expanded in the Final EIS. The process to obtain a variance is described in detail in Section 1.2.1 of the Final EIS. Section 1.2 of the Final EIS discusses conditions under which a variance to safeguards termination limits may be applied. Section 1.3.1 of the Final EIS identifies materials that have received a variance and introduces Alternative 4, Combination of Processing Technologies, to address materials for which a variance from safeguards termination limits has been granted. DOE has also responded individually to each comment related to proliferation risks in Section 9,5 of the Final EIS.*

## Comments Related to Transportation

A number of commentors addressed transportation. Many of these commentors were strongly opposed to any transportation of plutonium-bearing materials and suggested that the materials remain at Rocky Flats. Primary reasons and suggestions were:

- Transportation of materials poses the potential for accidents and resulting exposures to the public and contamination.
- Rocky Flats has the ability to stabilize or process the materials and, as such, transporting the materials is unnecessary.
- DOE should not transport materials through major metropolitan areas, such as Atlanta and Augusta.

Other comments on transportation included the following:

- Transportation can be accomplished safely (citing DOE's safe transportation record).
- DOE should better communicate with the public on the safety of DOE's shipments.
- The public should have input to routing decisions.
- DOE should not transport materials in Type B shipping containers that have not been certified by the U.S. Nuclear Regulatory Commission.

*In response to these comments, DOE notes that the amount of transportation that would occur is dependent on the processing technology that would be selected in the Record of Decision for each plutonium residue and scrub alloy. Under the Preferred Alternative described in Section 2.5.2 of the Final EIS, most of the materials considered in this EIS would be repackaged (with stabilization as necessary) at Rocky Flats, with minimal shipments to Los Alamos National Laboratory and the Savannah River Site for offsite processing (3 and 39 shipments, respectively). Section 2.8 of the Final EIS discusses the transportation system, including the Type B packaging used to transport these materials for any offsite processing. Appendix E, Section E.6, of this Final EIS shows that the incident-free radiological risk to the public in the form of latent cancer fatalities from transportation would be less than one fatality. The accident risk to the public, including latent cancer and traffic fatalities, would also be less than one. DOE has also responded individually to each comment related to transportation in Section 9.5 of the Final EIS.*

## Comments Related to Environmental, Safety, and Health Risks

About half of the comments addressed issues dealing with environment, safety, and health. These included comments on DOE's risk analysis methodology to determine impacts and concerns about risks posed by the alternatives.

Some commentors stated that the EIS analyses were adequate in addressing the impacts.

Others believed they were not adequate. Those comments dealing with inadequacies included the following:

- DOE underestimated worker exposures in the analyses (comments included both Rocky Flats and Savannah River Site processes). For example, DOE underestimated the condition of facilities at Rocky Flats (old and unsafe) and did not consider recent accidental exposures at the Savannah River Site.
- DOE should not compare voluntary activities (e.g., cigarette smoking) with involuntary activities.
- DOE underestimated waste volumes to be generated during processes.
- DOE underestimated water usage at Los Alamos National Laboratory.
- DOE needs to address RCRA permit modifications dealing with mixed waste in the EIS.
- WIPP documentation needs to address criticality due to some of the residue packages to be sent to WIPP.
- Transportation accidents pose unacceptable risks.

Some commentors (Federal and State agencies) noted no impacts from the proposed actions in this EIS, including no impacts to endangered or potentially endangered species and critical habitats. Some commentors offered comments on environmental justice or equity issues.

*In response to these comments, DOE has made refinements to the impact analyses in Chapter 4 of the Final EIS. Some of the changes occurred because DOE re-evaluated many of the processing technologies and introduced some new processing technologies. DOE believes that the processing methods analyzed in this EIS would be safe, based on the small potential impacts (less than one latent cancer fatality), as described in Sections 4.21, 4.22, and 4.23 of this Final EIS. DOE has also responded individually to each comment related to environmental, health and safety risks in Section 9.5 of the Final EIS.*

## Comments Related to Costs

A few commentors included cost as a factor in their support or opposition of a technical alternative. These comments included the following:

- DOE should minimize costs devoted to duplicate processing facilities.
- The preferred alternative in the Draft EIS is not the least costly alternative.

- The plutonium separation processes will be more costly — DOE underestimated the costs of operating the canyons.
- Using Rocky Flats facilities for processing (no shipments offsite to more capable facilities) will be more costly.
- Rocky Flats should be prepared to cover costs of extending the life of the canyons if required to complete processing of Rocky Flats' materials.
- DOE must provide the necessary funding to implement the alternatives.
- Money devoted to plutonium separation should be redirected to pursuit of innovative immobilization technologies.

*In response to these comments, DOE has provided a comparison of the costs of processing technologies in Section 4.17 of this Final EIS. Cost estimates range from $428 million for the Minimize Cost Approach to $1,129 million for the No Action Alternative. The Preferred Alternative has an estimated cost of $524 million. DOE has also responded individually to each comment related to costs in Section 9.5 of the Final EIS.*

### Other Comments — Miscellaneous

- DOE should define the ultimate decisionmaker for processing under this EIS.
- DOE should specify which site has ownership of the processed residues that will be shipped to WIPP.
- DOE has issued this EIS prematurely — more information on other innovative processing technologies, contingencies, and nonproliferation impacts is needed.
- DOE waited too long to address steps needed to remove the residues from Rocky Flats; expeditious DOE decisionmaking is vital to cleanup of Rocky Flats.
- More information is needed on selection criteria; the processing technologies in the preferred alternative are not consistent with selection criteria.
- The EIS was well-written and adequately addresses impacts.
- DOE should make the EIS available electronically.

*DOE has responded individually to each miscellaneous comment in Section 9.5 of the Final EIS.*

## 6.4.2 Environmental Protection Agency Rating of the Draft EIS

The U.S. Environmental Protection Agency, Region VIII, reviewed and rated the Draft EIS in its "Category EC-2," which indicates that "EPA has identified potential environmental impacts and the EIS does not contain sufficient information to fully assess these impacts." This rating was based on EPA's comment that there is no assurance that the Waste Isolation Pilot Plant will be open any time in the near future or if it will ever be open to accept waste. Thus, EPA is concerned that the alternatives analyzed in the Draft EIS did not specifically analyze interim storage of the processed residues pending disposal or other disposition, e.g., onsite storage. EPA commented that the EIS needs to have a back-up plan to safely secure and store all waste on site, including the evaluation of the use of existing buildings (upgrading) or the building of an additional structure.

*DOE has addressed this comment by revising the alternatives and adding additional analyses for contingency storage in Section 4.14 of the Final EIS.*

### 6.4.3 Summary of Public Hearings and Comments Received

Public comment hearings on the Draft EIS were held at the following locations during the public comment period:

- Rocky Flats Environmental Technology Site, Golden, Colorado, December 10, 1997
- Los Alamos Area Office, Los Alamos, New Mexico, December 11, 1997
- Savannah River Site area, Augusta, Georgia, December 16, 1997

The hearings were announced in the Federal Register Notice on the availability of the Draft EIS, as well as in local newspapers. The public comment hearings were informal in nature in order to allow for a free-flowing dialogue. The hearing attendees were offered an opportunity to provide formal remarks, which some opted to do. However, for the most part, attendees were able to ask questions, provide comments, and engage in open discussion. Attendees also had an opportunity to have one-on-one discussions with DOE representatives prior to and after the hearing sessions. A fact sheet and corresponding poster exhibits were made available at the hearings. The fact sheet is included in Appendix A of the Final EIS.

About 50 people attended the three public hearings. Attendees included local citizens, site employees, State and local officials, and representatives of various environmental or citizens organizations. About 40 comments and questions were received at the hearings. Key comments focused on the following concerns:

- More clarification on safeguards termination limits and variances to those limits, including conditions under which a variance would be granted, processing technologies that would be used for materials that have received or not received a variance, percentages of plutonium covered by existing variances, and status of variances.
- Questions or comments about specific processing technologies, such as salt distillation, salt scrub, water leach, Purex, and cementation.
- Suggestions to further evaluate vitrification options and use mobile vitrification units.
- Clarification on the final forms of the processed residues and separated plutonium.
- Clarification of the disposition path for separated plutonium.
- Clarification on the forms of the residues to be processed.
- Comments and clarification on the "pipe and go" concept (which is encompassed under the repackaging option in Alternative 4), including analyses that have been performed to address criticality.
- Suggestions to consider contingency storage at Rocky Flats.
- Suggestions to minimize transportation.
- Suggestions to consider other locations for smaller scale processing.
- Suggestions and questions on particular impacts analyses, including waste generated, emissions, process safety in terms of accidents, and transportation.
- Clarifications of materials that would be shipped to WIPP.
- Concerns about the Resource Conservation and Recovery Act designations for some residue categories, WIPP not receiving a State of New Mexico permit for receiving mixed wastes, and Colorado's jurisdiction over proposed disposition of RCRA wastes.

*In response to these oral comments, DOE has provided additional clarification in the applicable sections of Chapter 2 of the Final EIS, as well as in the individual DOE responses provided in Section 9.5.1 of the Final EIS. (See also above summary of written comments and DOE responses.)*

### 6.4.4 DOE Responses to Public Concerns

Individual responses to each of the comments submitted to DOE, including all of those summarized above, are provided in Chapter 9 of the Final EIS.

# 7.0 PUBLIC READING ROOMS

A complete copy of the Final EIS may be reviewed at any of the Public Reading Rooms and Libraries listed below.

Simi Valley Public Library
2629 Tapo Canyon Road
Simi Valley, CA 93063

Lawrence Livermore National Laboratory
East Gate Visitors Center
Greenville Road
Livermore, CA 94550

CSU Northridge/Oviatt Library
18111 Nordhoff Street
Northridge, CA 91330

U.S. Department of Energy
Oakland Operations Office
1301 Clay Street
Room EIC, 8th Floor
Oakland, CA 94612

Platt Brand Public Library
23600 Victory Boulevard
Woodland Hills, CA 91367

U.S. Department of Energy
Golden Field Office
Public Reading Room
14869 Denver West Parkway
Golden, CO 80401

U.S. EPA
Superfund Records Center
999 18th Street, Floor 5
Denver, CO 80202

Rocky Flats Citizens Advisory Board
Public Reading Room
9035 Wadsworth Avenue, Ste. 2250
Westminster, CO 80021

Standley Lake Public Reading Room
8485 Kipling Street
Arvada, CO 80005

Rocky Flats Public Reading Room
Front Range Community College Library
3645 W. 112th Avenue
Westminster, CO 80030

University of Colorado Libraries
Government Publications
Campus Box 184
Boulder, CO 80309

Colorado Department of Public Health
4300 Cherry Creek Drive South
Denver, CO 80222

Colorado State University
Document Department
The Libraries
Ft. Collins, CO 80523

Colorado School of Mines
Arthur Lakes Library
1400 Illinois Street
P.O. Box 4029
Golden, CO 80401

Colorado State University
Library Documents Department
Ft. Collins, CO 80523

U.S. Department of Energy
1000 Independence Avenue SW
FOI Room, 1E-190, Forrestal Bldg.
Washington, DC 20585

Pullen Public Library
100 Decatur Street SE
Atlanta, GA 30303

Chatham Effingham Library
2002 Bull Street
Savannah, GA 31499

Reese Library
Augusta College
2500 Walton Way
Augusta, GA 30904

Georgia Institute of Technology
Bobby Dodd Way
Atlanta, GA 30332

Argonne National Laboratory
Technical Library
P.O. Box 2528
Idaho Falls, ID 83403

University of Illinois at Chicago
U.S. DOE Public Documents Room
801 S. Morgan Street, 3rd Floor
Chicago, IL 60607

East St. Louis Public Library
Dr. Ram Chauhan
405 North 9th Street
East St. Louis, IL 62201

Lincoln Library
Reference Department
326 South 7th Street
Springfield, IL 62701

Salina Public Library
Marc Boucher, Reference Librarian
301 West Elm
Salinas, KS 67401

Washburn Law Library
1700 College
Topeka, KS 66621

Paducah Public Library
555 Washington Street
Paducah, KY 42001

U.S. DOE
Environmental Information Center
175 Freedom Boulevard
Kevil, KY 42053

Mid Continent Public Library
Blue Ridge Branch
9253 Blue Ridge Boulevard
Kansas City, MO 64138

St. Louis Public Library
1301 Olive Street
St. Louis, MO 63103

Scenic Regional Library
308 Hawthorn Drive
Union, MO 63084

Los Alamos Community Reading Room
1350 Central Avenue, Suite 101
Los Alamos, NM 87544

U.S. DOE Albuquerque Operations Office
National Atomic Museum
20358 Wyoming Boulevard SE
Kirtland Air Force Base
P.O. Box 5400
Albuquerque, NM 87185

U.S. Department of Energy
FOIA Reading Room
4700 Morris NE
Albuquerque, NM 87111

U.S. Department of Energy
Technical Vocational Institute
Main Campus Library
525 Buena Vista SE
Albuquerque, NM 87106

Los Alamos Community Reading Room
1350 Central Avenue
Suite 101
MS-C314
Los Alamos, NM 87544

New Mexico State Library
325 Don Gasper
Santa Fe, NM 87503

U.S. Department of Energy
Gregg Graniteville Library
171 University Parkway
Aiken, SC 29801

County Library
404 King Street
Charleston, SC 29403

South Carolina State Library
1500 Senate Street
P.O. Box 11469
Columbia, SC 29211

Orangeburg County Free Library
510 Louis Street NE
P.O. Box 1367
Orangeburg, SC 29116

Lawson McGhee Public Library
500 West Church Avenue
Knoxville, TN 37902

Nashville Public Library
225 Polk Avenue
Nashville, TN 37203

DOE Public Reading Room
Oak Ridge Operations Office
55 Jefferson Circle, Room 1123
Oak Ridge, TN 37831

QA: N/A

# COVER SHEET

***Responsible Agency:*** United States Department of Energy (DOE)

***Title:*** Final Environmental Impact Statement on Management of Certain Plutonium Residues and Scrub Alloy Stored at the Rocky Flats Environmental Technology Site

***Contact:*** For further information, or to submit comments concerning this Final Environmental Impact Statement (EIS), contact:


*Charles Head, Senior Technical Advisor*
Office of Nuclear Material and Facility Stabilization (EM-60)
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585
Telephone: 202-586-5151 ▪ Fax: 202-586-5393 ▪ E-Mail: RFPR.EIS@em.doe.gov


For general information on DOE's National Environmental Policy Act (NEPA) process, contact:


*Carol Borgstrom, Director*
Office of NEPA Policy and Assistance (EH-42)
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585
Telephone: 202-586-4600 or leave a message at 1-800-472-2756



***Abstract:*** DOE proposes to process certain plutonium-bearing materials being stored at the Rocky Flats Environmental Technology Site (Rocky Flats) located near Golden, Colorado. These materials are plutonium residues and scrub alloy remaining from nuclear weapons manufacturing operations formerly conducted by DOE at this site. Processing is needed to address immediate health and safety concerns regarding storage of the materials, as raised by the Defense Nuclear Facilities Safety Board in Recommendation 94-1, and to prepare the materials for offsite disposal or other disposition. These actions would be taken in a manner that supports Rocky Flats site closure and limits worker exposure and waste production. Disposal or other disposition would eliminate health and safety concerns associated with indefinite storage of these materials.

DOE has identified and assessed four alternatives for processing these plutonium-bearing materials: (1) *No Action*, (2) *Processing without Plutonium Separation*, (3) *Processing with Plutonium Separation*, and (4) *Combination of Processing Technologies*. Under the *No Action Alternative*, DOE would stabilize the materials for safe interim storage at Rocky Flats. Under the *Processing without Plutonium Separation Alternative*, DOE would conduct more extensive operations at Rocky Flats to process the materials for disposal using technologies such as immobilization or blend-down. Under the *Processing with Plutonium Separation Alternative*, DOE would remove most of the plutonium from the plutonium-bearing materials in preparation for disposal and would manage the separated plutonium in accordance with decisions to be reached after completion of the Surplus Plutonium Disposition Environmental Impact Statement. Rocky Flats, the Savannah River Site, and Los Alamos National Laboratory are identified as potential sites for processing with plutonium separation. Any plutonium resulting from separation processes would be placed in safe and secure storage pending disposition. Under the *Combination of Processing Technologies Alternative*, DOE would process certain residues using elements of technologies analyzed under Alternatives 1 and 2, and would apply a variance from safeguards termination limits to certain plutonium residues to allow disposal after they are stabilized and/or repackaged.


***Public Comment:*** In preparing the Final EIS, DOE considered comments received by mail, fax, Internet, and orally at public hearings. Public hearings were held in December 1997 near Rocky Flats, the Savannah River Site, and Los Alamos National Laboratory. The public has an additional 45-day opportunity to comment on materials identified in Section 1.5.2 of this Summary.

**Department of Energy**
Washington, DC 20585

August 18, 1998

Dear Interested Party:

The first enclosure to this letter is the *Summary of the Final Environmental Impact Statement on Management of Certain Plutonium Residues and Scrub Alloy Stored at Rocky Flats Environmental Technology Site* (DOE/EIS-0277F, August 1998). This Environmental Impact Statement (EIS) has been prepared in accordance with requirements of the National Environmental Policy Act (NEPA) to consider the potential impacts of alternatives for management of certain plutonium residues and all of the scrub alloy stored at the Rocky Flats Environmental Technology Site (Rocky Flats) to meet requirements for disposal or other disposition.

The Final EIS identifies preferred processing technologies for each category of material within the scope of the EIS, and includes activities that would be accomplished at three DOE sites. Under the preferred alternative, most of the material (88%) would be processed at Rocky Flats near Golden, Colorado and the remainder at the Savannah River Site near Aiken, South Carolina (10%) and Los Alamos National Laboratory in Los Alamos, New Mexico (2%). The analyses in the EIS demonstrate that the potential impacts on the environment, workers, and general public of implementing any of the alternatives evaluated in the Final EIS (including the preferred alternative) would be small and within applicable state and federal regulatory limits.

The alternatives analyzed in the Final EIS were either analyzed in the Draft EIS or are composed of elements of alternatives analyzed in the Draft EIS. For materials for which the preferred processing technology was not addressed in the Draft EIS in the same manner as it appears in the Final EIS, or for which any variances to safeguards termination limits had not been granted at the time the Draft EIS was issued, DOE is providing a 45-day comment period. The second enclosure to this letter identifies the material categories that are covered by the 45-day public comment period and explains how the public can submit comments.

To accommodate the 45-day comment period, DOE will issue Records of Decision (ROD) for this Final EIS in sequence. The first ROD will be issued no sooner than 30 days after issuance of the Final EIS and will address only materials not covered in the public comment period (i.e., those for which the preferred processing technology was specifically analyzed in the Draft EIS, and for which any necessary variances to safeguards termination limits had been granted at the time the Draft EIS was issued). The second ROD will be issued after the comment period has closed, and any additional comments have been considered and addressed, as appropriate.

The complete Final EIS is available for review in public reading rooms at the addresses listed at the end of the *Summary*. You may also obtain a copy of the entire Final EIS by telephoning the Center for Environmental Management Information at 1-800-736-3282 (or, in Washington, D.C., at 202-863-5084). The Final EIS will be available on DOE's NEPA website at **http://tis.eh.doe.gov/nepa**. The Environmental Management website will also contain the EIS summary at **http://www.em.doe.gov**.

Sincerely,

James M. Owendoff

James M. Owendoff
Acting Assistant Secretary for
Environmental Management

Enclosures

# PUBLIC COMMENT NOTICE

## ADDITIONAL 45-DAY COMMENT PERIOD ON PORTIONS OF THE *FINAL ENVIRONMENTAL IMPACT STATEMENT ON MANAGEMENT OF CERTAIN PLUTONIUM RESIDUES AND SCRUB ALLOY STORED AT THE ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE*

The Department of Energy (DOE) is inviting public comment on DOE's preferred alternative for management of the following plutonium residue categories, as described in the *Final Environmental Impact Statement on Management of Certain Plutonium Residues and Scrub Alloy Stored at the Rocky Flats Environmental Technology Site* (DOE/EIS-0277F of August 1998):

| Residue Category | Preferred Alternative |
|---|---|
| Incinerator Ash Residues | Repackage at Rocky Flats (Alternative 4) |
| Graphite Fine Residues | Repackage at Rocky Flats (Alternative 4) |
| Inorganic Ash Residues | Repackage at Rocky Flats (Alternative 4) |
| Molten Salt Extraction/ Electrorefining Salt Residues | Pyro-oxidize, if necessary, and repackage at Rocky Flats (Alternative 4) |
| Direct Oxide Reduction Salt Residues (Item Description Codes 365, 413, 417 and 427) | Acid Dissolution at Los Alamos National Laboratory (Alternative 3); or Pyro-oxidize, if necessary, and repackage at Rocky Flats (Alternative 4) |
| HEPA Filter Media Residues | Neutralize and dry, if necessary, and repackage at Rocky Flats (Alternative 4) |
| Sludge Residues | Filter and dry, if necessary, and repackage at Rocky Flats (Alternative 4) |

At the end of the 45-day comment period (which will begin with publication of the Notice of Availability of the Final EIS in the *Federal Register* by the Environmental Protection Agency [expected around August 28, 1998]), DOE will determine whether any comments have been received that raise issues requiring further analysis. If DOE determines that no further analysis is required, DOE will issue a second Record of Decision specifying its decisions for management of the material categories listed above. The second Record of Decision would include DOE's responses to any comments received from the public.

Alternatively, if DOE decides upon consideration of the public comments that further analysis is required before a second Record of Decision can be issued, DOE will so inform the public.

Written comments should be sent to:

Charles R. Head, Senior Technical Advisor
Office of Nuclear Material and Facility Stabilization (EM-60)
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

Or to Mr. Head at one of the following:

Fax: 202-586-5393 or E-mail: RFPR.EIS@em.doe.gov