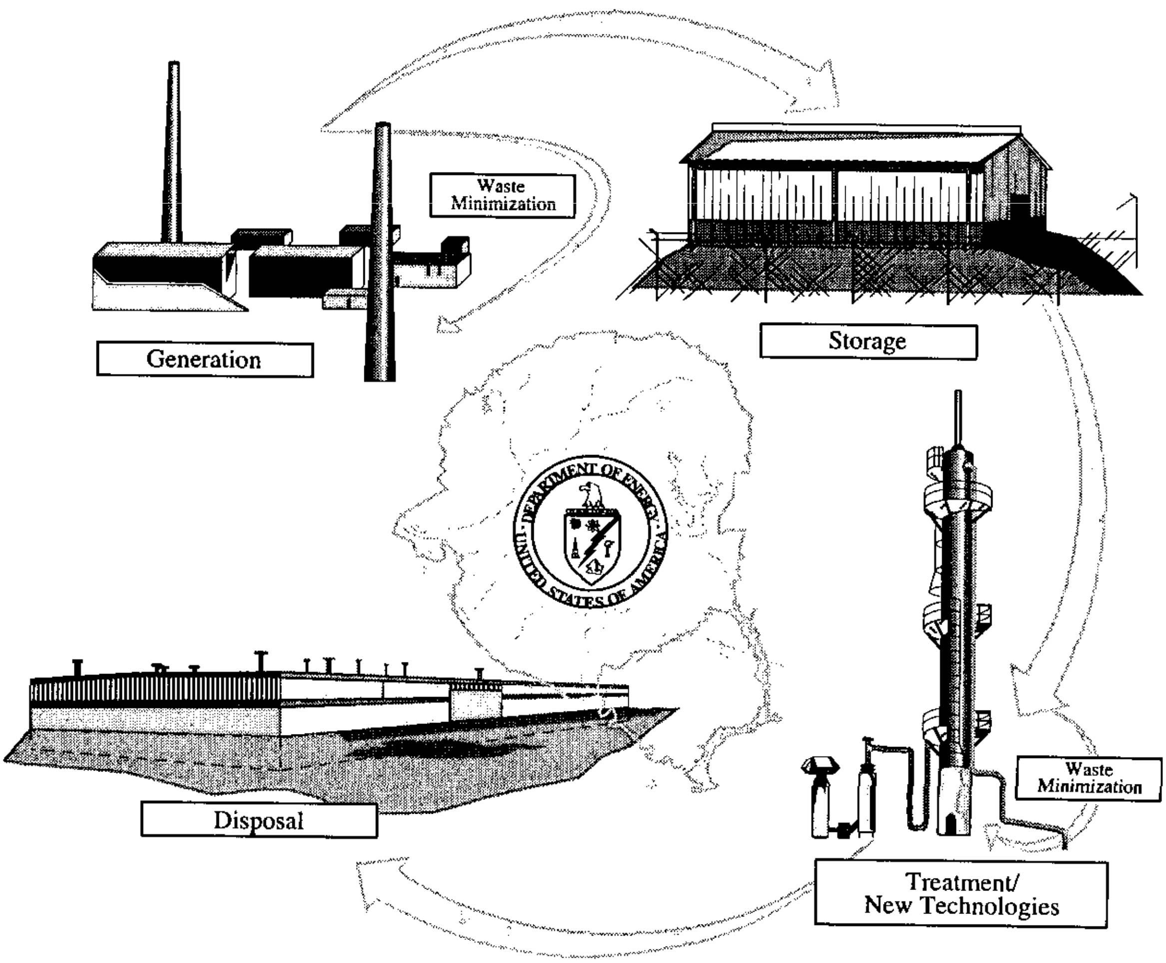
DOE/EIS-0217

Savannah River Site

Waste Management

Final
Environmental Impact Statement
Volume I



July 1995

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COVER SHEET

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ABSTRACT: The purpose of this environmental impact statement is to help DOE decide how to manage over the next 30 years liquid high-level radioactive, low-level radioactive, mixed, hazardous, and transuranic wastes generated during 40 years of past operations and on-going activities at Savannah River Site (SRS) in southwestern South Carolina. The wastes are currently stored at SRS. DOE seeks to dispose of the wastes in a cost-effective manner that protects human health and the environment. In this document, DOE assesses the cumulative environmental impacts of storing, treating, and disposing of the wastes, examines the impacts of alternatives, and identifies measures available to reduce adverse impacts. Evaluations of impacts on water quality, air quality, ecological systems, land use, geologic resources, cultural resources, socioeconomics, and the health and safety of onsite workers and the public are included in the assessment. TE TE TE

PUBLIC COMMENTS: In preparing this Final EIS, DOE considered comments received by letter and voice mail, and formal statements given at public hearings in Barnwell, South Carolina (February 21, 1995); Columbia, South Carolina (February 22, 1995); North Augusta, South Carolina (February 23, 1995); Savannah, Georgia (February 28, 1995); Beaufort, South Carolina (March 1, 1995); and Hilton Head, South Carolina (March 2, 1995). TC TC

FOREWORD

This environmental impact statement (EIS) evaluates alternative approaches to and environmental impacts of managing wastes at the Savannah River Site (SRS). The U.S. Department of Energy's (DOE's) primary mission at SRS from the 1950s until the end of the Cold War was to produce and process nuclear materials to support defense programs. These activities generated five types of waste: liquid high-level radioactive, low-level radioactive, hazardous, mixed (radioactive and hazardous combined), and transuranic wastes. These wastes are still being generated by ongoing operations, environmental restoration, and decontamination and decommissioning of surplus facilities. Because waste management alternatives would be implemented over several years, DOE may issue more than one Record of Decision based on this EIS. TE

Four waste management alternatives are evaluated in this EIS. In addition to the no-action alternative, which consists of continuing current management practices, this EIS examines one alternative for the limited treatment of waste, another for the extensive treatment of waste, and a third (the preferred alternative) that represents a moderate approach to waste treatment. The alternatives (except the no-action alternative) are analyzed based on three forecasts of the amounts of wastes that DOE could be required to manage over the next 30 years (1995 through 2024) at SRS. This EIS evaluates siting, construction, and start-up or operation of specific waste management facilities at SRS over the next 10 years, as well as operational impacts for the 30-year forecast horizon. Ten years was selected because that is approximately the time required to get a project approved, designed, and constructed. In addition, current treatment processes may be superseded by more effective processes as technology improves. Accordingly, it is not appropriate to select technologies now for treatment processes that will not be implemented in the next decade.

Assumptions and analyses in this EIS are generally consistent with those that are in or expected to be in the *Waste Management Programmatic EIS* (DOE/EIS-0200), the *Tritium Supply and Recycling Programmatic EIS* (DOE/EIS-0161), the *Stockpile Stewardship and Management Programmatic EIS* (DOE/EIS-0236), the *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs EIS* (DOE/EIS-0203), the *Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel EIS* (DOE/EIS-0218), the *Long-Term Storage and Disposition of Weapons-Useable Fissile Materials Programmatic EIS* (DOE/EIS-0229), the *Urgent-Relief Acceptance of Foreign Research Reactor Spent Nuclear Fuel Environmental Assessment* (DOE/EA-0912), the *Interim Management of Nuclear Materials at SRS EIS* (DOE/EIS-0220D), the *F-Canyon Plutonium Solutions at SRS EIS* (DOE/EIS-0219), the *Defense Waste Processing Facility Supplemental EIS* (DOE/EIS-0082S), the

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TC TE *Operations of the HB-Line Facility and Frame Waste Recovery Process for Production of Pu-238 Oxide* (DOE/EA-0948), the *Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components EIS* (DOE/EIS-0225), and the *SRS Proposed Site Treatment Plan* for mixed waste.

DOE published a Notice of Intent to prepare this EIS in the *Federal Register* on April 6, 1994 (59 FR 16494). The notice announced a public scoping period that ended on May 31, 1994, and solicited comments and suggestions on the scope of the EIS. DOE held scoping meetings during this period in Savannah, Georgia, and North Augusta and Columbia, South Carolina, on May 12, 17, and 19, 1994, respectively. During the scoping period, comments were received from individuals, organizations, and government agencies. Comments received during the scoping period and DOE's responses were used to prepare an implementation plan that defined the scope and approach of this EIS. The implementation plan was issued by DOE in June 1994. TE

TE Transcripts of public testimony received during the scoping process, copies of letters and comments, the implementation plan, and reference materials cited in this EIS are available for review in the DOE Public Reading Room, located at the University of South Carolina-Aiken Campus, Gregg-Graniteville Library, 2nd Floor, University Parkway, Aiken, South Carolina [(803) 648-6851], and the Freedom of Information Reading Room, Room IE-190, Forrestal Building, 1000 Independence Avenue, Washington, D.C. [(202) 586-6020].

DOE completed the draft of this EIS in January 1995, and on January 27, 1995, the U.S. Environmental Protection Agency (EPA) published a Notice of Availability of the document in the *Federal Register* (60 FR 5386). This notice officially started the public comment period on the draft EIS, which extended through March 31, 1995. Publication of the draft EIS provided an opportunity for public comment on the nature and substances of the analyses included in the document.

TC DOE has considered comments it received during the comment period in preparing this final EIS. These comments were received by letter, telephone, and formal statements made at public hearings held in Barnwell, South Carolina (February 21, 1995); Columbia, South Carolina (February 22, 1995); North Augusta, South Carolina (February 23, 1995); Savannah, Georgia (February 28, 1995); Beaufort, South Carolina (March 1, 1995); and Hilton Head, South Carolina (March 2, 1995). Comments and responses to comments are in Appendix I.

Changes from the draft EIS are indicated in this final EIS by vertical bars in the margin. The bars are marked TC for technical changes, TE for editorial changes, or, if the change was made in response to a public comment, the designated comment number as listed in Appendix I. Many of the technical changes were the result of the availability of updated information since publication of the draft EIS.

In May 1995, DOE announced its intention to revise the moderate treatment alternative to include supercompaction, size reduction (e.g., sorting, shredding, melting), and incineration at an offsite commercial treatment facility (60 FR 26417, May 17, 1995). The proposed change from the draft EIS concerned the location of, but not the technology used in the treatment of about 40 percent of the expected volume of low-level wastes at SRS. DOE provided an opportunity for public comment through June 12, 1995. No comments were received.

The proposed low-level waste volume reduction initiative is included in this final EIS, and as announced in the May 1995 *Federal Register* notice, it is subject to competitive procurement practices under procedures described in DOE's NEPA implementing regulations (10 CFR 1021.216). A Request for Proposals was sent to a selected group of 47 potential bidders on May 22, 1995 with a closing date of July 20, 1995. Work under any contract awarded would begin no earlier than the start of fiscal year 1996. TC

In June 1995, DOE published a draft of the *Environmental Assessment for the Off-Site Volume Reduction of Low-Level Radioactive Waste from the Savannah River Site* (DOE/EA-1061) for preapproval review by potentially affected states. The environmental assessment describes a proposed short-term temporary method of volume reduction for low-level waste by a commercial facility in Oak Ridge, Tennessee. This action would reduce the volume of low-level waste at SRS in an expedient and cost-effective manner over the near term (prior to the start of fiscal year of 1996). Because the impacts of the proposed action would be very small and the proposed action would not limit the selection of alternatives under consideration, this proposed volume reduction action qualifies as an interim action under the National Environmental Policy Act (NEPA) regulations (40 CFR 1506.1).

DOE prepared this EIS in accordance with the provisions of NEPA, Council on Environmental Quality regulations (40 CFR 1500-1508), and DOE NEPA Implementing Procedures (10 CFR 1021). This EIS identifies the methods used in the analyses and the sources of information. In addition, it incorporates, directly or by reference, information from other ongoing studies. The document is structured as follows: TE

Chapter 1 provides background information, sets forth the purpose and need for action, and describes related actions evaluated in other NEPA analyses. TE

TC Chapter 2 describes the alternatives, identifies the preferred alternative, and provides a summary comparison of the environmental impacts of each alternative.

TE Chapter 3 describes the environment at SRS potentially affected by the alternatives addressed.

TE Chapter 4 provides a detailed assessment of the potential environmental impacts of the alternatives. It also assesses unavoidable adverse impacts and irreversible or irretrievable commitments of resources, and cumulative impacts.

Chapter 5 identifies regulatory requirements and evaluates their applicability to the alternatives considered.

Appendix A provides waste forecasts (i.e., estimates of the expected, minimum, and maximum amounts of waste that could be managed over the 30-year analysis period at SRS).

Appendix B describes existing and proposed facilities that would be needed to implement the alternatives.

Appendix C describes the cost methodology and its application in estimating costs for facilities and processes to treat, store, and dispose of wastes.

Appendix D discusses emerging or innovative waste management technologies that were considered but rejected for use on SRS wastes. The technologies are in bench, pilot, or demonstration stages of development and are not likely to be available for implementation in the next decade, but might be suitable for implementation at some time during the 30-year period addressed in this EIS.

Appendix E furnishes a compilation of supplemental technical data used to prepare this EIS.

Appendix F describes accident scenarios related to the facilities that could be used to manage waste at SRS. It summarizes the potential consequences and risks to workers, the public, and the environment from the alternatives discussed in Chapter 2.

Appendix G is a compilation of the appendixes included in the Federal Facility Agreement and provides information on the commitments made by SRS to regulatory agencies to manage wastes and spills.

Appendix H compares DOE and Nuclear Regulatory Commission low-level waste requirements.

Appendix I contains copies of letters and hearing transcripts from the public comment period, and DOE's responses to those comments.

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Appendix J is a copy of the Protected Species Survey prepared in April 1995 in support of the draft EIS and agency confirmation that endangered species will not be impacted.

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SUMMARY

S.1 Introduction

The U.S. Department of Energy's (DOE's) primary mission at the Savannah River Site (SRS) from the 1950s until the end of the Cold War was to produce and process nuclear materials to support defense programs. The end of the Cold War has led the United States to reduce the size of its nuclear arsenal. Many of the more than 120 facilities across the country, including SRS, that DOE used to manufacture, assemble, and maintain the former arsenal -- referred to as the nuclear weapons complex -- are no longer needed for these activities and could be used for other purposes. Many of these facilities can be decontaminated and converted to new uses; others must be decommissioned. In addition, the wastes generated during the Cold War must be cleaned up in a safe and cost-effective manner. DOE must also manage wastes that might be generated in the future by ongoing operations, including new defense facilities that might be located at SRS. Finally, SRS must be brought into compliance with the environmental requirements enacted during the last 25 years.

DOE prepared this environmental impact statement (EIS) on alternative strategies for managing wastes at SRS (Figure S-1). This EIS evaluates the effects of managing liquid high-level radioactive, low-level radioactive, hazardous, mixed (radioactive and hazardous), and transuranic wastes at SRS. It describes alternatives that DOE could implement to manage these wastes [except alternatives for managing liquid high-level radioactive waste, which were addressed in the recently issued *Final Supplemental Environmental Impact Statement, Defense Waste Processing Facility* (DOE/EIS-0082S)]. It does not consider sanitary wastes or foreign and domestic spent nuclear fuel. In addition, this EIS describes studies that were performed to define and evaluate the alternatives.

Tables S-1 and S-2 present summary comparisons of the characteristics and impacts of the alternatives considered. The tables include the no-action alternative, which would be to continue ongoing activities and implement only activities that have already been evaluated under the National Environmental Policy Act (NEPA), and three action alternatives. The action alternatives are based on strategies to provide limited (alternative A), moderate (alternative B), and extensive (alternative C) treatment configurations, all of which would protect human health and the environment, meet applicable storage and disposal requirements, and use reasonable storage, treatment, and disposal technologies. This summary describes the alternatives and the basis for DOE to identify the moderate treatment configuration alternative as its preferred alternative.

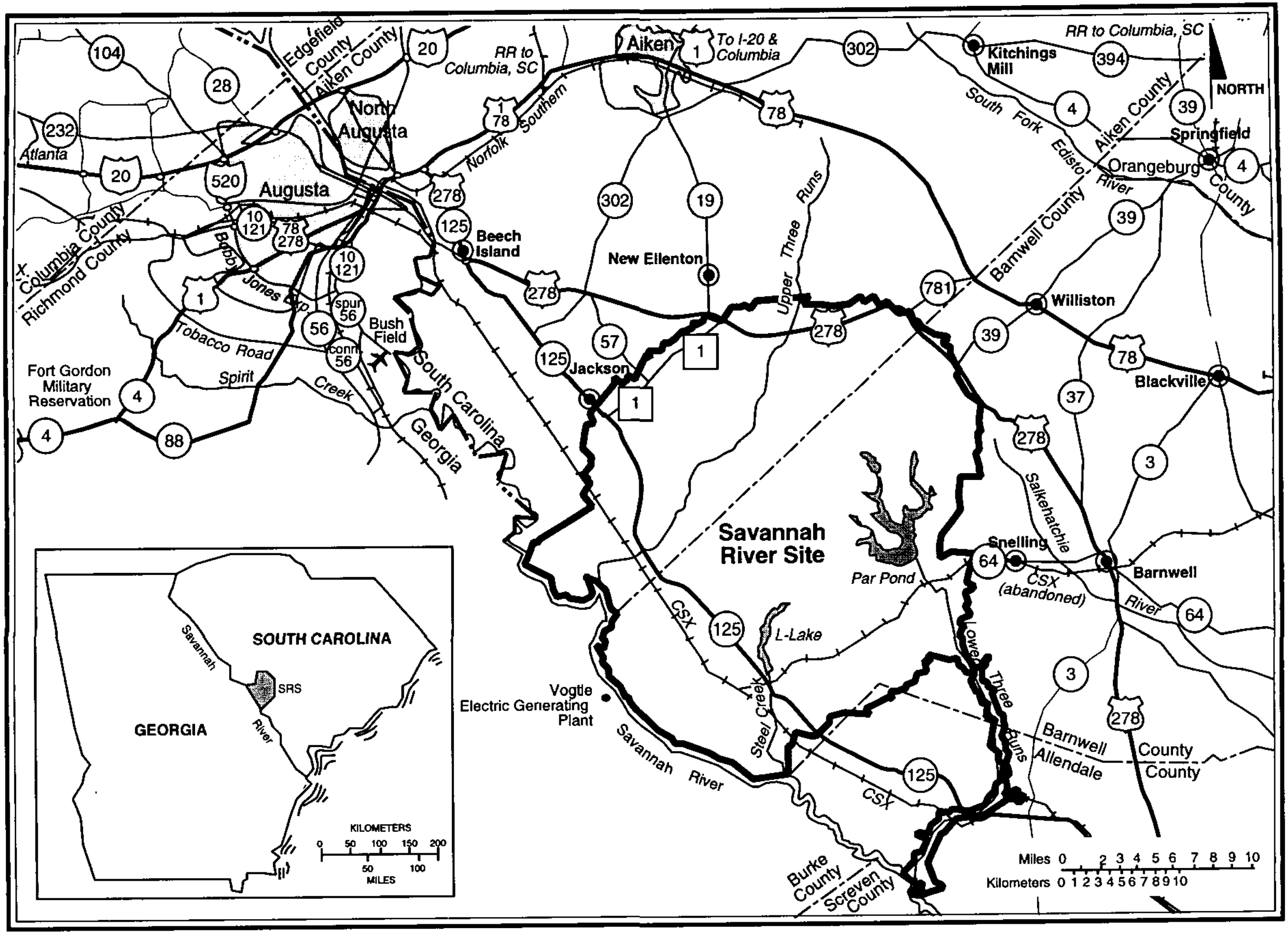

Figure S-1. Savannah River Site.

This EIS provides information on the environmental impacts of the construction and operation of the specific treatment, storage, and disposal facilities proposed in each management alternative. The EIS is based on current waste inventories; present and anticipated sources of new wastes; and existing and anticipated waste management facilities. The evaluations in this EIS are intended to be consistent with those in or expected to appear in the *Waste Management Programmatic EIS* (DOE/EIS-0200), the *Tritium Supply and Recycling Programmatic EIS* (DOE/EIS-0161), the *Stockpile Stewardship and Management Programmatic EIS* (DOE/EIS-0236), the *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs EIS* (DOE/EIS-0203), the *Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel EIS* (DOE/EIS-0218), the *Long-Term Storage and Disposition of Weapons-Useable Fissile Materials Programmatic EIS* (DOE/EIS-0229), the *Urgent-Relief Acceptance of Foreign Research Reactor Spent Nuclear Fuel Environmental Assessment* (DOE/EA-0912), the *Interim Management of Nuclear Materials at SRS EIS* (DOE/EIS-0220), the *F-Canyon Plutonium Solutions at SRS EIS* (DOE/EIS-0219), the *Defense Waste Processing Facility Supplemental EIS* (DOE/EIS-0082S), the *Operations of the HB-Line Facility and Frame Waste Recovery Process for Production of Pu-238 Oxide* (DOE/EA-0948), the *Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components EIS* (DOE/EIS-0225), and the *SRS Proposed Site Treatment Plan* for mixed waste. DOE will use these evaluations to make decisions on waste management. Because management alternatives would be implemented over the next decade, DOE may issue more than one Record of Decision following completion of this EIS. TE

In preparing this EIS, DOE considered the comments it received from organizations and individuals during the scoping process that extended from April 6 through May 31, 1994. The scoping process and plans for preparing this EIS were described in the *Implementation Plan Savannah River Site Waste Management Environmental Impact Statement*, which DOE issued in June 1994. DOE also considered comments it received on the draft EIS issued in January 1995 during a public comment period that extended from January 27, 1995, to March 31, 1995.

In May 1995, DOE announced its intention to revise the moderate treatment alternative to include supercompaction, size reduction (e.g., sorting, shredding, melting), and incineration at an offsite commercial treatment facility (60 FR 26417, May 17, 1995). The proposed change from the draft EIS concerned the location of, but not the technology used in the treatment of about 40 percent of the expected volume of low-level wastes at SRS. DOE provided an opportunity for public comment through June 12, 1995. No comments were received. TC

In June 1995, DOE published a draft of the *Environmental Assessment for the Off-Site Volume Reduction of Low-Level Radioactive Waste from the Savannah River Site* (DOE/EA-1061) for preapproval review by potentially affected states. The environmental assessment describes a proposed short-term temporary method of volume reduction for low-level waste by a commercial facility in Oak Ridge, Tennessee. This action would reduce the volume of low-level waste at SRS in an expedient and cost-effective manner over the near term (prior to the start of fiscal year of 1996). Because the impacts of the proposed action would be very small and the proposed action would not limit the selection of alternatives under consideration, this proposed volume reduction action qualifies as an interim action under NEPA regulations (40 CFR 1506.1).

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DOE has identified the moderate treatment configuration, alternative B, as its preferred alternative based on the careful consideration of beneficial and adverse environmental impacts, regulatory commitments, and other relevant factors. The moderate treatment configuration would provide a balanced mix of technologies that includes extensive treatment of those waste types that have the greatest potential to adversely affect humans or the environment because of their mobility or toxicity if left untreated (such as wastes containing plutonium-238), or that would remain dangerously radioactive far into the future (such as wastes containing transuranics). It would provide less extensive treatment of wastes that do not pose great threats to humans or the environment, or that will not remain dangerously radioactive far into the future (such as non-alpha low-level waste).

DOE bases its preference of alternative B on the following environmental impacts, regulatory commitments, and other factors:

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- Mixed waste technology selections are compatible with the site treatment plan. When a waste in the EIS 30-year forecast was also included in the site treatment plan 5-year forecast, alternative B uses the same technology as that identified as the preferred treatment by the proposed site treatment plan.

- Mixed waste technology selections are consistent with DOE's commitments under the Land Disposal Restrictions Federal Facility Compliance Agreement with EPA.

- Transuranic waste technology selections are compatible with what the final Waste Isolation Pilot Plant waste acceptance criteria are expected to require. Treatment is provided only for those transuranic wastes that do not conform to the shipping requirements (i.e., plutonium-238 and higher activity plutonium-239). All other SRS transuranic wastes are expected to meet the Waste Isolation Pilot Plant waste acceptance criteria after repackaging and characterization/certification.

- Hazardous wastes are treated onsite subject to availability of treatment capacity and compatibility with technologies required to manage mixed waste.

- Alternative B provides the best volume reduction for low-activity waste (75 percent reduction in alternative B compared to 22 percent for alternative A and 70 percent for alternative C), conserves space in low-activity waste vaults, reduces the total number of low-activity waste vaults, and thus avoids expenditures of land and money.

- Alternative B also results in the fewest number of additional transuranic and alpha waste pads, shallow land disposal trenches, and RCRA-permitted vaults.

- Alternative B results in the least construction-related air emissions. TC

- Alternative B employs less thermal treatment (technologies generally resulting in higher air emissions) than alternative C, resulting in smaller radiological air impacts than would occur in alternative C (e.g., fewer involved worker latent cancer fatalities and lower maximally exposed offsite individual fatal cancer probability).

In summary, DOE believes that alternative B provides the preferred configuration of treatment, storage, and disposal facilities for SRS. It maintains technology selection flexibilities that are not shared by alternatives based on strategies to provide limited (alternative A) or extensive (alternative C) treatment configurations.

Different wastes and volumes are proposed for treatment in the Consolidated Incineration Facility under alternatives A, B, and C. Under the no-action alternative, the Consolidated Incineration Facility would not operate and the wastes that could have been treated in it would be stored, sent offsite for treatment, or compacted and then disposed of in vaults. In the limited-treatment configuration (alternative A), the Consolidated Incineration Facility would burn certain mixed wastes (including mixed waste identified in the site treatment plan) and hazardous wastes for which incineration is the best demonstrated available or EPA-specified technology. In the moderate-treatment configuration (alternative B) the Consolidated Incineration Facility would burn some low-level radioactive wastes in addition to the mixed and hazardous wastes proposed in alternative A. In the extensive-treatment configuration (alternative C), the Consolidated Incineration Facility would burn the same wastes proposed in alternative B and a portion of the alpha waste, but only for approximately 10 years. After that period, two vitrification facilities would treat those wastes, and the Consolidated Incineration Facility would no longer operate.

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This EIS was prepared in accordance with the National Environmental Policy Act of 1969, which requires Federal agencies to prepare a detailed statement on the environmental impacts of the proposed action and alternatives to the proposed action for "major Federal actions significantly affecting the quality of the human environment." DOE's policy is to follow the letter and spirit of NEPA and to comply fully with the Council on Environmental Quality's *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* (40 CFR 1500-1508) (DOE regulations at 10 CFR 1021, National Environmental Policy Act Implementing Procedures).

S.2 Background

TE DOE's primary mission at SRS from the 1950s until the end of the Cold War was to produce and process nuclear materials to support defense programs in the United States. These activities resulted in the generation of the five types of waste discussed in this EIS. SRS's present mission focuses on waste management, environmental restoration, and decontamination and decommissioning of facilities that are no longer needed to produce and process nuclear materials.

DOE is responding to several needs and issues in proposing a waste management strategy for SRS and preparing this EIS. In addition to the examination of alternative strategies for waste management at SRS, this EIS presents the results of other analyses of waste management.

The Federal Facility Compliance Act of 1992, an amendment to the Resource Conservation and Recovery Act (RCRA) (Public Law 102-386, October 6, 1992), requires DOE to prepare a site treatment plan for SRS that sets forth options for treating mixed wastes currently in storage or that will be generated over the next 5 years. This EIS analyzes the environmental impacts of the facilities that could TE be used to treat mixed wastes according to the options presented in SRS's plan; the DOE *Waste Management Programmatic EIS* also examines the possible impacts of treating mixed wastes at SRS and elsewhere. The alternatives evaluated here and others are consistent with the options presented in the site treatment plan. However, the plan is limited to options for treating mixed wastes currently in storage or generated during the next 5 years. This EIS evaluates alternatives for managing mixed and other types TE of wastes using existing and new facilities that would be available during the next 10 years. This EIS also establishes a baseline for assessing options for waste management for the period beyond that of the site treatment plan. For example, this EIS examines options for storing, treating, and disposing of low- TE level radioactive and hazardous wastes that are not mixed waste and which, therefore, are not addressed in the site treatment plan.

On October 22, 1993, DOE stated that it would prepare this EIS on waste management strategies for SRS and identified some of the elements that would be evaluated. DOE committed to evaluate in this EIS TE both the facilities that might be used to treat mixed wastes, as required by the Federal Facility Compliance Act of 1992, and the operation of the Consolidated Incineration Facility. (DOE prepared an environmental assessment [DOE/EA-0400] and issued a Finding of No Significant Impact [*Federal Register*, December 24, 1992] on the Consolidated Incineration Facility, which is currently under TC construction.) The proposed treatments of mixed waste would be taken into account in formulating the alternatives for this EIS. DOE stated that it would evaluate the Consolidated Incineration Facility and other alternatives (e.g., compaction) for reducing the volume of low-level waste. The cost analysis of potential alternatives would be based on life-cycle costs (i.e., construction, operation, and decommissioning) of facilities so that the costs of the Consolidated Incineration Facility would be calculated on a consistent basis for comparison to the facilities for which detailed facility designs have not been developed. The incinerator's construction would continue on schedule, but trial burns would be TC deferred until this EIS is completed and DOE decides on how or whether to use the Consolidated Incineration Facility.

This EIS is intended to meet DOE's commitments to the public to re-examine the environmental impacts TE of operating the Consolidated Incineration Facility; it also provides a basis for future DOE decisions on operation of that facility.

This EIS incorporates the preferred options proposed in the *SRS Proposed Site Treatment Plan* for mixed TC wastes and evaluates the environmental impacts that may result from management activities for liquid high-level radioactive, low-level radioactive, hazardous, mixed, and transuranic wastes at SRS over the next 30 years. This EIS includes an assessment of the cumulative impacts of waste management and other past, ongoing, and reasonably foreseeable activities at SRS in Section 4.15. TE

S.3 Purpose and Need for Agency Action

Many of the more than 120 facilities across the country that DOE used to manufacture, assemble, and maintain its nuclear arsenal – referred to as the nuclear weapons complex – are no longer needed for TE these activities and could be used for other purposes. In addition, the wastes generated during the Cold War must be cleaned up in a safe and cost-effective manner. Furthermore, SRS facilities must be TC brought into compliance with the many environmental requirements enacted since 1970.

In order to convert a number of facilities to other uses and clean-up the Cold War's legacy at SRS, DOE needs to develop a strategy for managing existing and future wastes. The purpose of the alternatives TE evaluated in this EIS is to ensure the protection of human health and the environment, and to achieve and maintain regulatory compliance in a cost-effective manner. This EIS evaluates the potential environmental impacts of alternative strategies for minimizing, treating, storing, and disposing of radioactive and hazardous wastes at SRS.

To evaluate strategies for managing wastes, DOE must predict the amount of waste it will manage at SRS from operations, decontamination and decommissioning, and environmental restoration. Although TE the defense mission at SRS has been reduced, continuing and new operations will generate some wastes. In some cases, the amounts of wastes that will be generated can only be estimated approximately because final decisions about some operations have not been made. For example, processing high-level waste into borosilicate glass, as described in the *Final Supplemental Environmental Impact Statement, Defense Waste Processing Facility*, and the interim management of nuclear materials would generate secondary wastes. Estimates of these wastes have been included in the waste forecasts.

It is also difficult to predict the amounts of wastes requiring management because DOE does not know the extent of decontamination and decommissioning or environmental restoration that will take place at SRS. At present, DOE cannot identify all of the facilities that will become surplus or predict when a particular facility will no longer be needed to maintain the nuclear arsenal. Thus, DOE does not have a TE complete schedule of the facilities it will eventually decontaminate and decommission. In addition, DOE cannot identify at this time all of the contaminated areas at SRS that will require restoration. As a result of these uncertainties about the amounts of wastes that will be generated, DOE has estimated a range of waste quantities it could generate at SRS during the restoration of contaminated areas and the decontamination and decommissioning of surplus facilities. The maximum and minimum forecasts of TE the wastes generated by restoration and decontamination and decommissioning were used in the analyses presented in this EIS.

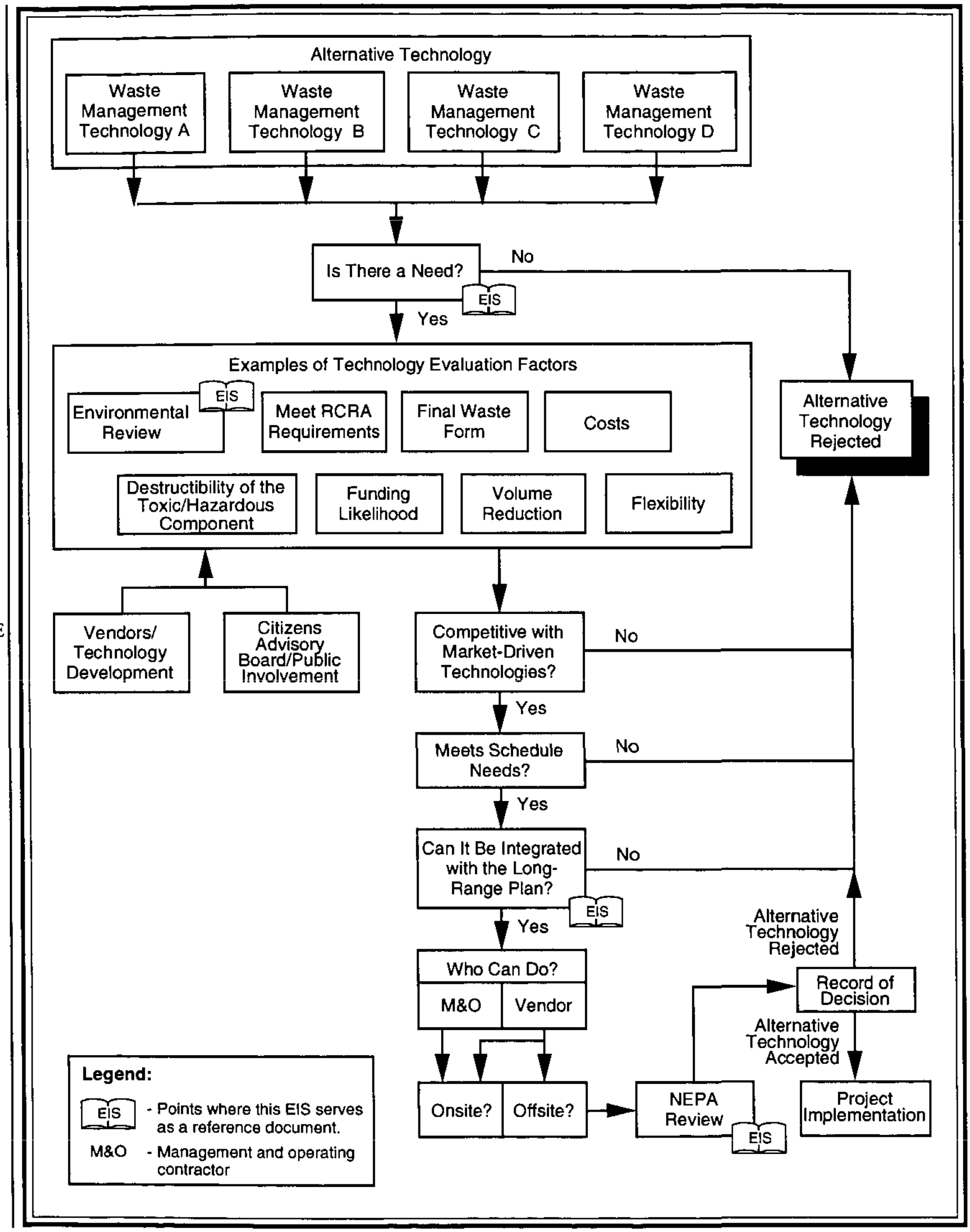
In addition to wastes that have been or will be generated at SRS, SRS may receive and manage wastes TE from other DOE facilities. Estimating the amounts of wastes to be received from other facilities is even more difficult than predicting the amounts of wastes that will be generated at SRS. The amounts of offsite waste sent to SRS will depend on activities at other DOE facilities involving ongoing operations, waste management, environmental restoration, and decommissioning. These activities in turn depend on NEPA reviews DOE is conducting on: (1) the future needs of the nuclear weapons complex; (2) the possible consolidation of nuclear materials and wastes at certain facilities; and (3) the locations of treatment, storage, and disposal facilities in the DOE complex. For purposes of this EIS, DOE has assumed that the wastes SRS will receive from other sites will fall somewhere between the amounts it now receives (included in the expected forecast) and a maximum estimate which includes all wastes that have been identified to date as possible candidates for treatment, storage, or disposal at SRS (included in the maximum forecast).

S.4 Proposed Action

DOE needs to develop a strategy to manage radioactive and hazardous wastes at SRS now and in the future. DOE proposes to select and implement a waste management strategy for SRS that protects human health, complies with environmental regulations, minimizes waste generation, utilizes effective and commercially available technologies for near-term management needs, and is cost effective. There are numerous technologies available to treat wastes like those generated and stored at SRS. DOE conducted a thorough evaluation to determine the best available technologies for specific SRS wastes. The abilities of emerging technologies to decontaminate, reduce the volume of, or stabilize SRS wastes were evaluated against three general criteria: their ability to treat SRS wastes and meet regulatory requirements; their safety and environmental risks; and their cost compared to competitive technologies. The technology evaluation process is illustrated in Figure S-2. Figure S-2 is a general representation of the process by which specific technologies may be selected over time as new technologies become available or as waste management issues become apparent. It is not intended to illustrate the structure of this EIS (references in the figure to this EIS are intended to show where this document serves as a useful planning baseline). Candidate technologies selected for evaluation include waste minimization, compaction, incineration, vitrification, macroencapsulation, and containment. Facilities that use these technologies and were selected as part of one or more of the action alternatives include: TC

- Consolidated Incineration Facility
- Transuranic waste characterization/certification facility
- Containment building for the treatment of hazardous and mixed wastes
- Alpha and non-alpha vitrification facilities
- Offsite supercompactor
- Soil sort facility

Other management facilities and treatments evaluated in the alternatives are listed in Table S-1. The strategy DOE selects must address minimization, treatment, storage, and disposal of low-level radioactive, hazardous, mixed, and transuranic wastes at SRS. This EIS evaluates the environmental impacts of three potential action alternatives, in addition to the no-action alternative required by NEPA. TE



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TE **Figure S-2.** Process for evaluating waste management technologies.

S.5 Alternatives

In this EIS, the no-action alternative is defined as the continuation of current management practices and includes building additional facilities to store newly generated waste, as has been done in the past. The no-action alternative is presented first because its implementation would continue current practices for treatment and storage of liquid high-level radioactive (including operation of the Defense Waste Processing Facility), mixed, and transuranic waste; disposal of low-level radioactive waste; and offsite treatment and disposal of hazardous waste.

The no-action alternative would not meet the need for DOE action. It would leave transuranic and mixed wastes untreated, in storage, and in forms not suitable for disposal. It could also cause DOE to violate some regulatory requirements and agreements. The no-action alternative provides a baseline against which the environmental impacts of the action alternatives can be compared. Because it is a baseline and represents a continuation of current practices, its impacts were evaluated using the expected 30-year waste forecast. TE TE

Under the no-action alternative, additional storage and disposal facilities would be constructed (shown in Table S-1) and some treatment facilities currently under construction and planned facilities already evaluated under NEPA would be completed and, with the exception of the Consolidated Incineration Facility, operated. Planned facilities that would operate under the no-action alternative as well as in the three action alternatives include: TE

- E-Area vaults for the disposal of low-level wastes
- Hazardous Waste/Mixed Waste Disposal Vaults
- M-Area Vendor Treatment Facility
- Long-Lived Waste Storage Building
- Replacement High-Level Waste Evaporator
- New Waste Transfer Facility

DOE would continue to implement pollution prevention and waste minimization activities, and would continue to prepare high-level wastes for vitrification in the Defense Waste Processing Facility, as described in the recently issued *Final Supplemental Environmental Impact Statement, Defense Waste Processing Facility*. DOE would continue to compact low-level waste where appropriate, and dispose of it by shallow land disposal or in vaults, depending on waste characteristics; DOE would store long-lived wastes in a long-lived-waste storage building. Hazardous wastes would continue to be recycled for onsite use or sent offsite for treatment and disposal. Storage of mixed wastes would continue in storage TC

TC buildings and tanks onsite; DOE would vitrify limited quantities of mixed waste onsite and would store the treatment residues pending disposal in vaults; DOE would begin to ship radioactive polychlorinated biphenyls (PCBs) offsite for processing and return the residues to SRS for shallow land disposal. Transuranic and alpha wastes would continue to be stored on transuranic waste storage pads, the existing Experimental Transuranic Waste Assay Facility/Waste Certification Facility would assay and X-ray drums of transuranic and alpha waste to verify packaging and content, and newly-generated alpha waste would be disposed of in vaults. SRS would continue to receive low-level waste from the Naval Reactors Program.

TC This EIS evaluates three action alternatives that would meet DOE's need to manage wastes in a safe and cost-effective manner. Five criteria were employed to identify the most desirable technologies: process parameters (including degree of volume reduction, secondary waste generated, and the efficiency of process decontamination and decommissioning); engineering parameters (including process maturity, availability, and ease of maintenance); environment, health, and safety factors (public and occupational risks, environmental risks, and transportation requirements); public acceptance (including regulatory permitting and schedule considerations); and cost. Although the five criteria were applied in all three alternatives, the value of each parameter was weighted differently among the alternatives. Alternatives A and C have one or more parameters skewed toward one extreme or another, while alternative B, the preferred alternative, attempts to balance the parameters. The following paragraphs briefly summarize these alternatives:

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- **Limited Treatment Configuration (Alternative A).** This alternative consists of siting, constructing, and operating facilities (shown in Table S-1) and implementing management techniques that would minimize impacts from treatment processes while complying with existing regulations. For each of the wastes, the treatment provided would be the minimum needed to meet applicable standards and allow prompt storage and disposal. This would minimize both worker exposure from handling and processing wastes, and public exposure to effluents or emissions generated by treatment processes. The limited treatment processes under this alternative would produce a safe waste form, but not one that had undergone the most vigorous treatment available, so the volumes of wastes would be greater and the potential for impacts in the future from storage and disposal would be more likely than under the other action alternatives.

  TE Under this alternative, low-level waste would only be treated by existing compactors at SRS, as appropriate, before storage in buildings or on storage pads or before disposal by shallow land disposal or in vaults. Hazardous wastes would be recycled, sent offsite for treatment and disposal, or together with appropriate mixed wastes, treated in the Consolidated Incineration Facility with the resulting stabilized ash and blowdown residues disposed of in RCRA-permitted disposal facilities or shallow land disposal. Other mixed wastes would be treated to permit reuse, or sent offsite for treatment and the residue returned to SRS for disposal. Transuranic waste meeting waste acceptance criteria for the Waste Isolation Pilot Plant would be repackaged and stored on storage pads pending shipment to that site for disposal, and alpha wastes would be disposed of in onsite vaults.

- **Moderate Treatment Configuration (Alternative B).** The preferred alternative consists of siting, constructing, and operating facilities (shown in Table S-1) and implementing management techniques that would provide a mix of cost-effective waste management and treatment technologies selected to balance short- and long-term impacts. TC

  Under this alternative, the volume of compatible low-level wastes would be reduced by onsite compactors and sent offsite for supercompaction, size reduction (e.g., sorting, shredding, melting), and incineration as part of the low-level waste offsite volume reduction initiative. The proposed offsite volume reduction initiative in this alternative was announced and public comments were solicited in the *Federal Register* on May 17, 1995 (60 FR 26417); it represents a change from the draft to the final EIS. TC Other low-level wastes would be disposed of without treatment, treated offsite for recycling or later disposal at SRS, or burned in the Consolidated Incineration Facility together with mixed and hazardous wastes. The resulting treatment residues would be disposed of in vaults or by shallow land disposal. Mixed soil and sludge wastes would be treated in a non-alpha vitrification facility (after 2006); other mixed wastes would be processed onsite or offsite for recycling or disposal. Hazardous wastes would generally be treated and disposed of offsite, or treated onsite for reuse or disposal. Transuranic wastes would be stored until 2008, when a transuranic waste characterization/certification facility and an alpha vitrification facility became available; these facilities would produce transuranic waste forms acceptable for transfer to the Waste Isolation Pilot Plant, and alpha waste forms acceptable for disposal in onsite disposal facilities.

  The moderate treatment configuration would provide extensive treatment for those wastes that have the greatest potential to adversely affect humans or the environment and limited treatment for those wastes for which more extensive treatment would not appreciably decrease the associated impacts. This alternative draws on both the more extensive treatments proposed under alternative C and the limited treatments proposed under alternative A. TC For example, under alternative A, all transuranic wastes would be repackaged in accordance with the acceptance criteria for the Waste Isolation Pilot Plant while under alternative C all transuranic wastes would be vitrified. Under alternative B, DOE proposes that only plutonium-238 and the high-activity portions of the plutonium-239 transuranic wastes be vitrified and the remainder of the plutonium-239 wastes be repackaged.

- **Extensive Treatment Configuration (Alternative C).** This alternative consists of siting, constructing, and operating facilities (shown in Table S-1) and implementing management techniques that would minimize environmental impacts from storage and disposal by extensive treatment of wastes to reduce their volume and toxicity and to create stable, migration-resistant waste forms. This alternative would, however, be more likely than other alternatives to increase short-term impacts because more treatment facilities would be built and there would be more exposure to radiological emissions from more intensive treatment and increased handling.

  Under this alternative, DOE would incinerate low-activity and tritiated low-level waste in the Consolidated Incineration Facility until 2006, when a non-alpha vitrification facility would begin operating. DOE would store or compact onsite, other low-level waste, or treat it offsite for recycling or later disposal at SRS. DOE would burn mixed waste in the Consolidated Incineration Facility, as appropriate, until a non-alpha vitrification facility became available, or otherwise treat it onsite (offsite for PCBs and lead) to allow reuse or disposal. Hazardous wastes would also be burned in the Consolidated Incineration Facility until a non-alpha vitrification facility became available, or otherwise treated onsite (offsite for PCBs) for reuse or disposal. Transuranic wastes would be characterized and repackaged according to their alpha radioactivity, converted into glass in an alpha vitrification facility, and stored pending disposal at the Waste Isolation Pilot Plant. DOE would burn alpha waste in the Consolidated Incineration Facility until 2006; after 2006, DOE would vitrify it, and dispose of it by shallow land disposal or in low-level waste or RCRA-permitted vaults.

DOE evaluated a wide variety of operational scenarios for the Consolidated Incineration Facility, from no operation to treatment of hazardous, mixed, low-level radioactive, and alpha wastes. DOE believes that the Consolidated Incineration Facility could play a vital role in an integrated waste management configuration for SRS. DOE also evaluated alternative configurations for reducing the volume of low-level waste. Application of compaction varies from operating the existing SRS compactors to sending low-level waste to a supercompactor at another location. DOE believes that both compaction and incineration are viable components of an integrated waste management configuration.

Three forecasts of waste volumes were developed for each alternative based on the expected, minimum, and maximum amounts of wastes SRS might need to manage. Because the no-action alternative does not satisfy the need for action, DOE evaluated the no-action alternative only with the expected waste forecast. The intent of the minimum and maximum forecasts was to identify how waste management activities might change with changes in the amounts of waste, and to identify the differing impacts of the waste management activities. Under all alternatives, liquid high-level wastes would be managed as described in the no-action alternative, although the volumes to be managed would vary between the three waste forecasts. TE

S.6 Affected Environment

SRS encompasses approximately 800 square kilometers (300 square miles) within the Atlantic Coastal Plain and includes portions of Aiken, Allendale, and Barnwell Counties in South Carolina. Four population centers — Augusta, Georgia; and Aiken, Barnwell, and North Augusta, South Carolina — are within 40 kilometers (25 miles) of SRS. Three small South Carolina towns — Jackson, New Ellenton, and Snelling — are immediately adjacent to the SRS boundary on the northwest, north, and east, respectively (Figure S-1). Approximately 69 percent of the SRS land is upland forest, approximately 22 percent is water and wetlands, and about 9 percent is developed. Land within E-Area (the proposed location of most of the waste management facilities; see Figure S-3) is classified as developed land. Table S-2 presents the acreages required for the additional facilities proposed for the alternatives.

S.7 Environmental Consequences

This section summarizes the potential environmental impacts of waste management activities, including the construction and operation of new facilities. This EIS examines impacts to natural resources such as air, water, and plants and animals, and to human resources, such as the health of workers and the public, and the social and economic structure of nearby communities. For many parameters, existing environmental conditions are not expected to change. TE

The evaluation of the environmental impacts of the alternatives considered in this EIS, which bound both the full range of reasonable waste management strategies and the quantities of waste that might be managed at SRS, TE indicates that many impacts would be very small. Furthermore, the differences in impacts among management alternatives are small for the same waste forecast. The major determinant of potential impacts is the amount of waste SRS would be called on to manage. In other words, differences in waste forecasts are more significant than differences in management strategies with regard to potential environmental impacts. The amount of waste SRS will manage depends largely on the extent TE of environmental restoration and facility decontamination and decommissioning undertaken at SRS in

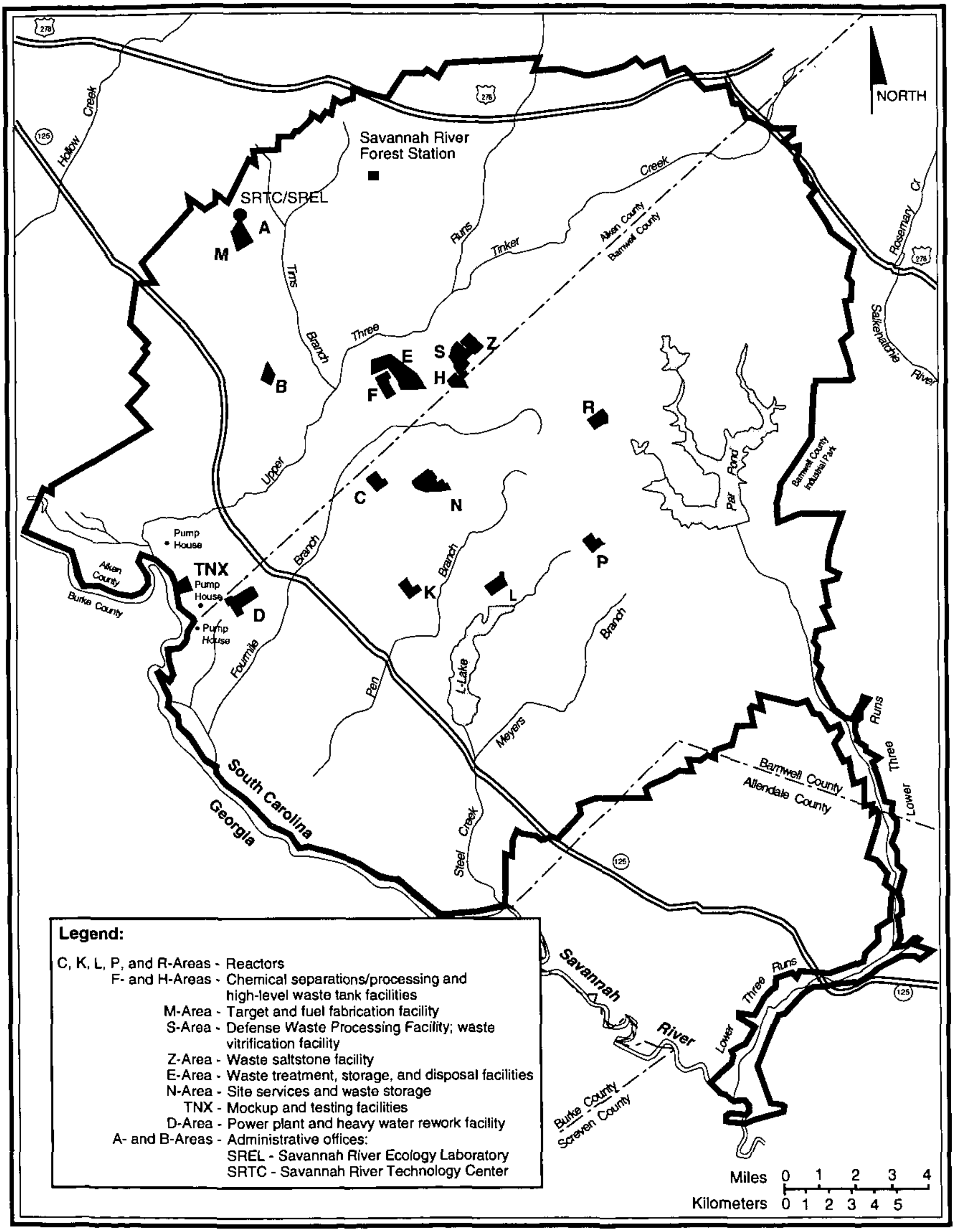

Figure S-3. SRS areas and facilities.

the future. The receipt of wastes from other facilities and ongoing operations at SRS make much smaller contributions to waste volume.

In eight resource categories -- socioeconomics, groundwater, surface water, air, traffic, transportation, occupational health, and public health -- there would be very small impacts. Cleared and uncleared land would be disturbed to build new facilities, which would impact ecological resources, would limit future land-use options, and might impact geologic (soils) and cultural resources. Additional conclusions from the analyses are summarized below and in Table S-2: TE

- Impacts and benefits of alternative ways to reduce the volume of low-level waste were evaluated. Under alternative A, low-level wastes would be compacted, resulting in a 22-percent reduction in the disposal volume. The size reduction (e.g., sorting, shredding and melting), supercompaction, and incineration proposed in alternative B would reduce the volume by 75 percent although with an increased (but still small) impact on the health risks to remote populations. Soil sorting and vitrification proposed in alternative C would reduce the volume of low-level waste by 70 percent. TC

- Construction and operation of facilities would be required for each alternative. In general, waste treatment by facilities proposed in the alternative involving extensive treatment (alternative C) would produce higher operational impacts than those in the alternative involving limited treatment (alternative A) because more handling and processing of wastes generally produces more emissions and greater worker exposure.

- Conversely, the limited-treatment alternative (alternative A) would require more disposal capacity and disposal facilities with more sophisticated methods of containment (i.e., more vaults and less shallow land disposal), because alternative A would not reduce or immobilize wastes to the degree that alternative C (extensive treatment configuration) would.

- The moderate-treatment alternative (alternative B) uses options from alternative A and alternative C, depending on the type of waste and its characteristics and physical properties, to balance the trade-offs between extensive treatment (the basis of alternative C) and extensive disposal (the basis of alternative A). Variations in the implementation of alternative B would result in impacts that would fall somewhere between those from the less stable waste forms produced in alternative A and those from the greater operational emissions produced in alternative C. Impacts would be very small for each of the alternatives. TE TE TC

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- The no-action alternative would require more storage facilities at the end of the 30-year period of analysis than any other alternative. Under the no-action alternative, mixed and transuranic wastes would not have been treated or disposed of during the 30-year period considered in this EIS, which would increase the probability of potential environmental impacts, including accidents and worker radiological exposure, above those of the other alternatives. The impacts would be deferred under the no-action alternative, not avoided. In addition, some impacts would be incurred during the 30-year storage period as a result of normal operations.

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- Although this EIS does not establish the amount of waste that SRS would be required to manage *in the future, it evaluates waste management requirements based on minimum, expected, and* maximum forecasts. Managing the maximum amount of waste in any of the alternatives, would require clearing approximately 1,000 acres. It would be difficult to clear this much land in a heterogeneous landscape, such as occurs at SRS, without measurably affecting the ecological resources of the area. The loss of this much natural habitat would result in the loss of large numbers of individual animals. Although there are 733 square kilometers (181,000 acres) of forested land on SRS, committing 1,000 acres to waste management under the maximum waste forecast would more severely restrict future land-use options than managing the minimum or expected waste forecasts, which would require less land.

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- Under the various alternatives and wastes forecasts, tritium released to the Savannah River from groundwater beneath E-Area seeping into Upper Three Runs would reach its highest concentration in 70 to 237 years. However, the concentration would be very small and would remain well within drinking water standards under each alternative.

TC

- Groundwater impacts from shallow land and vault disposal would be very small. Exceedances of health-based standards that were identified in the draft EIS would not occur for two reasons. First, after the draft EIS was issued, DOE reevaluated the isotopic inventory of wastes and determined that curium-247 and -248 are not present at detectable concentrations in the wastes. Therefore, these radionuclides were removed from the waste inventories considered in the EIS groundwater analysis. Second, the draft EIS groundwater analysis did not account for the reduced mobility of the stabilized waste forms, such as ashcrete and glass, that might be placed in slit trenches under alternative A, B, or C. The analysis in this final EIS instead assumes that the performance of stabilized waste forms would conform with the performance objectives of DOE Order 5820.2A.

- Airborne emissions of nonradiological constituents would not increase appreciably over current emissions and would remain within applicable state and Federal standards for each alternative. Radiological emissions and the resulting doses to the public and workers would remain within EPA standards. Over the 30-year evaluation period, these emissions would increase the risk of a fatal cancer to the maximally exposed member of the public by less than 2 in 100 million for the no-action alternative to about 6 in 100,000 under alternative C – maximum forecast.

- Under each alternative, additional commuter traffic and truck shipments on SRS and nearby roads would not exceed the capacity of these roads.

- Risk to workers at SRS and the public from exposure to toxic chemicals resulting from accidents would be very small and similar for each alternative. All workers follow stringent Occupational Safety and Health Act requirements when handling toxic chemicals. Facilities where toxic chemicals are handled are some distance from the SRS boundaries, so the risk of exposure to the public is minimal. TC

- Projected facility costs and manpower requirements differ between the draft and final EIS. This is due to the following factors: a refinement of the parameters that determine operating manpower, building, and equipment costs; a correction to the scope of no-action alternative costs to make them consistent with the other alternative – waste forecast estimates; and new initiatives in alternative B that lowered facility costs for this alternative. In addition, the costing methodology bases construction manpower requirements on building and equipment costs; therefore, both operating and construction employment differ between draft and final EIS. This, in turn, affects projections of socioeconomic and traffic impacts. The cost analysis was changed to be consistent with the *Baseline Environmental Management Report* developed by DOE to ensure consistent reporting or estimating future facility construction and operation costs. This report is used to establish future budgetary requirements for the DOE complex. TC

- Costs for implementing each alternative were estimated for comparison purposes. Because detailed designs have not been developed for all facilities, these are only preliminary estimates of the likely costs. TC However, since they were developed for all alternatives from a consistent set of assumptions, they provide a reasonable basis for comparisons. As shown in Table S-3, in terms of life-cycle costs, the implementation of the moderate treatment alternative for the minimum and expected waste forecasts would be equal to implementation of the limited treatment alternative and more costly than the extensive treatment alternative. TC Implementation of the limited treatment alternative for the maximum waste forecast would be somewhat more costly than implementation

TC of the moderate treatment alternative, which in turn would cost more than the extensive treatment alternative.

Table S-2 summarizes and compares the potential environmental impacts of the four waste management alternatives; these impacts would result from land clearing and the construction and operation of new facilities. The table focuses on the expected waste forecast, but it also presents the minimum and maximum waste forecasts when this is important to fully appreciate the impacts. In general, the impacts vary in proportion to the amount of waste that DOE would handle, but even in the maximum waste forecast, they are very small.

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Table S-3 presents the storage, treatment, disposal, and cost requirements for the four management alternatives (no-action, limited treatment configuration, moderate treatment configuration, and extensive treatment configuration) and the three waste forecasts (minimum, expected, and maximum).

Table S-1. Summary of new waste management facilities proposed for each alternative and waste forecast.

Facility or treatment	No action	Alternative A Minimum	Alternative A Expected	Alternative A Maximum	Alternative B Minimum	Alternative B Expected	Alternative B Maximum	Alternative C Minimum	Alternative C Expected	Alternative C Maximum
Storage										
Long-lived low-level waste storage buildings	24	7	24	34	7	24	34	7	24	34
Mixed waste storage buildings	291	45	79	757	39	79	652	39	79	652
Transuranic and alpha waste storage pads	19	3	12	1,168	2	10	1,168	2	11	1,166
Organic waste tanks in S-Area	4									
Organic waste tanks in E-Area	26									
Aqueous waste tanks in E-Area	43									
Treatment										
Consolidated Incineration Facility		MW[a], HW[b]; modify for soils and sludge	MW, HW; modify for soils and sludge	MW, HW, WWTF[c] effluent; modify for soils and sludge	MW, LLW[d], HW; modify for soils and sludge	MW, LLW, HW	MW, LLW, HW, WWTF effluent	MW, LLW, HW, alpha until vitrification is available	MW, LLW, HW, alpha until vitrification is available	MW, LLW, HW, alpha until vitrification is available
Containment building		MW	MW	MW; modify at WWTF	MW	MW	MW; modify at WWTF	MW, HW; includes wet oxide and R&R[e]	MW, HW; includes wet oxide and R&R	MW, HW; includes wet oxide and R&R
Soil sort facility		MW	MW	MW	LLW	LLW	LLW	NA[f]	NA	NA
Transuranic waste characterization/certification facility		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Small quantity offsite treatment of mixed waste and PCBs		MW, PCBs	MW, PCBs	MW, PCBs	MW, PCBs	MW, PCBs	MW, PCBs	PCBs	PCBs	PCBs
Offsite smelting of low-activity equipment waste		NA	NA	NA	Yes	Yes	Yes	Yes	Yes	Yes
Offsite volume reduction of low-activity waste		NA	NA	NA	Yes	Yes	Yes	NA	NA	NA
Non-alpha waste vitrification		NA	NA	NA	NA	MW	MW	MW, LLW, HW	MW, LLW, HW	MW, LLW, HW
Alpha waste vitrification		NA	NA	NA	Yes	Yes	Yes	Yes	Yes	Yes
Disposal										
Shallow land disposal trenches	29	25	73	644	37	58	371	45	123	576
Low-activity waste vaults	10	9	12	31	1	1	8	2	2	5
Intermediate-level waste vaults	5	2	5	31	2	5	9	1	2	3
RCRA-permitted disposal facilities	1	21	61	347	20	21	96	10	40	111

a. MW = mixed waste.
b. HW = hazardous waste.
c. WWTF = Wastewater treatment facility.
d. LLW = low-level waste.
e. R&R = roast and retort.
f. NA = the facility is not part of the alternative.

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Table S-2. Summary comparison of environmental impacts of each alternative.

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Area of impact	No-action alternative	Limited treatment configuration (alternative A)	Moderate treatment configuration (alternative B)	Extensive treatment configuration (alternative C)
Public Health				
Expected waste forecast:				
Offsite MEI[a]; fatal cancer probability[b]	4.1×10^{-10}[c]	5.8×10^{-9}	1.7×10^{-8}	9.0×10^{-8}
Offsite Population; fatal cancers[d] (1993 baseline: 0.11)	3.5×10^{-6}	2.8×10^{-4}	7.5×10^{-4}	0.0050
Maximum waste forecast:				
Offsite MEI[a]; fatal cancer probability[b]	Not applicable	4.0×10^{-8}	1.7×10^{-7}	2.0×10^{-6}
Offsite population; fatal cancers[d] (1993 baseline: 0.11)	Not applicable	0.0017	0.007	0.11
Occupational Health				
Involved worker; fatal cancer probability[b]	1.0×10^{-5}	1.3×10^{-5}	1.5×10^{-5}	1.6×10^{-5}
Involved worker; fatal cancers[d] (1993 baseline: 3.3)	0.021	0.028	0.032	0.034

Accidents (highest risk for each receptor)

	LCF[e]	F[f]	R[g]			
Uninvolved worker at 100 meters (328 feet)	0.052	0.02	0.001	All values are same as no action	All values are same as no action	All values are same as no action
Uninvolved worker at 640 meters (2,100 feet)	9.2×10^{-4}	0.02	1.8×10^{-5}			
MEI	1.7×10^{-5}	0.02	3.3×10^{-7}			
Offsite population; fatal cancers	0.84	0.02	0.017			

Table S-2. (continued).

Area of impact	No-action alternative	Limited treatment configuration (alternative A)	Moderate treatment configuration (alternative B)	Extensive treatment configuration (alternative C)
		Air Resources		
Construction Increase of criteria pollutants over baseline (in micrograms per cubic meter); baseline: [170.63 (standard = 40,000)] largest increase would be carbon monoxide (1-hour standard) reported here	1,919	769	673	737
Operations Offsite MEI dose (millirem per year) (see Public Health for health effects)	1.2×10^{-4}	0.011	0.032	0.18
Population dose (person-rem per year)	2.9×10^{-4}	0.56	1.5	10
Largest increase (in micrograms per cubic meter) would be carbon monoxide (1-hour standard)	24	Same as no action	31	Same as no action
		Surface Water Resources		
Construction Potential erosion impacts to SRS streams	Very small erosion impacts	Same as no action	Same as no action	Same as no action
Operations Contaminant concentrations in Savannah River (tritium peaks in 70 to 237 years)	Very small; substantially below drinking water standards	Same as no action	Same as no action	Same as no action

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Table S-2. (continued).

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Area of impact	No-action alternative	Limited treatment configuration (alternative A)	Moderate treatment configuration (alternative B)	Extensive treatment configuration (alternative C)
Groundwater Resources[h]				
Minimum waste forecast	Not applicable	Pu-239[i]; 0.24 millirem per year	Pu-239[i]; 0.23	Pu-239[i]; 0.15
Expected waste forecast	Pu-239[i]; 0.33	Same as no action	Same as no action	Pu-239[i]; 0.21
Maximum waste forecast	Not applicable	Pu-239[i]; 0.79	Pu-239[i]; 0.43	Pu-239[i]; 0.25
Socioeconomics (baseline: 1995 SRS employment of 20,000)				
Expected waste forecast:				
Construction Peak number of jobs	50	80	170	160
Net change in regional construction employment	No net change	Same as no action	Same as no action	Same as no action
Impact	No impact	Same as no action	Same as no action	Same as no action
Operations Peak number of jobs	2,450	2,560	2,550	1,940
Mode of filling jobs	Reassignment of existing workers	Same as no action	Same as no action	Same as no action
Impact	No impact	Same as no action	Same as no action	Same as no action
Maximum waste forecast:				
Construction Peak number of jobs	Not applicable	260	310	350
Net change in regional construction employment		No net change	No net change	No net change
Impact		No impact	No impact	No impact
Operations Peak number of jobs		11,200	10,010	10,060
Mode of filling jobs		3,300 new jobs	2,110 new jobs	2,160 new jobs
Impact		Small impact	Small impact	Small impact

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Table S-2. (continued).

Area of impact	No-action alternative	Limited treatment configuration (alternative A)	Moderate treatment configuration (alternative B)	Extensive treatment configuration (alternative C)
Land Use (impact measured in terms of land required)[j]				
Minimum[j] waste forecast: Land requirements in E-Area[k]	Not applicable	108 acres[l]	107	141
Expected[m] waste forecast: Land requirements in E-Area	241	152	158	167
Maximum[m] waste forecast: Land requirements in E-Area	Not applicable	254	254	254
Land requirements elsewhere on SRS		802	756	775
Ecological and Geologic Resources (impact measured in terms of acres to be cleared)				
Minimum waste forecast:	Not applicable	73	90	111
Expected waste forecast:	160	96	117	128
Maximum waste forecast:	Not applicable	986	940	959
Traffic				
Construction Peak vehicles per hour arriving at E-Area (1993 baseline: 741)	788	824	907	896
Operations Uninvolved truck traffic plus waste shipments per day (1993 baseline: 785)	815	817	819	814

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Table S-2. (continued).

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Area of impact	No-action alternative			Limited treatment configuration (alternative A)			Moderate treatment configuration (alternative B)			Extensive treatment configuration (alternative C)
Transportation - Incident free (additional excess fatal cancers)										
Involved workers	0.06 additional excess fatal cancer per year could develop			0.12 additional excess fatal cancer per year could develop			0.098 additional excess fatal cancer per year could develop			0.079 additional excess fatal cancer per year could develop
Uninvolved workers	8.4×10^{-4} additional excess fatal cancer per year could develop			8.8×10^{-4} additional excess fatal cancer per year could develop			8.9×10^{-4} additional excess fatal cancer per year could develop			8.6×10^{-4} additional excess fatal cancer per year could develop
Remote populations	Not applicable			1.2×10^{-6} additional excess fatal cancer per year could develop			3.2×10^{-3} additional excess fatal cancer per year could develop			2.7×10^{-4} additional excess fatal cancer per year could develop
Transportation - Accidents (latent cancer fatalities over 30 years)										
	LCF[e]	P[n]	R[o]	LCF[e]	P[n]	R[o]	LCF[e]	P[n]	R[o]	
Onsite population	120	2.6×10^{-6}	3.2×10^{-4}	Same as no action			Same as no action			Same as no action
Offsite population	14	2.6×10^{-6}	3.5×10^{-5}	Same as no action			Same as no action			Same as no action
Remote population (enroute to offsite facility)	NA[p]	NA	NA	2.4×10^{-6}	0.0011	2.5×10^{-9}	0.18	1.6×10^{-6}	2.9×10^{-7}	Same as alternative A

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a. MEI = maximally exposed individual.

b. Values represent the annual probability of an individual (MEI or worker) contracting a fatal cancer due to 30 years of exposure to radiation from waste management activities at SRS.

c. An explanation of scientific notation is provided in Acronyms, Abbreviations, and Use of Scientific Notation.

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d. Values represent the number of annual fatal cancers to a group (offsite population or onsite involved workers) due to 30 years of radiation exposure. Baseline is the number of annual fatal cancers that could result from exposure to radiation released in 1993.

e. Latent cancer fatalities per accident (dose × cancer conversion factor).

f. Frequency of occurrence (accidents per year).

g. Risk defined as estimates of increased risk of a latent cancer fatality per year (frequency × latent cancer fatalities per accident).

h. Values are peak dose per year. All would occur more than 10,000 years in the future. No exceedances of 4 millirem per year drinking water standard.

i. Pu = plutonium. Dose does not include contribution from disposal of stabilized waste forms in slit trenches or waste in RCRA-permitted vaults. Groundwater impacts from all vaults and shallow land disposal would be less than 4 millirem per year.

j. Acreage shown is the cumulative amount needed for construction activities over the 30-year period.

k. Current land-use plans have designated E-Area as an area for waste management facilities.

l. To convert from acres to square kilometers, multiply by 0.004047.

m. Acreage shown is the greatest amount needed for construction activities at any time during the 30-year period.

n. Annual probability of occurrence over the 30-year forecast period.

o. Risk defined as estimates of annual increased risk of latent cancer fatality over the 30-year period (probability × latent cancer fatalities per accident.)

p. NA = not applicable. (There are very few offsite radioactive waste shipments under the no-action alternative).

Table S-3. Treatment, storage, and disposal requirements for and cost of each alternative and waste forecast.

Additional treatment, storage, and disposal facilities for each alternative[a]			
Alternative	Waste forecast		
	Minimum	Expected	Maximum
No action		**STORAGE:** Buildings 24 long-lived low-level waste 291 mixed waste Pads 19 transuranic and alpha waste Tanks 4 organic waste in S-Area 26 organic waste in E-Area 43 aqueous waste in E-Area **TREATMENT:** Continue ongoing and planned waste treatment activities **DISPOSAL:** 29 shallow land disposal trenches 10 low-activity waste vaults 5 intermediate-level waste vaults 1 RCRA[b] disposal facility **COST** [c]**:** $\$6.9\times10^{9}$[d]	
A	**STORAGE:** Buildings 7 long-lived low-level waste 45 mixed waste Pads 3 transuranic and alpha waste **TREATMENT:** Same as expected waste forecast **DISPOSAL:** 25 shallow land disposal trenches 9 low-activity waste vaults 2 intermediate-level waste vaults 21 RCRA disposal facilities **COST:** $\$4.2\times10^{9}$	**STORAGE:** Buildings 24 long-lived low-level waste 79 mixed waste Pads 12 transuranic and alpha waste **TREATMENT:** Continue ongoing and planned waste treatment activities; treat limited quantities of mixed and PCB waste offsite; operate the Consolidated Incineration Facility for hazardous and mixed waste, modify the facility to accept mixed waste soils and sludges; construct and operate a mixed waste containment building; construct and operate a mixed waste soil sort facility; construct and operate a transuranic waste characterization/certification facility **DISPOSAL:** 73 shallow land disposal trenches 12 low-activity waste vaults 5 intermediate-level waste vaults 61 RCRA disposal facilities **COST:** $\$6.9\times10^{9}$	**STORAGE:** Buildings 34 long-lived low-level waste 757 mixed waste Pads 1,168 transuranic and alpha waste **TREATMENT:** Same as expected waste forecast, except containment building modified to include wastewater treatment capability to treat spent decontamination solutions; treat its secondary waste at the Consolidated Incineration Facility **DISPOSAL:** 644 shallow land disposal trenches 31 low-activity waste vaults 31 intermediate-level waste vaults 347 RCRA disposal facilities **COST:** $\$24\times10^{9}$

TC

Table S-3. (continued).

Alternative	Waste forecast		
	Additional treatment, storage, and disposal facilities for each alternative (continued)		
	Minimum	Expected	Maximum
B	**STORAGE:** Buildings 7 long-lived low-level waste 39 mixed waste Pads 2 transuranic and alpha waste **TREATMENT:** Same as expected waste forecast, except no non-alpha vitrification facility; modify Consolidated Incineration Facility to accept mixed waste soils and sludges **DISPOSAL:** 37 shallow land disposal trenches 1 low-activity waste vault 2 intermediate-level waste vaults 20 RCRA disposal facilities **COST:** $\$4.2 \times 10^9$	**STORAGE:** Buildings 24 long-lived low-level waste 79 mixed waste Pads 10 transuranic and alpha waste **TREATMENT:** Continue ongoing and planned waste treatment activities; treat limited quantities of mixed and PCB wastes offsite; begin volume reduction of low-activity job-control and equipment waste offsite; begin smelting low-activity equipment waste offsite; operate the Consolidated Incineration Facility for low-level, hazardous, and mixed wastes; construct and operate a low-level waste soil sort facility; construct and operate a mixed waste containment building; construct and operate a non-alpha vitrification facility for mixed waste soils and sludges; construct and operate a transuranic waste characterization/certification facility; construct and operate an alpha vitrification facility **DISPOSAL:** 58 shallow land disposal trenches 1 low-activity waste vault 5 intermediate-level waste vaults 21 RCRA disposal facilities **COST:** $\$6.9 \times 10^9$	**STORAGE:** Buildings 34 long-lived low-level waste 652 mixed waste Pads 1,168 transuranic and alpha waste **TREATMENT:** Same as expected waste forecast, except containment building modified to include wastewater treatment capability to treat spent decontamination solutions; treat its secondary waste at the Consolidated Incineration Facility **DISPOSAL:** 371 shallow land disposal trenches 8 low-activity waste vaults 9 intermediate-level waste vaults 96 RCRA disposal facilities **COST:** $\$20 \times 10^9$

TC

Table S-3. (continued).

Additional treatment, storage, and disposal facilities for each alternative (continued)			
Alternative	Waste forecast		
	Minimum	Expected	Maximum
C	**STORAGE:** Buildings 7 long-lived low-level waste 39 mixed waste Pads 2 transuranic and alpha waste **TREATMENT:** Same as expected waste forecast **DISPOSAL:** 45 shallow land disposal trenches 2 low-activity waste vaults 1 intermediate-level waste vault 10 RCRA disposal facilities **COST:** $\$3.8\times10^9$	**STORAGE:** Buildings 24 long-lived low-level waste 79 mixed waste Pads 11 transuranic and alpha waste **TREATMENT:** Continue ongoing and planned waste treatment activities; treat limited quantities of mixed and PCB wastes offsite; begin smelting low-activity equipment waste offsite; operate the Consolidated Incineration Facility for low-level, hazardous, and mixed waste until vitrification facility is available; construct and operate a hazardous and mixed waste containment building; construct and operate a non-alpha vitrification facility for low-level, hazardous, and mixed waste; construct and operate a transuranic waste characterization/certification facility; construct and operate an alpha vitrification facility **DISPOSAL:** 123 shallow land disposal trenches 2 low-activity waste vaults 2 intermediate-level waste vaults 40 RCRA disposal facilities **COST:** $\$5.6\times10^9$	**STORAGE:** Buildings 34 long-lived low-level waste 652 mixed waste Pads 1,166 transuranic and alpha waste **TREATMENT:** Same as expected waste forecast **DISPOSAL:** 576 shallow land disposal trenches 5 low-activity waste vaults 3 intermediate-level waste vaults 111 RCRA disposal facilities **COST:** $\$18\times10^9$

TC

a. Facilities identified are in addition to those currently constructed; activities are in addition to ongoing or planned activities.
b. Resource Conservation and Recovery Act.
c. Life-cycle costs are expressed as present worth in 1994 dollars with 3 percent escalation and 6 percent discount rate (refer to Appendix C for details).
d. Source: Cost for no-action (Hess 1995e); cost for other alternatives (Hess 1995f).

CHAPTER 1. PURPOSE AND NEED FOR ACTION

The end of the Cold War has led the United States to reduce the size of its nuclear arsenal. Many of the TE more than 120 facilities across the country, referred to as the nuclear weapons complex, that the U.S. Department of Energy (DOE) used to manufacture, assemble, and maintain the former arsenal are no longer needed for these activities and could be used for other purposes. One of those facilities is the Savannah River Site (SRS). Many facilities can be converted to new uses through decontamination TE processes; others must be decommissioned (see Glossary for definitions of terms). In addition, the wastes generated during the Cold War must be cleaned up in a safe and cost-effective manner. DOE must also manage wastes that may be generated in the future by ongoing operations, including new defense facilities that may be located at SRS. Finally, SRS must be brought into compliance with the environmental requirements enacted during the last 25 years.

DOE must develop a strategic approach to managing radioactive and hazardous wastes at SRS to achieve the objectives of cleanup and compliance. The purpose of this environmental impact statement (EIS) is to evaluate the potential environmental effects of minimizing, treating, storing, and disposing of radioactive and hazardous wastes at SRS. DOE will use the analyses presented in the EIS to decide on a strategic approach to managing these wastes.

This EIS examines impacts of managing several types of wastes at SRS: liquid high-level radioactive, TE low-level radioactive, hazardous, mixed (radioactive and hazardous), and transuranic. It does not consider sanitary wastes or spent nuclear fuel. The impacts of managing liquid high-level radioactive wastes are described here based on the alternative to operate the Defense Waste Processing Facility as TC evaluated in the *Final Supplemental Environmental Impact Statement Defense Waste Processing Facility* (DOE/EIS-0082S) and selected in the Record of Decision (60 FR 18589). This EIS includes wastes that already exist as a result of past activities, and those that will be generated in the future as a result of ongoing operations, new projects, environmental restoration (i.e., cleaning up contaminants released into the environment in the past), and decontamination and decommissioning of facilities that are no longer needed. The inventory of existing wastes is known; predicting the amounts and types of wastes that will be generated in the future is difficult, particularly for those that will be generated during environmental restoration and facility decontamination and decommissioning.

At present, DOE cannot identify all of the facilities that will become surplus, or when a particular facility will no longer be needed to maintain the nuclear arsenal. Accordingly, DOE does not have a complete schedule of the facilities it will eventually decontaminate and decommission. In addition, DOE cannot TE identify at this time all of the contaminated areas at SRS that will require restoration. As a result of this uncertainty about the amounts of wastes that will be generated in the future, DOE uses a range of estimates. This range is bounded by estimates of the minimum and maximum amounts of wastes that may be generated in the future. It is the best forecast DOE can make at this time.

In addition to wastes that have been or will be generated at SRS itself, the Site may receive and manage wastes from other DOE facilities. Estimating the amounts of wastes to be received from other facilities in the future is even more difficult than predicting the amounts of wastes that will be generated at SRS. The amounts of offsite waste sent to SRS will depend on activities at other DOE facilities involving ongoing operations, waste management, environmental restoration, and decommissioning. These activities in turn depend on National Environmental Policy Act (NEPA) reviews DOE is conducting on: (1) the future needs of the nuclear weapons complex, including management of the nuclear stockpile and the means of production and location of facilities for tritium supply and recycling; (2) the possible consolidation of nuclear materials and wastes at certain facilities; and (3) the locations of treatment, storage, and disposal facilities in the complex. For purposes of this EIS, DOE has assumed that the wastes SRS will receive from other sites will fall somewhere between the amounts it now receives and a maximum estimate (included in the maximum waste forecast) that includes all wastes that have been identified to date as possible candidates for treatment, storage, or disposal at SRS.

The amounts of wastes that are actually generated and managed at SRS will depend on a number of decisions that have not yet been made. For example, decisions on the ultimate use of land and facilities at SRS will determine the level of cleanup necessary to meet regulatory requirements for those uses. The level of cleanup determines the amounts of waste generated during the cleanup; more stringent cleanup requirements lead to the generation of more wastes. This EIS considers the reasonable range of waste generation and management at SRS in the future. It evaluates the impacts of this range of wastes to allow for flexibility in managing wastes in response to changes in the amounts of wastes that may eventually be treated, stored, and disposed of at SRS.

DOE reviewed a number of options for treating, storing, and disposing of wastes at SRS. These options included technologies and facilities that already exist, and those that are under construction or development. This EIS evaluates the 30-year environmental impacts of the construction and operation of specific waste treatment, storage, and disposal facilities that might be developed at SRS during the next 10 years. It also evaluates the treatment of certain wastes by private entities, as well as the treatment and disposal of wastes at government facilities outside SRS. This evaluation included a detailed evaluation of new and emerging technologies that could be used to treat the wastes. At present, it is not possible to evaluate facilities that might be built beyond the next decade due to the uncertainties surrounding the types of wastes that might be generated and the types of new treatment technologies that might be available. If DOE requires new treatment facilities more than 10 years in the future, it would conduct additional technology evaluations to ensure that the best available technology to treat the waste was selected. This EIS provides an environmental baseline for analyzing facilities that DOE might build and other actions to manage wastes that DOE might take after 2005. DOE would evaluate the environmental impacts of such facilities and activities in additional NEPA reviews that would rely, as appropriate, on this EIS for background information about SRS's environment. TE TE

The Federal Facility Compliance Act of 1992, an amendment to the Resource Conservation and Recovery Act (RCRA) (Public Law 102-386, October 6, 1992), requires DOE to prepare a site treatment plan for SRS that sets forth options for treating mixed wastes (i.e., mixtures of hazardous and radioactive wastes) currently in storage or that will be generated over the next 5 years. This EIS analyzes the environmental impacts of the facilities that DOE might use for treating mixed wastes as proposed in SRS's plan; the *DOE Waste Management Programmatic EIS* (DOE/EIS-0200), which discusses waste management throughout the nationwide DOE complex, also examines the possible impacts of treating mixed wastes at SRS and elsewhere. The alternatives evaluated here are consistent with the options presented in the site treatment plan. However, the plan is limited to options for treating mixed wastes currently in storage or generated during the next 5 years. This EIS evaluates alternatives for managing several types of wastes using existing, planned, and proposed facilities during the next 10 years. This EIS also establishes a baseline for assessing options for waste management for 20 years beyond that time. TE TE

DOE prepared an environmental assessment (DOE 1992) and issued a Finding of No Significant Impact [57 *Federal Register* (FR) 61402, December 24, 1992] on the construction and operation of the Consolidated Incineration Facility, which is currently under construction. This EIS responds to requests from citizens to re-examine the environmental impacts of operating the Consolidated Incineration Facility and provides a basis for future DOE decisions on operation of that facility. TE

On October 22, 1993, DOE stated that it would prepare this EIS for waste management at SRS (Grumbly 1993), and made a number of specific commitments:

- The EIS would consider both the facilities needed to treat mixed wastes, as required by the Federal Facility Compliance Act of 1992, and the operation of the Consolidated Incineration Facility. TE

- The proposed treatments of mixed waste would be factored into the formulation of alternatives for this EIS.

- DOE would evaluate volume reduction of low-level waste in the Consolidated Incineration Facility and other volume reduction alternatives (e.g., compaction).

TE

- The cost analysis of potential alternatives would be based on life-cycle costs (i.e., construction, operation, and decommissioning) of existing and planned facilities so that the costs of the Consolidated Incineration Facility would be realistically compared to the conceptual facilities.

- The incinerator's construction would continue on schedule, but trial burns would be deferred until this EIS is completed and its Record of Decision issued.

In addition to looking at the environmental impacts of actions that DOE may take over the next decade to manage wastes at SRS, this EIS also examines the cumulative impacts of the alternatives and past, present, and reasonably foreseeable future actions at SRS and adjacent areas.

Relationship to Other Environmental Analyses

DOE must clean up and bring into compliance other facilities across the country that were involved in the production of nuclear weapons. DOE must address the cleanup of the nuclear weapons complex as an integrated program in order to reduce risks and restore the environment in the most cost-effective manner. Cleanup requires many decisions at each site, and decisions at one site may influence options and decisions at other sites.

TE

DOE must formulate alternatives for waste management at SRS that are consistent with the alternatives considered in other EISs that relate to SRS. Consistency among other EISs and this EIS does not mean that the alternatives evaluated in each must match precisely; such precision is unnecessary and would be impossible to achieve given the broad scope of these EISs and the timing of decisions based on them. Consistency means that this EIS should reasonably take into account alternatives considered in other EISs that may impact the management of wastes at SRS.

TE

Several NEPA reviews that have been completed, are in process, or have been proposed examine SRS waste management or activities that could affect waste management decisions at SRS. These documents are briefly summarized in Table 1-1.

Table 1-1. Major NEPA reviews related to SRS waste management as of June 1, 1995.

Site	Title	NEPA document[a]	Status	
Savannah River Site	*Waste Management Activities for Groundwater Protection, Savannah River Plant*	DOE/EIS-0120	Final issued December 1987; ROD[b] issued March 1988.	
	Consolidated Incineration Facility, Savannah River Site	DOE/EA-0400	FONSI[c] issued December 1992.	
	Urgent-Relief Acceptance of Foreign Research Reactor Spent Nuclear Fuel	DOE/EA-0912	FONSI issued April 1994.	
	Treatment of M-Area Mixed Wastes at the Savannah River Site	DOE/EA-0918	FONSI issued August 1994.	TC
	Defense Waste Processing Facility Supplemental EIS	DOE/EIS-0082S	Final issued November 1994; ROD issued April 1995.	
	F-Canyon Plutonium Solutions at SRS	DOE/EIS-0219	Final issued December 1994; ROD issued February 1995.	
	Interim Management of Nuclear Materials at SRS	DOE/EIS-0220	Draft issued March 1995.	
	Operation of the HB-Line Facility and Frame Waste Recovery Unit for Production of Plutonium-238 Oxide	DOE/EA-0948	FONSI issued April 1995.	TE
	Independent Waste Handling Facility, 211-F at Savannah River Site, Aiken, South Carolina	DOE/EA-1062	Draft issued June 1995.	
Idaho National Engineering Laboratory	*Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs*	DOE/EIS-0203	Final issued April 1995; ROD issued June 1995.	
Pantex	*Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components*	DOE/EIS-0225	Draft scheduled for November 1995.	
DOE-wide	*Waste Management Programmatic EIS*	DOE/EIS-0200	Draft scheduled for July 1995.	
	Tritium Supply and Recycling Programmatic EIS	DOE/EIS-0161	Draft issued February 1995.	TC
	Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel	DOE/EIS-0218	Draft issued April 1995.	
	Long-Term Storage and Disposition of Weapons-Usable Fissile Materials Programmatic EIS	DOE/EIS-0229	Draft scheduled for December 1995.	
	Stockpile Stewardship and Management Programmatic EIS	DOE/EIS-0236	Notice of Intent to be issued.	

a. EA = environmental assessment; EIS = environmental impact statement; PEIS = programmatic EIS.
b. ROD = Record of Decision. TE
c. FONSI = Finding of No Significant Impact.

WASTE MANAGEMENT ACTIVITIES FOR GROUNDWATER PROTECTION (DOE/EIS-0120)

In 1987 DOE issued a programmatic and project-specific EIS to support the selection of a programmatic waste management strategy for SRS and to consider the environmental impacts of several specific projects, including closure and cleanup of active and inactive waste management sites; establishment of new waste storage and disposal facilities; and alternative means of discharging disassembly basin purge water from SRS reactors. A Record of Decision was issued in March 1988. This first waste management EIS provided the NEPA review for several of the waste management facilities and activities currently operating or being initiated at SRS. (For more information, see Table 2-21 in Chapter 2.) Changes since 1988 in SRS missions, the regulatory environment, and other factors have led to the need to reexamine SRS waste management strategies in the current EIS.

CONSOLIDATED INCINERATION FACILITY (DOE/EA-0400)

As explained above, construction of the Consolidated Incineration Facility is continuing on the basis of an environmental assessment and Finding of No Significant Impact issued for this facility in 1992. DOE expects that its decision on conducting trial burns, operating the facility, and the wastes that would be
TC treated will be based on the analyses in this EIS.

TREATMENT OF M-AREA MIXED WASTE AT THE SAVANNAH RIVER SITE (DOE/EA-0918)

In 1994 DOE issued an environmental assessment and Finding of No Significant Impact on treating six mixed waste streams by vitrification in a facility to be built and operated in M-Area by a commercial vendor. This project is proceeding on the basis of the previous NEPA review. Treatment of additional wastes in the M-Area vitrification facility is among the actions considered in this EIS.

UPGRADE OF INDEPENDENT WASTE HANDLING FACILITY, 211-F, AT THE SAVANNAH RIVER SITE (DOE/EA-1062)

The facility to be upgraded (211-F) is the only facility on SRS that receives liquid low-activity radioactive waste from remote SRS locations, neutralizes it, and concentrates it to minimize volume before transferring it to the tank farm for further processing/storage. The facility currently gets support services, such as electric power, waste transfer capabilities, and instrument air from the F-Canyon building. After F-Canyon is deactivated, the 211-F facility will need to operate independently in order to support SRS facilities, such as the Savannah River Technology Center, which produce limited amounts of low-level radioactive waste as a result of ongoing missions.

TE

Proposed upgrades to the facility will ensure that the 211-F waste handling operations are independent of the F-Canyon processes and services.

URGENT-RELIEF ACCEPTANCE OF FOREIGN RESEARCH REACTOR SPENT NUCLEAR FUEL (DOE/EA-0912)

DOE prepared an environmental assessment for the urgent acceptance of spent nuclear fuel elements from eight foreign research reactors and issued a Finding of No Significant Impact. The spent fuel will TC be shipped to the United States and transported to SRS for storage. The *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs EIS* (discussed below) evaluates management alternatives for the spent fuel elements. The expected waste forecast in this EIS is consistent with waste volumes that would be generated from receiving, storing, and handling the spent research reactor fuel, but not from processing TC it.

PROPOSED NUCLEAR WEAPONS NONPROLIFERATION POLICY CONCERNING FOREIGN RESEARCH REACTOR SPENT NUCLEAR FUEL (DOE/EIS-0218) TC

DOE is preparing an EIS to evaluate the potential impacts of the adoption and implementation of a policy to accept foreign research reactor spent nuclear fuel that contains uranium enriched in the United States. Under the proposed policy, the United States would accept approximately 24,300 fuel elements of highly enriched uranium or low-enriched uranium from foreign research reactors in approximately 30 nations during a 10- to 15-year period. The implementation of this policy would result in the receipt of spent nuclear fuel at one or more United States marine ports of entry and overland transport to one or more DOE sites (including SRS). The expected waste forecast in this EIS is consistent with waste volumes that would be generated from receiving, storing, and handling the spent research reactor fuel, TC but not from processing it.

INTERIM MANAGEMENT OF NUCLEAR MATERIALS AT SRS (DOE/EIS-0220)

DOE is preparing an EIS on interim management of nuclear materials that will evaluate in-process and stored nuclear materials at SRS to determine whether any materials require near-term stabilization to ensure continued safe management. Wastes incidental to the management activities included in TC alternative 4 of the draft *Interim Management of Nuclear Materials EIS* (March 1995) are considered in this EIS under the expected waste forecast. Alternative 4 includes processing to oxide, repackaging, continued storage, and vitrification of various nuclear materials at SRS. The minimum waste forecast includes waste volumes associated with alternative 1 (the no-action alternative) of the *Interim Management of Nuclear Materials EIS,* which proposed continued storage of all SRS nuclear materials. The maximum waste forecast was based on alternative 2, which included more processing and vitrification of nuclear materials at SRS than that proposed under alternative 4.

F-CANYON PLUTONIUM SOLUTIONS AT SRS (DOE/EIS-0219)

DOE issued a final EIS on plutonium solutions currently stored in F-Canyon that evaluates alternatives for stabilization of these materials. The alternatives examined are no-action, processing to a plutonium metal, processing to a plutonium oxide, and transferring the solutions to the high-level waste tanks for vitrification in the Defense Waste Processing Facility. In February 1995, DOE issued the Record of Decision to implement the alternative of processing to metal. Wastes incidental to these activities are considered in this EIS under the expected and maximum waste forecasts.

DEFENSE WASTE PROCESSING FACILITY (DOE/EIS-0082S)

The Defense Waste Processing Facility is almost complete, and the high-level waste pretreatment processes and the vitrification process are nearly ready to begin operating. The evaluation of whether to continue construction and how to operate the Defense Waste Processing Facility was the subject of a separate NEPA review (DOE 1994). In April 1995, DOE published a Record of Decision (60 FR 18589) to complete construction and startup testing, and begin operation of the Defense Waste Processing Facility. Management of the wastes generated by Defense Waste Processing Facility operations is considered in this EIS under all waste forecasts. The potential environmental impacts from the operation of the Defense Waste Processing Facility are included in the analysis of the alternatives in this EIS.

OPERATION OF THE HB-LINE FACILITY AND FRAME WASTE RECOVERY UNIT FOR PRODUCTION OF PLUTONIUM-238 OXIDE (DOE/EA-0948)

DOE has prepared an environmental assessment addressing future operations of the HB-Line Facility and the Frame Waste Recovery Unit at SRS to process the remaining civilian inventory of plutonium-238 materials for use as a heat source fuel in space missions. In April 1995, DOE issued a Finding of No Significant Impact concluding that the proposed action was not a major federal action significantly affecting the quality of the human environment and would, therefore, not require the preparation of an

EIS. The waste generated by the processing of plutonium-238 materials is considered in this EIS under all waste forecasts. TE TC

PROGRAMMATIC SPENT NUCLEAR FUEL MANAGEMENT AND IDAHO NATIONAL ENGINEERING LABORATORY ENVIRONMENTAL RESTORATION AND WASTE MANAGEMENT PROGRAMS (DOE/EIS-0203)

In April 1995, DOE issued the final programmatic EIS which addresses alternatives for complex-wide management of existing and projected quantities of spent nuclear fuel until 2035. The alternatives considered in the programmatic EIS include variations on several components: number of storage locations; amounts of spent nuclear fuel shipped; fuel stabilization methods; numbers and types of new storage facilities; and scope of research and development efforts related to spent fuel management technology. The programmatic EIS could have lead to a decision to maintain, increase, or decrease the amount of spent nuclear fuel managed at SRS. Among the options considered was renewed processing of spent nuclear fuel at SRS, which would generate additional high-level waste. The preferred alternative identified in the final programmatic EIS and selected in the Record of Decision (60 FR 28680), regionalization of spent fuel management by fuel type, will consolidate the management of aluminum-clad fuel at SRS. This will involve a moderate increase over current levels of the fuel currently managed at SRS; implementation of this alternative might involve fuel processing at SRS, pending future decisions. The maximum waste forecast here is consistent with the waste volumes associated with the selected alternative for this spent fuel EIS including wastes generated during processing of aluminum-clad fuel from within the DOE complex. The impacts of the programmatic alternative with the greatest potential impacts to SRS (i.e., the centralization of all DOE spent fuel management, including processing, at SRS, not the selected alternative) are included in the cumulative impacts analysis of this EIS. Aspects of the management of liquid high-level radioactive waste are the same under each alternative, thus volume changes due to decisions made as a result of the programmatic spent fuel EIS will not affect the selection of alternatives here. TC

CONTINUED OPERATION OF THE PANTEX PLANT AND ASSOCIATED STORAGE OF NUCLEAR WEAPON COMPONENTS (DOE/EIS-0225)

DOE is preparing an EIS that addresses the proposed continued operation of the Pantex Plant and continued current nuclear component storage activities at various DOE sites. SRS may be considered as a possible location for the recycling of tritium and plutonium from the Pantex Plant. The maximum waste forecast in this EIS is consistent with the waste volumes incidental to the activities included in DOE's preliminary proposed action for the Pantex Plant. TE

TE

WASTE MANAGEMENT (DOE/EIS-0200)

TE

DOE is preparing a programmatic EIS to evaluate complex-wide and site-specific alternative strategies and policies to maximize efficiency in DOE's waste management programs. DOE has attempted to coordinate this EIS with the programmatic EIS so that the alternatives considered in this EIS are as consistent as possible with the DOE complex-wide strategies to be analyzed in the programmatic EIS. If necessary, DOE will supplement this EIS to maintain consistency with future DOE-wide programmatic waste management decisions. The strategies and policies to be considered in the programmatic EIS include the possible transfer of some waste types from other DOE sites to SRS for treatment and disposal, and the possible transfer of some SRS wastes to other DOE sites. Those possible waste transfers are also considered in this EIS, under the maximum and minimum waste forecasts, respectively.

TE

TRITIUM SUPPLY AND RECYCLING (DOE/EIS-0161)

TE

DOE is preparing a programmatic EIS to address reconfiguration of the nuclear weapons complex. DOE intends to separate the reconfiguration proposal into two parts and will prepare a programmatic EIS on each part (59 FR 54175, October 28, 1994). The first programmatic EIS is the *Tritium Supply and Recycling Programmatic EIS*, which addresses alternatives associated with new tritium production and the recycling of tritium recovered from weapons retired from service. The EIS analyzes alternative technologies for producing tritium at five candidate sites, including SRS. It also assesses the same five sites as alternative locations for tritium recycling, which is currently done at SRS. Wastes from continued recycling of tritium at SRS are considered in this Waste Management EIS under all waste forecasts. The maximum waste forecast in this Waste Management EIS is consistent with the collocated tritium supply and recycling at SRS alternative (based on the advanced light water reactor technology which generally would produce the largest waste volumes). The maximum forecast includes all waste associated with that alternative except for spent nuclear fuel (approximately 23 cubic meters per year) and liquid low-level wastes (5 million gallons per year) associated with the operation of a potential tritium supply.

TE

STOCKPILE STEWARDSHIP AND MANAGEMENT (DOE/EIS-0236)

TC

The second programmatic EIS related to the reconfiguration of the nuclear weapons complex is the *Stockpile Stewardship and Management Programmatic EIS.* Stockpile stewardship includes activities required to maintain a high level of confidence in the safety, reliability, and performance of nuclear weapons in the absence of underground testing, and to be prepared to test weapons if so directed by the

President of the United States. Stockpile management activities include dismantlement, maintenance, evaluation, and repair or replacement of weapons in the existing stockpile. The *Stockpile Stewardship and Management Programmatic EIS* will analyze the environmental impacts of alternatives for the missions necessary to carry out DOE's stockpile stewardship and management responsibilities. Decisions made based on the *Stockpile Stewardship and Management Programmatic EIS* could result in generation of high-level waste that might be immobilized at the Defense Waste Processing Facility. TC

LONG-TERM STORAGE AND DISPOSITION OF WEAPONS-USABLE FISSILE MATERIALS (DOE/EIS-0229) TE

DOE is preparing a programmatic EIS to assist in the development of a comprehensive national policy for the storage and disposition of weapons-usable fissile materials. The term weapons-usable fissile materials refers to a specific set of nuclear materials that could be used in making a nuclear weapon, but does not include the fissile materials in spent fuel or irradiated targets from reactors. TE TE

References

DOE (U.S. Department of Energy), 1992, *Environmental Assessment, Consolidated Incineration Facility, Savannah River Site,* DOE/EA-0400, Office of Environmental Restoration and Waste Management, Savannah River Plant, Aiken, South Carolina.

Grumbly, T. P., 1993, U.S. Department of Energy, Washington, D.C., letter to Brian Costner, Energy Research Foundation, Columbia, South Carolina, October 22.

CHAPTER 2. DESCRIPTIONS OF THE ALTERNATIVES

The U.S. Department of Energy (DOE) proposes to implement a waste management strategy for the Savannah River Site (SRS) that is protective of human health, complies with environmental regulations, prevents pollution, minimizes waste generation, uses effective and commercially available technology, and controls cost. The strategy must address minimization, treatment, storage, and disposal of liquid high-level radioactive [dealt with more fully in the Defense Waste Processing Facility Environmental Impact Statement (EIS) and supplemental EIS], low-level radioactive, hazardous, mixed (low-level radioactive and hazardous), and transuranic wastes at SRS. Such a strategy may be structured in several ways, depending on the elements that are emphasized, and may include both onsite and offsite applications of the technologies selected. This chapter describes the no-action alternative and the three action alternatives that DOE has proposed as waste management strategies; the action alternatives place different degrees of emphasis on treatment, storage, and disposal. These alternatives encompass the full range of reasonable alternatives. In addition, this chapter summarizes the results of studies that were necessary to define the alternatives and to evaluate them consistently. Finally, this chapter presents a summary comparison of the alternatives and their potential impacts. TE TE

The analyses of the alternatives are based on forecasts of the amounts of wastes that DOE could be required to manage over the next 30 years (1995 through 2024). Section 2.1 presents the forecasts of waste volumes; the radiological, physical, and other characteristics of each waste type; and their requirements for handling and management.

DOE used information available in spring and summer 1994 to forecast the expected, minimum, and maximum amounts of waste that would require management. Several factors make it difficult to predict the types and amounts of waste that will be managed over the 30-year period considered in this EIS. These factors are the result of a number of uncertainties. One uncertainty is the future mission of SRS. DOE is evaluating alternative missions in several programmatic EISs (see Chapter 1). Future decisions based on these ongoing EISs may include changes in operations at SRS and transfers of waste to SRS from the Department of Defense and between SRS and other DOE facilities. The decisions on SRS's future operations will affect the amount of waste SRS will manage. Another source of uncertainty is the future decisions regarding the extent of environmental restoration and decontamination and decommissioning at SRS which would substantially affect the amount of waste generated onsite over the 30-year analysis period. There is limited data on the waste types and volumes from environmental restoration and decontamination and decommissioning because specific cleanup criteria have not yet been established. Not all of the existing waste sites have been sufficiently characterized to determine how much or what type of remediation is necessary and, hence, how much remediation waste would be TE TC produced. Similarly, estimates of the waste that would be generated by the decontamination and decommissioning program were extrapolated from data based on inspections of a limited number of surplus facilities and, therefore, are uncertain.

Section 2.2 describes the no-action alternative, under which DOE would continue current practices for treatment and storage of liquid high-level radioactive waste, mixed and transuranic wastes, and low-level waste (primarily long-lived); disposal of low-level radioactive waste; and treatment and disposal of hazardous waste offsite. The no-action alternative provides a baseline for comparing environmental impacts of the alternatives. Because it is a baseline and represents a continuation of current practices, it is based on the expected 30-year waste forecast (Section 2.1.3).

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For all but the no-action alternative, DOE investigated various combinations of waste minimization, pollution prevention, and technologies for treating, storing, and disposing of all waste types except high-level waste. The availability, advantages, and disadvantages of the potential technologies to treat the wastes must be understood before reasonable treatment, storage, and disposal systems for managing four of the five types of waste considered in this EIS can be determined. Note that the treatment and disposal options for high-level waste remain the same for all alternatives. Section 2.3 describes the technology evaluation process and the reasonable technologies that were chosen in developing the alternative systems of treatment, storage, and disposal. Under each alternative, DOE selected a mix of technologies which favorably met five criteria: process parameters (including degree of volume reduction, the amount of secondary waste generated, and the efficiency of process decontamination and decommissioning); engineering parameters (including process maturity, availability, and ease of maintenance); environment, health and safety factors (public and occupational risks, environmental risks, and transportation requirements); public acceptance (including regulatory permitting and schedule considerations); and cost considerations.

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DOE constructed two bounding waste management strategies that provide direction for choosing treatment, storage, and disposal options for the various types of waste. The bounding strategies considered in this EIS and described in this chapter include:

- Limited treatment configuration (alternative A) (Section 2.4) - This strategy seeks to provide the minimum treatment required to meet applicable storage and disposal standards.

- Extensive treatment configuration (alternative C) (Section 2.5) - This strategy applies to treatment technologies that minimize the volume and toxicity of wastes and create highly migration-resistant waste forms.

Under alternative A, DOE would select technologies that provide the minimum treatment required to meet applicable storage and disposal standards and expeditiously store or dispose of the wastes in a manner that prevents or minimizes short-term releases to the environment. Although this strategy focuses on the narrow objective of minimizing short-term impacts, it uses reasonable technologies analyzed in Section 2.3. DOE believes that this strategy establishes one end of the range of alternatives that meets the purpose and need for action as described in Chapter 1.

The other bounding strategy, alternative C, is based on applying proven treatment technologies that reduce the volume and toxicity of waste and create a highly migration-resistant waste form. In general, construction and operation of new treatment facilities would result in greater short-term impacts than options presented for alternative A, but would provide a greater margin of safety against adverse long-term effects of the waste after disposal. TE

- Moderate treatment configuration (alternative B) (Section 2.6) – This mix includes limited treatment of some wastes and extensive treatment of others, depending on the particular characteristics of the waste. TE

DOE has identified the moderate treatment configuration, alternative B, as its preferred alternative based on the careful consideration of beneficial and adverse environmental impacts, regulatory commitments, and other relevant factors. The moderate treatment configuration would provide a balanced mix of technologies that includes extensive treatment of those waste types that have the greatest potential to adversely affect humans or the environment because of their mobility or toxicity if left untreated (such as wastes containing plutonium-238), or that would remain dangerously radioactive far into the future (such as wastes containing transuranics). It would provide less extensive treatment of wastes that do not pose great threats to humans or the environment, or that will not remain dangerously radioactive far into the future (such as non-alpha low-level waste).

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DOE bases its preference of alternative B on the following environmental impacts, regulatory commitments, and other factors:

- Mixed waste technology selections are compatible with the site treatment plan. When a waste in the EIS 30-year forecast was also included in the site treatment plan 5-year forecast, alternative B uses the same technology as that identified as the preferred treatment by the proposed site treatment plan.

- Mixed waste technology selections are consistent with DOE's commitments under the Land Disposal Restrictions Federal Facility Compliance Agreement with EPA.

- Transuranic waste technology selections are compatible with what the final Waste Isolation Pilot Plant waste acceptance criteria are expected to require. Treatment is provided only for those transuranic wastes that do not conform to the shipping requirements (i.e., plutonium-238 and higher activity plutonium-239). All other SRS transuranic wastes are expected to meet the Waste Isolation Pilot Plant waste acceptance criteria after repackaging and characterization/certification.

- Hazardous wastes are treated onsite subject to availability of treatment capacity and compatibility with technologies required to manage mixed waste.

- Alternative B provides the best volume reduction for low-activity waste (75 percent reduction in alternative B compared to 22 percent for alternative A and 70 percent for alternative C), conserves space in low-activity waste vaults, reduces the total number of low-activity waste vaults, and thus avoids expenditures of land and money.

- Alternative B also results in the fewest number of additional transuranic and alpha waste pads,
TC shallow land disposal trenches, and RCRA-permitted vaults.

- Alternative B results in the least construction-related air emissions.

- Alternative B employs less thermal treatment (technologies generally resulting in higher air emissions) than alternative C, resulting in smaller radiological air impacts than would occur in alternative C (e.g., fewer involved worker latent cancer fatalities and lower maximally exposed offsite individual fatal cancer probability).

In summary, DOE believes that alternative B provides the preferred configuration of treatment, storage, and disposal facilities for SRS. It maintains technology selection flexibilities that are not shared by alternatives based on strategies to provide limited (alternative A) or extensive (alternative C) treatment configurations.

Throughout the public comment period, DOE continued to consider many of the issues addressed in the draft EIS. As a result of these considerations, DOE identified improvements in the management of its wastes and modified the alternative configurations accordingly, particularly the moderate treatment alternative (alternative B) for low-level waste. Table 2-1 describes the most significant changes between the draft and final EIS, the alternatives they affect and the sections that describe the modifications and their benefits in greater detail. Additional changes between the draft and final EIS, including changes to align the technologies proposed for mixed wastes with the preferred alternatives presented in the proposed site treatment plan, are discussed in the appropriate sections for the affected alternatives.

Table 2-1. Major changes in alternative configurations between the draft and final EIS.

Facility	Alternative	Discussion
Transuranic and Alpha Waste	No-action, A, B, and C	**Draft EIS**: In the draft EIS, DOE assumed that generators could not distinguish between transuranic waste (greater than or equal to 100 nanocuries per gram) and alpha waste (less than 100 nanocuries per gram and suitable for onsite treatment and disposal). Under the no-action alternative DOE would continue to store transuranic and alpha waste. Under alternatives B and C, DOE proposed to store the transuranic and alpha waste until a transuranic waste characterization/certification facility could be constructed and begin operation. The facility would have treated transuranic and alpha waste. Alpha waste would have been disposed of onsite and transuranic waste would have been stored pending the availability of the Waste Isolation Pilot Plant. **Final EIS**: DOE believes that generators of transuranic wastes will have the capability to identify newly-generated alpha waste. In all alternatives in the final EIS newly-generated nonmixed alpha waste would be certified by the generators for disposal in the low-activity waste vaults. In alternatives A, B, and C newly-generated mixed alpha waste would be treated and certified for disposal in the Resource Conservation and Recovery Act (RCRA) vaults when they become operational in 2002. TC **Reference Sections**: 2.2.6, 2.4.6, 2.5.6, and 2.6.6
Offsite Low-level Waste Volume Reduction	B	**Draft EIS**: Under alternative B in the draft EIS, DOE would have treated approximately 50 percent of the low-activity job-control waste and tritiated job-control waste in the Consolidated Incineration Facility; treated about 40 percent in a newly constructed onsite supercompactor; and the remaining 10 percent placed directly into vaults. DOE also proposed to send 50 percent of the low-activity equipment waste to the onsite supercompactor. **Final EIS**: In the final EIS, DOE would still treat 50 percent of the low-activity job-control waste and tritiated job-control waste in the Consolidated Incineration Facility; the remaining tritiated job-control waste would be sent directly to disposal vaults. DOE would ship 50 percent of the low-activity job-control waste to a commercial facility for volume reduction and return it to SRS for further treatment or disposal. DOE would solicit proposals from commercial facilities for reducing the volume of low-level radioactivity waste in the future, and would require the facilities to supply information that DOE would use to prepare additional environmental reviews as required by 10 CFR 1021.216. For purposes of analysis in the final EIS, it is assumed that the

Table 2-1. (continued).

Facility	Alternative	Discussion
Offsite Low-level Waste Volume Reduction (continued)	B	waste would be treated offsite as follows: 60 percent supercompacted; 20 percent reduced in size and repackaged for treatment in the Consolidated Incineration Facility; 10 percent incinerated, the resulting ash supercompacted; 5 percent reduced in size and repackaged for disposal; and 5 percent melted, with the melt residue supercompacted DOE would also ship 50 percent of the low-activity equipment waste to a commercial facility to be supercompacted. For purposes of assessment, it is assumed that the offsite treatment facility would be located in Oak Ridge, Tennessee. **Reference Section:** 2.6.3
Offsite Treatment and Disposal of Hazardous Waste	B	**Draft EIS:** Under alternative B in the draft EIS, DOE proposed to ship approximately 89 percent of its hazardous waste offsite for treatment and disposal and to treat composite filters, paint waste, organic liquids, and aqueous liquids in the Consolidated Incineration Facility; some aqueous liquids would have been treated in the M-Area Air Stripper. **Final EIS:** DOE would increase the amount of hazardous waste that remains onsite for treatment in the Consolidated Incineration Facility. Fifty percent of the inorganic, organic, and heterogeneous debris groups and 100 percent of the organic and inorganic sludges would be incinerated onsite, in addition to the wastes proposed for incineration in the draft EIS. **Reference Section:** 2.6.4
Treatment of Alpha Waste in the Consolidated Incineration Facility	C	**Draft EIS:** In the draft EIS under alternative C, DOE assumed that alpha waste would be stored on site and treated in the alpha vitrification facility after it became operational in 2008. **Final EIS:** In the final EIS, DOE would burn 50 percent of the alpha-waste (both mixed and nonmixed) in the Consolidated Incineration Facility from 1996 to 2005, then discontinue incineration and begin vitrifying these wastes at the alpha vitrification facility in 2008. **Reference Section:** 2.5.6
Vitrification of High-Activity Plutonium-239 Waste	B	**Draft EIS:** In the draft EIS, DOE assumed that all of the plutonium-239 waste would be acceptable for shipment to the Waste Isolation Pilot Plant after repackaging. **Final EIS:** DOE believes that it would be necessary to vitrify the high-activity fraction of plutonium-239 waste to eliminate unacceptable levels of gas associated with the higher-activity material. In alternative B of the final EIS, DOE would treat the high-activity plutonium-239 waste in the alpha vitrification facility. **Reference Section:** 2.6.6

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On May 17, 1995, DOE published a notice in the *Federal Register* (60 FR 26417) describing these improvements and soliciting comments through June 12, 1995. Modification of the treatment of low-level waste proposed in the draft EIS would change the location, but not the treatment technologies, for the treatment of approximately 40 percent of the expected volume of this type of waste. In the draft EIS, alternative B included onsite incineration, supercompaction, or direct disposal of low-level waste. The final EIS includes onsite incineration or direct disposal, and supercompaction, size reduction (e.g., sorting, shredding, and melting), and incineration at an offsite commercial treatment facility. All residues from offsite treatment would be returned to SRS for future treatment or disposal. This modification is more advantageous than the original proposal because it provides immediate utilization of commercial volume reduction capacity, and negates the need for DOE to construct a supercompactor. This is not only cost-effective, but saves existing disposal capacity.

In addition to the changes described in detail in Table 2-1, volumes and treatments for some mixed wastes were modified between the draft and final EIS to make the EIS compatible with changes to the proposed site treatment plan. These changes dealt with smaller volumes of waste and are described in the mixed waste sections of the alternatives. TC

DOE proposed a short-term, temporary method of volume reduction for low-level waste in the draft *Environmental Assessment for the Offsite Volume Reduction of Low-Level Radioactive Waste from the Savannah River Site* (DOE/EA-1061). The proposed action, by a commercial facility in Oak Ridge, Tennessee, would reduce the volume of low-level waste at SRS in an expedient and cost effective manner over the near-term (prior to the start of fiscal year 1996). Because the impacts of the proposed action would be very small and the proposed action would not limit the selection of alternatives under consideration in this EIS, this proposed volume reduction qualifies as an interim action under National Environmental Policy Act (NEPA) regulations (40 CFR 1506.1).

DOE developed expected, minimum, and maximum waste forecasts for each waste type based on mid-1994 information about the disposition of the various wastes stored throughout the DOE complex. DOE evaluated the differences in waste management decisions that would result from the different volumes under the alternatives that meet the purpose and need for action as described in Chapter 1. Because the no-action alternative does not meet this purpose and need for action, DOE bases the no-action alternative solely on the expected waste forecast. The intent of the minimum and maximum waste forecasts is to identify how waste management needs would change within an alternative with different waste amounts, and to bound the impacts that might result from potential changes in the amount of waste SRS could be required to handle as a result of decisions based on other NEPA evaluations TE
currently underway and described in Chapter 1.

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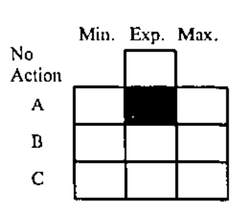
Based on the results of analyses in Chapter 4, Environmental Consequences, Section 2.7 summarizes and compares the environmental impacts of the alternatives (i.e., no-action, limited treatment, extensive treatment, and moderate treatment). Its intent is to clearly identify the critical issues for the public and to provide a sound basis for review by the decisionmaker. Cumulative impacts were assessed only for the moderate treatment alternative (alternative B) with the expected waste forecast since the impacts for this alternative generally fall between the other two action alternatives, and since the impacts do not vary greatly between alternatives. Despite some variation in impacts, this approach allowed DOE to assess the likely magnitudes of the cumulative impacts of the other alternatives based on the cumulative impacts of the moderate alternative. This EIS presents the no-action alternative first, followed by alternative A (limited treatment), alternative C (extensive treatment), and alternative B (moderate treatment).

Four alternatives and three waste forecasts are ultimately considered in this EIS. To help guide the reader, the stacked box symbol (Figure 2-1), is used throughout Chapters 2 and 4 to indicate the alternative and waste forecast being discussed. Shading indicates the alternative and forecast under consideration. Specific examples of this symbol are shown below.

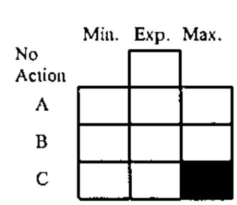
TE **Figure 2-1.** Explanation of grid symbol used in the *SRS Waste Management EIS.*

Alternative	Amount of waste to be managed		
	Minimum	Expected	Maximum
No action		Continue current waste management practices with the expected estimate of waste	
A	Limited treatment configuration; minimum estimate of waste	Limited treatment configuration; expected estimate of waste	Limited treatment configuration; maximum estimate of waste
B	Moderate treatment configuration; minimum estimate of waste	Moderate treatment configuration; expected estimate of waste	Moderate treatment configuration; maximum estimate of waste
C	Extensive treatment configuration; minimum estimate of waste	Extensive treatment configuration; expected estimate of waste	Extensive treatment configuration; maximum estimate of waste

For example,



Alternative A, expected waste forecast



Alternative C, maximum waste forecast

2.1 Waste Forecasts

This section describes the waste types and treatment categories discussed in this EIS. It provides estimates of the volumes of each of the five waste types: liquid high-level radioactive, low-level radioactive, hazardous, mixed low-level radioactive, and transuranic. DOE made assumptions regarding the future waste volumes to create a potential forecast for analysis. See Appendix A for these waste volume forecasts. The variations between the anticipated waste volumes in the forecasts are primarily a result of differences in assumptions about the environmental restoration and decontamination and decommissioning activities. TE TE

The assumptions DOE used to develop the waste forecasts were based on mid-1994 information from throughout the DOE complex. DOE recognized that the information available to predict the volumes and kinds of wastes that would be treated at SRS was subject to continual change as the DOE complex as a whole developed a waste management plan. For this reason, DOE tried to anticipate what might be treated at SRS, develop forecasts that it believes would encompass the most likely options, and analyze impacts for maximum and minimum waste forecasts, as well as what was considered most likely (or expected) at the time the forecasts were developed. However, if future decisions affect the waste volumes SRS anticipates treating so dramatically that the impacts fall outside the maximum-minimum envelope, DOE will prepare additional NEPA evaluations. TC

2.1.1 WASTE DESCRIPTIONS

Liquid high-level radioactive waste includes the highly radioactive material resulting from the reprocessing of spent nuclear fuel. This waste contains a combination of transuranic elements or isotopes and highly radioactive fission products in concentrations requiring permanent isolation, and hazardous constituents regulated under the Resource Conservation and Recovery Act (RCRA). DOE uses the F- and H-Area chemical separations plants to separate and purify plutonium-238 and plutonium-239 and to reclaim fissionable material (uranium-235) from onsite and offsite sources (e.g., research reactor fuel) for recycling. These processes dissolve fuel and target elements in nitric acid and separate them into (1) a solution of plutonium, uranium, and neptunium and (2) liquid high-level radioactive waste. Further processing separates and purifies the metals in solution, converts the plutonium to solid form for shipment, and prepares the other materials for shipment, storage, or reuse. The liquid high-level radioactive waste is stored in carbon steel tanks in the F- and H-Area tank farms. TE

Low-level radioactive waste is radioactive waste that is not classified as high-level waste, transuranic waste, or spent nuclear fuel, and does not contain waste designated as hazardous by RCRA. Typical solid low-level radioactive waste includes operating and laboratory wastes (e.g., protective clothing, plastic sheeting, gloves, analytical wastes, decontamination residue), contaminated equipment, reactor and reactor fuel hardware, spent lithium-aluminum targets from which tritium has been extracted, and spent deionizer resin from reactor areas. Liquid low-level radioactive waste includes tritiated oil (oil contaminated with tritium), process waste, evaporator condensate, and some storm and cooling waters. Numerous facilities listed in Table 2-2 and waste management, environmental restoration, and decontamination and decommissioning activities (including surveillance, maintenance, recovery, cleanup, and stabilization) generate low-level radioactive waste at SRS. Small amounts of additional low-level waste (less than 3 percent of the expected forecast low-level waste volume) are received at SRS from other DOE facilities and nuclear naval operations. The offsite low-level wastes consist primarily of job-control wastes and naval hardware but may include other materials such as soils and equipment or construction debris generated as a result of decommissioning activities.

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Table 2-2. Major facilities and types of waste generated at SRS.[a]

Facilities	Function	Waste types
Analytical Laboratories	Analytical services and testing	LLW[b], MW[c], TRU[d]
Defense Waste Processing Facility	High-level waste vitrification	LLW, HW[e], MW
F/H-Area Effluent Treatment Facility	Treatment of routine process effluent and wastewater	LLW, HW, MW
F/H-Area High-Level Waste Tanks	Storage and treatment of high-level waste supernatant, sludge, and saltcake	LLW, HW, MW
Reactor Materials (M-Area)	Fuel and target fabrication	LLW, HW, MW
Reactors	Production reactors currently in standby (K) or shutdown condition (C, L, P, and R)	LLW, HW, MW
Receiving Basin for Offsite Fuels/ Resin Regeneration Facility	Storage and packaging of offsite fuels, cleaning targets for processing, and processing deionizers	LLW
Replacement Tritium Facility	Tritium separation from targets	LLW, HW, MW
Separations (F- and H-Areas)	Chemical and physical processing of nuclear materials	HLW[f], LLW, HW, MW, TRU
Savannah River Technology Center	Research and development activities	LLW, HW, MW, TRU
Z-Area Saltstone Manufacturing and Disposal Facility	Saltcrete processing and disposal	LLW

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a. Source: WSRC (1994a).
b. Low-level radioactive waste.
c. Mixed waste.
d. Transuranic and alpha waste.
e. Hazardous waste.
f. Liquid high-level waste.

At SRS, low-level waste is segregated into several categories to facilitate proper treatment, storage, and disposal. Twelve such categories were defined for the five waste classes of low-level waste (Hess 1994a), as follows: TE

Long-lived low-level waste

(1) Long-lived spent-deionizer resins are low-level waste from purification systems for reactor moderators. They have less than 10 curies of tritium per container and large curie quantities of carbon-14, which has a half-life of 5,730 years.

(2) Other long-lived low-level waste, such as offgas filters from chemical separations areas, contains large quantities of long-lived radionuclides.

Tritiated low-level waste

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(3) Tritiated job-control waste contains tritium in quantities greater than 10 curies per 2.55 cubic meters (90 cubic feet).

(4) Tritiated equipment is large equipment (i.e., too large to be packaged in standard containers) contaminated with tritium in quantities greater than or equal to 10 curies per 2.55 cubic meters (90 cubic feet).

(5) Tritiated soil is contaminated with tritium in quantities greater than or equal to 10 curies per 2.55 cubic meters (90 cubic feet).

Bulk low-level waste

(6) Naval hardware consists of large nuclear-ship-reactor components that are shipped from the Naval Reactors Program to SRS.

(7) Low-activity equipment produces a radiation dose of less than 200 millirem per hour at 5 centimeters (2 inches) from an unshielded container. TE

Low-level waste soils

(8) Suspect soil consists of soils and construction debris excavated from a radiological materials area that is potentially contaminated and that cannot economically be demonstrated to be uncontaminated.

(9) Low-activity soil consists of soils and construction debris that produce a radiation dose of less than 200 millirem per hour at 5 centimeters (2 inches) from an unshielded container.

Job-control waste

TE TC (10) Offsite job-control waste is generated by other DOE sites and by nuclear naval operations. It is compacted, containerized, and shipped to SRS for disposal. Job-control waste consists of plastic sheeting, paper, small pieces of wood and metal, glass, gloves, protective clothing, and pieces of small equipment that was used in a radioactive process.

(11) Low-activity job-control waste produces a radiation dose rate of less than 200 millirem per hour at 5 centimeters (2 inches) from an unshielded container and is comprised of job-control waste.

(12) Intermediate-activity job-control waste contains beta or gamma emitters that produce a dose equal to or greater than 200 millirem per hour at 5 centimeters (2 inches) from an unshielded container and is comprised of materials such as contaminated equipment from the separations facilities or waste management facilities, spent lithium-aluminum targets from tritium
TE operations, equipment from F- and H-Area tank farm operations, reactor scrap, and irradiated reactor hardware that does not contain fuel.

Radioactivity in low-level waste generally consists of beta- and gamma-radiation-emitting radionuclides which decay to near-background levels within several hundred years, and therefore pose very small long-term risks to the environment. Alpha-emitting low-level wastes are discussed separately if the alpha-contamination level is sufficient to warrant special handling practices. Low-level wastes with transuranic nuclides at concentrations of 10 to 100 nanocuries per gram, called "alpha waste" in this EIS, are managed in a manner similar to transuranic wastes at SRS and are discussed in the transuranic and alpha waste sections of this EIS. The management of "non-alpha waste" (waste with less than 10 nanocuries per gram of transuranic contamination) is addressed in the low-level waste sections of this EIS.

Waste is classified as **hazardous waste** if it exhibits a characteristic of a hazardous waste (ignitability, corrosivity, reactivity, or toxicity), is identified as such and listed by the U.S. Environmental Protection Agency (EPA) or South Carolina Department of Health and Environmental Control (SCDHEC), is a mixture containing a listed hazardous waste and a solid waste, or is derived from the treatment, storage, or disposal of a listed hazardous waste. Hazardous wastes include materials such as lead, solvents, paints, pesticides, and hydrocarbons. For purposes of analysis in this EIS, hazardous wastes are categorized into the following primary treatability groups: organic liquids, aqueous liquids, organic debris, inorganic debris, heterogeneous debris, metal debris, glass debris, organic sludges, inorganic sludges, and soils. Wastes with unique treatment requirements or specific management practices (e.g., a waste managed in accordance with an approved RCRA variance to land disposal restrictions treatment standards) are categorized separately. Facilities listed in Table 2-2 and waste management, environmental restoration, and decontamination and decommissioning activities generate SRS hazardous waste. Hazardous waste is subject to regulation under RCRA. Polychlorinated biphenyl (PCB) wastes regulated under the Toxic Substances Control Act have been included in the hazardous waste analyses of this EIS.

Mixed low-level radioactive waste contains both hazardous waste subject to regulation under RCRA and low-level radioactive waste subject to the Atomic Energy Act. Mixed low-level radioactive waste includes materials such as tritiated mercury, tritiated oil contaminated with mercury, other mercury-contaminated materials, radioactively contaminated lead shielding, equipment from the tritium facilities in H-Area, and filter paper take-up rolls from the M-Area Liquid Effluent Treatment Facility. TE
Mixed wastes are categorized into the same primary treatability groups as listed above for hazardous wastes. The facilities listed in Table 2-2 and waste management, environmental restoration, and decontamination and decommissioning activities generate SRS mixed low-level radioactive waste. Radioactively contaminated PCBs regulated under the Toxic Substances Control Act are included with mixed waste in this EIS.

Transuranic waste is waste containing alpha-emitting radioactive isotopes of elements above uranium ("transuranic") on the periodic table (atomic number greater than 92) that have half-lives greater than 20 years (several abundant transuranic nuclides have half-lives greater than 10,000 years) at concentrations exceeding 100 nanocuries per gram. Alpha radiation emissions typically have very high energies but low penetrating power. A number of alpha-emitting radionuclides, when inhaled or ingested, are cleared from the body very slowly and can cause substantial radiation exposure to specific TE
organs of the body (e.g., bone surfaces, lungs) over long periods of time. Transuranic waste normally takes a long time to decay to background levels; thus it requires the same sort of long-term isolation as high-level waste. Due to the non-penetrating nature of alpha particles, little or no shielding is required,

but some transuranic waste does require shielding and remote handling when mixed with large quantities of beta-gamma emitting radionuclides. SRS also manages low-level radioactive waste with transuranic radionuclides at concentrations of 10 to 100 nanocuries per gram (called alpha waste at SRS) in a manner similar to transuranic waste. Due to the similarity in their management practices, alpha waste (which consists of low-level and mixed low-level wastes) is discussed in the transuranic waste sections of this EIS. The facilities listed in Table 2-2 and waste management, environmental restoration, and decontamination and decommissioning activities generate transuranic and alpha waste.

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Transuranic and alpha wastes can be segregated into four waste classes based on their treatment, storage, and disposal requirements (Hess 1994a), as follows:

Low-activity with processing

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(1) Mixed alpha job-control waste is similar to alpha job-control waste but includes hazardous wastes and is, therefore, also subject to RCRA (portions are in the burial ground complex).

(2) Transuranic job-control waste with less than 0.5 curie per drum would be accepted at the Waste Isolation Pilot Plant if it meets waste acceptance criteria.

(3) Mixed transuranic job-control waste with less than 0.5 curie per drum is the same as the third treatability group but contains hazardous waste and is subject to RCRA (portions are in the burial ground complex).

High activity

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(4) Transuranic job-control waste with greater than 0.5 curie per drum contains higher concentrations of transuranic isotopes than the third treatability group and would be sent to the Waste Isolation Pilot Plant.

(5) Mixed transuranic job-control waste with greater than 0.5 curie per drum is similar to the fifth treatability group but includes hazardous waste that makes it subject to RCRA (portions are in the burial ground complex).

(6) Transuranic equipment is bulk waste generated primarily by process modifications or decontamination and decommissioning activities that would be sent to the Waste Isolation Pilot Plant. The quantities of transuranic isotopes require special control of airborne contamination, heat load, and criticality. TC

(7) Mixed transuranic equipment is similar to the seventh treatability group but includes hazardous waste.

(8) Remote-handled transuranic and mixed-transuranic is job-control or bulk waste that emits a radiation dose rate greater than 200 millirem per hour at 5 centimeters (2 inches), and requires remote handling to protect workers. This waste would be sent to the Waste Isolation Pilot Plant. TE

Low activity without processing

(9) Alpha job-control waste is generated incidentally to transuranic processes; activity level is too low to warrant disposal in the Waste Isolation Pilot Plant, but the waste does require treatment and disposal. TE

Burial ground complex — Includes 50 percent mixed alpha job-control waste, 40 percent mixed transuranic job-control waste with less than 0.5 curie per drum, and 10 percent mixed transuranic job-control waste with greater than 0.5 curie per drum. TC

In view of the uncertainties in the various factors potentially affecting the amounts of wastes to be generated and managed, DOE developed estimates of amounts of waste for an expected, a minimum, and a maximum waste forecast. A summary of each 30-year forecast, by waste type and year, can be found in Table A-1 of Appendix A. Several refinements have been made to the waste forecasts since the draft EIS was published. In March 1995, DOE published the *SRS Proposed Site Treatment Plan* (WSRC 1995), which included revised estimates of mixed waste generation for the period 1995-1999. The mixed waste forecasts were updated to be consistent with the revisions to the site treatment plan. Table A-2 of Appendix A provides a summary of the forecast revisions that were incorporated in the analyses of the EIS. The net effect of these changes is a slight increase (approximately 4 percent) in the expected amount of mixed waste to be managed over the 30-year period considered in this EIS. TE

2.1.2 TREATABILITY GROUPS

DOE categorized wastes into treatability groups, which are based on waste characteristics that affect how the wastes can be treated. Treatability groups were developed based on three parameters: radiological properties, physical and chemical characteristics, and hazardous constituents. Wastes within a treatability group can generally be treated with similar technologies. Different treatability groups often require different technologies.

2.1.2.1 Radiological Properties

The radiological parameters reflect the level and nature of the radioactivity of the waste and influence the design and operation of facilities in order to limit releases and worker exposures. These parameters are based on the isotopes present (e.g., plutonium-238 versus plutonium-239), the curie content (a measure of the radioactivity of the material), and whether the radiation is penetrating (e.g., beta-gamma) or non-penetrating (e.g., alpha). The radiological categories of waste (as described in Section 2.1.1 and defined by DOE Order 5820.2A, "Radioactive Waste Management") determine treatment, storage, and disposal options. Other radiological parameters include handling requirements (e.g., can be handled directly by workers or must be handled remotely by machine) and transuranic alpha content. Generally, workers can handle most low-level waste without massive or bulky shielding around the waste; however, some form of worker protection may be required. Such wastes are referred to as contact-handled. Containerized wastes producing radiation levels greater than 200 millirem per hour at the surface of the container in the form of beta particles, gamma rays, or both, are usually handled remotely at SRS.

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Transuranic waste typically requires special handling to protect workers from inhaling or ingesting the material and to prevent releases to the environment. Because transuranic isotopes are primarily alpha emitters, external radiation exposure is usually low, and controls focus on preventing the inhalation of alpha particles. Controls also seek to minimize the potential for accidents that could result in airborne releases. Some transuranic wastes emit so much beta and gamma or neutron radiation that they cannot be directly handled. These remote-handled wastes have radiation levels that exceed 200 millirem per hour at the surface of their storage container. In disposing of transuranic waste, the objective is to isolate the waste and allow its radioactivity to diminish. The long half-lives of most transuranic isotopes make permanent isolation in a facility like a geologic repository the only suitable location for disposal.

The most prevalent isotopes in high-level waste are cesium-137 and strontium-90; this waste also contains transuranic isotopes. Because high-level waste contains high concentrations of beta-gamma-radiation-emitting isotopes (50 to 100 curies per gallon) and is in liquid form, controls are directed at radiation shielding, dissipation of the heat produced by the radioactive decay, and containment of the liquid. Due to the high radiation and presence of long-lived transuranic isotopes in high-level wastes, permanent isolation in a geologic repository is required. At SRS, liquid high-level waste is stored in underground steel tanks shielded by concrete and earth. Newer tanks have complete secondary containment and are much less likely to leak into the soil than older tanks with different containment configurations. Although the tanks use multiple leak detection systems, a risk of leaks will remain as long as the waste is in liquid form. High-level waste management is directed at processing the liquid wastes to stable solid forms (i.e., a borosilicate glass form encased in a stainless steel canister) for storage pending the availability of a geologic repository for disposal.

Nuclear processes at SRS generate low-level wastes that are generally packaged in 55-gallon drums or 90-cubic-foot metal boxes. While most low-level wastes contain short-lived radioisotopes, some may present an appreciable radiation hazard. The radiation from low-level wastes may be sufficient to require shielding for worker protection during handling and shipment. However, most low-level wastes will decay over a few hundred years and do not require permanent isolation in the manner required for transuranic and high-level wastes.

Mixed wastes are mixtures of hazardous and high-level, low-level, or transuranic waste components, which require management in accordance with the particular risks presented by the radioactive constituents they contain, as described above, in addition to the risks of their RCRA or Toxic Substances Control Act hazardous constituents. In this EIS, high-level and transuranic mixed wastes are evaluated with the nonhazardous radioactive wastes of those radiation types because the management requirements for these wastes are primarily determined by their radiological properties. The mixed waste category considered in this EIS is limited to low-level non-alpha mixed wastes.

2.1.2.2 Physical and Chemical Characteristics

Since the radioactive constituents account for only a small fraction of the waste volume, the physical and chemical characteristics of a waste determines its overall form. These characteristics affect both regulatory requirements and the applicability of specific treatment technologies. Wastes were grouped for a particular treatment based on the similarity of their physical and chemical characteristics. The three primary categories are liquid waste, solid waste, and unique waste. The liquid and solid categories have particular handling characteristics or requirements by virtue of their physical form. For example, liquids can be pumped via pipelines and are more readily subject to chemical processing (e.g., ion exchange), while solids require conveyor or containerized transfer systems and are processed, if at all, by physical means (e.g., compaction). Each category of unique wastes includes materials that have unique treatment or handling requirements. For example, radioactively contaminated lead is subject to specific RCRA treatment requirements and is categorized as a separate form of solid waste. Similarly, elemental mercury is subject to specific RCRA treatment requirements and is categorized as a separate form of liquid waste.

2.1.2.3 Hazardous Constituents

Hazardous constituents determine the treatment required to manage the hazardous properties of a waste from both a technical and a regulatory perspective. The primary categories are organics; metals; and ignitables, reactives, and corrosives. Organics and metals are classes of contaminants, while ignitability, reactivity, and corrosivity refer to the characteristics that a material may possess.

TE | The type of hazardous constituents will often dictate the regulatory requirements applicable to treating, storing, and disposing of the waste. The principal regulatory programs are RCRA and the Toxic Substances Control Act.

Hazardous wastes are defined and regulated under RCRA. A waste is a hazardous waste if, because of its quantity, concentration, or physical and chemical characteristics, it may pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of or otherwise managed.

Materials regulated under the Toxic Substances Control Act include PCBs and asbestos. The presence of these contaminants imposes specific requirements on the management of waste. PCB-contaminated materials are subject to treatment standards that specify more stringent destruction and removal efficiencies than those applicable to hazardous wastes under RCRA. Asbestos is an inhalation hazard and asbestos-bearing materials must be handled and packaged to avoid exposure to asbestos fibers by inhalation. Non-radioactive asbestos is outside the scope of this EIS, but radioactively contaminated asbestos-bearing materials have been included in the waste forecasts. Because asbestos does not generally have specific treatment or disposal requirements, asbestos-bearing materials have not been categorized into separate treatability groups in this EIS.

The technical requirements for waste treatment depend on whether the hazardous constituents can be destroyed (e.g., thermal destruction of an organic contaminant), extracted from the waste (e.g., removal of metal contaminants via ion exchange), or must be immobilized (e.g., stabilization of metal-bearing wastes with a binding agent). A waste can contain more than one constituent; if it does, a series of treatment processes could be required. For example, an ignitable liquid with metal contaminants could be incinerated to eliminate the ignitable fraction; residues from the incineration would then be stabilized to immobilize the metals. For reactive and corrosive materials, treatments such as neutralization can be used to eliminate the hazardous characteristics.

Tables A-3 through A-6 of Appendix A summarize the expected, minimum, and maximum 30-year waste forecast for low-level, hazardous, mixed, and transuranic waste by waste classes and year. Liquid high-level radioactive waste is considered as a single waste class; hence, it is included only in Table A-1 (30-year waste forecast by waste type) of Appendix A. TE

2.1.3 EXPECTED WASTE FORECAST

Thirty-year forecasts (based on fiscal years, not calendar years) of waste at SRS were developed for the types of wastes addressed in this EIS. For each waste type, three forecasts were developed to create an expected, minimum, and maximum estimate of volume. Each forecast is based on wastes generated by the three major activities at SRS: (1) operations, (2) decontamination and decommissioning, and (3) environmental restoration. DOE made assumptions regarding each of these activities to create three potential waste forecasts for analysis. This section presents the amounts of waste that could result from each activity for the expected forecast. Sections 2.1.4 and 2.1.5 describe changes in operations, decontamination and decommissioning, and environmental restoration that would produce the minimum and maximum amounts of waste. TE TE

The expected forecast is based on reasonable assumptions regarding waste generation over the next 30 years. It is assumed that SRS would continue to be a government-owned and contractor-operated facility. It is also assumed that defense material processing and environmental management activities (e.g., disposal and monitoring of waste materials that remain onsite) would continue to be consolidated within the central portion of SRS (Figure 2-2). Surplus defense material facilities located beyond the central portion of SRS would cease to operate and be decontaminated and decommissioned. The expected waste forecast reflects this change in the DOE mission.

The forecast assumes that 658 SRS facilities will be scheduled and funded for decontamination and decommissioning during the 30-year analysis period. *The SRS Decontamination and Decommissioning Program Facilities Plan* (WSRC 1993a) reported these facilities as having some form or combination of radiological, chemical, and/or asbestos contamination. These facilities include the Separations Equipment Development Facility at the Savannah River Technology Center, a tritium manufacturing facility (Building 232-F), the Beta-Gamma Incinerator (Building 230-H), and the Heavy Water Components Test Reactor.

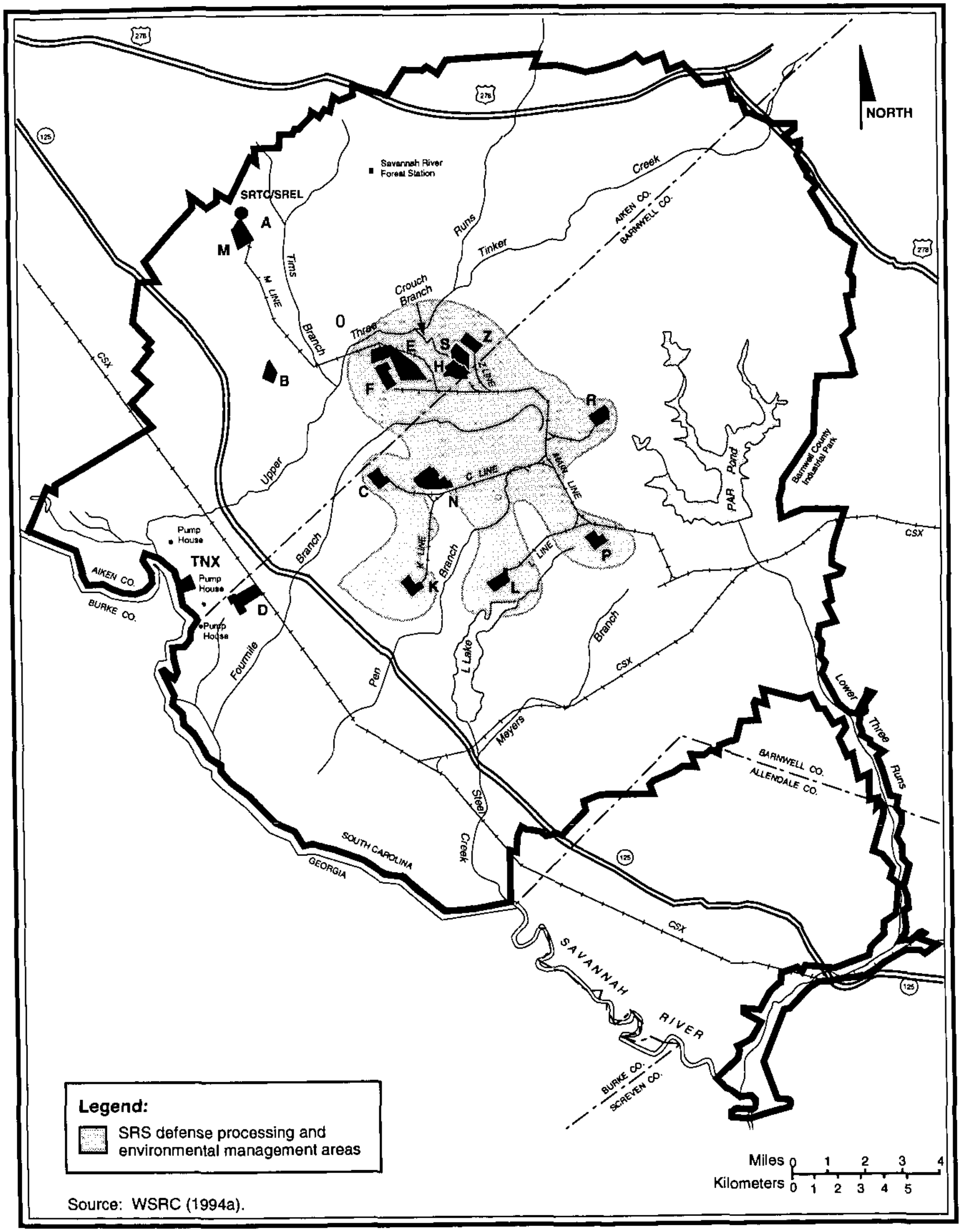

Figure 2-2. The central SRS defense processing and environmental management areas.

Table 2-3 lists the 12 major facilities that are expected to continue to operate beyond 2024 and that, therefore, will not be decontaminated and decommissioned during the analysis period. A list of the SRS facilities that will cease to operate during the forecast period (1995 through 2024) is provided in Table 2-4. The assumptions regarding when these facilities would cease to operate in the expected, minimum, and maximum waste forecasts are included in Table 2-4. TE

Table 2-3. Major SRS facilities that would continue to operate beyond 2024.[a] TE

Facilities	Function
Defense Waste Processing Facility	High-level waste vitrification
Z-Area Saltstone Manufacturing and Disposal Facility	Saltcrete processing and disposal
F/H-Area Effluent Treatment Facility	Treatment of routine process effluent and wastewater
In-Tank Precipitation	Removal of radionuclides from highly radioactive salt solution
Savannah River Technology Center	Research and development activities
Replacement Tritium Facility	Tritium separation from targets
Type III Liquid High-Level Waste Tanks	Storage of liquid high-level waste, sludge, and saltcake
New Special Recovery Facility of 221 FB-Line	Plutonium scrap recovery
484-D Powerhouse Facility	Coal-fired power generation
483-1D Water Treatment Facility and support buildings	Treatment and discharge of powerhouse effluent
Consolidated Incineration Facility (under alternative C would only operate until 2006)	Incineration of specific hazardous and radioactive waste
Analytical Laboratories (excluding Building 772-D)	Analytical services and testing

a. Source: WSRC (1994a).

The forecast assumes that environmental restoration activities would be scheduled for all 129 units identified in Appendixes C and H of the Federal Facility Agreement for SRS (EPA 1993a) and listed in Appendixes G.1 and G.2 of this EIS. The remediation may consist of in-place methods or stabilization and capping, and hence would not result in waste removal. Some form of remediation is also scheduled for a portion of the 303 units identified in Appendix G of the Federal Facility Agreement for SRS (and Appendix G.3 of this EIS). The selection of environmental restoration activities will be made in accordance with the Federal Facility Agreement and its supporting Comprehensive Environmental Response, Compensation and Liability Act and RCRA documents. TE

TE | **Table 2-4.** SRS facilities that will cease to operate under the expected, minimum, and maximum waste forecasts during the analysis period (1995 through 2024).[a]

SRS facility	Function	Expected and minimum case shutdown	Maximum case shutdown
Reactors	Plutonium/tritium production for national defense	1997	1997
D-Area	Heavy-water reprocessing	1997	1997
Reactor Materials (M-Area)	Fuel and target fabrication	1998	1998
Building 772-D	Analytical services and office space	1998	1998
TNX	Research and development testing	1999	1999
H-Canyon	Chemical and physical separation operations for reactor products	2005	2013
HB-Line	Plutonium-238 separation operations	2003	2013
F-Canyon	Chemical and physical separation operations for reactor products	2003	2013
FB-Line	Purified plutonium-solution processing	2003	2013
Receiving Basin for Offsite Fuels/ Resin Regeneration Facility	Storage and packaging of offsite fuels, cleaning targets for processing, and processing deionizers	2005	2013
235-F Plutonium Fabrication Facility (PuFF)	Plutonium-238 oxide fabrication and encapsulation	2013	2013
Thoria Line	Thorium separation operations	2013	2013

a. Source: WSRC (1994a).

The expected waste forecast assumes that waste minimization programs will proceed in accordance with the *Savannah River Site Waste Minimization Plan* (WSRC 1990). DOE does not assume major technological developments that would substantially decrease the waste generation. Other specific assumptions include: TE TE

- Nonradioactive PCB wastes are categorized as hazardous waste and radioactively contaminated PCB wastes as mixed waste.
- Radioactively contaminated oils are categorized as mixed waste, and only half of the radioactively contaminated oil will need RCRA-permitted storage.

2.1.3.1 SRS Operations and Offsite Waste Receipts

The first component of the expected waste forecast is the waste generated by routine SRS operations within the 30-year period of analysis. Individual SRS waste generators provided detailed estimates of their operation's waste generation for a 3-year period (1995 through 1997). The generators also provided a general estimate of waste generation for the next 27 years (1998 through 2024). These long-term estimates are representative of the types and volumes of wastes generated by SRS operations and are based on historical data, anticipated operations, and assumptions about each existing facility. The waste to be managed includes the forecast of waste generation in Appendix A and existing waste in storage, such as liquid high-level wastes stored in the F- and H-Area tank farms, transuranic waste stored on the transuranic waste storage pads, and mixed wastes stored in the mixed waste storage buildings. For this analysis, all facilities are considered to be in a safe inactive status (i.e., liquid waste and chemicals would have been removed, systems flushed and drained, and storage warehouses emptied) before decontamination and decommissioning. Waste volumes associated with reaching a safe storage condition have been included in the operations forecast. Wastes from ongoing environmental restoration operations (investigation-derived wastes such as waters purged from groundwater monitoring wells during sampling) are also included. Wastes generated from decontamination and decommissioning and planned environmental restoration projects are discussed in Sections 2.1.3.2 and 2.1.3.3, respectively. TE TC TC TE

TE Assumptions specific to the operations portion of the expected waste forecast include:

- Secondary waste from the Defense Waste Processing Facility, In-Tank Precipitation, and Extended Sludge Processing operations addressed in the *Final Supplemental Environmental Impact Statement Defense Waste Processing Facility* is accounted for in the operations forecast.

- High-level waste volumes are closely aligned with the selected option identified in the Record of Decision for *F-Canyon Plutonium Solutions Environmental Impact Statement* and the *Interim* TC *Management of Nuclear Materials at SRS Environmental Impact Statement.*

- High-level waste volumes do not include wastes that may result from future nuclear materials processing decisions, such as concentration/stabilization of plutonium residues or enriched uranium denaturing.

- RCRA regulations would require that some investigation-derived wastes be handled as hazardous waste (less than 20 percent of the soils and mud generated from routine environmental restoration activities).

- Purge water from well sampling would be handled as hazardous waste; however, it is assumed that monitoring well sample volumes could be reduced by 50 percent of current volumes.

- Continued receipt of small amounts (less than 3 percent of the forecast) of low-level waste from other DOE facilities and nuclear naval operations.

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TE The total quantity of waste generated by operations in the expected waste forecast during the next 30 years is approximately 6.03×10^5 cubic meters (2.13×10^7 cubic feet). The percentage that each waste type contributes to the total operations estimate is shown in Figure 2-3. The operations estimate is TC dominated by low-level and liquid high-level wastes. In fact, the operations estimate includes 1.31×10^5 cubic meters (4.63×10^6 cubic feet) of liquid high-level waste already accumulated in storage at the F- and H-Area tank farms. During the 30-year period, about 22,000 cubic meters (7.77×10^5 cubic feet) of additional liquid high-level waste would be generated. Beginning in 1996, when the Defense Waste Processing Facility is scheduled to begin operating, the liquid high-level waste will be reduced through treatment. Low-level, mixed, transuranic, and hazardous wastes will continue to be generated by defense-related operations and waste treatment activities, such as the Defense Waste Processing Facility. After a peak in volume in 1996, the quantity of operations waste would decrease until 2004 due to facility closures (Table 2-4) and then remain constant through 2024.

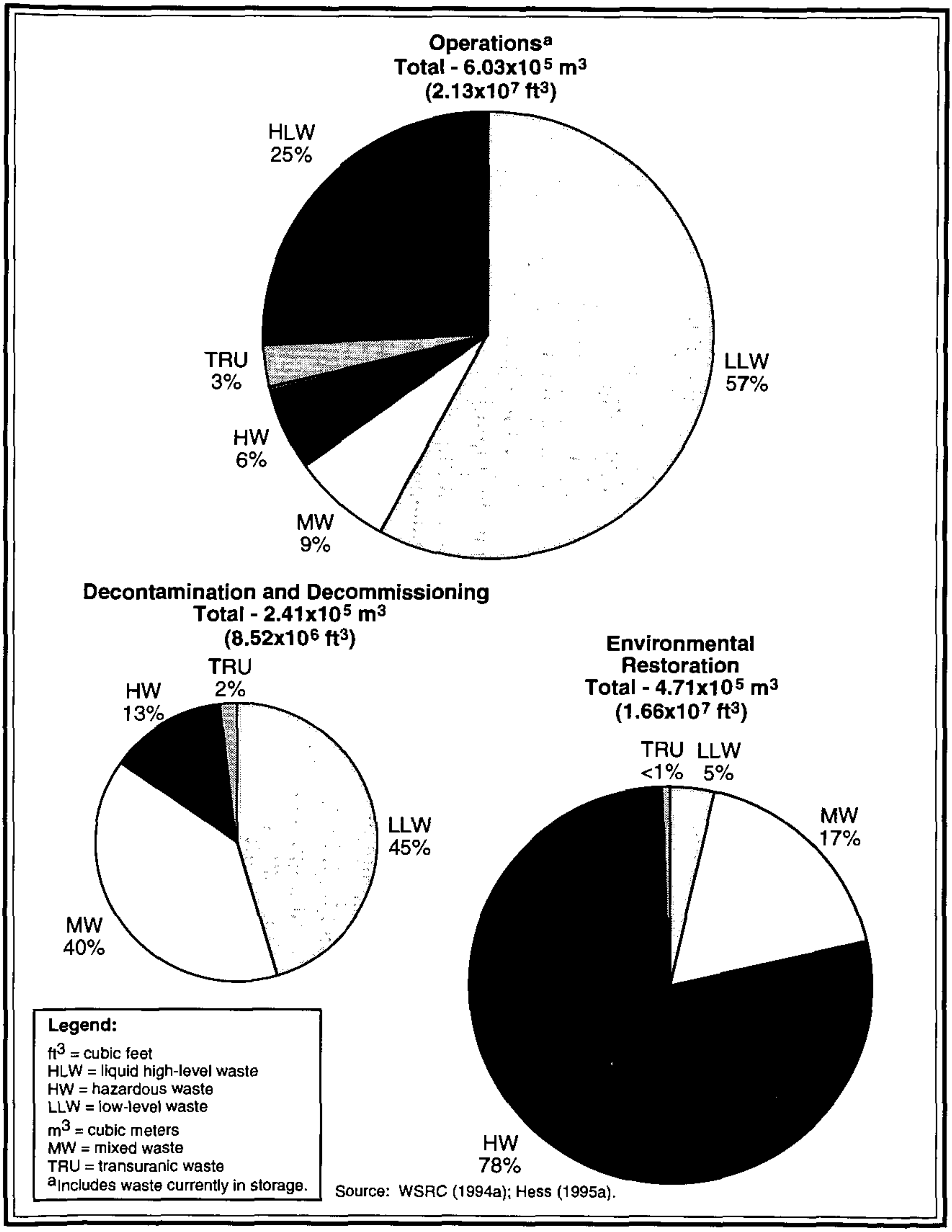

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Figure 2-3. The 30-year expected waste forecast by SRS activity.

Figure 2-4 charts the estimated changes in waste volume from operations, environmental restoration, and TE decontamination and decommissioning in the expected waste forecast during the 30-year period of analysis. *The quantities of operations, environmental restoration, and decontamination and* decommissioning waste fluctuate from year to year, as shown in the forecast, because of the assumptions made about the types of operations, environmental restoration, and decontamination and decommissioning performed and the amount of waste generated in a given year. Detailed plans for these three SRS programs are not known for the entire 30-year period, so estimates of waste generation become less reliable beyond the 5-to-10-year planning window.

2.1.3.2 Decontamination and Decommissioning

TE The second component of the expected waste forecast is the 30-year forecast for waste generated by decontamination and decommissioning. *The Thirty Year Decontamination and Decommissioning Waste Generation Forecast for Facilities at SRS* (WSRC 1994b) was derived from a detailed 5-year forecast of 53 typical SRS facilities scheduled to be decontaminated and decommissioned during the next 5 years (1995 through 1999). The 30-year estimate is an uncertain projection of the 5-year forecast; it estimates the wastes for 658 SRS facilities that are assumed to be scheduled and funded for decontamination and decommissioning during the period covered in this EIS.

TE DOE would decontaminate and decommission facilities as necessary to one of the following cleanup statuses: greenfield, foundation, gutting, or removal. To estimate volumes of waste that would be generated during decontamination and decommissioning, the average waste volume generated per facility was estimated. The volume does not include the sanitary waste that would be generated. The waste volume estimates are based on information extrapolated from the estimates for the first 53 facilities scheduled for decontamination and decommissioning. The range and distribution of sizes of the first 53 facilities were considered to be a reasonable basis for estimating the average size of the remaining 605 facilities. The methods that will be used to decontaminate and decommission facilities to a particular cleanup status at SRS are described in the following paragraphs.

"Greenfield" refers to the removal of the facility, its foundation, and contaminated soil under the foundation. It is estimated that on average 0.6 meter (2 feet) of soil would be removed from beneath a building's foundation. For purposes of the forecast, it was estimated that 15 percent of the removed soil would be contaminated and be transported to a treatment, storage, and disposal facility. The remaining soil would be used as backfill. If more than 15 percent of the soil were contaminated, then remediation TE would be conducted at the facility (in place treatment). The total waste volume generated by

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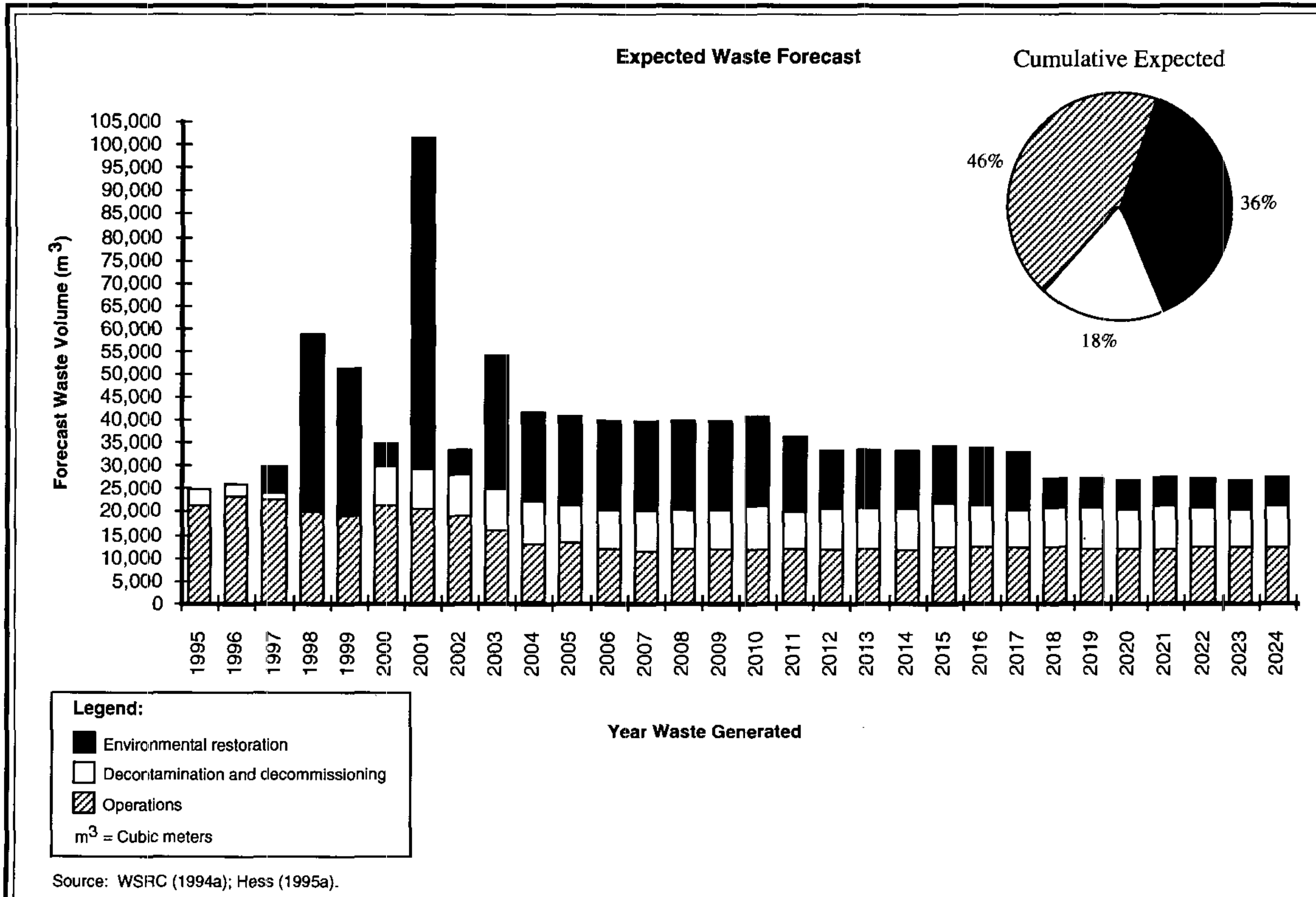

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Figure 2-4. Annual estimates of waste generated by each SRS mission activity for the 30-year expected waste forecast.

decontaminating and decommissioning an average facility to a greenfield state is estimated to be 1,434 cubic meters (50,600 cubic feet).

"Foundation" refers to the removal of the building to its foundation. The foundation and soil would remain in place. The total waste volume generated by decontaminating and decommissioning an average facility to its foundation is estimated to be 717 cubic meters (25,300 cubic feet), 50 percent of the greenfield waste volume.

"Gutting" refers to the removal of materials, equipment, ductwork, and process tanks from the building, and decontaminating the remaining structure. The building could be used for other purposes, such as storage. The total waste volume generated by gutting an average building is estimated to be 179 cubic meters (6,300 cubic feet), 13 percent of the greenfield waste volume.

"Removal" is the elimination of the major sources of contamination (either hazardous or radioactive) such as process equipment or storage tanks that contain product or waste, and decontaminating the remainder of the facility to levels that require only minimum monitoring and maintenance. The total waste volume generated by removal from an average building is estimated to be 90 cubic meters (3,200 cubic feet), 6 percent of the greenfield waste volume.

High-level waste tanks without adequate secondary containment would be stabilized in place. Associated equipment and buildings would be removed. The canyon and reactor buildings would be cleaned, but the buildings would remain in place. The decontamination and decommissioning forecast does not ensure that the volume of wastes will be reduced by volume reduction activities, compaction, treatment, or recycling (i.e., operations activities prior to decontamination and decommissioning). A total of 658 facilities are scheduled to be decontaminated and decommissioned during the next 30 years, pending available funding. The assumptions regarding the level of decontamination and decommissioning required are presented in Table 2-5.

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Table 2-5. Decontamination and decommissioning of facilities during the analysis period resulting in the expected waste forecast (1995 through 2024).

1995 through 1999	2000 through 2024	
	Inside central area	Outside central area
53 to foundation	182 gutted	423 to foundation

Source: WSRC (1994a).

The total quantity of waste forecast from decontamination and decommissioning under the expected waste forecast during the next 30 years is estimated to be 2.41×10^5 cubic meters (8.51×10^6 cubic feet). The percentage of each waste type that contributes to the total decontamination and decommissioning forecast is depicted graphically in Figure 2-3. Based on the forecast assumptions, low-level and mixed wastes would dominate the decontamination and decommissioning forecast for the expected waste forecast.

Figure 2-4 charts the changes in decontamination and decommissioning waste estimates during the 30-year period of analysis. The forecast waste volume would initially be small (1995 through 1999) due to the number of facilities addressed (i.e., 532), and would then increase and remain constant during the years 2000 through 2024 as the remaining 605 facilities are decontaminated and decommissioned. The quantities of decontamination and decommissioning waste fluctuate from year to year in the forecast because of the assumptions made about the number and types of facilities that would be decontaminated and decommissioned in a given year. Liquid high-level waste would not be generated during decontamination and decommissioning. TE

2.1.3.3 Environmental Restoration

The third component of the expected waste forecast is the 30-year estimate for waste generated by environmental restoration. The estimate for environmental restoration was derived from estimates for units (i.e., facilities, spills, miscellaneous) that would undergo restoration during the next 9 years (1995 through 2003). The 9-year waste estimate was averaged over the units undergoing restoration during this period to create an average volume of restoration waste of 3,292 cubic meters (1.16×10^5 cubic feet) per unit. This value was extrapolated to estimate the annual waste volume from environmental restoration for each year. The estimated volume for remediation of each area contaminated by spills would be 10 cubic meters (350 cubic feet) per spill unit. Of the 432 units identified in Appendix G of this EIS, two-thirds are assumed to have no radioactive contamination, and one-third are assumed to be radioactively contaminated. Assumptions were made about the types of waste that would be generated depending on whether a facility was assumed to have or lack radioactive contaminants (i.e., the percentage that would be low-level, mixed, hazardous, or transuranic waste). Large tracts of land that require environmental restoration, such as the Mixed Waste Management Facility in E-Area, would have their wastes treated in place without removal from the waste site, or the units would be capped. The distribution of environmental restoration waste into treatability groups was based on the assessment in the *Thirty-Year Solid Waste Generation Forecast by Treatability Group* (WSRC 1994c). TE

TE The expected waste volumes resulting from environmental restoration activities (Table 2-6) were developed based on the assumptions regarding the various types of units listed in the SRS Federal Facility Agreement (and presented in Appendix G of this EIS).

TE **Table 2-6.** Assumptions from the SRS Federal Facility Agreement that were used to develop forecasts of environmental restoration activities resulting in the expected waste forecast.

Appendixes G.1 and G.2		Appendix G.3 (non-spills)		Appendix G.3 (spills)
Inside central portion of SRS	Outside central portion of SRS	Inside central portion of SRS	Outside central portion of SRS	
7 of 36 units would have wastes removed (19 percent)	93 of 93 units would have wastes removed (100 percent)	No units would have wastes removed	43 of 143 units would have wastes removed (30 percent)	67 of 134 spill units would have wastes removed (50 percent)

Source: WSRC (1994a).

TE The total quantity of waste that would be produced by environmental restoration under the expected waste forecast is estimated to be 4.71×10^5 cubic meters (1.66×10^7 cubic feet). The contribution of each waste type to the total waste is depicted in Figure 2-3. Based on the forecast assumptions, environmental restoration waste would be dominated by hazardous waste.

Figure 2-4 charts the changes in environmental restoration waste during the 30-year period of analysis. The quantities of this waste fluctuate from year to year because of assumptions about environmental restoration activities in a given year. The forecast has four major volume peaks that can be attributed to
TE a few SRS units generating large volumes of waste. These units include: Silverton Road in 1998, the Metal Burning Rubble Pit in 1999, the D-Area Ash Basin and K-Area Sludge Land Application in 2001, and the Par Pond Sludge Application and Par Pond Groundwater Operable Unit in 2003. Liquid high-level wastes would not be generated by environmental restoration.

2.1.4 MINIMUM WASTE FORECAST

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2.1.4.1 SRS Operations and Offsite Waste Receipts

DOE made assumptions regarding projected waste volumes to create a potential minimum forecast for analysis. There are limited changes in the assumed operating status of SRS facilities for this minimum waste forecast. Minimum processing, maintenance, and upgrades would be used to maintain the safety of the liquid high-level waste tank farm facilities. Other assumptions for the minimum waste forecast are the same as for the expected waste forecast.

The minimum forecast assumes that small quantities of additional low-level waste (less than 4 percent of the low-level waste volume) would continue to be received at SRS from other DOE facilities and Naval Reactors Program sites.

Variation between the expected forecast and the minimum forecast for operations would occur because of presumed changes in requirements for handling wastes generated from environmental restoration activities (investigation-derived wastes). The minimum forecast assumes that only 5 percent of the waste (i.e., soil and mud) generated by routine environmental restoration activities would need to be managed as hazardous waste (versus an estimate of slightly less than 20 percent for the expected waste forecast). It was also assumed that purge water from well sampling would be treated as hazardous waste only if its contamination was greater than 10 times the applicable maximum contaminant limits as established by the Safe Drinking Water Act.

The total quantity of the waste from operations under the minimum waste forecast is approximately 5.06×10^5 cubic meters (1.79×10^7 cubic feet). The percentage that each waste type contributes to the total operations, environmental restoration, and decontamination and decommissioning minimum waste forecast is shown in Figure 2-5. The relative percentages of the waste types do not change substantially between the expected and minimum waste forecasts for operations waste. Figure 2-6 charts the estimated changes in the operations, environmental restoration, and decontamination and decommissioning minimum forecast during the 30-year period of analysis. TC

2.1.4.2 Decontamination and Decommissioning

A total of 658 facilities are scheduled to be decontaminated and decommissioned during the 30-year analysis period, pending available funding. The assumptions regarding the state of decontamination and decommissioning required under the minimum waste forecast are presented in Table 2-7. TE

Table 2-7. Decontamination and decommissioning of facilities during the analysis period resulting in the minimum waste forecast (1995 through 2024). TE

1995 through 1999	2000 through 2024	
	Inside central area	Outside central area
53 to foundation	182 by removal	338 gutted 85 to foundation

Source: WSRC (1994a).

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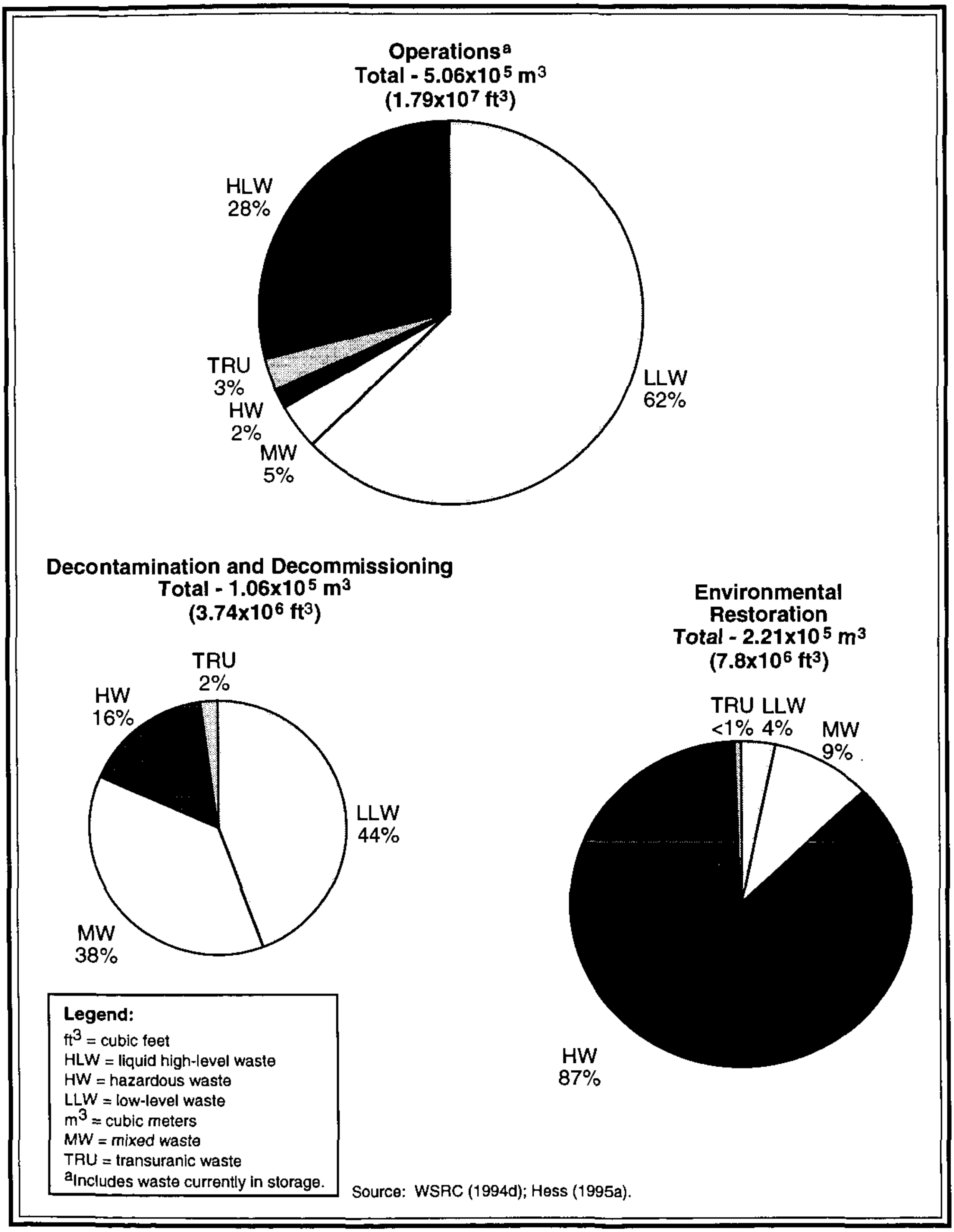

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Figure 2-5. The 30-year minimum waste forecast by SRS activity.

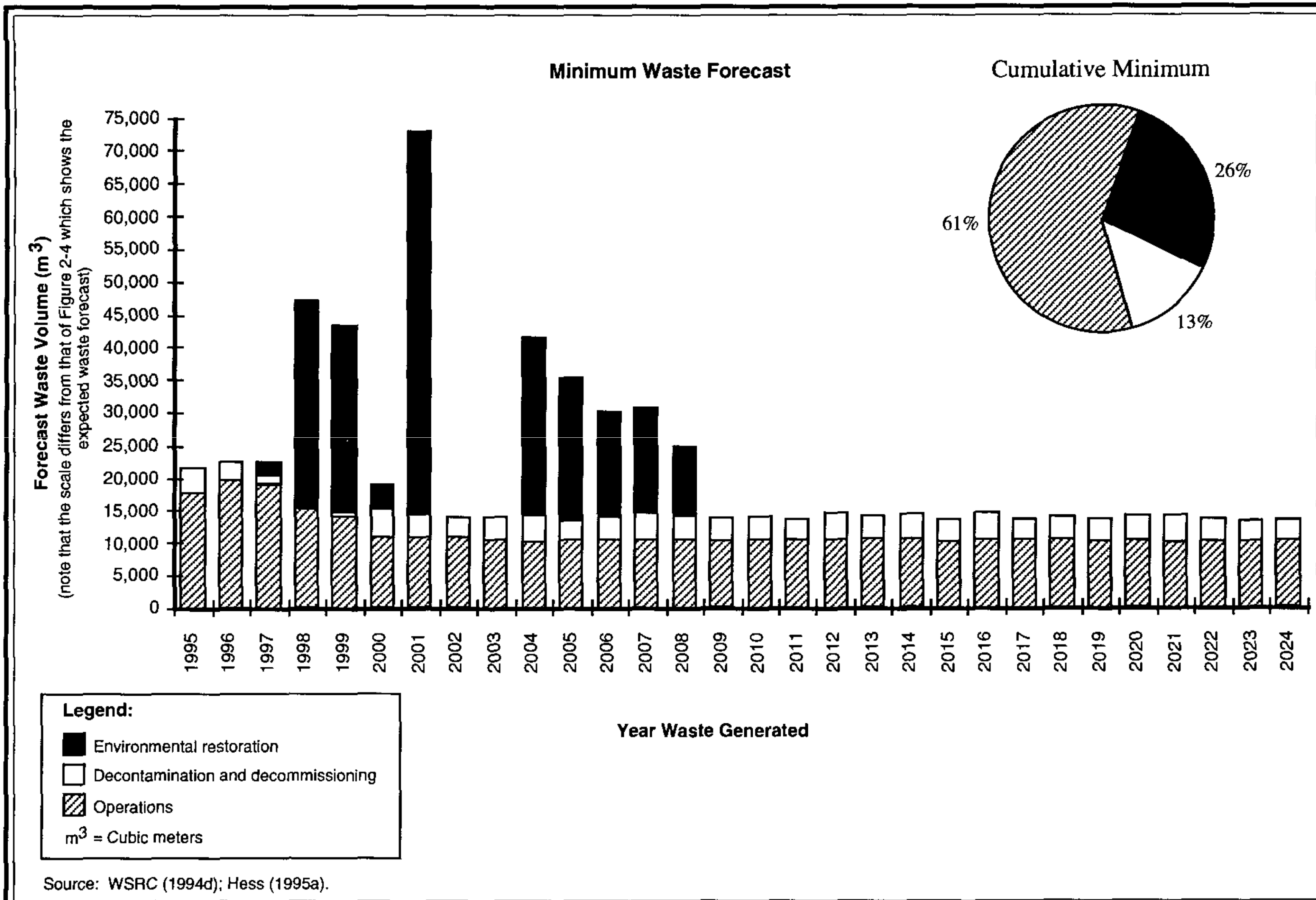

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Figure 2-6. Annual estimates of waste generated by each SRS mission activity for the 30-year minimum waste forecast.

The total waste volume during the next 30 years from decontamination and decommissioning under the minimum waste forecast is expected to be 1.06×10^5 cubic meters (3.74×10^6 cubic feet), less than half the volume of wastes generated by decontamination and decommissioning in the expected waste forecast. The contribution of each waste type to the total decontamination and decommissioning estimate is depicted in Figure 2-5. For decontamination and decommissioning, the relative percentages of the waste types are not substantially different between the expected and minimum waste forecasts. Figure 2-6 charts the estimated changes in the decontamination and decommissioning waste during the 30-year period of analysis.

2.1.4.3 Environmental Restoration

The minimum estimate of wastes resulting from environmental restoration activities (Table 2-8) were developed based on the assumptions regarding the various types of units listed in the SRS Federal Facility Agreement (and presented in Appendix G of this EIS).

Table 2-8. Assumptions from the SRS Federal Facility Agreement that were used to develop forecasts of environmental restoration activities resulting in the minimum waste forecast.

Appendixes G.1 and G.2		Appendix G.3 (non-spills)		Appendix G.3 (spills)
Inside central portion of SRS	Outside central portion of SRS	Inside central portion of SRS	Outside central portion of SRS	
No units would have wastes removed	23 of 93 units would have wastes removed (25 percent)	No units would have wastes removed	3 of 143 units would have wastes removed (2 percent)	40 of 134 spill units would have wastes removed (30 percent)

Source: WSRC (1994a).

The minimum forecast for environmental restoration during the next 30 years predicts 2.21×10^5 cubic meters (7.8×10^6 cubic feet) of waste, roughly half the volume of environmental restoration waste in the expected case. The contribution of each waste type to the total forecast is shown in Figure 2-5. For environmental restoration, the relative percentages of the waste types do not change substantially between the expected and minimum waste forecasts. Figure 2-6 charts the estimated changes in environmental restoration waste during the 30-year period of analysis.

2.1.5 MAXIMUM WASTE FORECAST

2.1.5.1 SRS Operations and Offsite Waste Receipts

The maximum waste forecast assumes that SRS would be required to manage additional waste due to: TE
(1) changes in the SRS mission or additional nuclear materials processing that would increase the
anticipated generation of waste, and (2) a small increase in the receipt of wastes from other DOE TE
facilities. Seven major SRS facilities would continue to operate until 2013 (Table 2-4) and would
continue to generate job-control waste. The wastes that DOE assumes it will receive in this forecast are
identified in alternatives being considered in other EISs. Sources of increased wastes volumes are: TE

- Aluminum-clad spent nuclear fuel would come to SRS for processing in accordance with the DOE *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs EIS.* TE

- Plutonium and tritium would come to SRS for recycling between 1995 and 2005 in accordance with DOE's plan to continue to operate the Pantex Plant as described in the *Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components EIS.*

- An additional 6,440 cubic meters (2.27×10^5 cubic feet) of low-level, 1.5 cubic meters (53 cubic feet) of mixed, and 9 cubic meters (320 cubic feet) of hazardous wastes would be generated at SRS from new or expanded DOE operations annually beginning in 2005 and continuing beyond the 30-year analysis period in accordance with the tritium supply and recycling alternatives under the programmatic EIS on reconfiguration of the nuclear weapons complex (now being considered in a separate tritium supply and recycling programmatic EIS). The forecast did not include spent nuclear fuel (approximately 23 cubic meters per year) or liquid low-level wastes (5 million gallons per year) associated with the operation of a potential tritium supply at SRS. TC

- Other wastes from elsewhere in the DOE complex as proposed in the working draft analyses of the *Waste Management Programmatic EIS.* TE

- Low-level waste received from the Naval Reactors Program was assumed to double due to the closure of the Barnwell commercial low-level radioactive waste disposal facility. TE

- Mixed waste from other DOE sites proposed for treatment at SRS in the *SRS Proposed Site Treatment Plan.* TC

It is anticipated that additional transuranic waste containing appreciable quantities of plutonium-238 would come to SRS. SRS was the primary producer of plutonium-238. The maximum forecast assumes the receipt of 127 cubic meters (4,490 cubic feet) per year of mixed plutonium-238 waste from other DOE operations over the 30-year period.

The maximum waste forecast assumes that additional low-level waste (approximately 30 percent of the low-level waste volume) would be received at SRS from other DOE facilities and nuclear naval operations. SRS would also receive limited quantities of mixed waste from other DOE facilities and Naval Reactors Program sites in accordance with the site treatment plan and other evaluations (approximately 3 percent of the mixed waste volume).

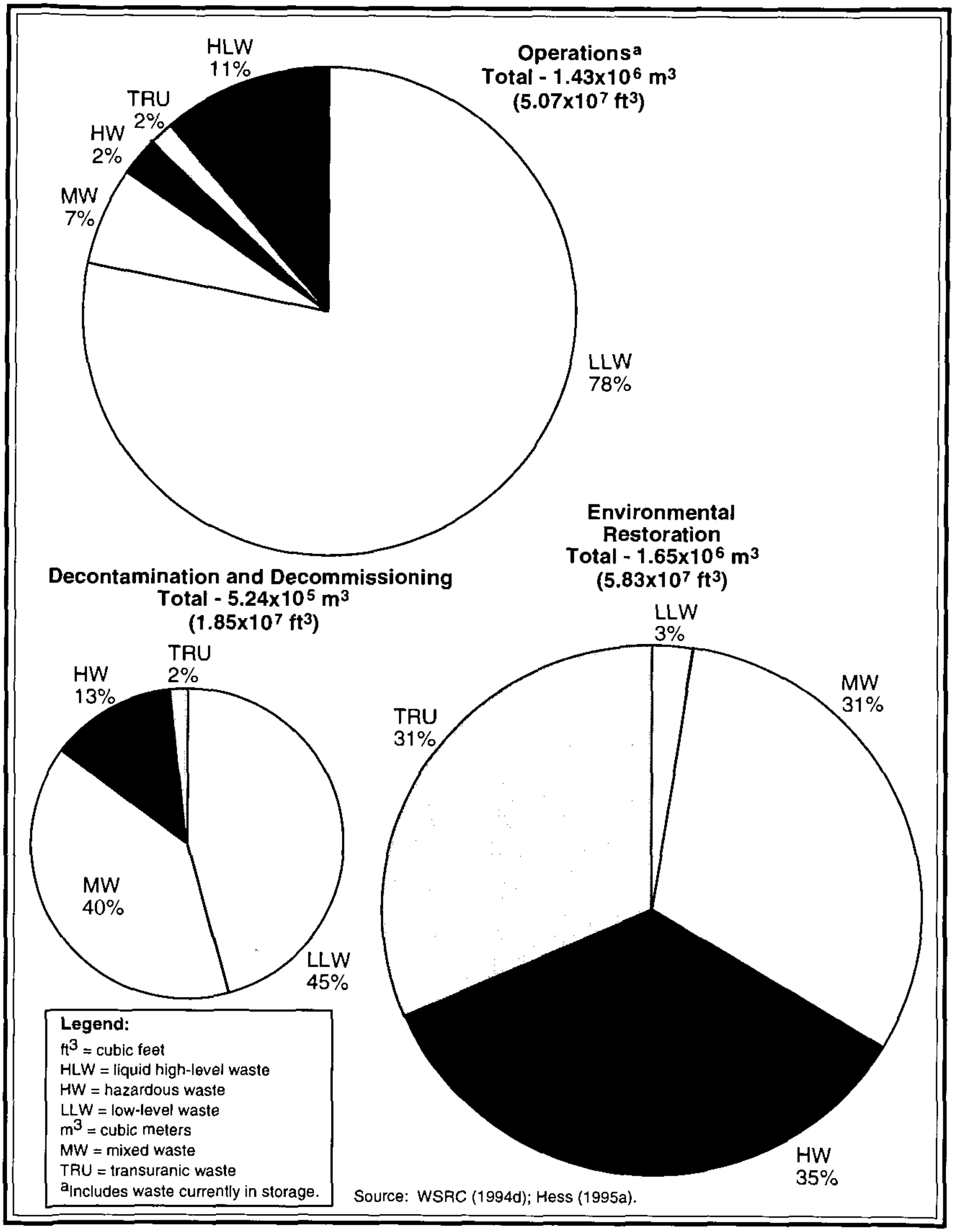
Another variation between the expected and maximum waste forecasts for operations is the result of presumed changes in requirements for handling wastes generated by environmental restoration (i.e., investigation-derived wastes). The maximum waste forecast assumes that all waste (i.e., soils and mud) generated by restoration activities would be handled as hazardous waste [versus estimates of less than 20 percent in the expected waste forecast (and 5 percent in the minimum waste forecast)]. Purge water from groundwater monitoring wells would be managed as hazardous waste.

The total quantity of waste from operations in this forecast during the next 30 years is estimated to be 1.43×10^6 cubic meters (5.05×10^7 cubic feet), roughly twice the volume in the expected forecast. The percentage of each waste type that contributes to the total operations forecast is shown in Figure 2-7. The relative percentage of high-level waste decreases and low-level waste increases substantially between the expected and maximum forecasts. Figure 2-8 charts the estimated changes in operations waste during the 30-year period of analysis.

2.1.5.2 <u>Decontamination and Decommissioning</u>

All 423 facilities outside the central portion of SRS scheduled for decontamination and decommissioning between 2000 and 2024 would be cleaned up to greenfield status (compared to foundation status in the expected waste forecast). Facilities within the central portion of SRS would be taken to their foundations (compared to gutted in the expected waste forecast).

A total of 658 facilities are scheduled to be decontaminated and decommissioned during the 30-year analysis period, pending available funding. The assumptions regarding the level of decontamination and decommissioning required under the maximum waste forecast are presented in Table 2-9.



TC

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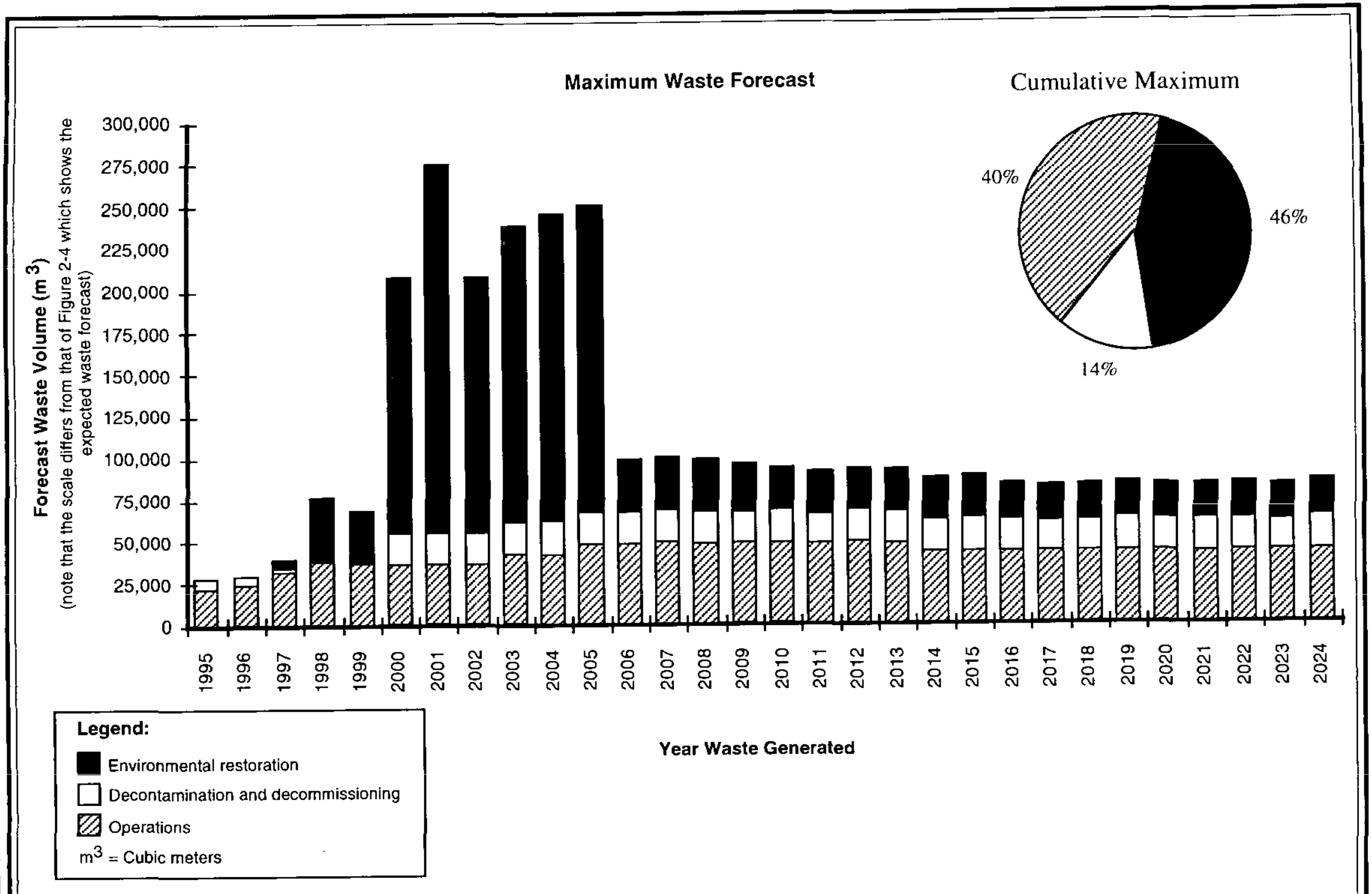
Figure 2-7. The 30-year maximum waste forecast by SRS activity.

TC
TE



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Source: WSRC (1994d); Hess (1995a).

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Figure 2-8. Annual estimates of waste generated by each SRS mission activity for the 30-year maximum waste forecast.

Table 2-9. Decontamination and decommissioning level of facilities during the analysis period resulting in the maximum waste forecast (1995 through 2024). TC

1995 through 1999	2000 through 2024	
	Inside central area	Outside central area
53 to foundation	182 to foundation	423 to greenfield

Source: WSRC (1994a). TC

The total quantity of waste generated by decontamination and decommissioning during the next 30 years in the maximum waste forecast is estimated to be about 5.24×10^5 cubic meters (1.85×10^7 cubic feet), more than twice the volume in the expected waste forecast. The contribution of each waste type to the total forecast is depicted in Figure 2-7. The relative percentages of the waste types do not change substantially between the expected and maximum waste forecasts. Figure 2-8 charts the estimated changes in the decontamination and decommissioning waste during the 30-year period of analysis. TC TC

2.1.5.3 Environmental Restoration

The maximum estimate of waste volumes from environmental restoration (Table 2-10) was based on the assumptions regarding the various types of units listed in the SRS Federal Facility Agreement (and presented in Appendix G of this EIS).

Table 2-10. Assumptions from the SRS Federal Facility Agreement that were used to develop forecasts of environmental restoration activities resulting in the maximum waste forecast. TE

Appendixes G.1 and G.2		Appendix G.3 (Non-spills)		Appendix G.3 (Spills)
Inside central portion of SRS	Outside central portion of SRS	Inside central portion of SRS	Outside central portion of SRS	
36 of 36 units would have wastes removed (100 percent)	93 of 93 units would have wastes removed (100 percent)	No units would have wastes removed	101 of 143 units would have wastes removed (71 percent)	134 of 134 spill units would have wastes removed (100 percent)

Source: WSRC (1994a).

In the central portion of SRS, 20 percent of the Burial Ground Complex in E-Area and 5 percent of the Mixed Waste Management Facility in E-Area would be removed for treatment and disposal. The remainder of the wastes at each of these facilities would be treated in place. As a result of the more intensive forms of environmental remediation (e.g., removal of previously disposed waste), the amount of each waste type would be greater than in the expected waste forecast. TE

TE | The total quantity of waste from environmental restoration in the maximum waste forecast during the
next 30 years is estimated to be 1.65×10^6 cubic meters (5.83×10^7 cubic feet), roughly three and one-half
TE | times the volume of the environmental restoration waste in the expected waste forecast. The percentage
of each waste type that contributes to the environmental restoration forecast is depicted graphically in
Figure 2-7. The relative percentages of transuranic and mixed wastes increase and hazardous waste
TE | decreases substantially between the expected and maximum waste forecasts. Large volumes of
transuranic and mixed waste result from the removal of previously disposed waste in the Burial Ground
Complex and Mixed Waste Management Facility during the years 2000 through 2005. The large volume
TC | of waste is in addition to the waste from those units previously discussed in the expected waste forecast.
Figure 2-8 charts the estimated changes in the environmental restoration waste during the 30-year period
of analysis.

2.2 No-Action Alternative

This section describes how each waste would be handled under the no-action alternative. For this EIS, the no-action alternative is defined as the continuation of current practices and includes the need to construct additional storage and disposal facilities to manage additional wastes, as has been done in the past.

Section 2.2.1 discusses the current waste minimization program at SRS and its goal of reducing the amounts of waste generated. Waste reduction is an essential aspect of the no-action alternative. The waste minimization program reduces the amounts of liquid high-level radioactive, low-level radioactive, hazardous, mixed, and transuranic wastes and would be applied under each alternative, including the no-action alternative. Sections 2.2.2 through 2.2.6 each describe a specific type of waste and how that waste is handled under the no-action alternative. Section 2.2.7 presents a summary of the treatment, storage, and disposal options applied to each waste type under the no-action alternative. See Acronyms, Abbreviations, Use of Scientific Notation, and Explanation of Number Conversions for a discussion of how numbers were treated. TE

2.2.1 POLLUTION PREVENTION/WASTE MINIMIZATION

2.2.1.1 Introduction

The pollution prevention program at SRS began as isolated efforts to reduce waste. In 1985, DOE developed a hazardous waste minimization plan (Roberts 1985) in response to the Hazardous and Solid Waste Amendments of 1984 (P.L. 98-616). A sitewide approach to waste minimization for each waste type began in 1990 with the development of the *Savannah River Site Waste Minimization Plan.* This more comprehensive approach was required by DOE Order 5400.1, "General Environmental Protection Program." TE

Since 1990, DOE expanded the waste minimization program with a dedicated management group and annual funding of approximately $1 million. The waste minimization program is part of SRS's pollution prevention program under the *Department of Energy, Savannah River Site Waste Minimization and Pollution Prevention Awareness Plan*, FY 1995 (WSRC 1994e).

Waste reduction is achieved through (1) source reduction or (2) recycling. Source reduction decreases or eliminates wastes before their generation and includes recycling within a process, material substitution, process modification, administrative controls, and good housekeeping practices. Recycling is the use, reuse (return of a material to a process as input), or reclamation (recovery of a useful or valuable material) of a material. Waste minimization activities are part of pollution prevention, which also includes energy conservation, source reduction and recycling of wastewater, and source reduction of air emissions.

2.2.1.2 Annual Reductions in the Generation of Waste

Since 1990, DOE has made substantial progress toward reducing wastes generated at SRS. The amounts of all types of waste have decreased since 1991, with the greatest percentage reductions in hazardous and mixed wastes. Reductions in hazardous and mixed wastes were accomplished mainly by material substitution. For example, hazardous solvents used for degreasing have been replaced by nonhazardous ones. Table 2-11 presents the amounts of each waste type generated in 1990 through 1993.

TE **Table 2-11.** Waste generated from 1990 through 1993 (cubic meters).[a,b]

Waste type	1990[c]	1991[c]	1992	1993
High-level	2,400	3,200	1,680	1,560
Low-level	25,480	22,090	12,500	14,200[d]
Hazardous	170	90	100	70
Mixed	NA[e]	33	20	4
Transuranic	760	660	570	390

a. Source: Boyter (1994a).
b. To convert to cubic feet, multiply by 35.31.
c. Based on quarterly averages.
d. The 1993 increase in the amount of low-level waste is attributed to environmental restoration activities. However, even though the amount of low-level waste increased, approximately 1,200 cubic meters (42,400 cubic feet) more waste would have been generated if waste minimization activities had not been implemented (Boyter 1994b). TE
e. NA = not available.

2.2.1.3 Waste Minimization Goals

The current goals for waste minimization are presented in Table 2-12. The goals are reviewed at least annually for appropriateness to SRS's wastes. Progress is tracked and reported quarterly.

A goal for the low-level waste minimization efforts for 1994 was to avoid generating at least 1,870 cubic meters (66,000 cubic feet) of waste. By August 1994, SRS had achieved 50 percent of this goal, eliminating approximately 935 cubic meters (33,000 cubic feet) of low-level waste generation (Stone 1994a).

Table 2-12. Waste minimization goals.[a]

Implement waste minimization activities to avoid generating at least 1,870 cubic meters (66,000 cubic feet) of low-level waste by December 31, 1994.
Reduce generation of high-level, hazardous, mixed, and transuranic wastes by 10 percent of fiscal year 1994 totals by September 30, 1995.
Reduce total releases of toxic chemicals and offsite transfers for treatment and disposal by 50 percent (based on the first year the chemical was reported on a TRI Report[b]) by December 31, 1999.
Reduce the volume of newly generated low-level, hazardous, mixed, and transuranic waste (excluding decontamination and decommissioning and environmental restoration waste) by 50 percent by December 31, 1999.

TE

a. Source: WSRC (1994e).
b. TRI Report = Toxic Release Inventory Report required by the Emergency Planning and Community Right-to-Know Act.

2.2.1.4 Waste Minimization Practices and Initiatives

Major source reduction and recycling practices and initiatives are briefly discussed below and are summarized in Table 2-13.

2.2.1.4.1 Source Reduction

Radiological Controls

SRS currently has more than 0.4 square kilometer (100 acres) of radiological materials areas within which waste is routinely categorized as low-level waste. DOE was able to reduce the size of such areas and thereby reduce the volume of low-level waste. In addition, SRS is implementing, on a trial basis, new waste segregation methods that could further reduce the amount of waste classified as low-level because it was generated in a radiological materials area.

SRS has implemented new radiological control procedures that eliminate some protective clothing requirements in radiological materials areas. In 1993, radiological controls kept approximately 540 cubic meters (19,100 cubic feet) of low-level waste from being generated as a result of changes in

Table 2-13. Waste minimization activities under the no-action alternative.[a]

	Minimization activity	Waste	Annual minimization amount[b,c]
	Implementing new radiological controls (reducing size of radiological materials areas, eliminating protective clothing requirements, using new waste segregation control protocols)	Low-level waste	540
	Using prefabricated radiological control structures	Low-level waste	850[d]
	Substituting for hazardous materials	Hazardous and mixed waste	46[e]
	Offering excess chemicals for reuse	Hazardous waste	5.69×10^{4}[f,g]
	Modifying process and procedures at F/H-Area Effluent Treatment Facility[h]	Low-level waste	NA[i]
	Modifying process at M-Area Liquid Effluent Treatment Facility[h]	Mixed waste	33[j]
	Reusing lead shielding	Mixed waste	NA
TC	Recycling cadmium-plated filter frames	Mixed waste	100[k]
	Replacing wooden pallets with reusable steel pallets	Low-level waste	370[d]
	Maximizing waste burial container volume	Low-level waste	NA
	Using metal waste as burial containers	Low-level waste	415
	Using "suspect" soils for backfill	Low-level waste	NA
	Recycling spent photographic fixative	Hazardous waste	2
	Recycling scrap lead	Hazardous waste	2.72×10^{4}[f]
	Recycling refrigerant chlorofluorocarbons	Hazardous waste	NA
	Recycling solvents	Hazardous waste	4
TE	Recycling lead-acid batteries	Hazardous waste	2,670[l]
	Decontaminating tools and equipment	Low-level and mixed waste	NA
TE	Recycling contaminated steel equipment	Low-level waste	6,551[m]

TE a. Sources: WSRC (1994e); Hess (1995a).
b. Amount given in cubic meters; to convert to cubic feet, multiply by 35.31.
c. Amount given is based on historical waste forecast records, unless otherwise indicated.
d. Projected annual waste reduction amount.
e. Waste reduction from 1992 to 1993, which was due primarily to material substitution. Waste reduction amount exclusively attributable to material substitution not available.
f. Amount given in kilograms; to convert to pounds, multiply by 2.2.
g. Waste minimization amount since 1992.
h. Example of a process improvement.
i. NA = not available.
j. Reduction over a 2-year period.
k. One-time recycling activity.
TC l. Number of batteries recycled.
m. Amount to be recycled over a 3-year period.

protective clothing requirements and the implementation of these controls (WSRC 1994e). These control procedures include the use of prefabricated radiological containment huts and windbreaks that can be checked for contamination and reused if not contaminated. Prefabricated glove bags were also introduced to eliminate the use and subsequent disposal of special protective clothing. Use of these prefabricated radiological control devices is estimated to reduce low-level waste generation by up to 850 cubic meters (30,000 cubic feet) per year (WSRC 1994e). TC

Material Substitution and Chemical Product Management

Since 1990, SRS has implemented programs to reduce the use of products that generate hazardous or mixed waste by substituting those that do not contain hazardous components and therefore would not produce a hazardous or mixed waste. These substitutions have decreased the amounts of hazardous and mixed waste. Under the new chemical management program, SRS has centralized efforts to find substitutes for products containing hazardous ingredients and to ensure that those substitutes are purchased whenever possible (Stone 1994b). For example, DOE substituted the nonhazardous *Engine Clean* for the hazardous organic solvent *Engine Brite* previously used to clean machine engines; the nonhazardous *Safetap* fluid for the *Rapid Tap* cutting fluid that was up to two-thirds trichloroethylene; and the nonhazardous *Decon-Ahol* for a xylene-based organic solvent called *Magnaflux SKC-HF Spotcheck*, used for cleaning welds during metal fabrication work.

SRS's centralized chemical management uses commodity management. The intent is to use procurement controls to minimize the amount and toxicity of chemicals entering SRS and to minimize the amount of chemicals disposed of as waste by marketing excess chemicals both onsite and offsite (Stone 1994b). Before chemicals are purchased, procurement requests are reviewed by the Chemical Commodity Management Center, excess chemical inventories are checked for the chemicals, and less toxic material substitutions are evaluated.

Chemicals that are no longer needed by the organization that purchased them are designated as excess. Once a chemical is designated as excess, an alternate onsite user is sought. If no onsite user is identified, offsite users are sought. Offsite users are solicited by procurement and through government and school donation programs. Since 1992, the excess chemical program has reduced the amount of hazardous waste disposed of by SRS by approximately 56,900 kilograms (1.25×10^5 pounds) (Larkin 1994; Tuthill 1994; Hess 1994b).

SRS sells used lead-acid batteries to a vendor for recycling. Approximately 1,600 (in 1992), 2,670 (in 1993) (Boyter 1994a), and 550 (through June 1994) (Stone 1994c) batteries have been sold to recyclers.

Miscellaneous Process Improvements

Numerous process improvements have been implemented to reduce waste generation. Process improvements are suggested by employees, imported from other DOE sites, and produced by in-depth studies of processes to evaluate minimization opportunities. Two examples of recent process improvements are:

- Modifications to process piping and procedures at the F/H-Area Effluent Treatment Facility now allow for backflushing of large carbon filter beds. This process improvement at least doubles the life of the filter, reducing the amount of low-level waste generated by the facility (Stone 1994b).

- Disposable filter paper take-up rolls used at the M-Area Liquid Effluent Treatment Facility were replaced with reusable, cleanable filter belts. As a result of this process improvement, 33 cubic meters (1,200 cubic feet) less mixed waste will be generated by the facility over a 2-year period (Stone 1994b).

In-Process Recycling

SRS continues to reuse within its radioactive processes lead shielding that has been contaminated, provided that it is below a certain level of radioactivity. If the shielding is no longer needed in a particular location, it is surveyed for contamination and, if the levels are low enough the lead is reinstalled where needed within the process. Lead that is too contaminated to reuse is considered mixed waste and managed accordingly.

Material and Waste Packaging Improvements

To minimize the amount of waste needing disposal, SRS has reduced material and waste packaging. Materials and equipment are unpacked before entering radiological materials areas so the packaging does not have to be treated as low-level waste. Wooden pallets are being replaced with steel pallets that can be surveyed with more confidence and decontaminated if necessary. Replacing the wooden pallets will result in a low-level waste savings of approximately 370 cubic meters (13,100 cubic feet) in 1994 (Stone 1994b).

Improvements in waste packaging have been implemented to maximize use of disposal containers and save space in disposal facilities. Some low-level waste destined for disposal containers is no longer first packaged in cardboard boxes. Elimination of the cardboard boxes increases the amount of waste that can be packed in each container (Stone 1994b). DOE converted low-level metal materials such as piping into burial containers. Reuse of these metal wastes as burial containers saved approximately 415 cubic meters (14,700 cubic feet) of disposal space in 1993 (Stone 1994b).

In addition to packaging improvements, SRS implemented a program to use soil that is suspected of being contaminated (called "suspect soil"), rather than fresh soil, in waste disposal. Soil that has been removed from a site because of radiological contamination is surveyed for radionuclides and sorted as radioactively contaminated or suspect. Instead of disposing of the suspect soil, SRS uses it as the backfill for the engineered low-level waste trenches where the contaminated soil and other low-level radioactive waste is disposed of (Stone 1994b). TE

2.2.1.4.2 Recycling

SRS reclaims some hazardous wastes onsite, including spent photographic fixative, scrap lead, refrigerant chlorofluorocarbons (Freon®), and paint solvents.

<u>Spent Photographic Fixative</u>

Silver is reclaimed from spent photographic fixative generated by SRS's silk screening and x-ray operations. The silver recovery unit is described in Appendix B.24. Approximately 2 cubic meters (70 cubic feet) and 2.5 cubic meters (88 cubic feet) (Stone 1994c) of spent photographic fixative was recycled in 1993 and through June 1994, respectively. The unit's cartridge filters capture the silver, and the remaining nonhazardous solution is sent to an SRS sanitary treatment facility (Harvey 1994a). When a cartridge filter is filled, it is sent to the U.S. Department of Defense for recovery of the silver.

<u>Scrap Lead</u>

Scrap lead that is not contaminated with radioactivity is recycled at SRS by melting the lead and fabricating it into a useful form. Approximately 9,980 kilograms (22,000 pounds), 27,200 kilograms (60,000 pounds) (Boyter 1994a), and 16,100 kilograms (35,500 pounds) (Stone 1994c) of lead were recycled in 1992, 1993, and through June 1994, respectively. The residue from the lead melting process, a hazardous waste, averages 2,450 kilograms (5,400 pounds) per year (Harvey 1994a). TE

Refrigerant Chlorofluorocarbons (Freon®)

Portable recovery units are used at SRS to recycle chlorofluorocarbons used in refrigeration and air conditioning units. The units are closed-loop systems that allow recovery and reuse of the existing refrigerant without escape to the atmosphere. Information on these recycling units is provided in Appendix B.24.

Solvents

Spent paint solvents from construction operations are distilled in five distillation units at SRS (described in Appendix B.24). Approximately 2 cubic meters (71 cubic feet), 4 cubic meters (140 cubic feet) (Boyter 1994a), and 1 cubic meter (35 cubic feet) (Stone 1994c) of spent paint solvents were recycled in 1992, 1993, and through June 1994, respectively. These amounts represent 100 percent of the spent paint solvent generated by construction operations. Since 1993, the distillation units have yielded approximately 4 cubic meters (140 cubic feet) of reclaimed solvents (Harvey 1994b) for construction projects. Approximately 220 kilograms (480 pounds) of residue is disposed of as hazardous waste per year (Harvey 1994a). In addition to paint solvents, SRS also plans to distill chlorofluorocarbons used as solvents.

Radioactively Contaminated Tools and Equipment

SRS minimizes disposal of radioactively contaminated tools and equipment by collecting them for decontamination and subsequent reuse. Tools are collected and sent to a staging area in C-Area for segregation. Contaminated tools are decontaminated at facilities located in C- or N-Areas. In N-Area, a vacuum stripping process, which is similar to a recycling sandblaster, uses aluminum oxide as the grit. SRS plans to implement carbon dioxide blasting, which is less erosive than vacuum stripping but highly effective, as the main decontamination technology beginning in 1995. Carbon dioxide blasting has no secondary wastes; only the contaminants themselves are left for disposal. In addition, beginning in 1995 a Kelly Decon Machine®, using superheated steam, will clean larger, more intricate equipment (Miller 1994). More information on decontamination technology is presented in Appendix B.24.

Beneficial Reuse Demonstration Program

Recycling opportunities exist for the large amount of scrap metal generated by the decommissioning of equipment. The beneficial reuse program demonstrates the viability of the decontamination of metals to levels where they can be smelted and fabricated into waste containers. This program is proceeding as a demonstration with private firms. This demonstration would convert approximately 54 metric tons (60 short tons) of radioactive scrap metal to waste containers over a 3-year period (Hess 1994b). If it is successful, it could lead to the recycling of large amounts of radioactive scrap metal into waste containers, eliminating the need to dispose of the contaminated metal as low-level waste and the need to obtain an equivalent number of new waste containers (Boettinger 1994a). Approximately 6,600 cubic meters (2.33×10^5 cubic feet) of low-level waste in the form of 68 scrap heat exchangers would be converted to waste containers and beneficially reused (Boettinger 1994b). Other types of contaminated scrap stainless steel would also be available for conversion. TE

Cadmium-Plated Filter Frames

DOE will recycle approximately 100 cubic meters of cadmium-plated high efficiency particulate air filter frames using an offsite vendor. The vendor will remove the filter media from the frames prior to processing the remaining metal. Filter media that are removed will be returned to SRS for disposal as low-level radioactive waste. This will be a one-time recycling activity because all of the cadmium-plated filters have been removed from service and replaced by nonhazardous stainless steel framed filters (WSRC 1995; Blankenhorn 1995). TC

2.2.2 HIGH-LEVEL WASTE

The no-action alternative for liquid high-level waste would continue current management practices. Figure 2-9 shows the management practices for high-level waste from receipt and storage of liquid high-level waste in tanks to preparation and processing into forms suitable for final disposal. As currently planned, liquid high-level waste would be removed from the storage tanks and processed through the Defense Waste Processing Facility into borosilicate glass sealed in stainless steel containers. The major components of this plan have been analyzed separately in the *Final Supplemental Environmental Impact Statement Defense Waste Processing Facility*. The remaining components of the plan, including storage, evaporation, wastewater treatment, and waste removal operations are considered in this EIS. TE TE

TC

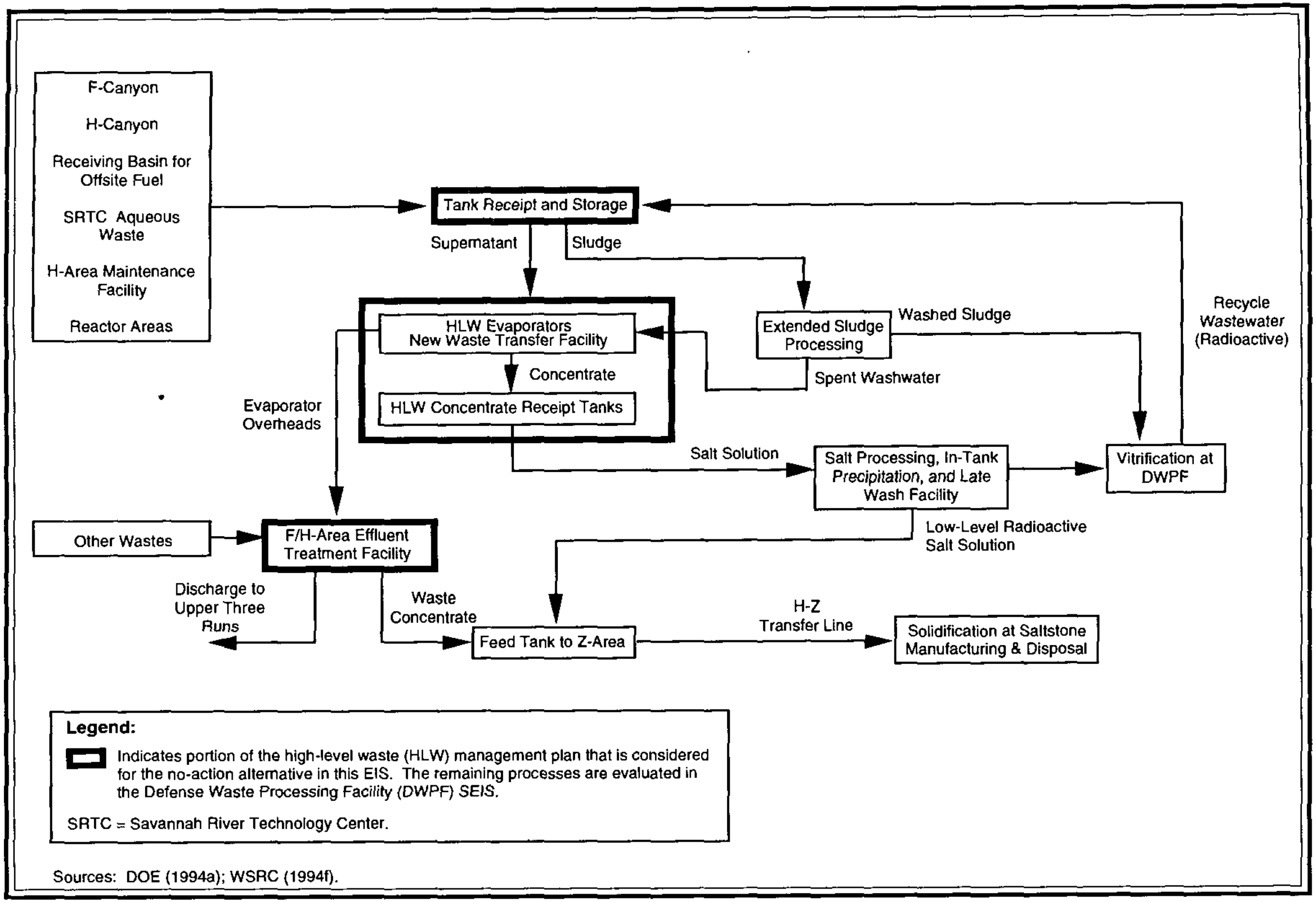

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Figure 2-9. Liquid high-level waste management plan.

Specific management practices for liquid high-level waste included under the no-action alternative are listed below.

- Continue receiving and storing liquid high-level waste in the F- and H-Area tank farms.
- Remove from service tank systems and components that do not have complete secondary containment.
- Continue operating existing evaporators.
- Continue removing waste from tanks and preparing it for treatment in the Defense Waste Processing Facility. | TE
- Continue operating the F/H-Area Effluent Treatment Facility.

In addition, under the no-action alternative, DOE would:

- Continue to construct and then operate the Replacement High-Level Waste Evaporator.
- Implement final construction, startup testing, and operation of the New Waste Transfer Facility.

2.2.2.1 Continue Receiving and Storing of Liquid High-Level Waste in the F- and H-Area Tank Farms | TE

Under the no-action alternative, the tank farms would continue to receive waste from the chemical separations facilities (F- and H-Canyons), the Receiving Basin for Offsite Fuel, the Savannah River Technology Center, the H-Area Maintenance Facility, and reactor areas. Two additional facilities, the Defense Waste Processing Facility and Extended Sludge Processing, are expected to send recycled wastewater to the tank farms during the next 30 years.

The tanks currently contain approximately 1.31×10^5 cubic meters (3.45×10^7 gallons) of high-level waste and are at more than 90 percent of usable capacity (WSRC 1994b, f). Approximately 22,000 cubic meters (5.81×10^6 gallons) of high-level waste would be received in the tank farms during the remaining years of the high-level waste program, which would continue until 2018. According to current operating plans and projected funding, by 2018 DOE expects that the high-level waste at SRS would have been processed into borosilicate glass, and the tanks would be empty (Hess 1994c). This forecast assumes the | TE expected amount of waste would be generated and that current waste management practices and stabilization options being considered for existing site inventories of nuclear materials would continue. Decisions made pursuant to other NEPA analyses could extend the period of waste generation. The effect of additional waste generated by future programs would primarily mean an extended period of waste storage and treatment, not treating larger volumes of waste within the next decade (Hess 1994d).

The no-action alternative assumes that DOE would continue to receive waste from the F- and H-Area separations facilities, store it in tanks with full secondary containment (Type III) in the tank farms (see Appendix B.13), operate the existing evaporators to reduce the volume of waste, complete construction and begin operation of the Replacement High-Level Waste Evaporator, and build no new tanks.

If the tank farms and evaporators operate as projected, tank space can be maintained at acceptable levels (Bignell 1994a). This projection assumes successful startup and operation of In-Tank Precipitation, Extended Sludge Processing, the Replacement High-Level Waste Evaporator, the New Waste Transfer Facility, and the Defense Waste Processing Facility, which are necessary to process the waste into borosilicate glass.

Approximately 3.03×10^4 cubic meters (8.0×10^6 gallons) of liquid high-level waste would continue to be stored in Type I, II, and IV tanks (older tanks with a greater potential for releasing waste into the environment) until waste removal operations were complete (Bignell 1994b). Additional tank capacity is reserved as a contingency in case scheduled surveillances reveal leaks in tanks or if a catastrophic failure were to occur. Should a situation arise that warranted it, alternative storage options, including constructing new tanks, would also be assessed and subjected to appropriate NEPA review. A detailed description of the tank farms is presented in Appendix B.13.

2.2.2.2 Waste Removal

In the Federal Facility Agreement (an agreement between DOE, EPA, and SCDHEC), DOE committed to removing wastes from older tanks that do not meet secondary containment requirements (Tanks 1 through 24). The high-level waste removal operations described in this EIS would comply with the proposed plan and schedule provided under the Agreement. Under the no-action alternative, DOE would continue to remove waste from the older tanks that have the greatest potential for releases to the environment. All tanks would be empty by 2018. Under this alternative, activities would include removal of waste, water washing, and transferring tanks to a decontamination and decommissioning program. Completion of several key activities is necessary before waste removal can begin. These include putting the Replacement High-Level Waste Evaporator into operation, restarting and operating

Extended Sludge Processing, and starting up and operating the New Waste Transfer Facility, In-Tank Precipitation, and the Defense Waste Processing Facility. A detailed discussion of waste removal operations as currently planned is presented under the tank farms facility description in Appendix B.13.

2.2.2.3 Continue Operating Existing High-Level Waste Evaporators | TE

Under the no-action alternative, DOE would continue to operate the 2F and 2H evaporators. The primary goal of operating the two evaporators would be to reduce the current backlog of waste and ensure that there would be at least 1.14×10^4 cubic meters (3.01×10^6 gallons) of available tank space to receive recycled wastewater from the Defense Waste Processing Facility when that facility begins operating and maintain 4,900 cubic meters (1.29×10^6 gallons) of available space that is required to be held in reserve should a tank fail. After the Defense Waste Processing Facility begins operating, the 2F and 2H evaporators could not process waste fast enough to keep pace with the generation of recycled Defense Waste Processing Facility wastewater and other new waste. As a result of this shortfall in evaporation capacity, available space in the tank farms would decrease until the Replacement High-Level Waste Evaporator begins operating (targeted for May 1999) (WSRC 1994f). A detailed discussion of the existing evaporators is presented in Appendix B.13.

2.2.2.4 Continue Operating the F/H-Area Effluent Treatment Facility | TE

Under the no-action alternative, DOE would continue to operate the F/H-Area Effluent Treatment Facility to support high-level waste processing. This facility discharges treated effluents to surface water in accordance with a National Pollutant Discharge Elimination System permit and transfers concentrated waste to the Saltstone Manufacturing and Disposal facility for treatment and disposal. Additional treatment capacity would not be required for the additional wastes from treatment of high-level wastes over the 30-year period. Appendix B.10 describes the F/H-Area Effluent Treatment Facility in detail. | TE

2.2.2.5 Continue Constructing and Begin Operating the Replacement High-Level Waste Evaporator | TE

Under the no-action alternative, DOE would complete construction of and operate the Replacement High-Level Waste Evaporator. A detailed discussion of the capabilities of the Replacement High-Level Waste Evaporator is presented in Appendix B.25. Operation of the Replacement High-Level Waste Evaporator would not be substantially different than operations of the existing high-level waste evaporators. The annual quantity of overheads processed and the characteristics of the materials handled would be similar to those of the existing evaporators.

Based on the 30-year waste forecast, the Replacement High-Level Waste Evaporator or another method of reclaiming tank space is needed to support the long-term operation of DOE's high-level waste program. Without the Replacement High-Level Waste Evaporator, the tank farm would run out of the tank space required for the Defense Waste Processing Facility to recycle wastewater within a few years
TE of its startup (Davis 1994).

TE

2.2.2.6 Complete Construction and Begin Operating the New Waste Transfer Facility

Under the no-action alternative, DOE would complete construction of and operate the New Waste Transfer Facility, which allows transfers between the H-Area tank farm and the Defense Waste
TE Processing Facility. Appendix B.17 presents a detailed description of the facility.

TE The New Waste Transfer Facility was built to replace an old diversion box and would operate in a manner similar to existing pump pits and diversion boxes used for waste transfers in the F- and H-Area tank farms.

2.2.3 LOW-LEVEL WASTE

Under the no-action alternative, DOE would continue management practices for low-level waste that are in effect now and initiate those in current DOE plans (Figure 2-10). At SRS, low-level waste is
TE segregated into several categories to facilitate proper management (see Sections 2.1.1 and 2.1.2). Management practices for low-level waste under the no-action alternative are listed below.

- Continue to compact some low-activity waste to reduce its volume.

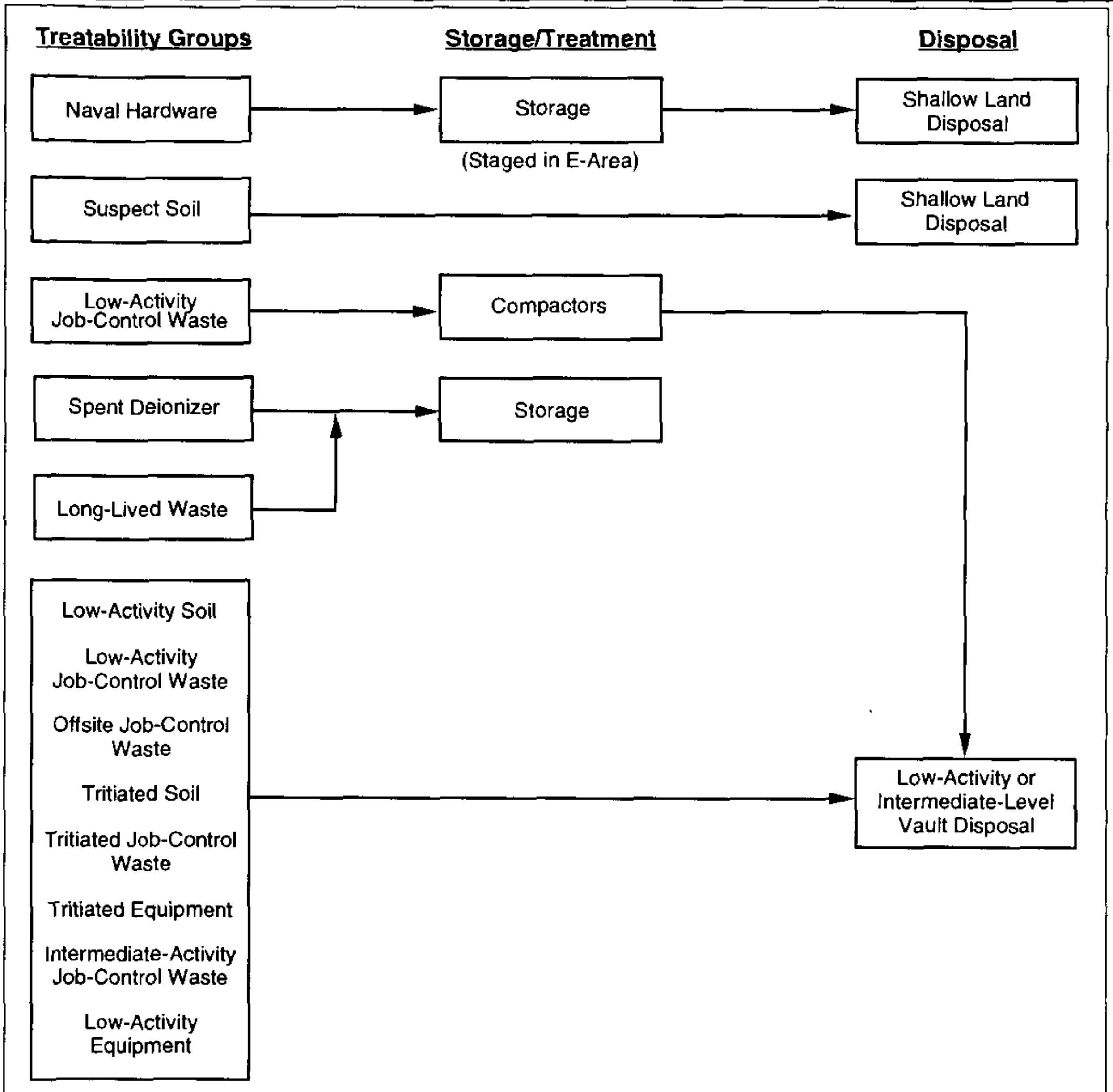
- Continue to dispose of low-activity waste in the low-activity waste vaults.

TC

- Continue to dispose of suspect soil in the engineered low-level trench until its capacity is reached, then send suspect soil to shallow land disposal in slit trenches.

- Continue to dispose of intermediate-activity waste, both tritiated and nontritiated, in the intermediate-level waste vaults.

- Continue to store long-lived process water deionizers and other long-lived wastes in the long-lived waste storage building.



Source: Hess (1994e).

Note: This figure does not include short-term or transition activities. | TE

PK56-17

Figure 2-10. Low-level waste management plan for the no-action alternative.

- Continue to store naval hardware on the storage pads in E-Area pending completion of the radiological performance assessment and subsequent shallow land disposal.

TE | DOE Order 5820.2A ("Radioactive Waste Management") establishes performance objectives for the disposal of low-level wastes. A radiological performance assessment is required to ensure that the waste inventory and the proposed disposal method provide reasonable assurance that the performance objectives of DOE Order 5820.2A will be met. The performance objectives list specific dose limits and protect human health. The performance assessment projects the migration of radionuclides from the waste to the environment and estimates the resulting dose to people. DOE completed the radiological performance assessment for the current low-level waste vault design and incorporated the results into the waste acceptance criteria to define maximum radionuclide inventory limits for disposal (Martin Marietta, EG&G, and WSRC 1994). Prior to 1988, DOE disposed of naval hardware by shallow land disposal. Since 1988, DOE has stored naval hardware pending completion of a radiological performance assessment. DOE has also completed a radiological performance assessment for trench disposal of suspect soils as part of the radiological performance assessment for the E-Area vaults. DOE anticipates that naval reactor hardware would also be deemed suitable for shallow land disposal after additional data on the composition and configuration of the waste forms is obtained and can be incorporated in the radiological performance assessment. The long-lived waste storage buildings are designed to provide long-term storage for low-level wastes containing isotopes that exceed the performance criteria for disposal.

For purposes of analysis in this EIS, low-level wastes that are not stabilized prior to disposal (except for suspect soils and naval hardware, as discussed above) would be certified to meet the waste acceptance criteria for disposal in the low-level waste vaults. Stabilized waste forms resulting from the proposed treatment activities would be evaluated against DOE Order 5820.2A performance objectives. Radiological performance assessments for these stabilized low-level wastes (e.g., wastes in which the radionuclides have been immobilized in a cement or glass matrix or encapsulated) are expected to demonstrate that shallow land disposal achieves the objectives. For purposes of analysis in this EIS, it has been assumed that stabilized waste forms would be sent to shallow land disposal. The following sections discuss the treatment, storage, and disposal of low-level wastes under the no-action alternative.

2.2.3.1 Disposal of Low-Activity Waste

Under the no-action alternative, DOE would continue to compact low-activity job control waste to extend disposal capacity. Refer to Appendix B.4 for a description of the compactors. Compactible
TE | low-activity waste in 21-inch cardboard boxes would be placed in steel containers and compacted at one

of two low-level waste compactors. Some compactible low-activity waste in plastic bags would also be placed in 21-inch cardboard boxes and compacted in the L-Area compactor. Low-activity waste that cannot be compacted or does not meet compactor waste acceptance criteria would be placed in steel boxes (WSRC 1993b). Approximately 1.19×10^5 cubic meters (4.20×10^6 cubic feet) (25 percent of the forecast low-level waste) would be compacted over the 30-year analysis period. This waste volume represents the maximum operating capacity of the three existing compactors.

Containerized low-activity waste was disposed of in engineered low-level trenches in the Low-Level Radioactive Waste Disposal Facility in E-Area until March 31, 1995 (WSRC 1994g). To date, three engineered low-level trenches have been filled. The fourth engineered low-level trench is currently receiving suspect soil only (Hess 1995b). In September 1994, DOE began to use concrete vaults (referred to as the low-activity waste vaults) for disposal of containerized low-activity waste. The same wastes that had been disposed of in the engineered low-level trenches would be disposed of in low-activity waste vaults. One low-activity waste vault has been constructed and additional vaults would be constructed as needed. Refer to Appendix B.8 for a description of the low-activity waste vaults. Operation of low-activity waste vaults would be similar to the engineered low-level trench operation for low-activity waste.

The 30-year waste forecast indicates that approximately 4.11×10^5 cubic meters (1.45×10^7 cubic feet) of low-activity waste is expected over the next 30 years. Assuming that the engineered low-level trench would receive suspect soil only and all containerized low-activity waste is being disposed of in a low-activity waste vault, it is expected that the existing vault would reach its capacity by the year 1997. A new vault would need to be constructed every 2 to 4 years for the remainder of the 30-year period, for a total of ten additional vaults (Hess 1995c).

Under the no-action alternative, DOE would send suspect soil to shallow land disposal (Hess 1994e). See Appendix B.27 for a description of shallow land disposal. Currently, soil that is suspected of being contaminated (suspect soil) is transported to E-Area and used as backfill material in the engineered low-level waste trench, which is expected to be full in early 1995. In this EIS, a slit trench serves as the prototype for future shallow land disposal. It has usable disposal capacity of 1,100 cubic meters (38,800 cubic feet). Based on this capacity, it is estimated that 29 slit trenches would be required to dispose of the forecast 3.0×10^4 cubic meters (1.06×10^6 cubic feet) of suspect soil over the 30-year analysis period (Hess 1995c).

2.2.3.2 Disposal of Intermediate-Activity Waste

DOE has disposed of intermediate-activity waste in two types of greater confinement disposal facilities, boreholes and engineered trenches, in the Low-Level Radioactive Waste Disposal Facility in E-Area. Existing boreholes have reached capacity and no further borehole construction is anticipated. Refer to Appendix B.27 for a description of greater confinement disposal boreholes and engineered trenches.

DOE disposed of intermediate-activity waste (reactor scrap metal and bulk materials) in the greater confinement disposal engineered trench until March 31, 1995 (WSRC 1994g). The current engineered trench has a capacity of 3,400 cubic meters (1.2×10^5 cubic feet) and is filled to 75 percent of capacity (Hess 1994f). There is 850 cubic meters (30,000 cubic feet) of capacity remaining; however, DOE has no plans to place any additional intermediate-activity waste in the greater confinement disposal engineered trench (Hess 1995b). In February 1995, DOE began to use concrete vaults, referred to as the intermediate-level waste vaults, for disposal of containerized intermediate-activity waste. Refer to Appendix B.8 for a description of intermediate-level waste vaults.

Under the no-action alternative, DOE would dispose of intermediate-activity tritiated and nontritiated wastes in the intermediate-level waste vaults. In the past, separate intermediate-level tritium and nontritium vaults were constructed with tritium vaults having two cells and nontritium vaults having seven cells. In the future, all intermediate-level waste vaults would have nine cells, but intermediate-activity (tritiated and nontritiated) waste would still be segregated for disposal; tritiated and nontritiated waste would be disposed of in separate cells in the same vault (Hess 1994e).

The expected waste forecast indicates that 22,000 cubic meters (7.77×10^5 cubic feet) of nontritiated intermediate-activity waste and 6,600 cubic meters (2.33×10^5 cubic feet) of tritiated intermediate-activity waste would be managed over the next 30 years. A small percentage of this waste would be bulk equipment disposed of in slit trenches. The current slit trench has a capacity of 2,700 cubic meters (95,300 cubic feet) and would reach capacity in 1995. Additional slit trenches would be constructed as needed to accommodate bulk equipment that is intermediate-activity waste. However, disposal of bulk intermediate-activity waste in slit trenches would not appreciably decrease the required vault capacity (Hess 1995c).

The existing intermediate-level tritium vault would reach capacity by 2000 and the intermediate-level nontritium vault would reach capacity by 1999. DOE would construct intermediate-activity waste disposal capacity equivalent to a nine-cell intermediate-level waste vault approximately every 5 years for the remainder of the 30-year period, for a total of five additional vaults (Hess 1995c).

2.2.3.3 Storage of Long-Lived Waste

Under the no-action alternative, DOE plans to store long-lived waste such as process water deionizers from reactors in long-lived waste storage buildings in E-Area. One storage building has been constructed. Refer to Appendix B.8 for a description of that long-lived waste storage building. DOE would construct additional buildings as needed.

Over the next 30 years, 3,333 cubic meters (1.18×10^5 cubic feet) of long-lived waste is anticipated under the expected waste forecast. Based on this forecast, the current storage building would reach capacity by 2000. DOE would construct a new storage building approximately every year for the remainder of the 30-year period. A total of 24 additional long-lived waste storage buildings would need to be constructed (Hess 1995c). TE

2.2.3.4 Storage of Naval Hardware Waste

Under the no-action alternative, DOE would continue to store naval reactor core barrels and other components from offsite pending demonstration that the waste form meets performance objectives and approval for shallow land disposal. DOE currently stores these materials on gravel pads in E-Area. Refer to Appendix B.27 for a description of naval hardware waste storage pads.

Approximately 1,190 cubic meters (42,000 cubic feet) of naval reactor waste is currently stored at SRS. The current gravel storage pad has a remaining capacity of 174 square meters (1,900 square feet) (Hess 1994f). Capacity to accommodate naval reactor waste would require two additional slit trenches, or equivalent shallow land disposal capacity, during the 30-year analysis period.

Under the no-action alternative, DOE would dispose of approximately 92 percent of low-level waste in low-level waste vaults; 7 percent would be sent to shallow land disposal; less than 1 percent would be stored pending disposal.

2.2.4 HAZARDOUS WASTE

The no-action alternative for hazardous waste as defined in Section 2.1 is to continue waste management practices that are now in effect and to initiate those that are currently planned (Figure 2-11). Management practices for hazardous waste under the no-action alternative are listed below.

TE

- Continue to receive and store hazardous waste in six existing storage facilities.
- Continue to treat and dispose of hazardous waste offsite.
- Continue to treat and dispose of PCB waste offsite.
- Continue to collect hazardous waste for recycling or resale.
- Continue to treat aqueous liquids generated from groundwater monitoring well operations (investigation-derived wastes) in the M-Area Air Stripper.

DOE would continue to store hazardous waste in three storage buildings that have RCRA permits and on three solid waste storage pads with RCRA interim status. (Refer to Glossary for the definition of interim status.) The hazardous waste storage buildings and storage pads located in B- and N-Areas are collectively known as the Hazardous Waste Storage Facility and are used to store wastes generated at various sites across SRS (WSRC 1993c).

TE

TE

Both hazardous and mixed wastes generated in M-Area are currently stored in a building in M-Area; that practice would continue (WSRC 1994h). Hazardous wastes that are currently stored in the Hazardous Waste Storage Facility or the M-Area storage building would continue to be stored until they are transported offsite for treatment and disposal. Because DOE would continue to send hazardous waste offsite for treatment and disposal as it is generated, the existing Hazardous Waste Storage Facility and M-Area storage building would provide sufficient short-term storage capacity over the next 30 years.

TE

In addition to hazardous wastes that are stored until they are sent for offsite treatment and disposal, DOE currently accumulates several types of hazardous wastes for recycling on- and offsite. Under the no-action alternative, these recycling practices (described in Section 2.2.1) would continue.

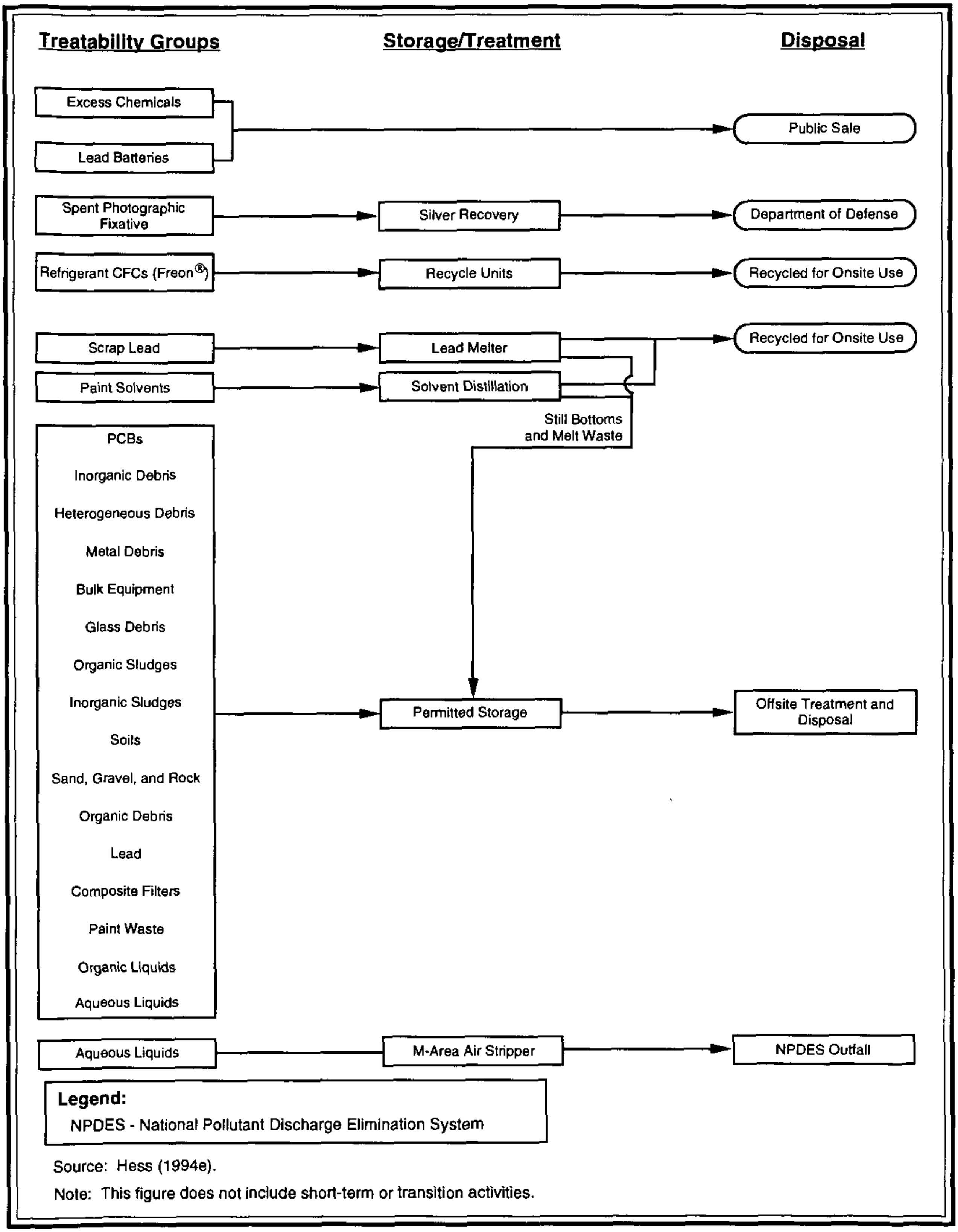


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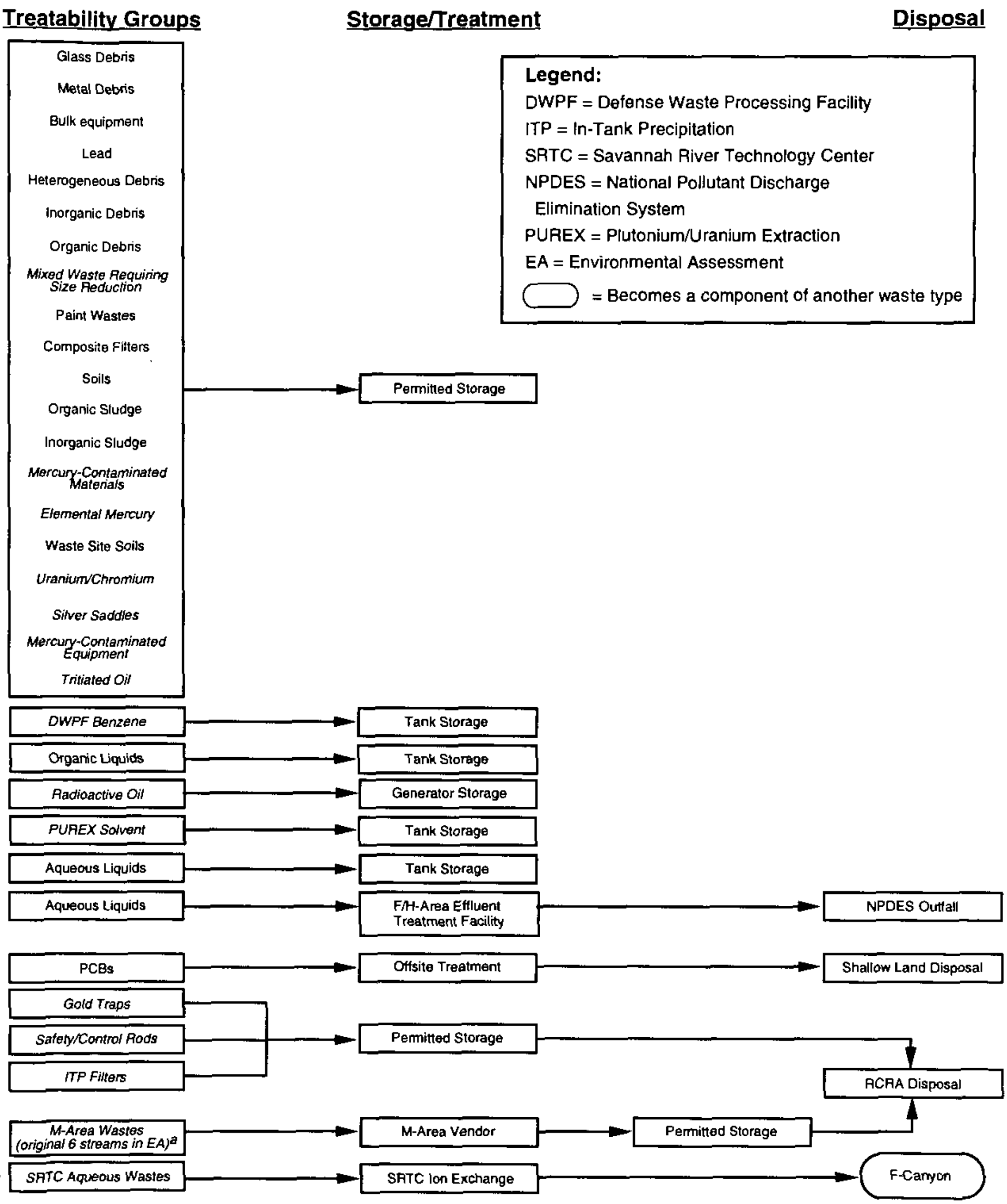
Figure 2-11. Hazardous waste management plan for the no-action alternative.

DOE would continue to treat hazardous aqueous liquids collected from groundwater monitoring wells (investigation-derived wastes) in the M-Area Air Stripper. Once treated, the liquids would be discharged to an outfall in accordance with National Pollutant Discharge Elimination System criteria. Because DOE would continue to treat and discharge these liquids, additional storage capacity would not be necessary for these aqueous wastes over the next 30 years.

2.2.5 MIXED WASTE

Management practices under the no-action alternative for mixed waste (which includes radioactively contaminated PCB wastes regulated under the Toxic Substances Control Act and nonhazardous radioactive oil) are listed below and shown in Figure 2-12.

- Continue to receive and store mixed waste in existing storage buildings, existing tanks, and on existing storage pads.
- Continue to receive, store, and treat by an ion exchange process the aqueous mixed waste in existing storage tanks at the Savannah River Technology Center.
- Continue to receive and store mixed waste (PUREX solutions) in the existing solvent storage tanks in E-Area until these tanks are replaced with new tanks in H-Area and solvent wastes are transferred to new tanks.
- Continue to store mixed waste in tanks at the M-Area Process Waste Interim Treatment/Storage Facility.
- Store benzene in the Defense Waste Processing Facility Organic Waste Storage Tank.
- Continue to store low-level PCB wastes until they are shipped offsite for treatment of the PCB waste fraction.
- Continue to accumulate radioactive oil at individual sites throughout SRS where it is generated.



[a]See Appendix B under M-Area Vendor Treatment Facility.

Source: Hess (1994e).

Note: This figure does not include short-term or transition activities. Treatability groups in italics are specific waste streams discussed in the site treatment plan.

TE

PK56-17

Figure 2-12. Mixed waste management plan for the no-action alternative.

- Continue to treat aqueous liquids collected from groundwater monitoring well operations (investigation-derived waste) in the F/H-Area Effluent Treatment Facility.

- Treat filters generated at In-Tank Precipitation by acid leaching and placement in specially designed boxes that meet disposal criteria in accordance with the EPA-approved treatability variance.

Management practices for mixed waste in the no-action alternative would consist of implementing the following activities.

- Construct and operate the M-Area Vendor Treatment Facility for vitrification of certain wastes generated by M-Area electroplating operations.

- Receive and store mixed waste in the most recently constructed mixed waste storage building (which has not been used to date).

- Construct additional mixed waste storage buildings as necessary to meet the demand for mixed waste storage.

- Dispose of mixed waste in the planned RCRA-permitted disposal vaults that will be constructed once the permit is approved.

- Continue constructing the Consolidated Incineration Facility.

- Construct additional Defense Waste Processing Facility organic waste storage tanks as necessary to meet the demand for benzene storage.

- Dispose of residuals returned from the treatment of radioactive PCBs by shallow land disposal.

- Receive and store organic and aqueous liquid waste in planned storage tanks, with additional tanks constructed as necessary.

2.2.5.1 Containerized Storage

Under the no-action alternative, DOE would continue to store mixed waste in four mixed waste storage buildings and on three mixed waste storage pads. One storage building has a RCRA permit, while permits for the remaining facilities have been applied for and the buildings are operating under interim status. The existing storage facilities would reach capacity in 1998. DOE would have only limited capacity to treat mixed waste under the no-action alternative; therefore, approximately 1.84×10^5 cubic meters (6.50×10^6 cubic feet) of containerized mixed waste would be placed in RCRA-permitted storage over the next 30 years if waste generation proceeds as expected. To accommodate future storage needs, DOE would construct additional storage buildings as needed. The most recently constructed storage building, Building 643-43E, serves as the prototype for additional storage buildings in this analysis. It has usable capacity of 619 cubic meters (21,900 cubic feet). Based on this capacity, it is estimated that 291 additional buildings would be needed over the next 30 years to accommodate the expected amounts of mixed waste (Hess 1995c). TC TC

DOE would continue to store low-level PCB wastes in one of the mixed waste storage buildings. DOE is completing arrangements to treat the PCB component of this waste at a commercial facility. Once treated, the residuals would be returned to SRS for shallow land disposal. Refer to Section 2.2.7.3 for projections of low-level waste disposal capacity over the next 30 years.

DOE would continue to generate radioactive oil and store it in containers in the areas where it is generated. Radioactive oil is not a mixed waste, so there are no RCRA requirements for its storage (i.e., it does not need to be stored in a permitted storage facility); it can continue to be stored wherever it is generated. For this reason, there would be sufficient storage capacity for the next 30 years.

2.2.5.2 Treatment and Tank Storage

Under the no-action alternative, DOE would continue to receive, store, and treat aqueous wastes at the Savannah River Technology Center. Because DOE treats the waste as it is generated, tank capacity would not be exceeded and additional tanks would not be required.

DOE would continue constructing the Consolidated Incineration Facility, which is expected to be completed by September 1995 (Crook 1995). TE

The 568-cubic-meter (150,000-gallon) interim status Organic Waste Storage Tank would be used under the no-action alternative for storing mixed organic waste generated at the Defense Waste Processing Facility. Based on the expected waste forecast, the tank's storage capacity would be reached in approximately 5 years. The no-action alternative assumes that the Consolidated Incineration Facility does not operate. Thus, DOE would need to build four additional organic waste storage tanks similar to TE TE TC the existing tank to accommodate mixed organic waste generated at the Defense Waste Processing Facility over the 30-year period (Hess 1995c).

Under the no-action alternative, two of the 95-cubic-meter (25,000-gallon) solvent tanks in E-Area would continue to be used for mixed waste until October 1996 when these tanks reach the end of their service life (WSRC 1994i). Replacement tanks would be required to extend storage capacity. Currently, DOE plans to construct four 114-cubic-meter (30,000-gallon) solvent tanks in H-Area to replace these
TE tanks (WSRC 1993d). Based on the expected waste forecast, these solvent tanks would provide sufficient storage capacity (Hess 1995c).

Under the no-action alternative, DOE would also need to construct two additional 114-cubic-meter (30,000-gallon) storage tanks in E-Area in 1995, one for aqueous liquid waste and one for organic waste. These tanks would be similar to solvent storage tanks proposed for H-Area. DOE would add new tanks as needed to accommodate expected aqueous and organic liquid waste over the next 30 years. DOE
TC estimates that 43 aqueous waste and 26 organic waste storage tanks would be needed under the no-action alternative.

Under the no-action alternative, the tanks at the M-Area Process Waste Interim Treatment/Storage Facility would continue to store concentrated mixed wastes from the M-Area Liquid Effluent Treatment
TE Facility. DOE plans to treat six kinds of M-Area wastes (identified in Appendix B.15) stored in the Process Waste Interim Treatment/Storage Facility tanks and the M-Area storage building by vitrification in the M-Area Vendor Treatment Facility. The potential effects of vitrifying these wastes were considered in an environmental assessment (DOE 1994b); a Finding of No Significant Impact was issued in August 1994. Additional storage capacity would not be required, and the existing tanks would be used
TE for feed preparation and to transfer offgas -scrubber -blowdown (exhaust residue) waste from the vitrification process to the M-Area Liquid Effluent Treatment Facility. DOE submitted an application for a wastewater treatment permit to SCDHEC for the M-Area Vendor Treatment Facility. DOE plans to place the vitrified waste in containers and store it on a storage pad in M-Area until RCRA-permitted disposal capacity becomes available (see Section 2.2.5.3). DOE has submitted a RCRA permit application requesting interim status for this storage pad. Additionally, DOE plans to petition EPA to have the vitrified waste delisted as a RCRA hazardous waste. If the delisting petition is successful, DOE would then be able to dispose of these wastes as a low-level waste.

Under the no-action alternative, DOE would continue to treat aqueous liquids collected from groundwater monitoring wells in the F/H-Area Effluent Treatment Facility. Once treated, the liquids would be discharged to an outfall in accordance with the facility's National Pollutant Discharge Elimination System permit.

DOE submitted a petition for a land disposal restrictions treatability variance for the filters used at In-Tank Precipitation (WSRC 1991). The petition requested that DOE be allowed to treat the filters by acid leaching followed by placement in specially designed containers. EPA approved this variance on October 1, 1993 (EPA 1993b). Under the no-action alternative, DOE would treat In-Tank Precipitation filters by the method prescribed in the treatability variance. After treatment, the In-Tank Precipitation filters in their containers may be temporarily stored on waste storage pads prior to RCRA-permitted disposal (see Section 2.2.5.3). A similar treatment and disposal method would be used for the Defense Waste Processing Facility late-wash filters, which are similar to the In-Tank Precipitation filters. TE

2.2.5.3 Disposal

DOE submitted an application to SCDHEC for a RCRA permit to construct 10 Hazardous Waste/Mixed Waste Disposal Vaults. A radiological performance assessment will be prepared to determine the performance of the Hazardous Waste/Mixed Waste Disposal Vault design and establish waste acceptance criteria defining the maximum radionuclide inventory limits for disposal. Based on the results from the radiological performance assessment, DOE may determine that alternative disposal methods meeting the RCRA specifications would also achieve the performance objectives of DOE Order 5820.2A for certain SRS mixed wastes. It is anticipated that mixed wastes that are not stabilized prior to disposal may require disposal in the RCRA-permitted disposal vaults. Stabilized waste forms resulting from the proposed treatment activities would be evaluated against the DOE Order 5820.2A performance objectives. Radiological performance assessments for these stabilized wastes (e.g., wastes in which the radionuclides have been immobilized in a cement or glass matrix or encapsulated) are expected to demonstrate that shallow land disposal, in facilities conforming to RCRA design requirements, achieves the performance objectives.

For purposes of analysis in this EIS, RCRA-permitted disposal capacity has been based on the current design of the Hazardous Waste/Mixed Waste Disposal Vault. Under the no-action alternative, RCRA-permitted disposal capacity would be used only for the disposal of mixed waste. Mixed waste that would be sent to RCRA-permitted disposal includes vitrified waste from the M-Area Vendor Treatment Facility, gold traps, safety/control rods, In-Tank Precipitation filters, and Defense Waste Processing Facility late-wash filters. Since all hazardous wastes are sent offsite for treatment, storage, or disposal under the no-action alternative, RCRA-permitted disposal capacity would not be needed for the disposal of hazardous waste treatment residuals. Due to the limited amount of treatment conducted under the no-action alternative, a single vault would be sufficient to meet SRS RCRA-permitted disposal capacity requirements.

2.2.6 TRANSURANIC AND ALPHA WASTE

TC Under the no-action alternative, DOE would perform activities required to achieve regulatory compliance for alpha and transuranic waste storage. The no-action alternative would continue the transuranic and alpha waste management practices now in effect or currently planned, as follows (Figure 2-13):

- Store transuranic and alpha waste on transuranic waste storage pads.
- Retrieve the drums of transuranic waste stored in earthen mounds on Transuranic Waste Storage Pads 2 through 6.
- Assay containers at the Experimental Transuranic Waste Assay Facility/Waste Certification
TC Facility following upgrades to the facility.
- Construct additional storage facilities (new transuranic waste storage pads) to accommodate the projected waste volumes.

TC • Dispose of newly generated nonmixed alpha waste in the low-activity waste vaults.

TC 2.2.6.1 <u>Storage</u>

The waste generators would handle and package transuranic and alpha wastes in accordance with existing administrative procedures. In the draft EIS, DOE proposed to continue to store all alpha waste (10 to 100 nanocuries per gram). However, to reduce the amount of additional storage capacity required, DOE will now use the low-activity waste vaults for disposal of alpha waste that can be certified to
TC comply with the vaults' waste acceptance criteria. Under the no-action alternative, DOE would manage newly generated nonmixed alpha waste by segregating these materials and certifying the waste for disposal in the low-activity waste vaults. The existing inventory of nonmixed alpha waste and all mixed alpha waste would be managed in the same manner as the transuranic waste (greater than 100 nanocuries per gram). Waste containers would be placed on the existing transuranic waste storage pads.
TE Appendix B.30 describes these waste storage pads and how the wastes are handled.

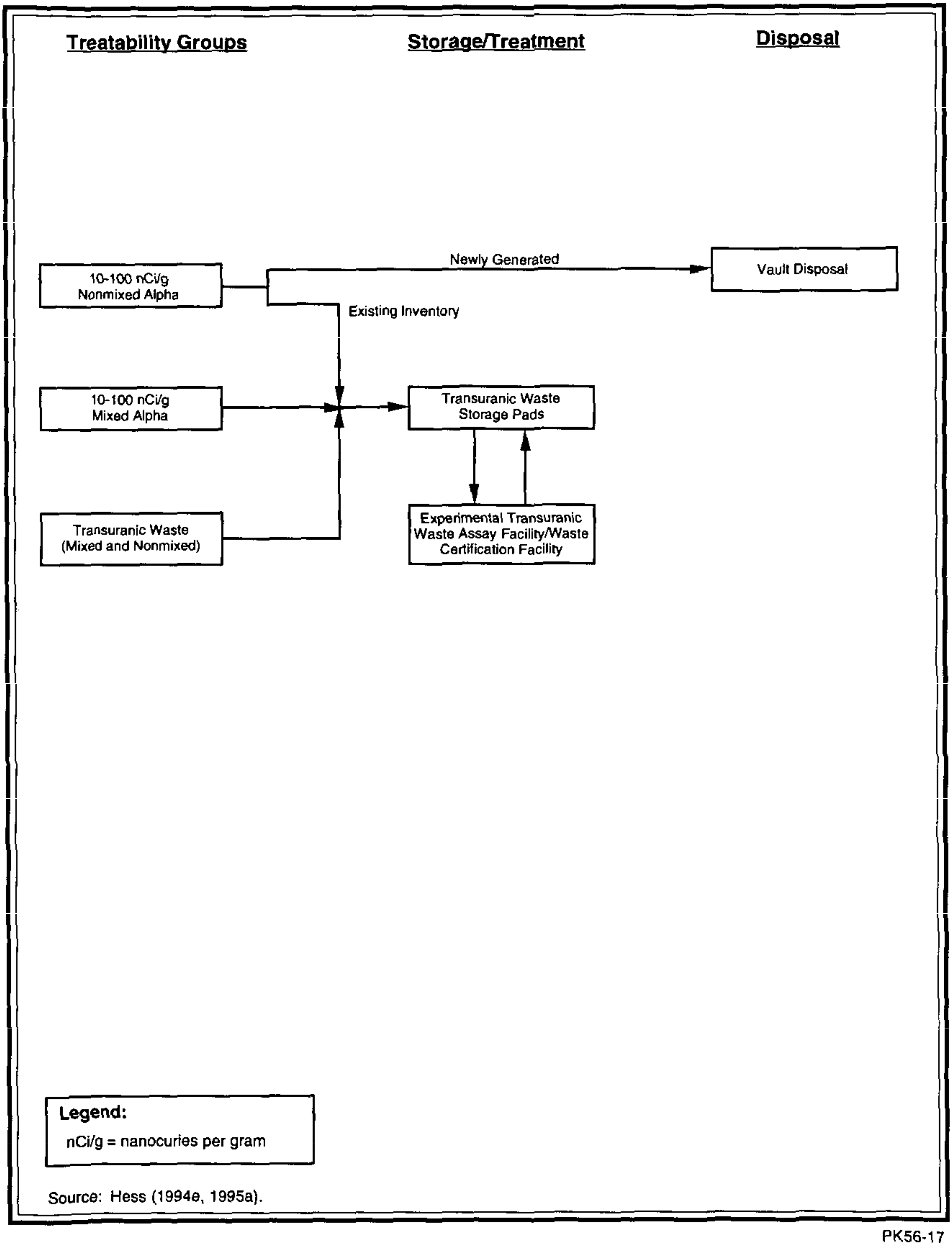


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Figure 2-13. Transuranic waste management plan for the no-action alternative.

DOE has committed to SCDHEC to rearrange the wastes stored on Transuranic Waste Storage Pads 14 through 17 by 1998. Under the no-action alternative, DOE would implement a transuranic, alpha, and low-level mixed waste storage strategy to maximize the capacity of the transuranic waste storage pads. For purposes of analysis in this EIS, it is assumed that the low-level non-alpha mixed waste currently stored on Transuranic Waste Storage Pads 7 through 13 would be removed and placed on Waste Storage Pads 20 through 22. Transuranic Waste Storage Pads 18 and 19 would be used for mixed transuranic waste storage. DOE would retrieve the wastes on Transuranic Waste Storage Pads 2 through 6 from mounded storage because they are about to reach the limit of their original 20-year retrievable life. DOE would not disturb the transuranic containers on Transuranic Waste Storage Pad 1 because the waste is inside concrete culverts, which are expected to provide adequate storage for the next 30 years. DOE would rearrange the transuranic and alpha waste stored on Transuranic Waste Storage Pads 2 through 13 to maximize the container storage capacity. Large steel boxes and culverts would be placed on pads without covers. Drums on the covered pads 14 through 17 would be stacked three high in rows with aisles between them to provide the ability to inspect containers (WSRC 1994j).

TC As part of DOE's storage strategy for the transuranic waste storage pads, DOE would consider the R- and P-Reactor Areas as well as other locations to determine if they could provide suitable alternative storage so that additional transuranic waste storage pads would be unnecessary (WSRC 1994j).

DOE plans a retrieval project to safely recover the drums from the earthen mounds over Transuranic Waste Storage Pads 2 through 6, overpack them in larger drums, and restore them in a safe configuration on the transuranic waste storage pads. The overpacked drums would have an activated carbon filter vent TE to prevent gas accumulation. The project would begin in 1997 or 1998. Appendix B.30 provides a detailed description of the retrieval project (WSRC 1994j).

As part of the no-action alternative for transuranic waste, the existing Experimental Transuranic Waste Assay Facility/Waste Certification Facility would require minor upgrades and would assay and x-ray TC drums of transuranic and alpha waste to verify packaging and content. The facility, which is not currently operating, was designed to assay transuranic waste (greater than 100 nanocuries per gram) for certification in accordance with Revision 3 of the Waste Isolation Pilot Plant waste acceptance criteria. TE Appendix B.9 describes in detail the Experimental Transuranic Waste Assay Facility/Waste Certification Facility.

Additional storage space would be required under the no-action alternative to accommodate transuranic and alpha wastes. The current volume of stored transuranic and alpha waste represents 44 percent of the 30-year transuranic waste forecast. Based on the waste forecast, DOE would need to construct

19 additional transuranic and alpha waste storage pads during the 30-year analysis period. The first pad would be needed in 1998 (Hess 1995c). DOE would model the transuranic waste storage pads after existing Transuranic Waste Storage Pads 14 through 17 and locate the pads within E-Area. TC TE

2.2.6.2 Disposal

DOE would dispose of newly generated nonmixed alpha wastes (approximately 5-percent of the forecast waste) in the low-activity waste vaults. This disposal would reduce the amount of additional storage capacity required under the no-action alternative by the equivalent of 3 storage pads (Hess 1995c). Refer to Section 2.2.7 for projections of low-activity vault disposal capacity over the 30-year period. TC

2.2.7 SUMMARY OF THE NO-ACTION ALTERNATIVE FOR ALL WASTE TYPES

The siting of the proposed waste treatment, storage, and disposal facilities in this EIS was conducted on two levels. The first level identified the most likely candidate site based on its proximity to major SRS waste generating operations and the existing and planned waste management facilities. The second level evaluated the available land within that site to identify specific areas suitable for development that would comply with applicable regulations and minimize the impacts to ecological resources, archaeological resources, and threatened and endangered species. The following discussion explains the rationale by which candidate sites were selected for the proposed facilities evaluated in this EIS (Ucak and Noller 1990). TE TC

DOE proposes to consolidate several waste processing facilities in a waste treatment complex. The close proximity of the facilities would allow sharing of some equipment and infrastructure. Utilities such as water, process steam, and electrical supplies, and emergency response capabilities such as stand-by power supplies, spill cleanup equipment and personnel, and supplies of water for fighting fires could be shared to eliminate redundancies and provide economies of scale. In addition, secondary waste treatment (such as wastewater treatment capacity) could be provided to meet the needs of facilities located in the waste treatment complex. TE TE

Potential siting of the waste treatment complex involved identifying candidate sites based on their proximity to the existing waste treatment, storage, and disposal facilities and to the waste generators. The siting evaluation then considered additional criteria including the available acreage, possibility of acquiring SRS site use approval (permission to use the site for waste management facilities in lieu of other potential uses for the same location), and topography. The available acreage needs to be sufficient

TE to accommodate current needs and future growth. Site topography was evaluated for engineering preparation, drainage, and forest clearing requirements.

TE The 600-acre site north and west of F-Area was selected on the basis of its close proximity to existing SRS facilities and infrastructure and because surveys had determined that it had no archaeological resources or threatened and endangered species (Ucak and Noller 1990). E-Area includes the past and current SRS waste disposal facilities and is anticipated to remain under DOE control. Contaminated soils and groundwater associated with past disposal activities in this area are being addressed under the environmental restoration program.

By siting the facilities in E-Area as close as possible to existing facilities that are currently generating the waste, DOE would minimize the potential exposure to workers and the general public. Most of the SRS TC waste is in E-, F-, and H-Areas. Siting new facilities close to these areas would minimize the potential for an accident and for occupational exposure by reducing the distances that wastes would be transported and limiting most of the transportation to dedicated roadways. E-Area is centrally located within SRS; hence, conducting activities there minimizes exposure to the general public. The roads and railroads serving this location have already been constructed and the area contains approximately 70 acres of land that has been previously cleared, graded, stabilized, and fenced. This area is large enough to construct facilities to manage most of the waste volume under the expected waste forecast.

TE RCRA regulations that govern site selection for hazardous and mixed waste management facilities include restrictions relating to seismic considerations, floodplains, and recharge zones (40 CFR 264.18). SCDHEC has promulgated Hazardous Waste Management Location Standards (R.61-104) pursuant to the South Carolina Hazardous Waste Management Act that impose additional restrictions on the siting of hazardous and mixed waste management facilities at SRS. DOE must demonstrate compliance with the siting standards under RCRA and R.61-104 as part of the permitting process for hazardous and mixed waste management facilities. DOE has submitted a location standards compliance demonstration for the Hazardous Waste/Mixed Waste Disposal Vaults for SCDHEC's review and approval. The 600-acre site north and west of F-Area has also been considered in two other SRS location standards compliance demonstrations.

TE In selecting sites for the facilities, every effort was made to avoid wetlands, sensitive species, steep slopes, exceptional wildlife habitat, established forest, and archaeological sites. In some instances this could not be done. Some 70-year-old upland hardwood sites would be required to provide sites for sediment catchment basins and stormwater management ponds downslope from the facilities. Some facilities would be placed in 60- to 70-year-old longleaf pine stands and would result in the loss of the habitat and those species currently inhabiting those sites.

Under the no-action alternative, which continues current practices to manage waste, DOE would:

- Continue waste minimization activities as described in Section 2.2.1.
- Continue receiving and storing liquid high-level waste in the F- and H-Area tank farms.
- Remove from service tank systems and components that do not have complete secondary containment.
- Continue operating existing evaporators.
- Continue removing high-level waste from tanks and preparing it for treatment in the Defense Waste Processing Facility. TE
- Continue operating the F/H-Area Effluent Treatment Facility.
- Continue to construct and then operate the Replacement High-Level Waste Evaporator.
- Implement final construction, startup testing, and operation of the New Waste Transfer Facility.
- Continue to dispose of suspect soils in the engineered low-level trench until its capacity is reached, then send suspect soil to shallow land disposal in slit trenches. TC
- Continue to compact some low-activity waste to reduce its volume.
- Continue to dispose of low-activity waste in the low-activity waste vaults. TC
- Continue to dispose of intermediate-activity waste, both tritiated and nontritiated, in the intermediate-level waste vaults.
- Continue to store long-lived process water deionizers and other long-lived wastes in the long-lived waste storage building.

- Continue to store naval hardware on the storage pads in E-Area pending completion of the radiological performance assessment and subsequent shallow land disposal.

- Continue to receive and store hazardous waste in six existing storage facilities.

- Continue to treat and dispose of hazardous waste offsite.

- Continue to treat and dispose of PCB waste offsite.

- Continue to collect hazardous waste for recycling or resale.

- Continue to treat hazardous aqueous liquids generated from groundwater monitoring well operations (investigation-derived wastes) in the M-Area Air Stripper.

- Continue to receive and store mixed waste in existing storage buildings, existing tanks, and on existing storage pads.

- Continue to receive, store, and treat by an ion exchange process the aqueous mixed waste in existing storage tanks at the Savannah River Technology Center.

- Continue to receive and store mixed waste (PUREX solutions) in the existing solvent storage tanks in E-Area until the tanks are replaced with new tanks in H-Area and solvent wastes are transferred to the new tanks.

- Continue to store mixed waste in tanks at the M-Area Process Waste Interim Treatment/Storage Facility.

- Store benzene in the Defense Waste Processing Facility Organic Waste Storage Tank.

- Continue to store low-level PCB wastes until they are shipped offsite for treatment of the PCB waste fraction. Dispose of residuals returned from the treatment of radioactive PCBs by shallow land disposal.

- Continue to accumulate radioactive oil at the individual sites throughout SRS where it is generated.

- Continue to treat mixed waste aqueous liquids collected from groundwater monitoring well operations (investigation-derived waste) in the F/H-Area Effluent Treatment Facility.

- Treat filters generated at In-Tank Precipitation by acid leaching and placement in specially designed boxes that meet disposal criteria in accordance with the EPA-approved treatability variance.

- Construct and operate the M-Area Vendor Treatment Facility for vitrification of certain wastes generated by M-Area electroplating operations.

- Receive and store mixed waste in the most recently constructed mixed waste storage building (which has not yet been used).

- Construct additional mixed waste storage buildings as necessary to meet the demand for mixed waste storage.

- Dispose of mixed waste in the planned RCRA-permitted disposal vaults that will be constructed once the permit is approved.

- Continue constructing the Consolidated Incineration Facility.

- Construct additional Defense Waste Processing Facility organic waste storage tanks as necessary to meet the demand for benzene storage.

- Receive and store organic and aqueous liquid waste in planned storage tanks, with additional tanks constructed as necessary.

- Store transuranic and alpha waste on transuranic waste storage pads.

- Retrieve the drums of transuranic waste stored in earthen mounds on Transuranic Waste Storage Pads 2 through 6.

- Assay containers at the Experimental Transuranic Waste Assay Facility/Waste Certification Facility.

- Certify newly generated nonmixed alpha wastes for disposal in the low-activity waste vaults. TC

- Construct additional storage facilities (new transuranic waste storage pads) to accommodate the projected waste volumes.

2.2.7.1 Storage

DOE would continue to store wastes at the following facilities:

- 1 long-lived low-level waste storage building in E-Area
- 3 hazardous waste storage buildings in N- and B-Areas
- 3 hazardous waste storage pads in N-Area
- 4 mixed waste storage buildings in N-, M-, and E-Areas
- 3 mixed waste storage pads in E-Area
- 2 solvent storage tanks in E-Area (to be replaced by 4 solvent storage tanks in H-Area)
- 1 organic waste storage tank associated with the Defense Waste Processing Facility
- 10 Savannah River Technology Center mixed waste tanks in A-Area
- 10 mixed waste storage tanks in M-Area
- 1 proposed mixed waste storage pad in M-Area
- 19 transuranic (and alpha) waste storage pads in E-Area

TC

Under the no-action alternative, DOE would need to construct additional waste storage facilities to accommodate the forecast 30-year waste generation. These facilities include:

- 24 long-lived low-level waste storage buildings
- 291 mixed waste storage buildings
- 19 transuranic (and alpha) waste storage pads
- 4 organic waste storage tanks associated with the Defense Waste Processing Facility
- 26 organic waste storage tanks in E-Area
- 43 aqueous waste storage tanks in E-Area

TC

2.2.7.2 Treatment

DOE would continue ongoing or planned waste treatment at the Savannah River Technology Center, M-Area Vendor Treatment Facility, F/H-Area Effluent Treatment Facility, M-Area Air Stripper, Defense Waste Processing Facility and associated high-level waste management facilities, and the three existing low-level waste compactors.

2.2.7.3 Disposal

Under the no-action alternative, DOE would construct disposal facilities for mixed and low-level wastes. To accommodate the forecast 30-year waste generation, the following additional facilities would be required:

- 29 slit trenches [1,100 cubic meters (38,800 cubic feet) of usable capacity]
- 10 low-activity waste vaults [30,500 cubic meters (1.08×10^6 cubic feet) of usable capacity]
- 5 intermediate-level waste vaults [5,300 cubic meters (187,000 cubic feet) of usable capacity]
- 1 RCRA-permitted disposal vault [2,300 cubic meters (81,200 cubic feet) of usable capacity]

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Figure 2-14 shows a timeline for the on-going or planned waste management activities that would occur under the no-action alternative. For all waste types except high-level waste, the ongoing and planned waste management activities that would occur are shown in Figure 2-15.

TC

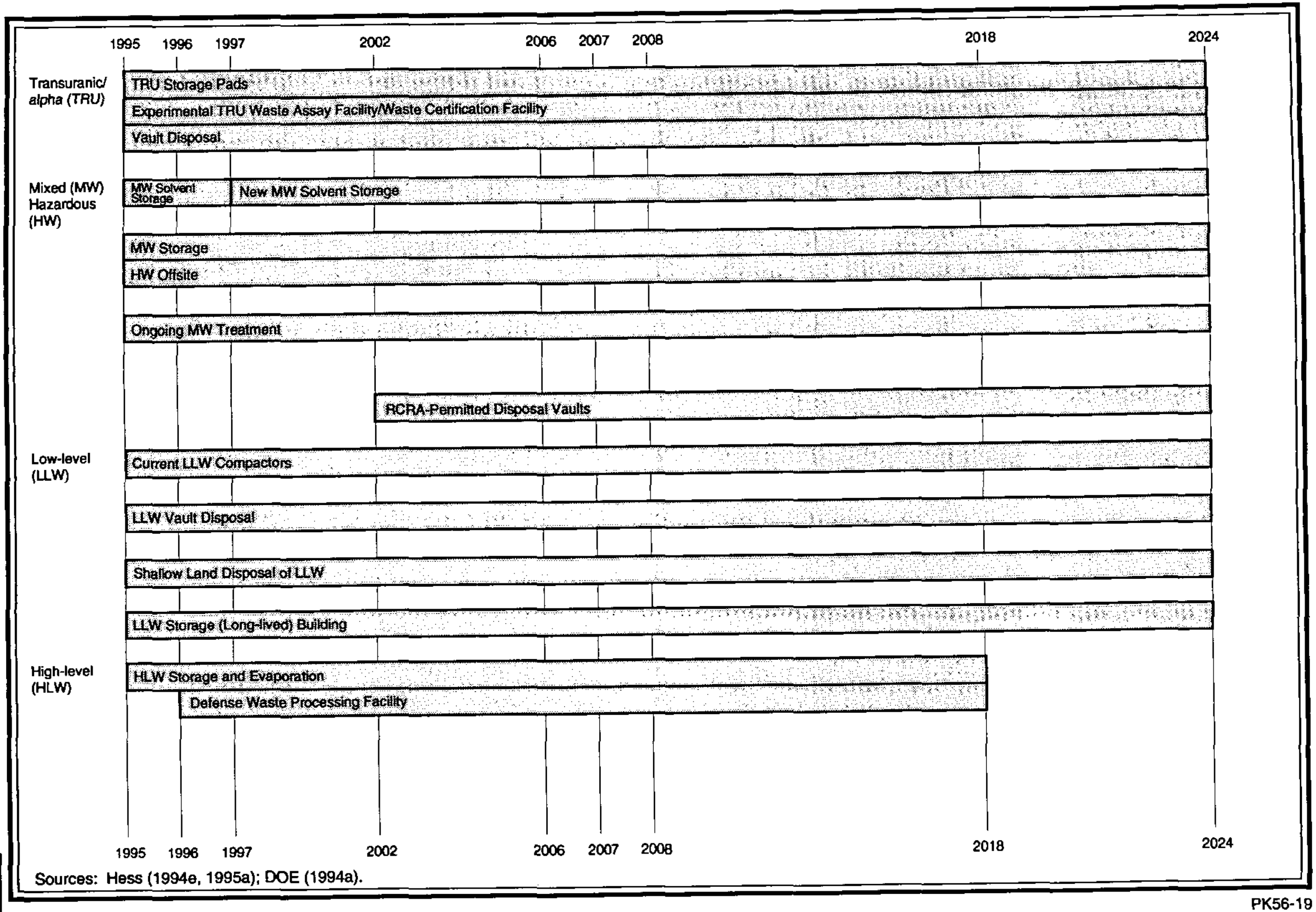

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Figure 2-14. Timeline for waste management facilities in the no-action alternative.

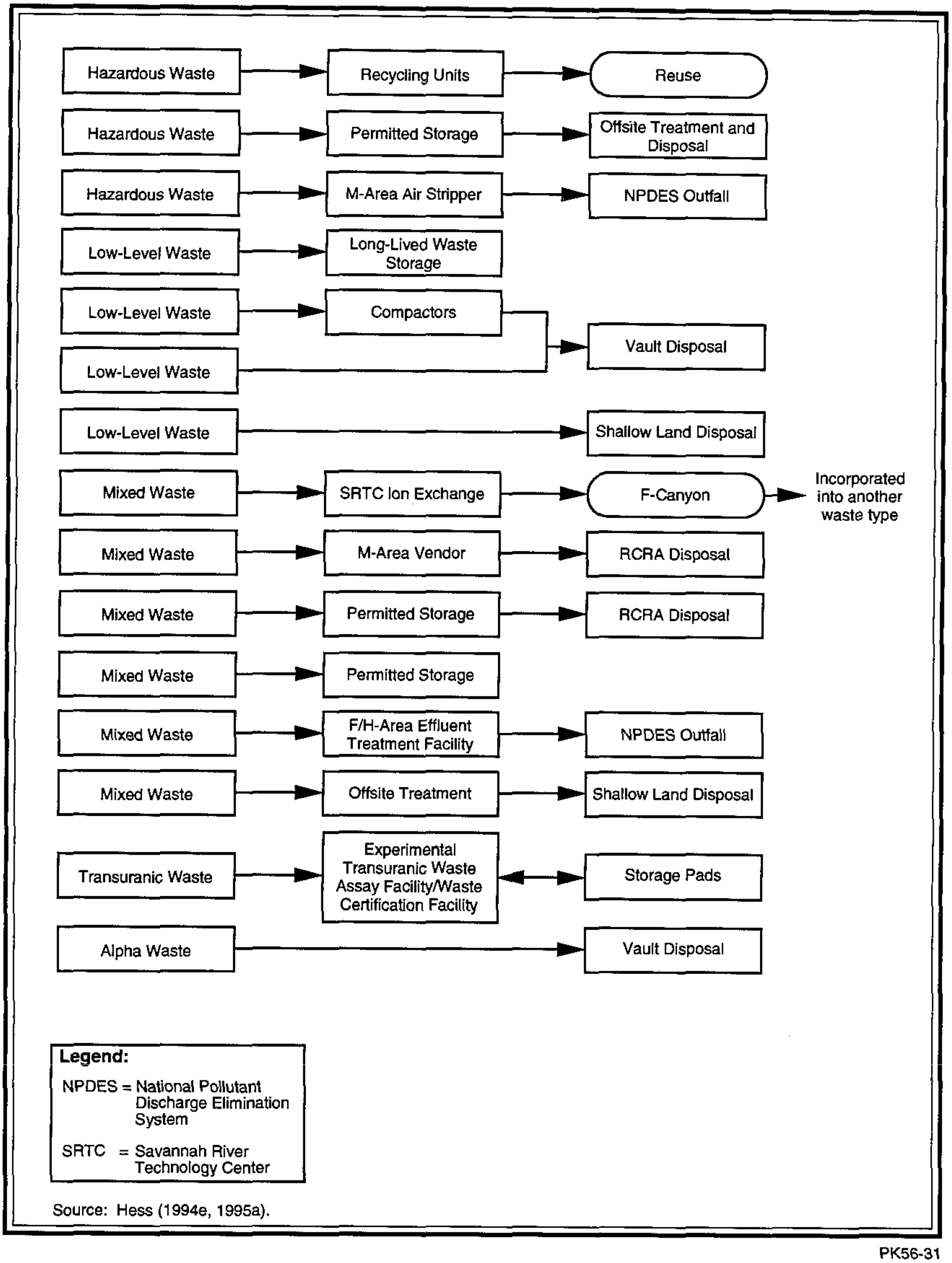

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Figure 2-15. Summary of waste management activities in the no-action alternative .

2.3 Screening and Selecting Waste Management Technologies

This section describes the processes and methodologies used to evaluate and screen various technologies for treating, storing, and disposing of low-level radioactive, transuranic, mixed, and hazardous wastes that SRS may manage in the 30-year period from 1995 through 2024. DOE must evaluate and select technologies because continuation of current waste management practices (i.e., the no-action alternative) would not allow DOE to comply with environmental requirements. DOE did not evaluate alternative technologies to treat, store, or dispose of liquid high-level radioactive waste because, as identified in Section 2.2, vitrification of high-level waste in the Defense Waste Processing Facility was analyzed in the *Final Supplemental Environmental Impact Statement Defense Waste Processing Facility*. Section 2.3.1 presents the technologies assessed for potential application to the treatability groups of various low-level radioactive and transuranic waste.

The evaluation of mixed wastes (both low-level and transuranic) in this EIS is an extension of the process of evaluating treatment options as documented in the *SRS Proposed Site Treatment Plan*. The site treatment plan addresses the treatment of mixed wastes over the next 5 years only, as required by RCRA and the Federal Facility Compliance Act (P.L. 102-386). This EIS, however, evaluates a 30-year period, and thus must consider both wastes and potential technologies not considered in the site treatment plan. For example, large volumes of soils containing mixed waste are forecasted to be generated from environmental restoration (1995 through 2024) in this EIS, but only limited quantities of these soils were forecast in the 5 years (1995 through 1999) considered by the site treatment plan. Furthermore, DOE did not evaluate technologies to treat transuranic mixed wastes in the site treatment plan. The plan does describe the various transuranic waste treatment studies that are under way to evaluate potential technologies, but does not specifically evaluate these technologies to identify a preferred option to treat transuranic mixed wastes to meet the Waste Isolation Pilot Plant waste acceptance criteria. Alternative technologies to treat, store, or dispose of the transuranic waste treatability groups (including mixed transuranic and mixed alpha wastes) are evaluated in this EIS. The *Treatment Selection Guides* (DOE 1994c), which document the overall technology selection process used by DOE in developing site treatment plans, guided the further screening of technologies considered in this EIS for these wastes, as presented in Section 2.3.2.

Hazardous waste is currently transferred to and managed at permitted treatment and disposal facilities outside of SRS, and this practice would continue, except for hazardous wastes amenable to processing in onsite facilities that treat mixed wastes with similar hazardous characteristics and have excess capacity and thus can accept these wastes. Section 2.3.2 identifies these facilities.

Although technology assessments first focused on specific waste treatability groups, DOE realized that some technologies were applicable to a range of groups. Furthermore, applying these technologies, in either existing or new facilities, to several waste groups would provide both economic and environmental advantages. Section 2.3.3 presents the derivation of and bases for these associations of waste groups for treatment by specific technologies.

2.3.1 SCREENING PROCESS FOR LOW-LEVEL AND TRANSURANIC WASTE

DOE used a structured, three-step screening process to identify possible technologies, select potential candidates, and choose reasonable technologies for various low-level and transuranic wastes. Wastes were aggregated into groups having common treatment, storage, and disposal requirements. Section 2.3.1.1 describes the process for identifying the possible technologies. The methods and criteria DOE used to assess them are presented in Section 2.3.1.2 for low-level waste and Section 2.3.1.3 for transuranic waste.

The screening process examined many technologies capable of remediating the individual treatability groups, and identified those that were viable from the perspectives of safety and environmental risk, cost, regulatory compliance, ability to meet functional need and performance expectations, and public acceptance. DOE then assembled for integration the technologies identified for low-level waste with similarly identified technologies for mixed and hazardous wastes. Figure 2-16 shows the screening process DOE used to identify the "menu" of reasonable technologies for low-level waste treatability groups. Although Figure 2-16 is based on low-level waste treatability groups, DOE screened the same technologies to select potential and then reasonable technologies for groups of transuranic waste. TE

2.3.1.1 <u>Identification of Possible Technologies</u>

The first step in the screening process was to identify possible technologies to treat, store, and dispose of low-level and transuranic wastes. A group of experts participated in an intensive brainstorming workshop. The group included representatives from all areas of SRS: facility managers, scientists from the Savannah River Technology Center doing research on remediation, engineers, technology developers, and technology consultants. DOE also consulted with various experts at other Federal agencies, state governments, universities, and the private sector, as appropriate.

The workshop generated a list of 85 possible technologies for managing these wastes. Table 2-14 identifies the 85 technologies. This list includes "storage" and three direct disposal technologies

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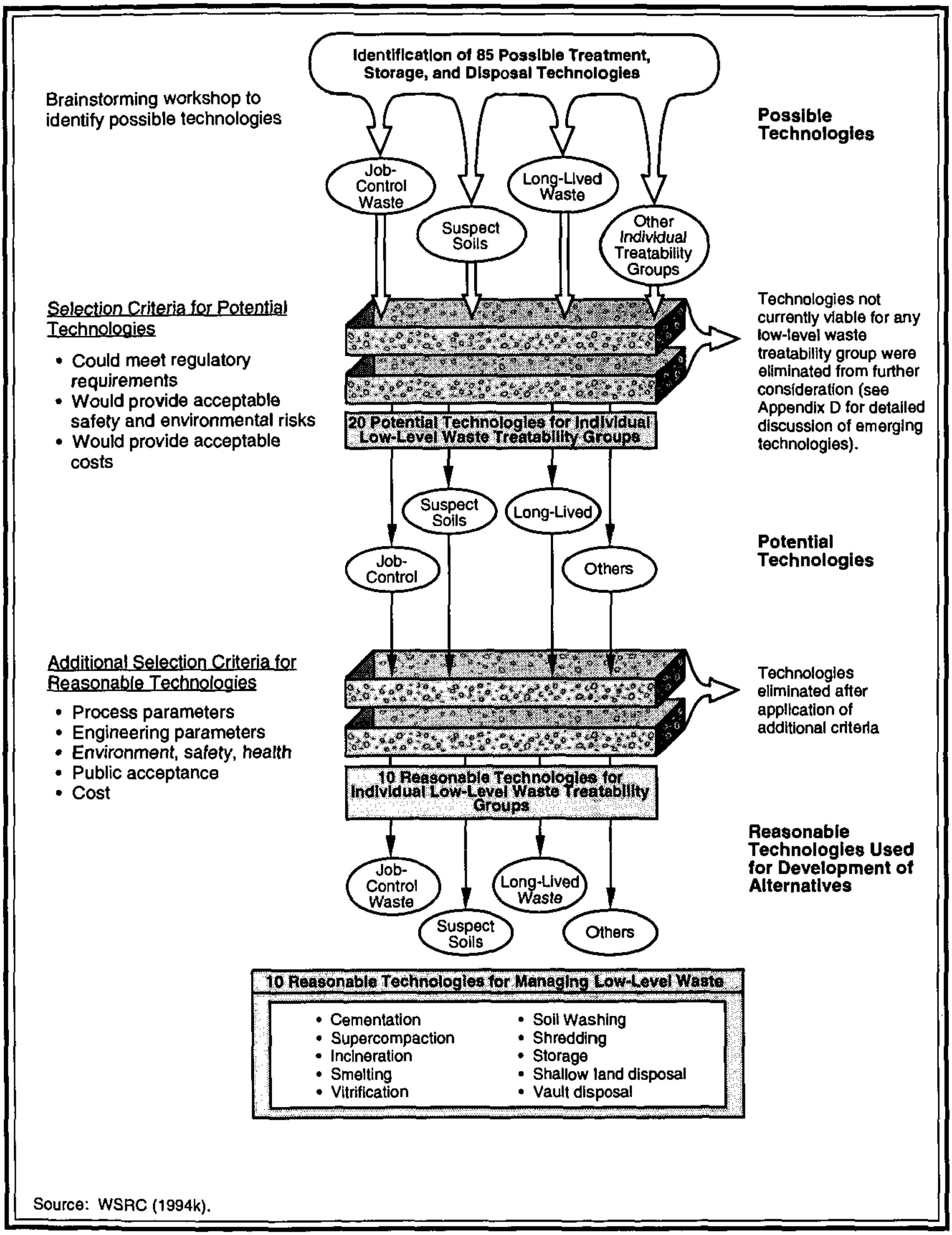

TE

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Figure 2-16. Technology screening process for low-level waste treatability groups. The same technology screening process was applied to transuranic waste treatability groups.

Table 2-14. Possible technologies to manage low-level and transuranic waste.[a]

Abrasive blasting	Microwave
Absorption	Molten glass
Acid/base digestion, solids dissolution	Molten salt destruction
Activated sludge	Neutralization
Advanced electrical reactor	Oil/water separation
Aerobic bio treatment	Oxidation by H_2O_2
Air stripping	Ozonation
Alkali metal dechlorination	Phase separation
Alkali metal/polyethylene glycol	Plasma torch
Alkaline chlorination	Polymerization
Amalgamation	Pyrolysis
Anaerobic digestion	Recycle
Asphalt-based microencapsulation	Repackage/containerize
Bio-reclamation	Reverse osmosis
Blast furnaces	Roasting/retorting
Carbon adsorption	Rotary kiln incineration
Catalytic dehydro chlorination	Rotating bio contactors
Cementation	Scarification/grinding/planing
Centrifugation	Sealing
Chelation	Sedimentation
Chemical hydrolysis	Shallow land disposal
Chemical oxidation/reduction	Shredding/size reduction
Chemical precipitation	Smelting
Circulating bed combustion	Soil flushing/washing
Compaction	Solvent extraction
Crystallization	Sorption
Dissolved air flotation	Sorting/reclassifying
Distillation	Spalling
Electrodialysis	Steam stripping
Evaporation	Storage
Filtration	Supercompaction
Flocculation	Supercritical extraction
Fluidized bed incinerator	Supercritical water oxidation
Heavy media separation	Thermal desorption
High pressure water steam/spray	Ultraviolet photolysis
High-temperature metal recovery	Vault disposal
Industrial boilers	Vibratory finishing
Industrial kilns	Vitrification
Ion exchange	Waste Isolation Pilot Plant disposal
Lime-based pozzolans	Water/washing spraying
Liquid injection incinerators	Wet air oxidation
Liquid/liquid extraction	White rot fungus
Macroencapsulation	

TC

a. Source: WSRC (1994k).

(shallow land disposal, vault disposal, and Waste Isolation Pilot Plant disposal) in which the waste is sent directly to a disposal unit without treatment. Table D.1 of Appendix D describes the 81 possible treatment technologies. The following sections describe the evaluation of these technologies for low-level and transuranic wastes.

2.3.1.2 Selection of Potential and Reasonable Technologies for Low-Level Waste

Before the technologies could be matched to low-level wastes for evaluation, DOE combined low-level wastes into groups that had common treatment, storage, and disposal requirements. Twelve waste categories were defined for low-level waste, as described in Section 2.1 (WSRC 1994k). Table 2-15 presents the application of the 85 possible management technologies to the 12 waste categories. Note that each of the potential treatment technologies accomplish one (or more) of three functions: "decontamination" to separate the radioactive constituents from the other components of the waste; TE "volume reduction" to reduce the size of material requiring management; and "stabilization" to immobilize radioactive materials. DOE screened the technologies to determine which had the best potential for success; a technology had to meet the following criteria to be deemed a potential technology:

- It could reasonably be expected to work on SRS wastes and meet regulatory requirements.
- It would pose acceptable safety and environmental risks.
- Its costs were comparable to other possible technologies.

Application of these criteria eliminated most of the technologies, many of which are emerging technologies not suitable for detailed evaluation at this time. The other reason for eliminating TE technologies in the potential technology screening step was that they would be ineffective for either decontaminating, reducing the volume of, or stabilizing low-level waste. Table 2-15 identifies 20 potential technologies that were selected based on the criteria. In certain instances, these potential technologies are subsets of the same source technology (e.g., compaction and supercompaction); in other instances, the source technology is expanded to meet the needs of the treatability group (e.g., storage was expanded to storage/venting for tritiated soils). As another example, decontamination could be achieved by applying one of several technologies, such as distillation, reverse osmosis, or steam stripping. Some technologies (e.g., vitrification) could be applied to many low-level waste treatability groups, while others (e.g., decontamination) have limited applications (Table 2-15).

TE

Table 2-15. Potential and reasonable technologies for managing low-level waste.[a]

Offsite job-control waste		Low-activity job-control waste		Intermediate-activity job-control waste	
Potential	Reasonable[b]	Potential	Reasonable	Potential	Reasonable
Acid/base digestion	Shallow land disposal (after stabilization) (1)	Acid/base digestion	Cementation (3)	Acid/base digestion	Cementation
Cementation	Vault disposal (2)	Cementation	Supercompaction (4)	Cementation	Supercompaction
Compaction		Compaction	Incineration (5)	Compaction	Incineration
Supercompaction		Supercompaction	Vitrification (6)	Supercompaction	Shallow land disposal (after stabilization)
Microwave		Microwave	Shallow land disposal (after stabilization)	Microwave	Vault disposal
Plasma torch		Plasma torch	Vault disposal	Plasma torch	Vitrification
Incineration		Incineration		Incineration	
Shallow land disposal (after stabilization)		Shallow land disposal (after stabilization)		Shallow land disposal (after stabilization)	
Smelting		Smelting		Smelting	
Vault disposal		Vault disposal		Vault disposal	
Vitrification		Vitrification		Vitrification	
Washing		Washing		Washing	

Long-lived spent deionizer waste		Other long-lived waste		Tritiated job-control waste	
Potential	Reasonable	Potential	Reasonable	Potential	Reasonable
Cementation	Cementation	Cementation	Cementation	Acid/base digestion	Cementation
Shallow land disposal (after stabilization)	Storage (7)	Shallow land disposal (after stabilization)	Storage	Cementation	Supercompaction
Storage		Storage	Vitrification	Compaction	Incineration
Vault disposal		Vault disposal		Supercompaction	Shallow land disposal
Vitrification		Vitrification		Microwave	Vault disposal
				Plasma torch	Vitrification
				Incineration	
				Shallow land disposal[c]	
				Smelting	
				Vault disposal	
				Vitrification	
				Washing	

Table 2-15. (continued).

Suspect soil		Low-activity soil		Tritiated soil	
Potential	Reasonable	Potential	Reasonable	Potential	Reasonable
Cementation	Cementation	Cementation	Cementation	Cementation	Cementation
Repackage/Containerize	Soil washing (8)	Repackage/Containerize	Soil washing	Incineration	Shallow land disposal (after stabilization)
Soil washing	Shallow land disposal	Soil washing	Shallow land disposal (after stabilization)	Repackage/Containerize	Vault disposal
Shallow land disposal	Vault disposal	Shallow land disposal (after stabilization)	Vault disposal	Soil washing	
Vault disposal		Vault disposal	Vitrification	Shallow land disposal (after stabilization)	
Vitrification		Vitrification		Storage/venting	
				Vault disposal	
				Vitrification	

Tritiated equipment		Naval hardware		Low-activity equipment	
Potential	Reasonable	Potential	Reasonable	Potential	Reasonable
Cementation	Supercompaction	Cementation	Shallow land disposal	Cementation	Cementation
Supercompaction	Shred/size reduction/ cementation (9)	Decontamination	Vault disposal	Decontamination	Supercompaction
Plasma torch	Shallow land disposal (after stabilization)	Repackage/Containerize		Supercompaction	Smelting (10)
Recycle	Vault disposal	Shredding/size reduction		Repackage/Containerize	Shallow land disposal (after stabilization)
Repackage/Containerize		Shallow land disposal		Size reduction	Vault disposal
Shredding/size reduction		Smelting		Shallow land disposal (after stabilization)	
Shallow land disposal (after stabilization)		Storage		Smelting	
Smelting		Vault disposal		Storage	
Storage				Vault disposal	
Vault disposal					

a. Source: WSRC (1994k).
b. Numbers in parentheses show the 10 reasonable technologies chosen.
c. Indicates shallow land disposal without prior stabilization of waste.

Many of the innovative technologies that were not selected are undergoing full- or pilot-scale demonstration programs and could provide additional options for waste management in the future. Appendix D summarizes innovative and emerging technologies that were eliminated from detailed consideration at this time. Many of these technologies were eliminated because they are not commercially available, have not been proven to work on the waste types at SRS, or are not economically or technically viable at this time. This EIS supports future sitewide programmatic decisions based on a 30-year forecast of waste generation, but the analyses performed support project-level decisions on the construction and operation of specific treatment, storage, and disposal facilities only within the near term (10 years or less). Some of the emerging technologies may prove viable in the future (i.e., beyond the next 10 years) and may be chosen for more detailed design and operations analyses later.

In the next step, DOE screened the 20 potential technologies for their appropriateness for low-level and transuranic waste treatability groups using more detailed evaluation criteria. The process consisted of scoring each of the remaining 20 technologies based on selected attributes of five criteria. Each attribute of each criterion was weighted in a way similar to that used in the site treatment plan, and the technology was assigned a score based on how well it meets the goals of the attribute of each criterion. The attribute weight was multiplied by the technology score to get a net score for each attribute for each technology. The net scores were then summed, with the higher scores identifying the more desirable technologies. The weighting and scoring guides are shown below:

Criteria: Attribute	Weight of each element[a]	Score		
		3	2	1
Process Parameters:				
Volume alteration	3	Decreased	Maintained	Increased
Secondary waste forecast	2	Minimal	Treatable	Untreatable
Decontamination and demobilization efficiency	3	Decontaminated and demobilized	Reduces contamination or mobility	No change
Engineering Parameters:				
System implementability	2	In full-scale operation	Not in full-scale operation	Not evaluated for treatability group
Availability	1	Exists onsite	Other DOE site or vendor	No full-scale operating facility
Maintainability	1	Simple or no maintenance	Less than 25% downtime	More than 25% downtime

Criteria: Attribute	Weight of each element[a]	Score		
		3	2	1
Environment, Safety, and Health:				
Risk to offsite population and Environment	3	Lower third of technologies evaluated	Middle third of technologies evaluated	Upper third of technologies evaluated
Operational worker health and safety considerations	2	Less than 10 workers	10-20 workers	More than 20 workers
Transportation risk	1	No transportation	Onsite transportation	Offsite transportation
Public Acceptance	3	Acceptable	Neutral	Not acceptable
Cost	4	Lower third of technologies evaluated	Middle third of technologies evaluated	Upper third of technologies evaluated

a. The weight of each element is a qualification of the relative importance of each attribute. For example, volume alteration, decontamination and demobilization efficiency, risk to offsite population and environment, and public acceptance are equally important, and each is more important than any other attribute except cost.

Source: WSRC (1994k).

As an example, Table 2-16 applies the scoring procedure to the incineration of intermediate-activity job-control waste.

Application of these additional criteria resulted in the identification of 10 reasonable technologies. The 10 reasonable technologies are identified in Figure 2-16 and Table 2-15 and are described in greater detail in Appendix B. Reasons for eliminating certain technologies for particular treatability groups included immature technology (e.g., plasma torch for tritiated equipment), a large or untreatable secondary waste stream (e.g., vitrification of long-lived spent deionizer resin), and being ineffective for a particular waste stream matrix (smelting of offsite job-control waste).

2.3.1.3 Selection of Potential and Reasonable Technologies for Transuranic Waste

Table 2-17 presents the 85 possible waste management technologies and their application to transuranic waste treatability groups. DOE combined the transuranic wastes into nine waste categories based on their alpha activity levels, their curie content, and the type of waste (e.g., job-control waste). After characterization (a process of reexamining and analyzing the contents of packaged transuranic wastes currently in storage), much of the waste that is currently managed as transuranic waste would be

Table 2-16. Example of scoring the incineration technology for intermediate-activity job-control waste.[a]

Criteria/Attribute	Weighting Factor	Score	Net Score	Discussion/Notes
In-depth options analysis for reasonable options				
Waste category: Intermediate-activity job-control waste				Process being evaluated: Incineration
Process Parameters				
Volume alteration	3	3	9	Assumed 8 to 1 reduction in initial waste volumes after stabilization of both treated and secondary wastes.
Secondary waste generation	2	3	6	Secondary waste easily treated using currently available technologies.
Decontamination and demobilization efficiency	3	2	6	No destruction or removal of contaminants. Decreased mobility due to stabilization of both treated and secondary wastes.
Engineering Parameters				
System implementability	2	3	6	Incineration of intermediate-activity job-control waste is a well demonstrated and proven technology.
Availability	1	3	3	Facility being built onsite. Commercially available incinerators exist offsite.
Maintainability	1	1	1	Assume 50 percent downtime for maintenance and batching of waste.
Environmental, Health, and Safety				
Risks to offsite population/environment	3	1	3	Increased potential for accidents. Inventory control minimizes impacts of a release due to an accident. Ranks in upper third of technologies evaluated.
Operational worker health and safety	2	1.5	3	More than 20 workers; increased handling and processing and increased system complexity.
Transportation risk	1	2	2	Onsite transportation required.
Public Acceptance				
Public acceptance	3	1.5	4.5	Concern because treatment is a high-temperature process, yielding emissions, though minimal.
Cost Considerations				
Costs developed according to draft site treatment plan	4	2	8	Cost of technology is in the middle third for technologies selected for this waste.
Total	25		51.5	
Total Technical Weighted Score				
Actual score excluding cost	[43.5] ×			
Factor to adjust max score to 100	[100] ÷			
Max possible score excluding cost	[21×3] =	69.05		
Total Weighted Score				
Actual score	[51.5] ×			
Factor to adjust max score to 100	[100] ÷			
Max possible score	[25×3] =	68.67		

a. Source: Hess (1994a).

Table 2-17. Potential and reasonable technologies for transuranic waste.[a]

Alpha job-control waste		Mixed-alpha job-control waste		Transuranic job-control waste less than 0.5 curie per drum	
Potential	Reasonable	Potential	Reasonable	Potential	Reasonable
Acid/base digestion	Cementation (1)	Acid/base digestion	Cementation	Acid/base digestion	Cementation
Cementation	Supercompaction (2)	Cementation	(Characterize)/repackage	Cementation	Supercompaction
(Characterize)/repackage	(Characterize)/repackage (3)	(Characterize)/repackage	Incineration	(Characterize)/repackage	(Characterize)/repackage
Compaction	Incineration (4)	Compaction	RCRA disposal (8)	Compaction	Incineration
Decontamination	Shallow land disposal (after stabilization) (5)	Decontamination	Storage (9)	Decontamination	Storage
Incineration	Vault disposal (6)	Incineration	Vitrification	Incineration	Vitrification
Plasma torch	Vitrification (7)	Plasma torch	Waste Isolation Pilot Plant disposal (10)	Plasma torch	Waste Isolation Pilot Plant disposal
Shallow land disposal (after stabilization)		RCRA disposal		Storage	
Supercompaction		Storage		Supercompaction	
Vault disposal		Supercompaction		Vitrification	
Vitrification		Vitrification		Waste Isolation Pilot Plant disposal	
		Waste Isolation Pilot Plant disposal			

Mixed transuranic job-control waste less than 0.5 curie per drum		Transuranic job-control waste greater than 0.5 curie per drum		Mixed transuranic job-control waste greater than 0.5 curie per drum	
Potential	Reasonable	Potential	Reasonable	Potential	Reasonable
Acid/base digestion	Cementation	Acid/base digestion	Cementation	Acid/base digestion	Cementation
Cementation	Supercompaction	Cementation	Supercompaction	Cementation	Supercompaction
(Characterize)/repackage	(Characterize)/repackage	(Characterize)/repackage	(Characterize)/repackage	(Characterize)/repackage	(Characterize)/repackage
Compaction	Incineration	Compaction	Incineration	Compaction	Incineration
Decontamination	Storage	Decontamination	Storage	Decontamination	Storage
Incineration	Vitrification	Incineration	Vitrification	Incineration	Vitrification
Plasma torch	Waste Isolation Pilot Plant disposal	Plasma torch	Waste Isolation Pilot Plant disposal	Plasma torch	Waste Isolation Pilot Plant disposal
Storage		Storage		Storage	
Supercompaction		Supercompaction		Supercompaction	
Vitrification		Vitrification		Vitrification	
Waste Isolation Pilot Plant disposal		Waste Isolation Pilot Plant disposal		Waste Isolation Pilot Plant disposal	

Table 2-17. (continued).

Transuranic equipment		Mixed transuranic equipment		Remotely handled transuranic and mixed transuranic	
Potential	Reasonable	Potential	Reasonable	Potential	Reasonable
Acid/base digestion	Cementation	Acid/base digestion	Cementation	Acid/base digestion	Cementation
Cementation	Supercompaction	Cementation	(Characterize)/repackage	Cementation	Supercompaction
(Characterize)/repackage	(Characterize)/repackage	(Characterize)/repackage	Incineration	(Characterize)/repackage	(Characterize)/repackage
Compaction	Incineration	Compaction	RCRA disposal	Compaction	Incineration
Decontamination	Shallow land disposal (after stabilization)	Decontamination	Storage	Decontamination	Storage
Incineration	Vault disposal	Incineration	Vitrification	Incineration	Vitrification
Plasma torch	Vitrification	Plasma torch	Waste Isolation Pilot Plant disposal	Plasma torch	Waste Isolation Pilot Plant disposal
Shallow land disposal (after stabilization)		RCRA disposal		Storage	
Supercompaction		Storage		Supercompaction	
Vault disposal		Supercompaction		Vitrification	
Vitrification		Vitrification		Waste Isolation Pilot Plant disposal	
		Waste Isolation Pilot Plant disposal			

a. Source: Hess (1994a).

reclassified as alpha waste or mixed alpha waste because the characterization will confirm that the wastes have activity levels between 10 and 100 nanocuries per gram (referred to as "alpha waste" in this TE EIS). Nine waste categories were defined for transuranic and alpha waste (WSRC 1994k), as described in Section 2.1.

TE The evaluation process described in Section 2.3.1.2 was applied to transuranic and alpha waste categories to select potential and reasonable treatment, storage, and disposal technologies. Again, most of the technologies were eliminated in the first screening step. Table 2-17 identifies 14 potential technologies. Of the potential technologies, acid/base digestion, compaction (but not supercompaction), decontamination, and plasma torch were eliminated in the selection of reasonable technologies. Many of the reasonable technologies for transuranic waste, which are described in greater detail in Appendix B, are the same as those selected for low-level waste (Tables 2-15 and 2-17).

TE There is little difference in the reasonable technologies for transuranic waste among the categories, except for the method of disposal. The alpha waste would be disposed of as low-level waste by shallow land disposal or vault disposal. Mixed alpha waste would be disposed of onsite in a RCRA-permitted disposal facility (e.g., shallow land disposal or vault disposal). The fractions of job-control waste that contain greater than or equal to 100 nanocuries per gram would be treated to meet waste acceptance criteria and shipped to the Waste Isolation Pilot Plant for disposal.

2.3.2 SCREENING PROCESS FOR MIXED AND HAZARDOUS WASTES

This section describes the screening process used to identify possible technologies, select potential technologies, and select reasonable technologies for the treatment of mixed and hazardous wastes.

TE DOE based the screening process for mixed wastes primarily on the analyses done for the *SRS Draft Site Treatment Plan* (DOE 1994d), which identifies treatment options for 59 waste streams. Prior to evaluating options for the site treatment plan, DOE determined that a number of wastes required no further evaluation. Twenty-five wastes already had existing or planned treatment programs in the SRS waste management plan. Three wastes were consolidated for purposes of options analysis and four were deleted. Furthermore, DOE did not evaluate possible technologies for the three transuranic-mixed and TE two alpha-mixed waste categories. Alternatives for these transuranic and alpha wastes are addressed in this EIS, as discussed in Section 2.3.1.3. This technology screening process identified 22 low-level mixed wastes for which further analysis of treatment options was required. The following section describes the in-depth evaluation of the remaining 22 low-level mixed wastes.

2.3.2.1 Options Analysis in the Site Treatment Plan

The SRS draft site treatment plan describes a three-step process for evaluating options for treating mixed waste: identifying feasible options; screening these options; and analyzing the most promising options in depth. The first step, identification of feasible options, resulted in a list of existing and planned facilities that were capable of treating mixed wastes. Technical personnel from each candidate facility and a group of SRS engineers and scientists evaluated these options. TE

The initial screening assessed the maturity and complexity of the technology used in each feasible option. This assessment favored simple and well-established technologies. A success-factor score was assigned to each technology and the highest-ranking options based on those scores were analyzed further; low-scoring options were rejected. The rejected technologies were unproven and could not be recommended at this time.

After identifying the better options, the in-depth analysis identified the preferred option for a given waste using a model that assigned numerical scores to a set of criteria and requirements. The options analysis model was developed from the *Treatment Selection Guides* and the *Draft Site Treatment Plan Development Framework* (DOE 1994e). The model assigned numerical scores to each attribute and applied a weighting factor based on the relative importance of the attributes to provide an overall score to rank the option. These scores were used to reduce the list of possible options to a more manageable number for further analysis and review. The final step of the options analysis was an engineering assessment that considered less quantifiable factors than those assessed by the model to identify the preferred option for each waste.

Details of the options analyses and the preferred options can be found in the SRS draft site treatment plan. DOE continues to refine the option analyses performed for the draft site treatment plan and to incorporate additional mixed waste streams as they are identified. The Options Analysis Team was formed by DOE to evaluate the preferred treatment options proposed in individual sites' draft treatment plans from a complex-wide perspective. This evaluation encompassed considerations such as requirements to develop similar treatment capability at more than one DOE site that could be met by the implementation of a single mobile treatment unit, and economies of scale in the construction and operation of treatment facilities. As a result of refinements and additions to the draft site treatment plan options analyses, the *SRS Proposed Site Treatment Plan* incorporated the changes described below. TE TE TE

The Options Analysis Team's *Proposed Changes to the Draft Site Treatment Plan Mixed Waste Treatment Configuration* (DOE 1994f) recommended alternate preferred treatment options for two SRS mixed-waste streams. DOE is investigating the potential for a small quantity (less than 1 cubic meter) of calcium metal waste to be treated using a mobile unit located at the Los Alamos National Laboratory. In addition, DOE is considering a mobile unit using a packed bed reactor technology at SRS for the treatment of tritiated oil. Tritiated oil is not amenable to treatment using any currently available technologies and, in this EIS, was proposed for continued storage pending further technology development.

In-depth options analyses were not performed for mixed alpha waste streams in the draft site treatment plan. However, DOE conducted analyses for two mixed alpha waste streams for the proposed site treatment plan. The preferred options for these waste streams are consistent with the alternatives considered in this EIS.

Twelve new mixed-waste streams were identified after the development of the draft site treatment plan:

- Four new investigation-derived wastes; the volumes and characteristics of these waste streams and their preferred treatment options would be established at a later date as part of the RCRA/Comprehensive Environmental Response, Compensation, and Liability Act remedial decisions.

- Off-specification mercury reclaimed from the Defense Waste Processing Facility that may potentially be classified as a mixed waste. The small volume (approximately 0.2 cubic meters over 5 years) could be managed like the elemental mercury waste considered in this EIS.

- Liquid high-level waste sludge and supernatant-contaminated debris from F- and H-Area tank farm operations (approximately 1,065 cubic meters over 5 years) that could be treated by acid washing at an existing SRS containment building, followed by vitrification of the spent acid solution.

- Three additional mixed waste streams (a total of approximately 24 cubic meters over 5 years) that could be treated at the Consolidated Incineration Facility.

- Noncombustible debris contaminated with toxic constituents. Small volumes of these wastes could be macroencapsulated (coated with a polymer) at the facilities that generate them or they could be accommodated by the containment building for treating mixed wastes considered in this EIS.

- One mixed-waste stream that conforms to the RCRA land disposal treatment standard for macroencapsulation in the form in which it is generated.

- One additional mixed-waste stream that could be macroencapsulated (welded into a stainless steel box) under a treatability variance. TC

Details of the options analyses and the preferred options for these wastes can be found in the *SRS Proposed Site Treatment Plan.* TC

The changes and additions described here were incorporated in the analyses presented in this EIS. DOE anticipates that many of the newly identified wastes will be generated in very small volumes. The characteristics of the additional wastes are not substantially different from wastes considered in the draft. The proposed treatment technologies are consistent with mixed waste technologies considered within the alternatives of this EIS. The following section describes how these preferred options were used in this EIS to identify reasonable technologies for managing mixed wastes. TC TE

2.3.2.2 Selection of Reasonable Technologies for Mixed and Hazardous Wastes

DOE used the options analyses performed for the SRS site treatment plan to develop the list of potential and reasonable technologies for hazardous and mixed wastes evaluated in this EIS. The preferred options identified in the *SRS Proposed Site Treatment Plan* correspond to the technologies evaluated in alternative B. TE

DOE aggregated the mixed waste into treatability groups that had common management requirements. These treatability groups consist of mixed wastes that may be managed at SRS but did not appear in the 5-year forecast used in the SRS draft site treatment plan. In other words, these new groups represent mixed wastes that SRS may manage between 2000 and 2024. The analyses performed for the site treatment plan were applied to these new treatability groups. Table 2-18 presents a summary comparison of the new treatability groups, the corresponding mixed wastes in the site treatment plan and the preferred options, and the technologies selected for consideration in this EIS. The following paragraphs describe the treatability groups and technology selections for which there is not a direct correlation between the site treatment plan and the EIS. TE

Table 2-18. Waste Management EIS and *SRS Proposed Site Treatment Plan* comparison of treatment options for low-level mixed waste.

EIS treatability group	EIS treatability group subcategories	PSTP[a] waste streams	PSTP preferred options	Reasonable EIS technologies
Glass debris		Not considered	none	Macroencapsulation Vitrification
Metal debris		Not considered	none	Macroencapsulation
Bulk equipment		Not considered	none	Macroencapsulation
Lead		Low-level waste lead	Offsite decontamination	same
		Low-level waste lead	Macroencapsulation	Macroencapsulation Vitrification
Heterogeneous debris	All heterogeneous debris including streams specifically called out in the PSTP	Not considered	none	Incineration Macroencapsulation Vitrification
		Spent filter cartridges and carbon filter media	Incineration	Incineration Vitrification
Inorganic debris	All inorganic debris including streams specifically called out in the PSTP	Not considered	none	Incineration Macroencapsulation Vitrification
		Mercury/tritium-Contaminated Equipment	Macroencapsulation	same
		Cadmium safety/control rods	Macroencapsulation	same
		ITP[b] and Late Wash filters	Treatability variance	same
		Calcium metal	Wet oxidation	same
		Toxic characteristic contaminated debris	Macroencapsulation	Macroencapsulation Vitrification
		Supernatant and sludge-contaminated debris from high-level waste operations	Extraction or Macroencapsulation	same
Organic debris	All other organic debris including streams specifically called out in the PSTP	Not considered	none	Incineration Macroencapsulation Vitrification
		Solvent contaminated debris Incinerable toxic characteristic material Plastic/lead/cadmium raschig rings	Incineration	Incineration Vitrification
	Job-control waste with enriched uranium and solvent applicators	Job-control waste with enriched uranium and solvent applicators	None	Storage
	Mixed waste requiring size reduction and/or repackaging for CIF[c]	Filter paper take-up rolls Mark-15 filter paper Job-control waste containing solvent-contaminated wipes	Incineration	Incineration Vitrification

TC

Table 2-18. (continued).

EIS treatability group	EIS treatability group subcategories	PSTP[a] waste streams	PSTP preferred options	Reasonable EIS technologies
Organic liquid	All other organic liquids including streams specifically called out in the PSTP	Not considered	none	Incineration Vitrification
	DWPF[d] Benzene	DWPF Benzene	Incineration	Incineration Vitrification
	PUREX[e] solvent	Tributyl phosphate and n-Paraffin	Incineration	Incineration Vitrification
	Radioactive oil	Not considered	none	Incineration Vitrification
		Rad-contaminated[f] solvent Mixed waste oil	Incineration	Incineration Vitrification
Paint waste		Paint and thinner	Incineration	Incineration Vitrification
Composite filters		Not considered	none	Incineration Vitrification
Tritiated oil		Tritiated oil with mercury	Storage	same
Aqueous liquids	All other aqueous liquids including those specifically called out in the PSTP	Not considered	none	Incineration Vitrification
		Aqueous mercury and lead	Ion Exchange	same
		Mixed waste from laboratory samples Wastewater from TRU[g] drum dewatering	Incineration	Incineration Vitrification
	SRTC[h] aqueous	SRTC low-activity waste SRTC high-activity waste	Ion Exchange	same
	Aqueous liquids from groundwater monitoring well operations (investigation-derived waste)	Not considered	none	Ion exchange
Soils		Soils from spill remediation	Vitrification	Vitrification Incineration
Organic sludge		Not considered	none	Vitrification Incineration
Inorganic sludge	All inorganic sludge including streams specifically called out in the PSTP	Not considered	none	Incineration Vitrification
		Tank E-3-1 clean-out material	Stabilization	Stabilization Vitrification
PCBs		Not considered	none	Offsite treatment/onsite disposal
M-Area wastes		M-Area plating-line sludge from supernatant treatment Mark-15 filtercake M-Area sludge treatability samples M-Area high-nickel plating-line sludge	Vitrification	same

TC

Table 2-18. (continued).

EIS treatability group	EIS treatability group subcategories	PSTP[a] waste streams	PSTP preferred options	Reasonable EIS technologies
M-Area wastes (continued)		Plating-line sump material Nickel plating-line solution Uranium/chromium solution		
Elemental mercury		Tritium-contaminated mercury Elemental (liquid) mercury DWPF mercury	Amalgamation	same
Silver saddles		Silver-coated packing material	Macroencapsulation	same
Gold traps		Gold traps	No treatment required	same

TC

Source: WSRC (1994c); DOE (1994d); Hess (1994e); Hess (1995a).

a. *Proposed Site Treatment Plan.*
b. In-Tank Precipitation.
c. Consolidated Incineration Facility.
d. Defense Waste Processing Facility.
e. Plutonium-Uranium Extraction.
f. Radioactively contaminated.
g. Transuranic.
h. Savannah River Technology Center.

The site treatment plan includes several treatments for low-volume wastes at the individual facilities which produce them. These wastes would be treated by the facilities that generate them rather than as a part of the sitewide waste management program. DOE did not consider management alternatives for these mixed wastes in the EIS.

DOE evaluated radioactive oil and low-level PCB wastes in the options analysis for this EIS because management of these materials at SRS is similar to that of mixed wastes. Reasonable technologies were identified for the radioactive oil based on its treatability group (organic liquids). The quantities of low-level PCB wastes that require treatment are not large enough to economically justify applying the more stringent regulatory requirements of the Toxic Substances Control Act (which governs PCB treatment) to the technologies selected for mixed wastes treated onsite. Accordingly, DOE determined that existing offsite treatment would be the reasonable alternative for both radioactive and nonradioactive PCB wastes for the 30-year period considered in this EIS.

The change from weapons production at SRS to decontamination, decommissioning, and environmental restoration is expected to generate appreciably larger volumes of some treatability groups than those considered in the 5-year forecast used in the site treatment plan. For those wastes, DOE would modify TC the technology proposed in the site treatment plan to accommodate the larger volume. For example, the plan proposes a temporary vitrification process to treat a fixed and relatively limited quantity of soils and sludges. In this EIS, DOE proposes to use the temporary vitrification process during the first 5 years, but would replace it with a permanent vitrification facility to treat the increased volume of soils and sludges anticipated in years 6 through 30. Similarly, DOE would construct the containment building proposed in TE this EIS as a stand-alone facility to accommodate quantities of waste too large to be managed within existing SRS facilities, or wastes for which there is no existing facility that conforms to RCRA standards. TE

Many of the treatability groups of debris generated by decontamination, decommissioning, and environmental restoration are less well defined than the wastes addressed in the site treatment plan because these wastes have not yet been generated. This EIS identifies multiple technologies to accommodate the anticipated variability of these wastes.

DOE proposes that it continue to send hazardous wastes to offsite treatment and disposal facilities, except for wastes amenable to treatment in onsite facilities that have excess capacity. Hazardous wastes were assumed to be managed by the same technologies evaluated for mixed wastes of the same treatability group.

The method of disposal is dictated by the treatment technologies and the hazardous constituents of the waste. Mixed and hazardous wastes listed under RCRA (40 CFR 261.D) must be managed in accordance with RCRA after treatment. Mixed and hazardous wastes that exhibit a RCRA-regulated characteristic (ignitability, corrosivity, reactivity, or toxicity) may be treated to eliminate the characteristic; if the characteristic is eliminated, the treated waste need not be sent to a RCRA facility. The reasonable technologies for disposal of mixed and hazardous wastes were identified based on the composition of the treatability groups with respect to listed and characteristic wastes.

TC

2.3.3 SYSTEM EVALUATION/OPTIMIZATION FOR THE ACTION ALTERNATIVES

Upon completion of the options analysis for each treatability group, the higher-ranked technologies for each group were compiled in a single list of candidate technologies for the waste management program. DOE reviewed this list to identify technologies capable of handling a wide range of wastes. Application of such technologies, either in existing or planned facilities, to several waste groups would provide both economic and environmental advantages over the construction of numerous specialized treatment facilities. With that goal in mind, the candidate technologies were ranked according to the following criteria:

- technologies with facilities currently existing onsite
- technologies with facilities under construction or planned at SRS
- technologies that had been identified in the draft site treatment plan as preferred options to treat mixed wastes
- technologies proposed for treating transuranic waste to meet the Waste Isolation Pilot Plant waste acceptance criteria
- technologies proposed for treating low-level wastes

The first two criteria promote efficient use of existing and planned capabilities and resources. The remainder address the specificity of the regulatory requirements applicable to each waste.

TC

RCRA imposes specific requirements on waste management. In its site treatment plan, DOE proposed to the State of South Carolina several technologies to treat the various groups of mixed waste at SRS. South Carolina, in conjunction with DOE, will select the technologies for mixed wastes that will be used at SRS. The technologies identified as preferred options for mixed wastes in the draft site treatment plan and their corresponding facilities will form the foundation of the SRS waste management program. To this foundation, DOE will add those technologies necessary to accommodate the types of mixed wastes that will be generated beyond 5 years.

DOE is committed to ensuring that the Waste Isolation Pilot Plant in Carlsbad, New Mexico, will comply with all applicable requirements so that DOE can place its transuranic wastes, including those at SRS, in that repository. The waste acceptance criteria for the Waste Isolation Pilot Plant will establish requirements to ensure the safe handling and preparation of transuranic waste for transportation to and placement in the repository. The technologies and facilities needed to treat transuranic wastes (primarily wastes containing plutonium-238) to meet these waste acceptance criteria were considered as necessary elements of the SRS waste management program. Because of the specific handling precautions for alpha-emitting wastes, these technologies should be located in separate facilities. TC

Additional factors used to refine the list of technologies included capacity of existing and planned facilities, life-cycle costs, and stability of final waste forms. Treatment by commercial vendors (such as offsite treatment of PCB wastes), direct disposal (disposal without treatment), and long-term storage were considered as alternatives when appropriate. Table 2-19 identifies the criteria used in the system evaluation and optimization process, and summarizes the results for the facilities considered for inclusion in the SRS waste management program.

Once the technologies had been ranked in accordance with the criteria outlined above, the treatability groups within each waste type were assigned to a specific facility until each facility reached its capacity. New facilities were added as necessary to meet capacity requirements and to provide technologies not currently available at SRS. Mixed and transuranic wastes were assigned to their respective facilities first. Hazardous waste amenable to treatment in onsite facilities that treat mixed waste were assigned to these facilities. After mixed and hazardous wastes were assigned to specific facilities, low-level wastes that could be treated in the same facilities were identified. This process continued until each waste had been assigned to a treatment, storage, or disposal facility. In the final step, secondary wastes provided by the various treatments were identified and evaluated to determine which technologies were suited for their treatment and disposal.

Table 2-20 identifies the management technologies and facilities selected for each of the alternatives considered in this EIS. The technologies selected for alternative B were identified as potential technologies for alternatives A and C as well. These potential technologies for the two alternatives were evaluated against the objective of each alternative: for alternative A, that objective was to provide a TE

Table 2-19. System evaluation/optimization criteria.[a]

Facility:	Criteria								
	Status	Flexibility[b]	*Construction* cost[c]	Volume alteration[d]	Destruction capability for organics[e]	Meets RCRA treatment requirements[f]	Leach resistance of final waste form[g]	Cost to operate[c]	Waste disposal costs[h]
Soil sort	Planned/onsite	MW[i] soils	2	NA[j]	No	No	No	2	NA-treatment req.
		LLW[k] soils	2	NA	No	NA	No	2	1
Consolidated Incineration Facility	Under construction/ onsite	MW/HW[l] liquids	7	40:1	Yes	Yes	Moderate (Cement)	6	5
		LLW liquids	7	40:1	No	NA	Moderate (Cement)	6	3
		MW/HW soils	7	1:3	Yes	Yes	Moderate (Cement)	8	7
		MW/HW job-control	7	8:1	Yes	Yes	Moderate (Cement)	8	5
		LLW job-control	7	11:1	No	NA	Moderate (Cement)	8	3
		Alpha job-control	10	11:1	No	NA	Moderate (Cement)	10	7
		Mixed alpha job-control	10	8:1	Yes	Yes	Moderate (Cement)	10	7
Supercompactor	*Existing/offsite*	*LLW job-control*	NA	8:1	No	NA	Poor (Unstabilized)	2	3
		LLW bulk	NA	8:1	No	NA	Poor (Unstabilized)	2	3
Incineration/ supercompaction	Existing/offsite	LLW job-control	NA	100:1	No	NA	Poor (Unstabilized)	8	3
Size reduction/ repackaging	Existing/offsite	LLW job-control	NA	1.4:1	No	NA	Poor (Unstabilized)	6	3
Metal melt/ *supercompaction*	Existing/offsite	LLW job-control	NA	20:1	No	NA	Moderate	8	3
Smelter	Existing/offsite	LLW bulk	NA	10:1	No	NA	Moderate	5	5
Non-alpha vitrification	Planned/onsite	MW/HW soils	7	1.2:1	Yes	Yes	Best available	8	5
		LLW soils	7	1.2:1	No	NA	Best available	8	1
		MW/HW liquids	6	75:1	Yes	Yes	Best available	7	3
		LLW liquids	6	75:1	No	NA	Best available	7	1
		MW/HW job control	7	15:1	Yes	Yes	Best available	8	3
		LLW job control	7	15:1	No	NA	Best available	8	1
		MW/HW bulk	8	15:1	Yes	Yes	Best available	9	3
		LLW bulk	8	15:1	No	NA	Best available	9	1
Transuranic waste characterization/ certification	Planned/onsite	TRU[m] (Pu-239)[n] job control	8	1.4:1	No	Meets WIPP/WAC[o]	Poor (Unstabilized)	8	10
		TRU (Pu-238)[n] job control	10	1.4:1	No	No	NA-treatment Req.	10	NA-treatment req.
		Mixed alpha[p] job control	8	1.4:1	No	Yes	Poor (Unstabilized)	8	
		Alpha job control	8	1.4:1	No	NA	Poor (Unstabilized)	8	5
		TRU (Pu-239) bulk	9	1.4:1	No	Meets WIPP/WAC[o]	Poor (Unstabilized)	8	10
		TRU (Pu-238) bulk	10	1.4:1	No	No	NA-treatment req.	10	NA-treatment req.
		Mixed alpha bulk	8	1.4:1	No	Yes	Poor (Unstabilized)	8	
		Alpha bulk	8	1.4:1	No	NA	Poor (Unstabilized)	8	5
Containment building	Planned/onsite	MW/HW Bulk	4	1:1.2	No	Yes	Poor	6	5

Table 2-19. (continued).

Facility:	Status	Flexibility[b]	Construction cost[c]	Volume alteration[d]	Destruction capability for organics[e]	Meets RCRA treatment requirements[f]	Leach resistance of final waste form[g]	Cost to operate[c]	Waste disposal costs[h]
			Criteria						
Alpha vitrification	Planned/onsite	Mixed alpha liquids	8	75:1	Yes	Yes	Best available	8	8
		Alpha liquids	8	75:1	No	NA	Best available	8	8
		TRU liquids	8	75:1	No	Yes	Best available	8	8
		Mixed alpha job control	9	15:1	Yes	Yes	Best available	9	9
		Alpha job control	9	15:1	No	NA	Best available	9	9
		TRU job control	9	15:1	No	Yes	Best available	9	9
		Mixed alpha bulk	10	15:1	Yes	Yes	Best available	10	9
		Alpha bulk	10	15:1	No	NA	Best available	10	9
		TRU bulk	10	15:1	No	Yes	Best available	10	9
Shallow land disposal	Existing/onsite	LLW	2	NA	No	No	NA	3	NA
Vault disposal	Existing/onsite	LLW	4	NA	No	No	NA	3	NA
		Alpha waste	4	NA	No	No	NA	4	NA
RCRA disposal	Existing/onsite	MW/HW	5	NA	No	No	NA	3	NA
		Mixed alpha waste	5	NA	No	No	NA	4	NA
WIPP disposal	Existing/offsite	TRU	NA	NA	No	No	NA	NA	NA

a. Source: Hess (1994g, 1995d).
b. Denotes the waste types and matrices that could be managed at the facility.
c. Cost scores are on a 1 to 10 scale with 10 being the most expensive.
d. Denotes the ratio of the incoming waste volume to the post-treatment waste volume.
e. Denotes whether the facility provides a destruction and removal capability for organic hazardous constituents that meets RCRA incineration standards (i.e., 99.99 percent).
f. Denotes whether the facility provides treatment that meets RCRA land disposal restriction standards.
g. Ranks the stability of the final waste form provided by the technology(ies) used at each facility.
h. Scores the cost to dispose of the treatment residuals and secondary wastes on a 1 to 10 scale with 10 being the most expensive.
i. Mixed waste.
j. Not applicable.
k. Low-level waste.
l. Hazardous waste.
m. Transuranic waste.
n. Plutonium-238, -239.
o. Waste Isolation Pilot Plant waste acceptance criteria.
p. Waste containing between 10 and 100 nanocuries per gram of transuranic radionuclides.

Table 2-20. Treatability groups and the proposed management facilities for each alternative.[a]

		Treatment, storage, and disposal facility[b,c]					
		Vault disposal	Shallow land disposal	Storage	Compaction; Offsite vendor[d]	Non-alpha vitrification	Incineration
Waste	Categories	Alternative	Alternative	Alternative	Alternative	Alternative	Alternative
Low-level	Long-lived			A B C			
Low-level	Spent deionizers			A B C			
Low-level	Tritiated equipment	A B				C	
Low-level	Tritiated job-control waste	A B				C	B
Low-level	Tritiated soil	A B				C	
Low-level	Naval hardware		A B C				
Low-level	Low-activity equipment	A B C			B		
Low-level	Offsite job-control waste	A B				C	
Low-level	Low-activity job-control waste	A B			A B	C	B
Low-level	Intermediate-activity job-control waste	A B				C	
Low-level	Suspect soil	B	A B			C	
Low-level	Low-activity soil	A B	B			C	
Transuranic/ Alpha	Alpha job-control waste	A B					C
Mixed waste	Glass debris					C	
Mixed waste	Heterogeneous debris					C	B
Mixed waste	Lead					C	
Mixed waste	Inorganic debris					C	B
Mixed waste	Organic debris					C	B
Mixed waste	Mixed waste needing size reduction					C	A B
Mixed waste	DWPF[e] benzene					C	A B
Mixed waste	Organic liquid					C	A B
Mixed waste	Radioactive oil					C	A B
Mixed waste	PUREX[f] solvents					C	A B
Mixed waste	Paint wastes					C	A B
Mixed waste	Composite filters					C	A B
Mixed waste	Aqueous liquids					C	A B
Mixed waste	Soils					B C	A
Mixed waste	Organic sludge					B C	A
Mixed waste	Inorganic sludge					B C	A
Mixed waste	Mercury-contaminated materials					C	
Mixed waste	Tritiated oil			A B C			
Hazardous waste	Composite filters					C	A B
Hazardous waste	Paint wastes					C	A B
Hazardous waste	Organic liquids					C	A B
Hazardous waste	Aqueous liquids					C	A B
Hazardous waste	Inorganic debris					C	B
Hazardous waste	Heterogeneous debris					C	B
Hazardous waste	Glass debris					C	
Hazardous waste	Organic sludges					C	B
Hazardous waste	Inorganic sludges					C	B
Hazardous waste	Soils					C	
Hazardous waste	Organic debris					C	B

Table 2-20. (continued).

		Treatment, storage, and disposal facility[g]							
		WIPP disposal[h]	Alpha vitrification	Smelting	Containment Building	M-Area vendor	Offsite treatment	RCRA[i] disposal	
Waste	Categories	Alternative	Alternative	Alternative	Alternative	Alternative	Alternative	Alternative	
Low-level	Low-activity equipment			B C					
Transuranic/ Alpha	Alpha job-control waste		C						
Transuranic/ Alpha	Mixed alpha job-control waste		B C					A B	
Transuranic	<0.5 curie TRU[j] job-control waste	A B	B C						
Transuranic	<0.5 curie mixed TRU job-control waste	A B	B C						
Transuranic	>0.5 curie TRU job-control waste	A B	B C						
Transuranic	>0.5 curie mixed TRU job-control waste	A B	B C						
Transuranic	TRU equipment	A B	B C						
Transuranic	TRU equipment, mixed	A B	B C						
Transuranic	Remote and mixed remote TRU	A B	B C						
Mixed waste	Glass debris				A B				
Mixed waste	Metal debris				A B C				
Mixed waste	Bulk				A B C				
Mixed waste	Lead				A B		A B C		
Mixed waste	Heterogeneous debris				A B				
Mixed waste	Inorganic debris				A B				
Mixed waste	Organic debris				A B				
Mixed waste	Composite filters				A				
Mixed waste	PCBs						A B C		
Mixed waste	Elemental mercury				C		A B		
Mixed waste	Waste site soil					A B C			
Mixed waste	Uranium/chromium					A B C			TC
Mixed waste	M-Area waste					A B C			
Mixed waste	Silver saddles							A B C	
Mixed waste	Gold traps							A B C	
Mixed waste	Safety/control rods							A B C	
Mixed waste	ITP[k] Filters							A B C	TE
Mixed waste	Process equipment							A B C	
Hazardous waste	PCBs						A B C		
Hazardous waste	Inorganic debris						A B		
Hazardous waste	Heterogeneous debris						A B		
Hazardous waste	Metal debris				C		A B		
Hazardous waste	Bulk equipment				C		A B		
Hazardous waste	Glass debris						A B		
Hazardous waste	Organic sludges						A		TC

Table 2-20. (continued).

		Treatment, storage, and disposal facility[g]						
		WIPP disposal[h]	Alpha vitrification	Smelting	Containment Building	M-Area vendor	Offsite treatment	RCRA[i] disposal
Waste	Categories	Alternative	Alternative	Alternative	Alternative	Alternative	Alternative	Alternative
Hazardous waste	Inorganic sludges						A	
Hazardous waste	Soils						A B	
Hazardous waste	Organic debris						A B	
Hazardous waste	Lead				C		A B	

TC
TE

a. Source: Hess (1994e, 1995d).
b. Storage includes wastes stored for radioactive decay and wastes stored pending further analysis to determine their ultimate disposition.
c. Disposal includes wastes sent directly to a disposal unit without treatment.
d. "Compaction" refers to the use of the existing onsite compactors under alternative A for low-activity job-control waste. "Offsite vendor" refers to those technologies to be used under alternative B for low-activity job-control and equipment wastes as a result of the request for proposal for low-level waste volume reduction. For purposes of analysis in the EIS, these technologies are assumed to include supercompaction, size reduction/repackaging, incineration/supercompaction, and metal melt/supercompaction. TC
e. Defense Waste Processing Facility.
f. Plutonium-uranium extraction.
g. Note change in header to show different waste treatment, storage, and disposal processes from first page.
h. Waste Isolation Pilot Plant.
i. Resource Conservation and Recovery Act.
j. Transuranic.
k. In-Tank Precipitation.

limited treatment configuration; for alternative C, it was to provide an extensive treatment configuration. The treatability group was then assigned to the technology most suited to that treatability group, in keeping with the overall objective of the alternative. For example, mixed waste in the treatability group "heterogeneous debris" would be macroencapsulated (see glossary) at the containment building (see Appendix B.6) in alternative A, incinerated or macroencapsulated in alternative B, and vitrified in alternative C. TE

2.3.4 NEPA ANALYSES FOR FACILITIES CONSIDERED IN THE SRS WASTE MANAGEMENT EIS

The no-action alternative described in the Notice of Intent to prepare this EIS for Waste Management at SRS (59 FR 16494, April 6, 1994) indicated that DOE would "analyze a no-action alternative that would continue waste generation and current management practices. DOE would continue ongoing activities and implement planned actions, including high-level radioactive waste management, for which National Environmental Policy Act review has been completed and decisions made." The proposed action would include "the no-action alternative activities plus programmatic and project-level actions to enhance waste management operations" at SRS.

On this basis, DOE formulated a no-action alternative and three "action" alternatives; the action alternatives could fulfill DOE's need for a waste management strategy. This EIS provides information for decisions DOE will make in its Records of Decision following publication of the EIS. Table 2-21 lists existing and planned facilities that are included in the no-action and the action alternatives. In addition, the table identifies the NEPA basis for including planned activities in the no-action alternative, facilities that could be constructed and operated under decisions based on this EIS, and facilities that might require further NEPA evaluations. TE

Table 2-21. NEPA review of facilities in the *SRS Waste Management EIS*.

Facility	NEPA review	Discussion
Containment Building (Hazardous Waste/Mixed Waste Treatment Building)	This EIS	
Low-Level Waste Soil Sort Facility	This EIS	
Consolidated Incineration Facility (CIF) - Construction	Consolidated Incineration Facility (DOE/EA-0400) and its Finding of No Significant Impact (57 FR 61402)	Construction of the CIF would continue under the no-action alternative.
Consolidated Incineration Facility (CIF) - Operation	This EIS	The action alternatives explore a wide range of operational scenarios for the CIF. Decisions on whether to operate and what wastes to treat would be based on this EIS.
Replacement High Level Waste Evaporator (RHLWE)	Categorical exclusion, September 24, 1990	
New Waste Transfer Facility (NWTF)	Categorical exclusion, September 18, 1991	The NWTF, a replacement "valve box" located in H-Area, receives waste from both the Defense Waste Processing Facility (DWPF) and other F- and H-Area operations.
M-Area Vendor Treatment Facility	Additional waste streams-this EIS	The original M-Area Vendor Treatment Facility was addressed in *Environmental Assessment, Treatment of M-Area Mixed Waste at the Savannah River Site,* which assessed the treatment of six mixed wastes. In this EIS, DOE proposes to use this facility for the treatment of two more mixed waste streams that were identified in the *SRS Draft Site Treatment Plan*. The treatment technology would be vitrification. TC

Table 2-21. (continued).

Facility	NEPA review	Discussion
M-Area Air Stripper	Ongoing activity	The M-Area Air Stripper treats the M-Area groundwater plume that is contaminated with organic solvents as part of environmental restoration. Under the four alternatives, DOE would continue to treat, in the M-Area Stripper, the waste withdrawn from monitoring wells during sampling (investigation-derived waste).
F/H-Area Effluent Treatment Facility	Memo-to-File, *F/H Effluent Treatment Facility (ETF)*, August 12, 1986	The NOI for the DWPF SEIS (59 FR 16499, April 6, 1994) states that operation of the ETF will be included in the Waste Management EIS. NEPA was completed under then-current DOE NEPA Guidelines.
Hazardous Waste/Mixed Waste Disposal Vaults	*Final Environmental Impact Statement, Waste Management Activities for Groundwater Protection*, DOE/EIS-0120 and its Record of Decision (53 FR 7557))	The EIS assessed RCRA landfills and vaults for disposal of hazardous and mixed waste. Specific project-level actions listed under *Decision* in the Record of Decision included construction and operation of new storage/disposal facilities for hazardous and/or mixed waste.
High-Level Waste Tank Farms	EISs on high-level waste include: *Final Environmental Impact Statement, Waste Management Operations* (ERDA-1537); *Final Environmental Impact Statement, Double-Shell Tanks for Defense High-Level Radioactive Waste Storage*; and *Final Environmental Impact Statement, Defense Waste Processing Facility*, DOE/EIS-0082 and its Supplemental EIS (DOE/EIS-0082S)	
E-Area Vaults	DOE/EIS-0120 and its Record of Decision (53 FR 7557)	Vault design was one of several project-specific technologies considered for new disposal/storage facilities.
Shallow Land Disposal	ERDA-1537 and subsequent confirmation in DOE/EIS-0120	Shallow land disposal has continued in the operating burial ground and would continue in E-Area for a portion of SRS low-level waste (e.g., suspect soil).
E-Area Burial Ground Solvent Tanks	Ongoing activity	Existing solvent tanks store spent solvent generated by the plutonium-uranium extraction (PUREX) process.
Transuranic Waste Storage Pads	Ongoing activity	Under the no-action and the action alternatives, DOE would construct additional pads to increase the storage capacity. The number of pads needed would be greatest under the no-action alternative and least under alternative A.

TC

TC

TC

Table 2-21. (continued).

Facility	NEPA review	Discussion	
Mixed Waste Storage Facilities	Categorical exclusion, October 5, 1990		
M-Area Liquid Effluent Treatment Facility (LETF)	Ongoing activity		
Savannah River Technology Center Mixed Waste Storage Tanks	Ongoing activity		
Experimental Transuranic Waste Assay Facility/ Waste Certification Facility (ETWAF)	Ongoing activity		
Hazardous Waste Storage Facilities	Ongoing activity	Under the no-action alternative, hazardous wastes would continue to be sent offsite for treatment and disposal. Therefore, additional hazardous waste storage would not be required.	
Compactors	Ongoing activity	Under no-action and alternative A, the existing compactors operate over the full period of analysis. Under alternatives B and C, they would be replaced by other volume-reducing technologies.	TE
Long-Lived Waste Storage Building	DOE/EIS-0120		TC
Transuranic Waste Characterization/ Certification Facility	Would require further NEPA evaluation	The transuranic waste characterization/ certification facility would provide extensive containerized waste processing and certification capabilities. The facility would have the ability to open various containers (e.g., boxes, culverts, or drums); assay, examine, sort, decontaminate the alpha and transuranic wastes; reduce large wastes to 55-gallon-drum size; weld; and certify containers for disposal.	
Non-Alpha Vitrification	Would require further NEPA evaluation	The non-alpha vitrification facility would provide treatment for liquid, solid, soil, and sludge wastes, primarily resulting from environmental restoration and decontamination and decommissioning activities, for which treatment capacity is not otherwise available at SRS. For the expected waste forecast, the facility would be constructed and operated under alternatives B and C. Because conceptual designs have not been developed, DOE believes that further NEPA evaluation might be required.	TC

Table 2-21. (continued).

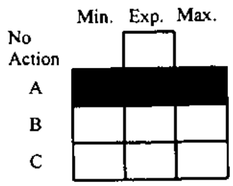
Facility	NEPA review	Discussion
Alpha Vitrification	Would require further NEPA evaluation	The alpha vitrification facility would provide treatment of non-mixed and mixed alpha waste (10 to 100 nanocuries of transuranics per gram of waste) and nonmixed and mixed transuranic waste (greater than 100 nanocuries of transuranics per gram of waste). The facility would have the ability to open drums of wastes, perform size reduction, produce a glass waste form suitable for disposal, and treat secondary wastes. The facility would be constructed and operated under alternatives B and C. Similar to the non-alpha vitrification facility, the alpha vitrification facility is in a pre-conceptual design stage and DOE believes that further NEPA evaluation would be required.

TE

2.4 Alternative A – Limited Treatment Configuration

As described at the beginning of Chapter 2, DOE bases alternative A on a strategy to provide limited TE
treatment, generally the minimum treatment required to meet applicable storage and disposal standards.
This section discusses the activities and facilities that would be used under alternative A and the
expected waste forecast, and discusses the changes in such activities and facilities that would be required
to accommodate the minimum and maximum waste forecasts. Under alternative A, DOE would use
technologies that provide the minimum treatment required to meet applicable storage and disposal
standards and would expeditiously store or dispose of the wastes in a manner that prevents or minimizes
short-term impacts.

Alternative A is identical to the no-action alternative with respect to the management of liquid high-level
and low-level radioactive wastes. This section discusses only changes, if any, for these wastes necessary
to accommodate the minimum and maximum waste forecasts. Alternative A would use several treatment TE
facilities for mixed and transuranic wastes including the Consolidated Incineration Facility, a mobile soil
sort facility, the containment building for mixed wastes, and the transuranic waste TE
characterization/certification facility for transuranic and alpha wastes. Small quantities of hazardous
waste would be treated onsite at the Consolidated Incineration Facility. By implementing these
treatments, DOE would appreciably decrease the amount of additional storage capacity for mixed and
transuranic wastes from that required under the no-action alternative. Mixed waste storage would peak
in 2005 and transuranic and alpha waste storage in 2006; the required number of storage facilities would TC
then decrease as new treatment facilities begin operations. Small quantities of mixed and PCB wastes
would be sent offsite for treatment, and transuranic wastes would be sent to the Waste Isolation Pilot
Plant for disposal when that facility becomes available. The waste volumes sent to shallow land disposal
and to RCRA-permitted disposal facilities would increase from those projected for the no-action
alternative, due to the increased volume of treatment residuals. Sections 2.4.4, 2.4.5, and 2.4.6 discuss
the proposed treatment, storage, and disposal activities for hazardous, mixed, and transuranic wastes
under alternative A. Section 2.4.7 summarizes the activities and facilities under alternative A and
compares them to those that would be required under the no-action alternative. TE



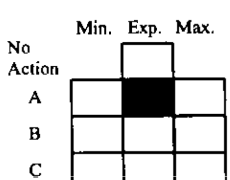
2.4.1 POLLUTION PREVENTION/WASTE MINIMIZATION

The ongoing waste minimization activities described for the no-action alternative (Section 2.2.1) would continue in each waste forecast under alternative A. DOE would also initiate activities to reduce the amounts of lead and contaminated soils. Table 2-22 summarizes waste minimization activities that would occur under alternative A beyond the ongoing (no-action alternative) activities.

Table 2-22. Waste minimization activities for alternative A.[a]

Minimization activity	Treatability group	Waste forecast	Estimated amount of reduction (cubic meters)[b]
TC Reuse decontaminated lead	Mixed waste lead	Expected	2,408
		Minimum	1,053
		Maximum	6,140
Sort soil to divert for beneficial reuse	Mixed waste soils	Expected	35,332
		Minimum	9,549
		Maximum	176,024

a. Source: Hess (1994e, 1995c).
b. To convert to cubic feet, multiply by 35.31.

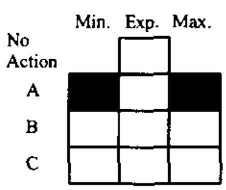


2.4.1.1 Pollution Prevention/Waste Minimization – Expected Waste Forecast

TC DOE estimates that 3,010 cubic meters (1.06×10^5 cubic feet) of radioactively contaminated lead (a
TE mixed waste) would be generated and available for recycling over the next 30 years (Hess 1995c). Lead that cannot be decontaminated (i.e., lead that is radioactive throughout its volume due to activation rather than contaminated only on its surface) would be treated and disposed of onsite rather than recycled because the onsite lead smelter can only be used for uncontaminated lead.

Lead with surface contamination would be sent offsite for decontamination at an existing commercial facility (see Appendix B.21). After decontamination, the lead would be checked for radioactivity. Lead that had been adequately decontaminated would be sold to private industry for reuse. Lead that was not adequately decontaminated would be returned to SRS for disposal. The small amount of waste generated during the decontamination process also would be disposed of at SRS. It is estimated that more than 80 percent [2,408 cubic meters (85,000 cubic feet)] of the lead generated over the next 30 years could be recycled (DOE 1994d). TC

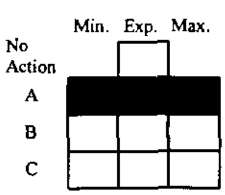
The volume of soils containing mixed waste would be minimized by separating the contaminated materials from those in which the contamination cannot be detected. An estimated 88,331 cubic meters (3.12×10^6 cubic feet) of mixed waste soils would be generated over the 30-year period. An estimated 35,332 cubic meters (1.25×10^6 cubic feet) of this material is expected to be below detection limits (Hess 1995c). Material free of detectable contaminants would be used at SRS for backfill. The soil sort facility is described in Appendix B.28. TC TE



2.4.1.2 Pollution Prevention/Waste Minimization – Minimum and Maximum Waste Forecasts

For alternative A – minimum and maximum forecasts, lead with radioactive contamination limited to the surface would be recycled as in the expected forecast, but the volume of throughput and decontaminated lead available for reuse would vary, as indicated in Table 2-22.

Mixed waste soils would be sorted to divert uncontaminated material for beneficial uses. The estimated amounts expected to be free of detectable contamination and available for reuse in the minimum and maximum waste forecasts are presented in Table 2-22. TE



2.4.2 HIGH-LEVEL WASTE – EXPECTED, MINIMUM, AND MAXIMUM FORECAST TE

Under alternative A, DOE would treat liquid high-level radioactive waste as it would be treated under the no-action alternative (see Section 2.2.2, Figure 2-9). For each waste forecast, DOE would continue current management activities, from receipt and storage of liquid high-level waste in tanks to preparation, processing, and treatment into forms suitable for final disposal. The high-level waste volumes that would be generated over the next 30 years (Table 2-22) in addition to the existing inventory of high-level waste currently in storage [approximately 1.31×10^5 cubic meters (3.45×10^7 gallons)] (DOE 1994d) are given in Table 2-23.

TE **Table 2-23.** Thirty-year liquid high-level waste volumes for the expected, minimum, and maximum waste forecasts.[a]

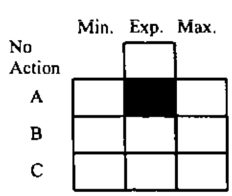
Waste forecast	Volume
Expected	22,000 cubic meters (5.81×10^6 gallons)
Minimum	12,000 cubic meters (3.17×10^6 gallons)
Maximum	27,000 cubic meters (7.13×10^6 gallons)

a. Source: Hess (1994d).

These volumes are not additive, because newly generated waste volumes would be reduced approximately 75 percent via evaporation. These volumes would not require construction of new high-level waste tanks or facilities. Instead, DOE proposes to continue current management practices and to manage waste with the objective of emptying the tanks and immobilizing SRS's inventory of liquid high-level waste by 2018 (DOE 1994a).

DOE would not change proposed high-level waste management practices as a result of the smaller volumes forecast in the minimum waste forecast (45 percent less than the expected waste forecast). The only difference in management practices as a result of the larger volumes forecast in the maximum waste forecast (23 percent more than the expected waste forecast) would be to operate the existing evaporators at higher rates to maintain adequate reserve tank storage capacity. TE

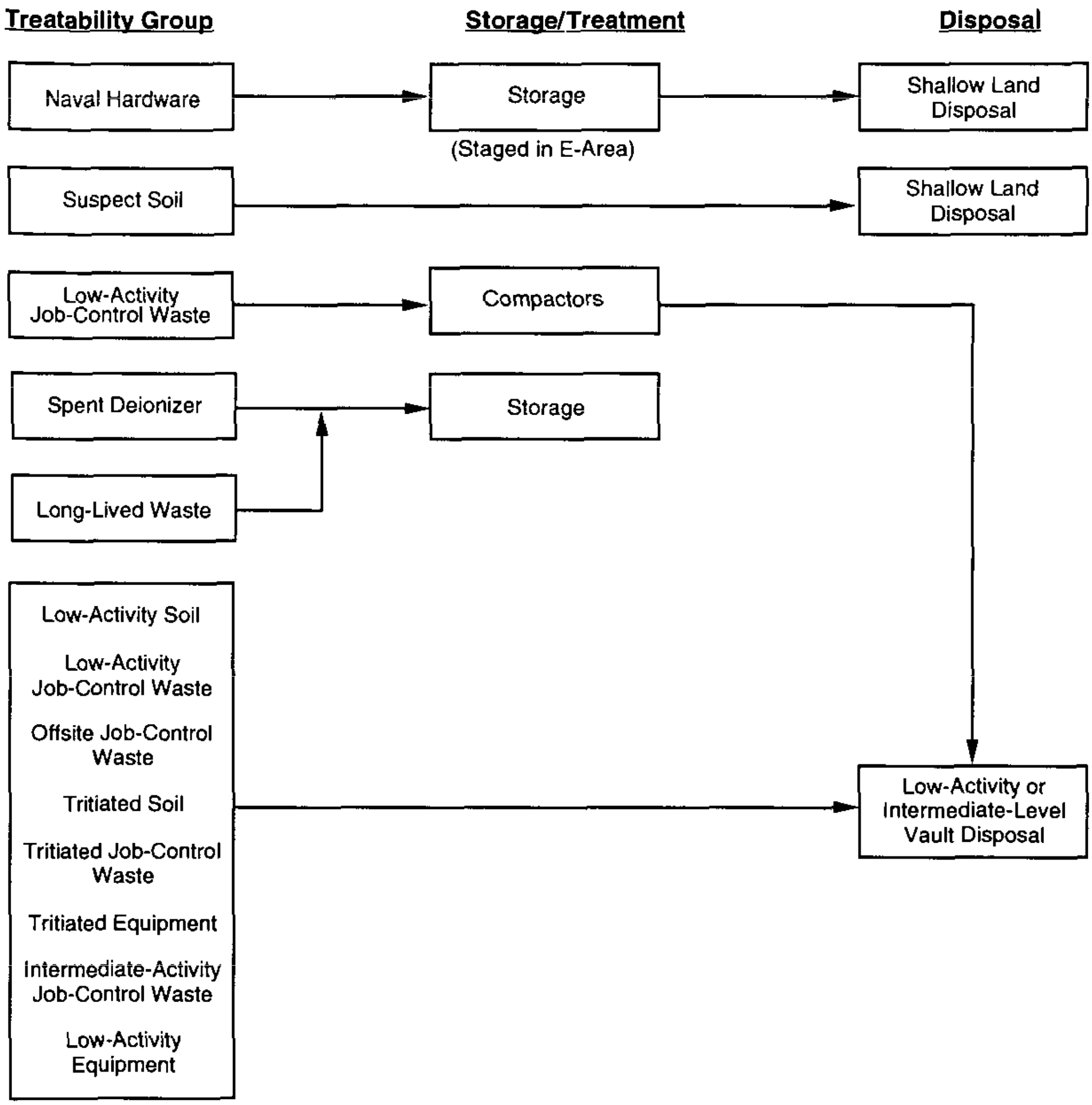
2.4.3 LOW-LEVEL WASTE



2.4.3.1 <u>Low-Level Waste – Expected Waste Forecast</u>

For alternative A – expected forecast, DOE would process low-level waste in a manner identical to the no-action alternative discussed in Section 2.2.3. Figure 2-17 summarizes these proposed activities to manage low-level waste.

Under alternative A, DOE would store process water deionizers from reactors (less than 1 percent of the forecast low-level waste) in long-lived waste storage buildings in E-Area. The existing building would



TC

Source: Hess (1994e).

Note: This figure does not include short-term or transition activities.

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Figure 2-17. Low-level waste management plan for alternative A expected waste forecast.

reach capacity by 2000, and 24 additional buildings would be needed over the 30-year period (Hess 1995c).

DOE would compact low-activity job-control waste to more efficiently use capacity. For purposes of analysis in this EIS, it is assumed that approximately 1.19×10^5 cubic meters (4.22×10^6 cubic feet) (22 percent of the low-level waste forecast) would be compacted over the next 30 years. See Section 2.2.3.1 for additional information. Compacting the waste would decrease needed disposal capacity to 78 percent of that required if waste were not compacted (Hess 1995c).

Table 2-24 lists the distribution of low-level waste among the various treatment and disposal options.

Table 2-24. Low-level waste treatment and disposal options for alternative A expected waste forecast.[a,b]

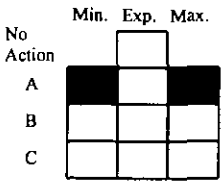
Disposal options	Treatment options
93 percent to vaults	22 percent to compactor
7 percent to shallow land disposal	

a. Source: Hess (1995c).
b. Percentages are approximate.

DOE would continue to dispose of suspect soils in the engineered low-level trench. Under alternative A, DOE would dispose of low-activity waste, which comprises approximately 86 percent by volume of the low-level waste that would be disposed of, in the low-activity waste vaults. The material disposed of would include low-activity waste equipment resulting from the decontamination of mixed waste (discussed in Section 2.4.5.1.2). The existing vault would reach capacity by 1997 (Hess 1995c). Additional vaults would be constructed as needed. See Section 2.2.3.1 for additional information.

Under alternative A, DOE would dispose of intermediate-activity waste, which comprises approximately 7 percent of the waste that would be disposed of, in the intermediate-level waste vaults. The existing vaults would reach capacity by 2000, and additional vaults would be constructed as needed (Hess 1995c). See Section 2.2.3.2 for additional information.

Under alternative A, DOE would dispose of suspect soils and naval hardware that meet waste acceptance criteria, which would comprise approximately 7 percent of the low-level waste to be disposed of, by shallow land disposal (Hess 1995c). See Sections 2.2.3.1 and 2.2.3.4 for additional information.



2.4.3.2 Low-Level Waste – Minimum and Maximum Waste Forecasts

For alternative A – minimum and maximum waste forecasts, DOE would change the way it manages some low-level waste in the expected case (see Figure 2-17). The changes from waste management practices described under the expected waste forecast are primarily attributed to the larger volume of soils in the maximum waste forecast (48 percent of all low-level waste, compared to 9 percent for the expected waste forecast). The existing compactors would operate at maximum capacity for the duration of the 30-year period and would process approximately 30 percent of the total volume of low-level waste in the minimum case and 7 percent in the maximum case. Less than 1 percent would be placed in storage buildings pending disposal (Hess 1995c). Table 2-25 describes the percentage of low-level waste distributed among the various treatment and disposal options under the minimum and maximum waste forecasts.

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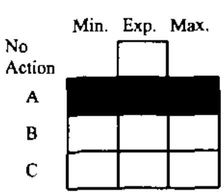
Table 2-25. Low-level waste treatment and disposal options for alternative A minimum and maximum waste forecasts.[a,b]

Minimum waste forecast	Maximum waste forecast	
Treatment options	Treatment options	
30 percent to compactors	7 percent to compactors	
Disposal options	Disposal options	
95 percent to vaults	69 percent to vaults	TC
5 percent to shallow land disposal	31 percent to shallow land disposal	

a. Source: Hess (1995c).
b. Percentages are approximate.



2.4.4 HAZARDOUS WASTE – EXPECTED, MINIMUM, AND MAXIMUM WASTE FORECASTS

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For each alternative A waste forecast, DOE would manage hazardous waste in a manner similar to the no-action alternative for hazardous waste presented in Section 2.2.4. The only difference would be to incinerate a few treatability groups onsite rather than sending them offsite for treatment and disposal.

TE

Figure 2-18 presents these proposed hazardous waste management activities. In general, DOE would not construct new facilities or implement new onsite treatment processes solely for hazardous wastes. Rather, hazardous waste management alternatives would be based on the alternatives suggested for mixed waste. If DOE constructs a facility or implements a method of treatment for mixed waste that can also be applied to hazardous waste, DOE could use it for hazardous waste to the extent excess capacity is available.

In addition to the management practices for hazardous waste under the no-action alternative (Section 2.2.4), under alternative A DOE would:

- Complete construction of and operate the Consolidated Incineration Facility, including incineration of selected hazardous wastes.

- Construct RCRA-permitted disposal vaults to dispose of stabilized ash and blowdown waste from the incineration process, or send them to shallow land disposal.

Under alternative A, DOE would continue to accumulate hazardous wastes for recycling, both onsite and offsite. DOE would continue to manage aqueous liquids generated from groundwater monitoring wells (investigation-derived wastes) at the M-Area Air Stripper, as described in Section 2.2.4. DOE would also continue storing hazardous waste in the three RCRA-permitted hazardous waste storage buildings, the M-Area storage building, and on the three interim status solid waste storage pads. DOE would
TC continue to send most (89 percent for expected, 93 percent for minimum, and 91 percent for maximum waste forecasts) of the hazardous waste offsite for treatment and disposal. However, several hazardous wastes (composite filters, paint waste, organic liquids, aqueous liquids) would be treated in the Consolidated Incineration Facility, assuming it begins operating in 1996. These wastes represent approximately 4 percent of the hazardous waste quantities forecast for the next 30 years. The stabilized ash and blowdown from the Consolidated Incineration Facility would be sent to onsite RCRA-permitted disposal or shallow land disposal. It is estimated that 70 percent of the stabilized ash and blowdown would require RCRA-permitted disposal and 30 percent would be sent to shallow land disposal (Hess 1995c).

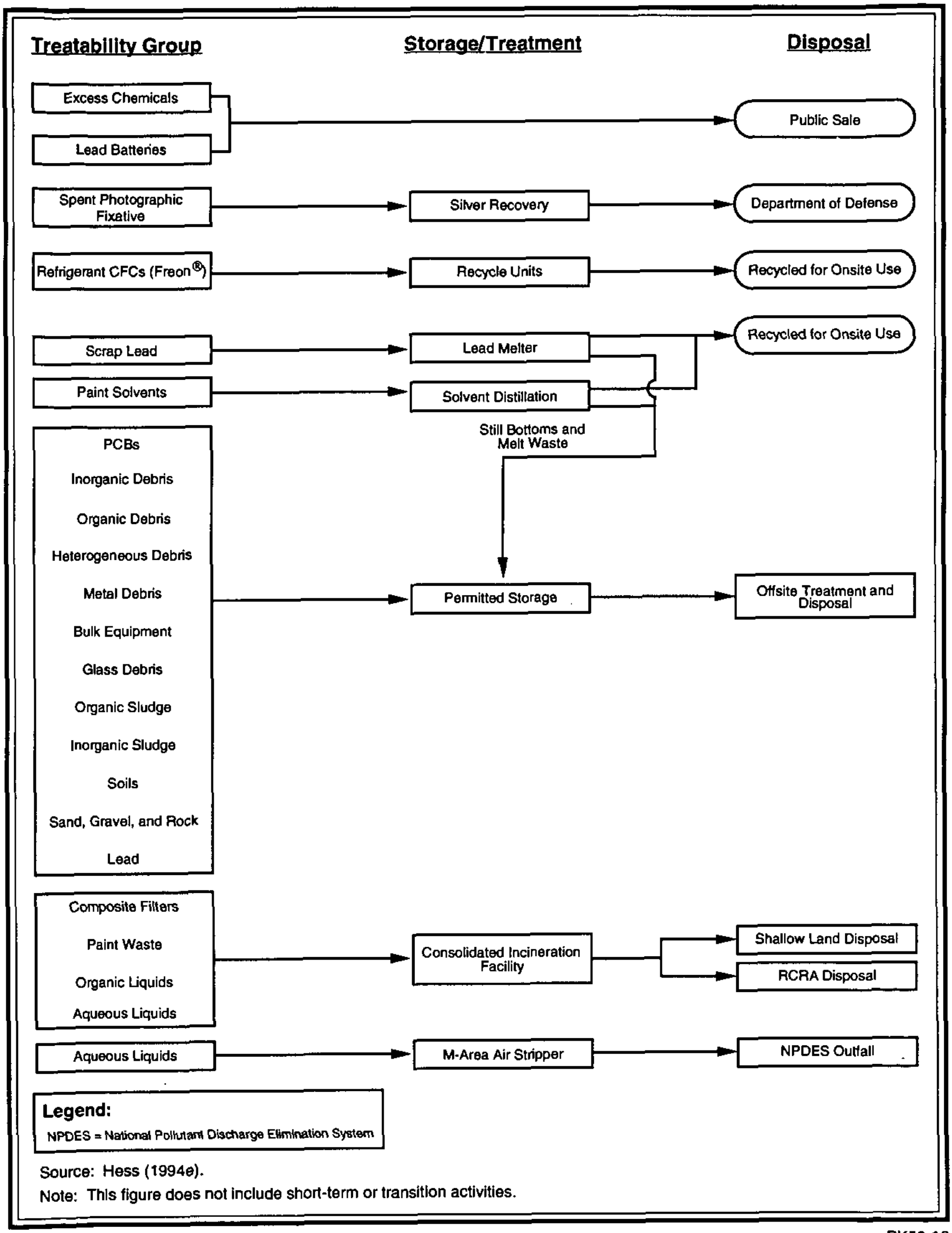

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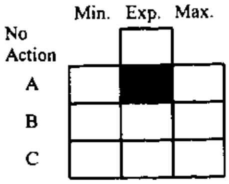
Figure 2-18. Hazardous waste management plan for alternative A expected waste forecast.

2.4.5 MIXED WASTE



2.4.5.1 Mixed Waste – Expected Waste Forecast

For the expected forecast of waste generation, DOE would manage mixed waste to include activities under the no-action alternative presented in Section 2.2.5. In addition, under alternative A, DOE would implement limited mixed waste treatment activities necessary to provide a final waste form that would be suitable for disposal. Figure 2-19 summarizes the proposed mixed waste management activities under this alternative. In addition to the waste management practices for mixed waste under the no-action alternative, under alternative A DOE would:

- Store tritiated oils to allow time for radioactive decay.

TC

- Send elemental mercury and mercury-contaminated waste to the Idaho National Engineering Laboratory for treatment; residuals would be returned to SRS for RCRA-permitted disposal or shallow land disposal.

TC

- Send calcium metal waste to the Los Alamos National Laboratory for treatment; residuals would be returned to SRS for shallow land disposal.

- Send radioactive PCB wastes offsite for treatment; residuals would be returned for shallow land disposal at SRS.

- Send lead offsite for decontamination and recycling; residuals would be returned for RCRA-permitted disposal at SRS.

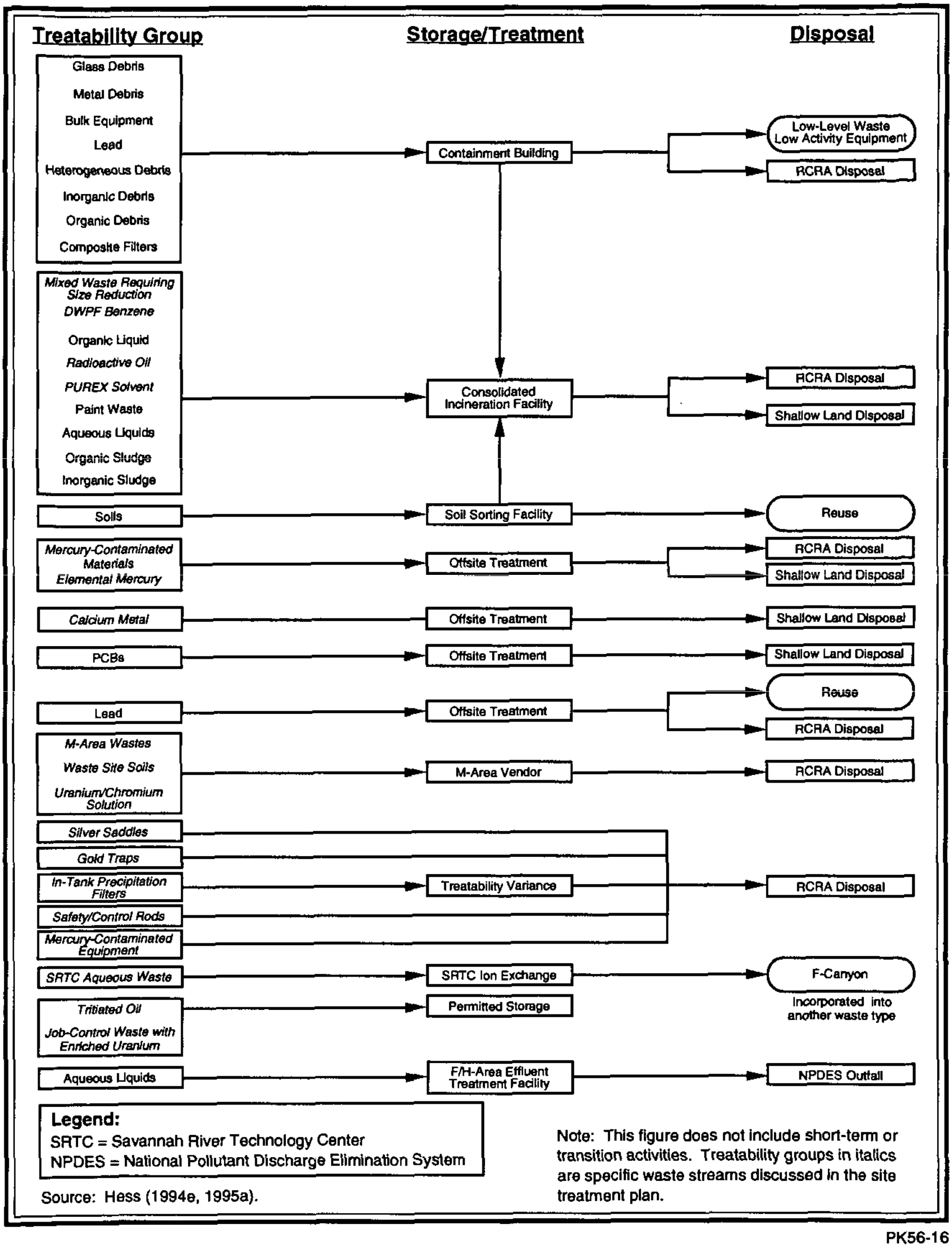


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Figure 2-19. Mixed waste management plan for alternative A expected waste forecast.

In addition, under alternative A, DOE would:

- Construct a containment building to decontaminate mixed wastes (mostly debris) and macroencapsulate contaminated debris and lead wastes.
- Operate the Consolidated Incineration Facility and burn certain mixed wastes, such as benzene generated by the Defense Waste Processing Facility, organic and aqueous liquid wastes, contaminated soils, spent decontamination solutions from the containment building, PUREX (plutonium-uranium extraction) solvent, paint waste, radioactive oil, and organic and inorganic sludges.
- Construct RCRA-permitted disposal vaults to dispose of stabilized ash and blowdown from the incineration process or send them to shallow land disposal.
- Construct and operate a soil sort facility to separate soil with undetectable contamination from contaminated soil. Contaminated soil would be burned in the Consolidated Incineration Facility and soil without detectable contamination would be used onsite as backfill material. TE
- Construct and operate the M-Area Vendor Treatment Facility to vitrify wastes generated by M-Area electroplating operations and the specific wastes identified in the *SRS Proposed Site Treatment Plan*. TE

2.4.5.1.1 Containerized Storage

For alternative A – expected waste forecast, DOE would continue to store mixed waste in the three mixed waste storage buildings, the M-Area storage building, and on three waste storage pads. The non-alpha mixed waste (i.e., waste with less than 10 nanocuries per gram of transuranics) that is now stored on the transuranic waste storage pads would be transferred to the mixed waste storage pads. To allow for storage of mixed waste while treatment facilities are being constructed, DOE would build additional mixed waste storage buildings as needed. Based on the usable capacity of Building 643-43E described in Section 2.2.5.1, DOE estimates that a maximum of 79 additional buildings would be required by 2005 (Hess 1995c). Due to their small size (Building 643-29E) or remote locations (Buildings 645-2N and 316-M), DOE would no longer use the existing mixed waste storage buildings after their waste inventories were removed for treatment and disposal. If these existing mixed waste storage buildings were used for future storage needs, their combined storage capacities would offset the need for approximately one new storage building.

TC TE

DOE would continue to store mercury-contaminated tritiated oils generated by SRS tritium facilities in the mixed waste storage buildings. Due to the high tritium content of these oils, DOE determined that the tritiated oil would need to be stored for an extended period to allow the tritium (with a half-life of about 10 years) to decay to manageable levels. DOE is investigating the possibility of treating the tritiated oil with a mobile packed bed reactor currently under development at Los Alamos National Laboratory. The reactor is a mobile unit that DOE could transport to SRS and operate within a containment building. DOE would continue to store the tritiated oil for decay pending Los Alamos National Laboratory's development of the packed bed reactor or other technology (WSRC 1995). For purposes of this EIS, it is assumed that DOE would continue to store radioactive oils with high tritium content for the duration of the 30-year analysis period. TC

In the draft EIS, DOE proposed to send job-control wastes contaminated with solvents and enriched uranium to the Consolidated Incineration Facility. DOE has determined that this treatment could concentrate the uranium in the incinerator ash at levels that could result in an unplanned nuclear reaction. DOE is currently investigating alternate treatments for this waste, such as reprocessing the materials to recover the uranium or macroencapsulation. Additionally, the initial characterization of these materials was conservative and DOE believes that chemical analyses and further review of documentation regarding the composition of the waste may result in reclassification as nonhazardous low-level waste rather than mixed waste (WSRC 1995). The EIS assumes that this material (approximately 260 cubic meters) will remain in permitted storage pending recharacterization or the development of an appropriate treatment technology. TC

2.4.5.1.2 Treatment and/or Tank Storage

For alternative A – expected waste forecast, DOE would continue treatment and tank storage practices for Savannah River Technology Center aqueous wastes and PUREX solvent waste, as described in Section 2.2.5.2. In addition, the 568-cubic-meter (150,000-gallon) Organic Waste Storage Tank would be used under this case for storing mixed organic waste generated by the Defense Waste Processing Facility. DOE would treat this waste at the Consolidated Incineration Facility, assuming it begins operating in 1996. Assuming the Consolidated Incineration Facility operates, additional tank storage capacity would not be required. TE

DOE would continue to use the M-Area Process Waste Interim Treatment/Storage Facility tanks to store concentrated mixed wastes from the M-Area Liquid Effluent Treatment Facility. DOE plans to treat six types of waste currently stored in the Process Waste Interim Treatment/Storage Facility tanks (as listed in Appendix B.15) and the M-Area storage building by a vitrification process in the M-Area Vendor TE

Treatment Facility. The M-Area Vendor Treatment Facility was identified as the preferred option for two additional wastes (listed in Appendix B.15) in the *SRS Proposed Site Treatment Plan*. Additional tank capacity would not be required; the existing M-Area Process Waste Interim Treatment/Storage Facility tanks would be used for feed preparation and to transfer blowdown waste from the offgas scrubber from the vitrification process to the M-Area Liquid Effluent Treatment Facility. DOE has submitted a RCRA permit application requesting interim status for a pad in M-Area to store the vitrified wastes and the stabilized ash and blowdown wastes from the Consolidated Incineration Facility.

For the expected forecast, DOE would construct and operate a containment building for decontaminating approximately 34 percent of the expected mixed waste for the 30-year period (glass, metal, organic, inorganic, and heterogeneous debris; bulk equipment; and composite filters). The decontamination process would consist of such technologies for the removal of hazardous constituents as degreasing, water washing, and frozen carbon dioxide pellet blasting. Decontaminated debris and equipment would be managed as low-activity waste equipment (see Section 2.4.3). Materials that could not be decontaminated would be macroencapsulated in welded stainless steel boxes or in a polymer coating. Secondary wastes from the decontamination process would be collected for incineration in the Consolidated Incineration Facility. It is estimated that 80 percent of the materials would be decontaminated. Spent decontamination solutions are estimated to constitute 50 percent of the original volume of the materials to be decontaminated (Hess 1994e). DOE would also macroencapsulate lead wastes in the containment building. The lead would be placed in a polymer coating in accordance with RCRA requirements. See Appendix B.6 for a description of the containment building.

DOE would construct and operate a soil sort facility to separate contaminated soils from soils with no detectable contamination. Under alternative A, the soil sort facility would be mobile. Approximately 39 percent of the anticipated mixed waste consists of soils that would be processed at this facility. It is estimated that 60 percent of the incoming soils would be contaminated and require treatment prior to disposal (Hess 1994e). Contaminated soils would be incinerated in the Consolidated Incineration Facility, and soils with nondetectable contamination would be used as backfill. See Appendix B.28 for a description of the soil sort facility.

DOE would begin operating the Consolidated Incineration Facility in 1996 to treat approximately 33 percent of the mixed waste anticipated in the expected forecast, including benzene waste generated by the Defense Waste Processing Facility, organic and aqueous liquid wastes, PUREX solvent, paint waste, radioactive oil, contaminated soils, and organic and inorganic sludges. Certain mixed wastes (e.g., filter media from the M-Area Liquid Effluent Treatment Facility and solvent-contaminated rags and wipes) would be reduced in size or repackaged to conform to the Consolidated Incineration Facility's waste acceptance criteria (i.e., solid wastes must be packaged in 21-inch cardboard boxes) prior to incineration. The Consolidated Incineration Facility would also treat approximately 2,000 cubic meters (5.30×10^5 gallons) per year of spent decontamination solutions from the containment building. Stabilized ash and blowdown waste from the Consolidated Incineration Facility would be sent to RCRA-permitted disposal or to shallow land disposal. It is estimated that 70 percent of the stabilized ash and blowdown would be sent to RCRA-permitted disposal and 30 percent would be sent to shallow land disposal (Hess 1994e).

DOE would begin shipping small quantities of elemental mercury and mercury-contaminated waste for treatment at the Idaho National Engineering Laboratory Waste Experimental Development Facility, as identified in the *SRS Draft Site Treatment Plan*. The elemental mercury would be treated by amalgamation, and the mercury-contaminated waste would be stabilized in a grout matrix. The treated wastes would be returned to SRS for disposal. See Appendix B.21 for a description of the offsite treatment activities.

DOE would begin shipping low-level PCB wastes offsite for treatment of the PCB fraction. The radioactive residuals from treatment would be returned to SRS for shallow land disposal. TE

DOE would begin shipping lead to an offsite commercial facility for decontamination. It is estimated that 80 percent of the lead would be decontaminated (Hess 1994e). The commercial facility would return radioactive residuals from the decontamination process and the portion of the lead waste that could not be decontaminated to SRS for disposal. For purposes of assessment, the commercial facility to be used for the treatment of mixed waste lead was assumed to be located in Oak Ridge, Tennessee. In terms of transportation distance and surrounding population, this location is representative of the range of possible locations. TC

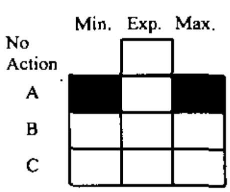
DOE would make a one-time shipment of calcium metal waste to the Los Alamos National Laboratory for treatment by the Reactive Metals Skid, a mobile wet oxidation unit. The radioactive residuals from treatment would be returned to SRS for shallow land disposal (WSRC 1995). TC

2.4.5.1.3 Disposal

DOE submitted an application for a RCRA permit to SCDHEC for 10 Hazardous Waste/Mixed Waste Disposal Vaults. For purposes of this EIS, DOE based its proposed disposal vaults on the design of its current Hazardous Waste/Mixed Waste Disposal Vault.

As described in Section 2.2.5.3 under the no-action alternative, DOE would construct and operate TE RCRA-permitted vaults for disposal of mixed wastes. In addition, for the alternative A – expected waste forecast, DOE would manage hazardous waste in these vaults and would also dispose of 70 percent of the stabilized ash and blowdown from the Consolidated Incineration Facility; treated elemental mercury from the Idaho National Engineering Laboratory; and macroencapsulated debris, bulk equipment, and lead from the containment building in the vaults. The first of the RCRA-permitted disposal vaults would begin accepting wastes in 2002, and DOE would construct additional vaults as needed (Hess 1995c). Refer to Section 2.4.7 for mixed waste disposal capacity projections over the 30-year period.

Mixed wastes subject to RCRA because they exhibit a hazardous characteristic may be treated in a way that eliminates the characteristic (e.g., toxic metals may be immobilized). If mixed wastes are treated in this manner, they need not be disposed of in RCRA-permitted facilities and DOE would dispose of them as low-level wastes. DOE would send 30 percent of the stabilized ash and blowdown from the Consolidated Incineration Facility, stabilized mercury waste from the Idaho National Engineering Laboratory, stabilized residuals from treating radioactive PCB wastes, and calcium metal treatment TC residuals to shallow land disposal (Hess 1994e, 1995a). Refer to Section 2.4.7 for projections of low-level waste disposal over the 30-year period.



2.4.5.2 Mixed Waste – Minimum and Maximum Waste Forecasts

For the alternative A – minimum and maximum waste forecasts, DOE would manage mixed waste somewhat differently than under the expected waste forecast (see Figure 2-19). These changes in waste management practices described for the expected waste forecast are attributed to the volume of soils TC anticipated in the minimum (27 percent) and maximum (54 percent) forecasts, compared to the expected (39 percent) forecast. In addition, because of the large volume of debris that would be decontaminated at the containment building for the maximum forecast, a wastewater treatment unit would be constructed to treat spent decontamination solutions (see Appendix B.6 for a discussion of the wastewater treatment unit). Limited quantities of liquid and solid residuals from the wastewater treatment unit (approximately 6 percent of the influent wastewater volume) would be burned at the Consolidated Incineration Facility. Table 2-26 describes the percentage of mixed waste distributed among the various treatment options for the minimum and maximum forecasts.

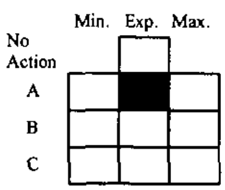
Table 2-26. Mixed waste treatment options for alternative A minimum and maximum forecasts.[a,b]

Minimum waste forecast	Maximum waste forecast
27 percent to soil sort facility	54 percent to soil sort facility
46 percent to containment building	34 percent to containment building
33 percent incinerated	36 percent incinerated

TC

a. Source: Hess (1995c).
b. Percentages are approximate.

2.4.6 TRANSURANIC AND ALPHA WASTE



2.4.6.1 Transuranic and Alpha Waste – Expected Waste Forecast

For alternative A – expected waste forecast, DOE would provide the treatment (primarily packaging) essential to allow disposal of alpha (10 to 100 nanocuries per gram) and transuranic (greater than 100 nanocuries per gram) wastes. TE

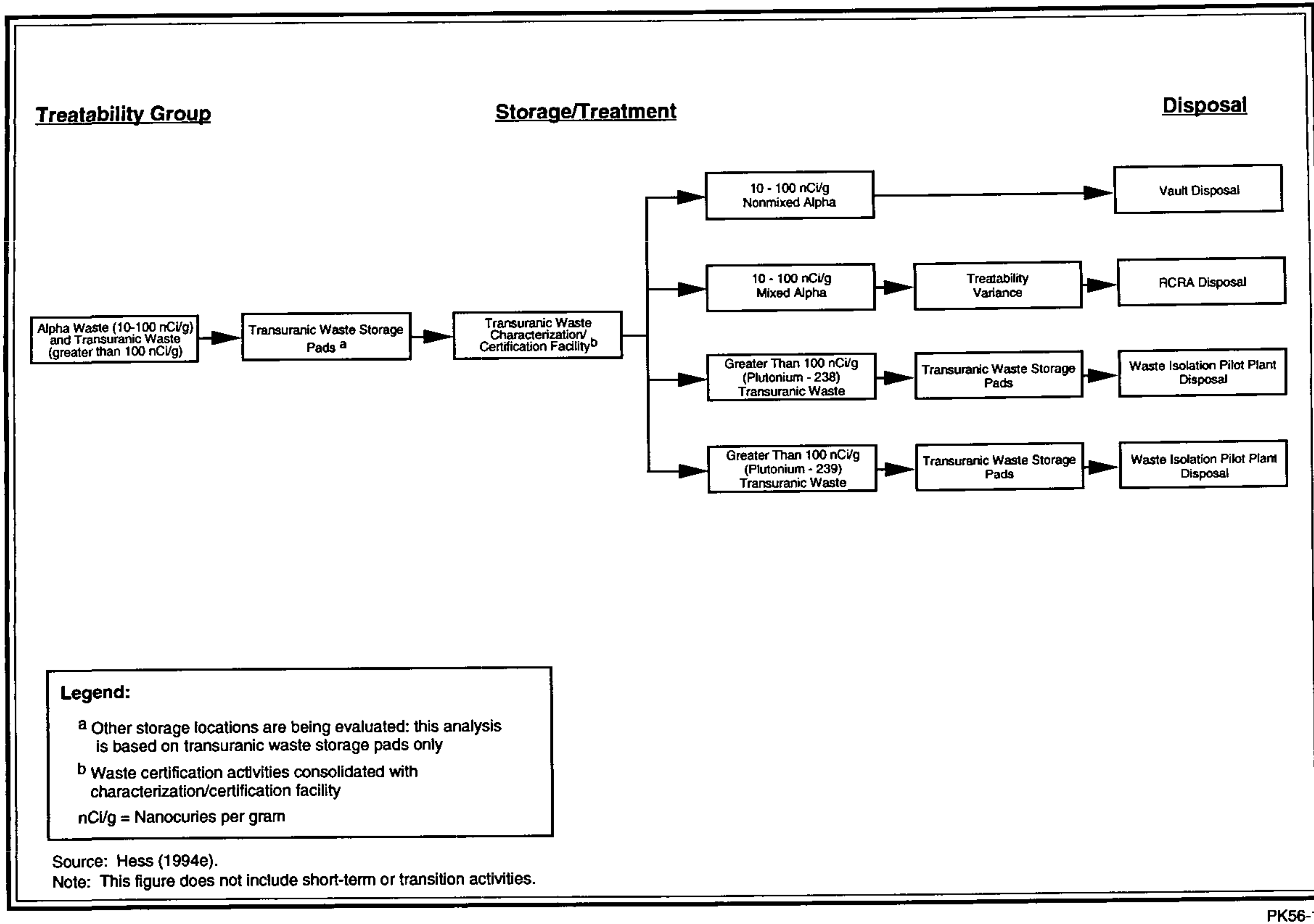
Figure 2-20 summarizes management practices for the proposed alpha and transuranic waste under alternative A, which include the waste management practices under the no-action alternative as described in Section 2.2.6 and the following:

- Construct and operate a transuranic waste characterization/certification facility to characterize, treat, repackage, and certify waste for disposal.

- Construct facilities to dispose of nonmixed and mixed alpha waste onsite in the low-activity waste vaults or RCRA-permitted disposal vaults.

- Return Rocky Flats incinerator ash currently in storage for consolidation and treatment with similar wastes at that facility. TC

- Dispose of transuranic waste at the Waste Isolation Pilot Plant (Hess 1994e, 1995a). TE



TE

TC

Figure 2-20. Transuranic waste management plan for alternative A expected waste forecast.

2.4.6.1.1 Storage

DOE would continue to accumulate alpha and transuranic waste as described in the no-action alternative (Section 2.2.6). DOE would package and store containers on transuranic waste storage pads to await processing, retrieve drums from mounded storage on Transuranic Waste Storage Pads 2 through 6, and construct new pads as needed.

To meet RCRA storage requirements for newly generated waste, DOE would construct 12 additional transuranic storage pads by 2006 (Hess 1995c). TC

For purposes of this EIS, it is assumed that the Waste Isolation Pilot Plant would operate from 1998 to 2018 and would accept SRS's transuranic waste (WSRC 1995). Transuranic waste processed by the transuranic waste characterization/certification facility (Appendix B.31) after 2018 would remain in TE
storage at SRS until a new geologic repository became available. DOE would require 2 transuranic TC
waste storage pads to store the transuranic waste processed and packaged between 2019 and 2024 (Hess 1995c). DOE has not yet determined how these wastes will be disposed of. TE

2.4.6.1.2 Treatment

DOE would return a small amount (0.1 cubic meter) of incinerator ash from Rocky Flats that is currently stored at SRS to Rocky Flats for consolidation and treatment with similar wastes. The *SRS Proposed Site Treatment Plan* concluded that it was not cost effective to develop treatment at SRS for this small quantity of material. Rocky Flats is currently investigating alternatives for management of the ash and at this time it is not known what the final disposition of the material will be. TE TC

From 1995 to 2006, the Experimental Transuranic Waste Assay Facility/Waste Certification Facility (Appendix B.9) would process for disposal 6 percent of the 30-year forecast waste volume. The facility would operate at an average capacity of 118 cubic meters (4,200 cubic feet) per year during this period. The facility would characterize and certify newly generated nonmixed and mixed alpha waste (4 and 2 percent of the forecast waste volume, respectively) for disposal in low-activity waste vaults and RCRA-permitted disposal vaults, respectively. TE TC The facility would handle only drummed waste and would need to be modified to encapsulate mixed alpha debris waste by welding shut the lids of drums. DOE would request a treatability variance from EPA so that the non-debris portion of the mixed alpha waste (less than 5 percent) could be treated in accordance with the land disposal restrictions standards for hazardous debris. Macroencapsulation in welded containers would be the preferred treatment for the

TE mixed alpha waste that did not meet the RCRA definition of debris (Hess 1994e). Further details on this topic are found in Appendix B.9.

TE For the purposes of this EIS, it is assumed that the Waste Isolation Pilot Plant would receive a no-migration variance (DOE 1986). A no-migration variance means that the disposal facility has been shown to be protective of the environment because migration of hazardous constituents from the facility would not occur while the waste remains hazardous. As a result, wastes sent to the Waste Isolation Pilot Plant would not need to meet RCRA requirements for land disposal. DOE would perform very little treatment on the transuranic waste and would package it to meet waste acceptance criteria for the Waste Isolation Pilot Plant.

TE TE DOE would construct and operate a transuranic waste characterization/certification facility to perform assays and characterize the existing waste in drums, culverts, and boxes stored on transuranic waste storage pads. The facility would begin operating in 2007 and would segregate the waste into one of the following four categories based on its radiological and RCRA characteristics (Hess 1994e):

- TE <u>Nonmixed Alpha Waste</u> (10 to 100 nanocuries per gram) consist of job-control and bulk wastes that do not meet the DOE definition of transuranic waste. DOE manages this waste as transuranic waste because the generating facilities did not have the capabilities to test them to demonstrate that they have less than 100 nanocuries of transuranic contamination per gram.

- TE <u>Mixed Alpha Waste</u> (10 to 100 nanocuries per gram) consists of job-control and bulk wastes that also contain RCRA hazardous waste. Because of the presence of the hazardous constituents, this waste must meet RCRA requirements.

- TE <u>Plutonium-238 Waste</u> (greater than 100 nanocuries per gram) is contaminated predominantly with the plutonium-238 radioisotope. Plutonium-238 is difficult to ship because of the heat and gas generated by its radiological decay. DOE would reevaluate its curie loading limits for shipping containers used to package plutonium-238 to determine whether this waste could be transported safely (Hess 1994i). DOE would characterize the plutonium-238 waste separately to accommodate modifications to the shipping requirements for this waste.

- <u>Plutonium-239 Waste</u> (greater than 100 nanocuries per gram) is contaminated predominantly with the plutonium-239 radioisotope. Decay heat and gas generation do not generally present problems for shipping this waste to the Waste Isolation Pilot Plant in the current containers. Higher-activity plutonium-239 waste may require treatment to eliminate gas generation that would impede shipment of this waste.

From 2007 to 2024, the transuranic waste characterization/certification facility would process 94 percent TC
of the forecast waste volume. The job-control and bulk waste would be sorted according to its
radioactive and hazardous constituents and repackaged into 55-gallon drums. This EIS assumes the
following distribution among the four categories of transuranic waste: 17 percent nonmixed alpha,
3 percent mixed alpha, 64 percent plutonium-238, and 16 percent plutonium-239. It is further assumed TC
that the facility would reduce the volume of the alpha waste by 30 percent through processing and TE
repackaging (Hess 1994e). In the draft EIS, DOE assumed that a 30 percent volume reduction would be
realized for transuranic wastes. However, due to shipping constraints (i.e., curie loading restrictions of
the transuranic waste transportation vehicle) imposed on transuranic wastes containing organic materials TC
that could generate gas, DOE no longer believes it would be possible to achieve more efficient
packaging, and thereby increase the curie loading, of the transuranic waste drums that would be shipped
to the Waste Isolation Pilot Plant. Therefore, no volume reduction was assumed for the transuranic
waste processed between 2007 and 2018. A 30 percent volume reduction is assumed to result from the
processing and repackaging of transuranic waste between 2019 and 2024 as this waste would not be
shipped to the Waste Isolation Pilot Plant. TC

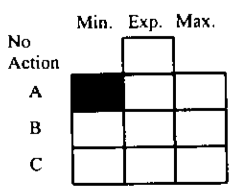
The nonmixed alpha wastes would be repackaged for disposal in the low-activity waste vaults. DOE
would macroencapsulate mixed alpha waste in accordance with the treatability variance from EPA for
the non-debris portion as described for the Experimental Transuranic Waste Assay Facility/Waste
Certification Facility (Hess 1994h). The macroencapsulated mixed waste would be sent to TE
RCRA-permitted disposal vaults. Transuranic waste would be repackaged according to the predominant
radioisotope content (i.e., plutonium-238 or -239) to meet shipping requirements and the waste
acceptance criteria for disposal at the Waste Isolation Pilot Plant (Hess 1994i). Further details on this TE
topic are found in Appendix B.31.

2.4.6.1.3 Disposal

Under alternative A, it is estimated that volumes for disposal would be reduced 7 percent through TC
operation of the transuranic waste characterization/certification facility. During the period between 1995
and 2006, nonmixed and mixed alpha wastes would be disposed of in the low-activity waste vaults or
sent to RCRA-permitted disposal (4 and 2 percent of the processed volume, respectively) through
certification by the waste generators that would be verified through operation of the Experimental TC
Transuranic Waste Assay Facility/Waste Certification Facility (Hess 1995c). TE

During the period between 2007 and 2024, nonmixed alpha waste (12 percent of the processed volume) would be disposed of in the low-activity waste vaults, treated mixed alpha waste (2 percent of the processed volume) would be sent to RCRA-permitted disposal, and transuranic waste (77 percent of the processed volume) would be sent to the Waste Isolation Pilot Plant (until 2018) (Hess 1995c). Transuranic waste not sent to the Waste Isolation Pilot Plant by 2018 (3 percent of the processed volume) would remain in storage on 2 transuranic waste storage pad until a new geologic repository became available. DOE has not evaluated how it will dispose of this waste.

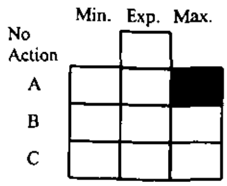
DOE would ship 1,345 cubic meters (47,500 cubic feet) per year of transuranic waste to the Waste Isolation Pilot Plant between 2008 and 2018. The Waste Isolation Pilot Plant Land Withdrawal Act (P.L. 102-579, October 30, 1992) authorizes a total of 1.76×10^5 cubic meters (6.2×10^6 cubic feet) of waste in this repository. By 2018, DOE would have shipped a volume of waste equal to 9 percent of the total capacity of the Waste Isolation Pilot Plant (Hess 1995c).



2.4.6.2 Transuranic and Alpha Waste – Minimum Waste Forecast

Despite smaller volumes anticipated in the minimum waste forecast, DOE would continue management practices for transuranic and alpha wastes, as shown in Figure 2-20. To accommodate the transuranic waste storage pads and newly generated waste, DOE would need three additional pads by 2006 for alternative A – minimum waste forecast. By 2024, DOE would need only one pad to store the remaining processed and packaged transuranic waste.

The Experimental Transuranic Waste Assay Facility/Waste Certification Facility would process newly generated alpha waste until the transuranic waste characterization/certification facility began operating in 2007 (Hess 1994e). Following characterization and repackaging, the nonmixed alpha waste (15 percent of the processed volume) would remain at SRS for disposal in low-activity waste vaults. Mixed alpha waste (5 percent of the processed volume) would be macroencapsulated and sent to RCRA-permitted disposal. The transuranic waste (79 percent of the processed volume) would go to the Waste Isolation Pilot Plant. One percent of the processed transuranic waste volume would remain in storage on one transuranic waste storage pad. DOE would ship 975 cubic meters (34,400 cubic feet) per year of transuranic waste to the Waste Isolation Pilot Plant during the period between 2008 and 2018. By 2018, DOE would have shipped for disposal a quantity of transuranic waste equal to 7 percent of the total capacity of the Waste Isolation Pilot Plant (Hess 1995c).



2.4.6.3 Transuranic and Alpha Waste – Maximum Waste Forecast

For alternative A – maximum waste forecast, DOE would change transuranic and alpha waste management practices because of the substantially larger volumes of transuranic waste (25 times the expected waste forecast). In addition, there would be a larger volume of mixed alpha waste (45 percent of the total volume compared to 16 percent for the expected waste forecast) for processing and disposal. The larger volumes would result from extensive environmental restoration such as exhuming previously disposed waste. Environmental restoration during the period 2000 through 2005 would account for 93 percent of the forecast waste volume.

DOE would require 1,168 additional transuranic waste storage pads by 2006 for the alternative A – TC
maximum waste forecast to store the anticipated waste volumes. By 2024, DOE would need only
two transuranic waste storage pads to store the remaining processed and packaged transuranic waste TC
(i.e., that which had not been disposed of) (Hess 1995c). TE

DOE would manage mixed alpha waste somewhat differently under the maximum waste forecast than under the expected waste forecast. In the expected forecast, most of the mixed alpha waste would be macroencapsulated by the waste generators or in the Experimental Transuranic Waste Assay TC
Facility/Waste Certification Facility; however, in the maximum case, most macroencapsulation would be conducted in the transuranic waste characterization/certification facility. DOE would need macroencapsulation capacity 375 times that required for the expected forecast to manage mixed alpha waste. DOE would need approximately 160 times the disposal capacity as well.

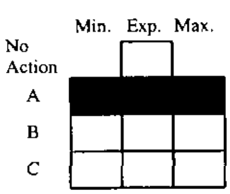
From 1995 through 2006, nonmixed and mixed alpha waste would be placed in low-activity waste vaults
or sent to RCRA-permitted disposal, respectively (each less than 0.25 percent of the processed volume), TC
through the operation of the Experimental Transuranic Waste Assay Facility/Waste Certification Facility
(Hess 1995c). TE

For the maximum waste forecast, the operation of the transuranic waste characterization/ certification facility would reduce the waste volume for disposal by 17 percent. The facility would
process most of the waste (99 percent of the forecast waste volume) for disposal. The waste TC
characterization assumed the following distribution among the four categories: 17 percent nonmixed

alpha, 41 percent mixed alpha, 34 percent plutonium-238, and 8 percent plutonium-239 waste (Hess 1995a, c).

During the period between 2007 and 2024, nonmixed alpha waste (14 percent of the processed volume) would be disposed of in low-activity waste vaults. Treated mixed alpha waste (35 percent of the processed volume) would be sent to RCRA-permitted disposal, and most of the transuranic waste (50 percent of the processed volume) would be available for shipment to the Waste Isolation Pilot Plant. Less than one-half percent of the processed volume of transuranic waste would remain in storage on two transuranic waste storage pads (Hess 1995c).

For the maximum forecast, DOE would have available for shipment to the Waste Isolation Pilot Plant approximately 19,197 cubic meters (6.78×10^5 cubic feet) per year of transuranic waste between the years 2008 and 2018 as a result of the transuranic waste characterization/certification facility's operations. This transuranic waste volume is more than 30 percent greater than the total capacity (1.76×10^5 cubic meters or 6.2×10^6 cubic feet) authorized for the repository under the Waste Isolation Pilot Plant Land Withdrawal Act. The only alternative to transfer of this material to the Waste Isolation Pilot Plant would be storing it at SRS beyond the 30-year period analyzed by this EIS. The volume of transuranic waste in excess of the maximum capacity authorized for the repository would be the equivalent of approximately 120 storage pads. Therefore, the limited treatment configuration proposed under alternative A is incompatible with the transuranic waste volumes anticipated in the maximum waste forecast.



2.4.7 SUMMARY OF ALTERNATIVE A FOR ALL WASTE TYPES

Under alternative A, DOE would continue the activities to manage waste at SRS listed for the no-action alternative (Section 2.2.7), including construction of additional storage capacity for mixed waste and transuranic and alpha wastes, but less than is required under the no-action alternative. In addition, DOE would:

- Construct and operate a containment building to process mixed wastes.
- Operate a mobile soil sort facility.
- Treat small quantities of mixed and PCB wastes offsite.
- Burn mixed and hazardous wastes in the Consolidated Incineration Facility.

- Construct and operate a transuranic waste characterization/certification facility.
- Store transuranic waste until it can be sent to the Waste Isolation Pilot Plant.

Figure 2-21 presents a timeline for the ongoing and proposed waste management activities for alternative A. DOE would operate the existing and planned waste management facilities until the proposed facilities could be designed, constructed, and begin operating. For all the waste types except high-level waste, the ongoing and planned activities that would occur from 1995 to approximately 2007 are shown in Figure 2-22. The proposed waste management activities after 2007 are shown in Figure 2-23. Table 2-27 presents the additional storage, treatment, and disposal facilities under alternative A and a comparison to those required under the no-action alternative. TC

The largest impacts to land outside of E-Area would occur under the maximum waste forecast. Approximately 802 acres would be required for waste storage facilities until treatment begins in approximately 2006. However, by 2024, most of the waste would have been treated and disposed of and the land needed outside of E-Area would be only 248 acres. It is highly unlikely that the technology used to store the waste volumes under the minimum and expected forecasts would be suitable for the maximum forecast. However, to compare the different treatment configurations among the alternatives of this EIS, the comparison was made assuming the same technology would be applied for all three waste forecasts. For example, DOE would likely construct the 12 additional transuranic waste storage pads required for the expected case; however, DOE would probably elect not to use the same technology to build 1,168 pads required for the maximum forecast. TC

The large volumes anticipated in the maximum forecast would become reality only if all of the assumptions in the maximum forecast prove true. The waste volumes in the maximum forecast are dominated by large amounts of transuranic and mixed wastes from the exhumation of waste previously disposed of in the Burial Ground Complex and Mixed Waste Management Facility. If future remediation decisions regarding those units were to determine that waste removal of the magnitude assumed for the maximum forecast were in fact required, additional NEPA evaluation might be required to identify the appropriate technologies for this amount of waste. It is doubtful that the hundreds of acres estimated in this EIS would be used. DOE would examine alternatives such as using surplus facilities across SRS to store waste while the treatment facilities were being built. TE

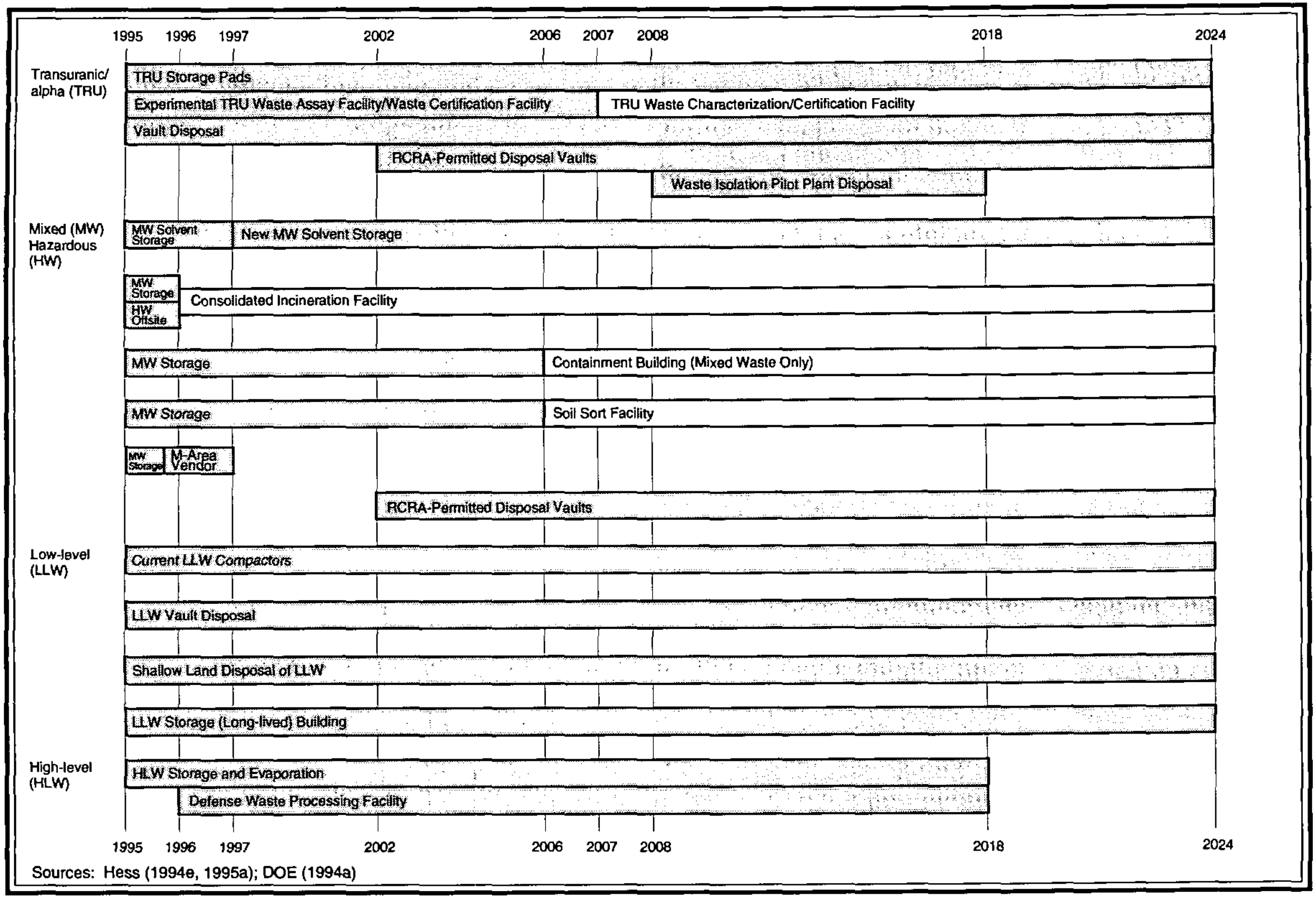


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Figure 2-21. Timeline for waste management facilities in alternative A.

Legend:
Activities or facilities that are part of the no-action alternative
Activities or facilities that would occur under alternative A

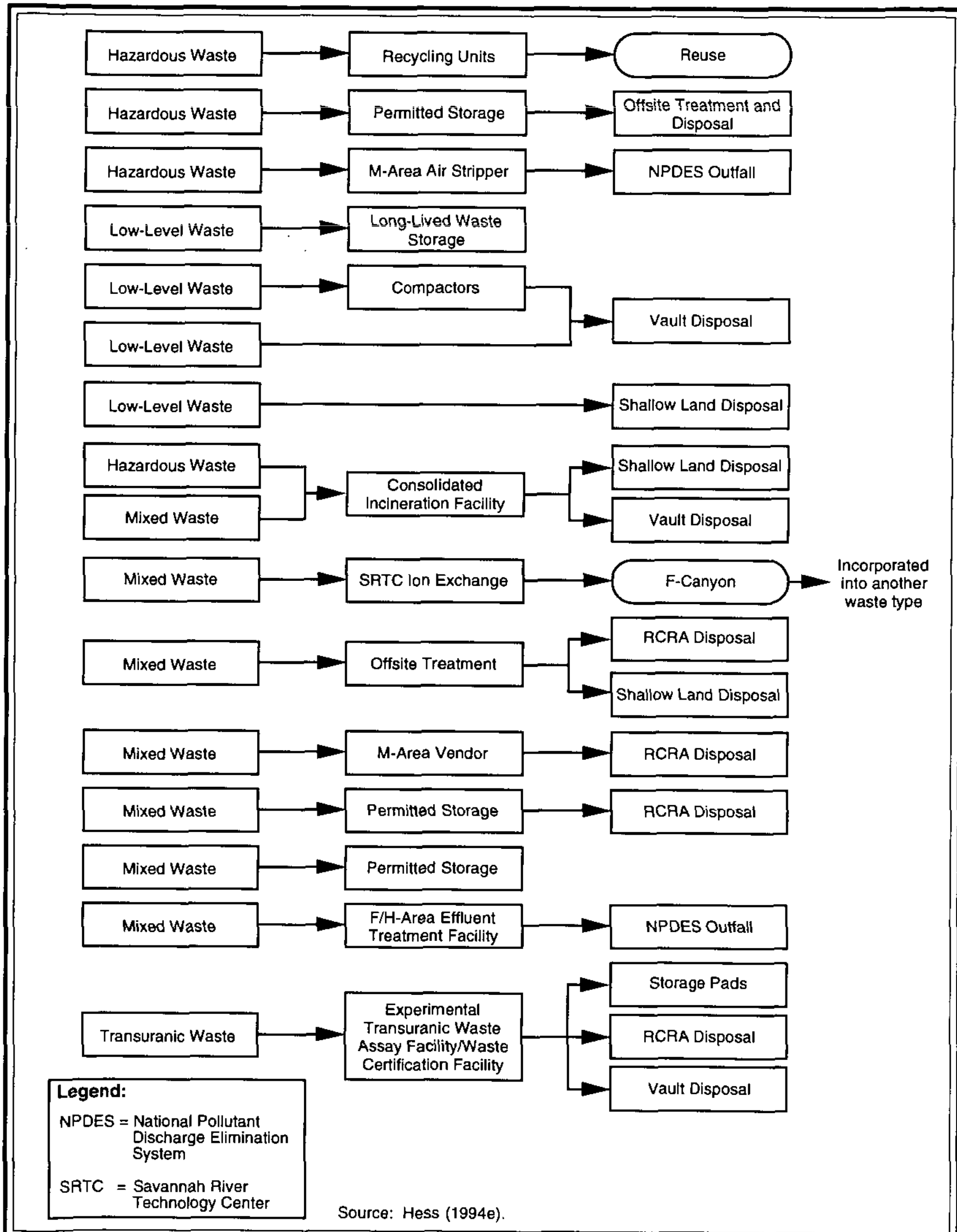

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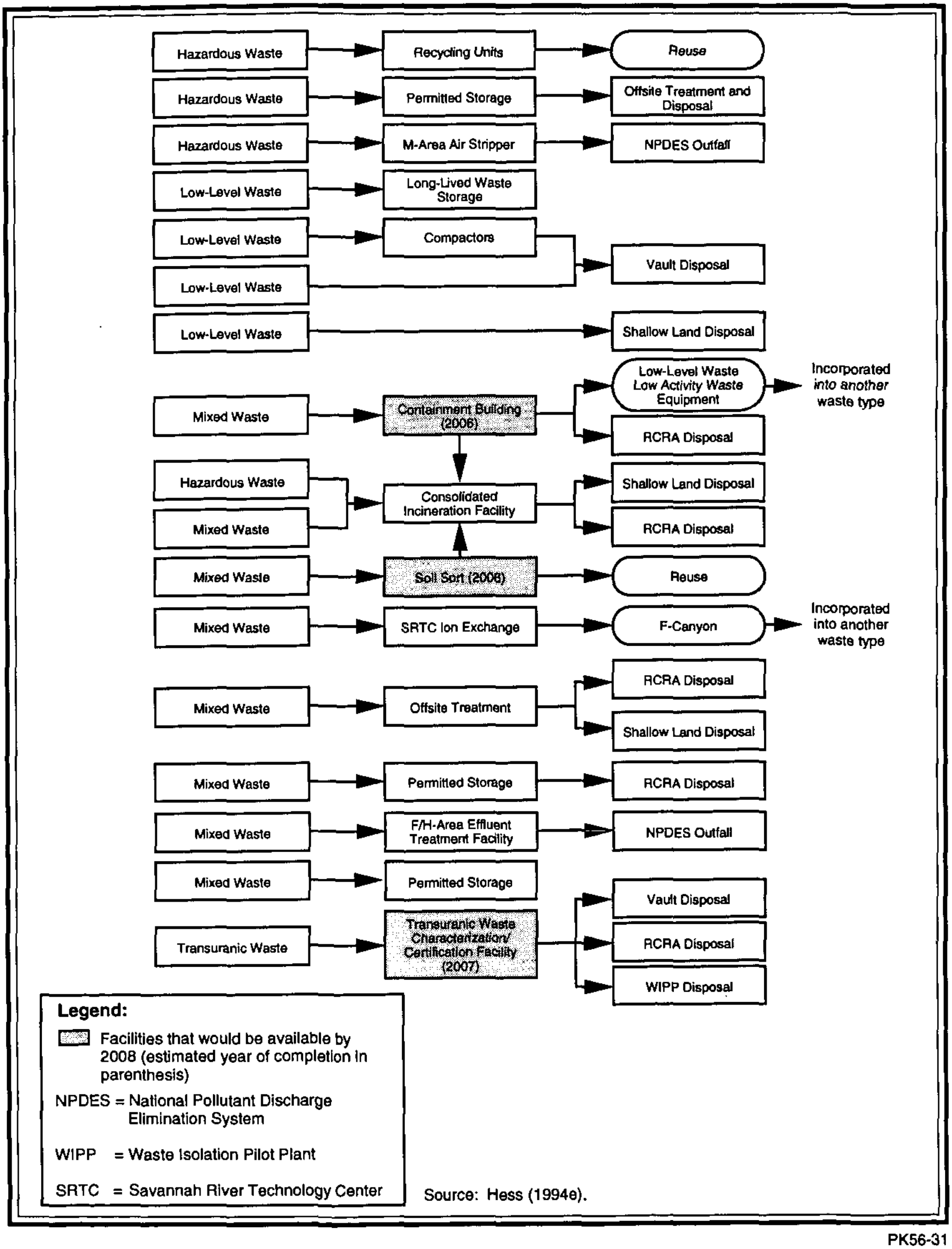
Figure 2-22. Summary of waste management activites in alternative A until approximately the year 2007.



TE **Figure 2-23.** *Summary of waste management activities in alternative A after the year 2007.*

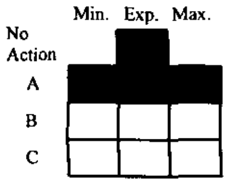
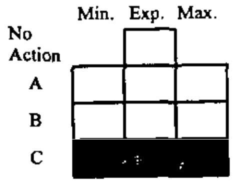


Table 2-27. Comparison of treatment, storage, and disposal facilities under alternative A and the no-action alternative. | TC

	Minimum	Expected	Maximum
No action		**STORAGE:** Buildings 24 long-lived low-level waste 291 mixed waste Pads 19 transuranic and alpha waste Tanks 4 organic waste in S-Area 26 organic waste in E-Area 43 aqueous waste in E-Area **TREATMENT:** Continue ongoing and planned waste treatment activities **DISPOSAL:** 29 shallow land disposal trenches 10 low-activity waste vaults 5 intermediate-level waste vaults 1 RCRA disposal facility	
A	**STORAGE:** Buildings 7 long-lived low-level waste 45 mixed waste Pads 3 transuranic and alpha waste **TREATMENT:** Same as expected waste forecast **DISPOSAL:** 25 shallow land disposal trenches 9 low-activity waste vaults 2 intermediate-level waste vaults 21 RCRA disposal facilities	**STORAGE:** Buildings 24 long-lived low-level waste 79 mixed waste Pads 12 transuranic and alpha waste **TREATMENT:** Continue ongoing and planned waste treatment activities; treat limited quantities of mixed and PCB waste offsite; operate the Consolidated Incineration Facility for hazardous and mixed wastes; modify the facility to accept mixed waste soils and sludges; construct and operate a mixed waste containment building, mixed waste soil sort unit, and transuranic waste characterization/certification facility **DISPOSAL:** 73 shallow land disposal trenches 12 low-activity waste vaults 5 intermediate-level waste vaults 61 RCRA disposal facilities	**STORAGE:** Buildings 34 long-lived low-level waste 757 mixed waste Pads 1,168 transuranic and alpha waste **TREATMENT:** Same as expected waste forecast, except containment building modified to include wastewater treatment capability to treat spent decontamination solutions; treat its secondary waste at the Consolidated Incineration Facility **DISPOSAL:** 644 shallow land disposal trenches 31 low-activity waste vaults 31 intermediate-level waste vaults 347 RCRA disposal facilities

TC

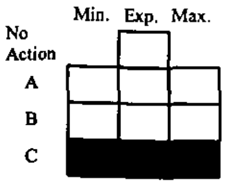
TE



2.5 Alternative C – Extensive Treatment Configuration

TE As described in the beginning of Chapter 2, DOE bases alternative C on proven treatment technologies that would minimize the volume and toxicity of waste and would create a highly migration-resistant final waste form. This alternative would comply with applicable regulatory requirements and would implement technologies and practices that emphasize treatment for stabilization or destruction of hazardous constituents to ensure protection of the environment.

Alternative C is identical to the no-action alternative with respect to the management of liquid high-level waste. This section discusses only the changes, if any, necessary in alternative C to accommodate the minimum and maximum forecasts of high-level wastes. Alternative C includes several treatment facilities for low-level, mixed, and transuranic wastes, including an offsite smelter, the Consolidated Incineration Facility, and the non-alpha vitrification facility for low-level waste; the Consolidated Incineration Facility, containment building, and non-alpha vitrification facility for mixed waste; and the
TC transuranic waste characterization/certification facility, Consolidated Incineration Facility, and alpha vitrification facility for transuranic and alpha wastes. Hazardous waste would also be treated onsite at the Consolidated Incineration Facility, containment building, and non-alpha vitrification facility. By implementing these treatments, DOE would appreciably decrease the amount of additional storage capacity for mixed and transuranic wastes from that required under the no-action alternative. Mixed waste storage would peak in 2005 and transuranic and alpha waste storage in 2006; the number of storage facilities would then decrease as new treatment facilities begin operations. Small quantities of mixed and PCB wastes would be sent offsite for treatment, and transuranic wastes would be sent to the Waste Isolation Pilot Plant for disposal when that facility becomes available. The waste volumes sent to shallow land disposal and to RCRA disposal facilities would increase from those projected for the no-action alternative due to the increased volume of treatment residuals. Sections 2.5.3, 2.5.4, 2.5.5, and
TC 2.5.6 discuss the proposed management activities for low-level, hazardous, mixed, and transuranic and alpha wastes under alternative C. Section 2.5.7 summarizes the activities and facilities under alternative C and compares them to those required under the no-action alternative.



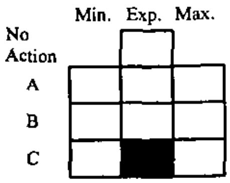
2.5.1 POLLUTION PREVENTION/WASTE MINIMIZATION

The waste minimization activities described for the no-action alternative (Section 2.2.1) would continue under alternative C. Only the waste throughput and recycled product output volumes would change. In addition to ongoing activities, DOE would initiate other waste minimization activities addressing low-level, hazardous, and mixed wastes. Table 2-28 summarizes the waste minimization activities that would occur under alternative C in addition to the ongoing (no-action) activities.

Table 2-28. Waste minimization activities for alternative C.[a]

Minimization activity	Treatability group	Waste forecast	Estimated reduction (cubic meters)[b]	
				TE
Source reduction	Low-level job-control waste	Expected	850	
		Minimum	850	
		Maximum	850	
Recycle into waste containers (beneficial reuse)	Low-activity metal waste	Expected	10,501	
		Minimum	5,894	TC
		Maximum	27,556	
Decontaminate for salvage	Hazardous metal waste	Expected	10,994	
		Minimum	3,182	
		Maximum	19,460	
Reuse decontaminated lead	Mixed waste lead	Expected	2,408	
		Minimum	1,053	TC
		Maximum	6,140	
Sort soil to divert for beneficial reuse	Mixed waste soils and concrete	Expected	35,332	TC
		Minimum	9,549	
		Maximum	176,039	
Sort soil to divert for beneficial reuse	Low-activity and suspect soil and small concrete pieces	Expected	19,333	
		Minimum	5,733	
		Maximum	301,469	

a. Sources: Hess (1994e, 1995c). TE
b. To convert to cubic feet, multiply by 35.31.



2.5.1.1 Pollution Prevention/Waste Minimization – Expected Waste Forecast

Source reduction efforts would be initiated to prevent the generation of an estimated 850 cubic meters (30,000 cubic feet) of low-level job-control waste. One such effort would eliminate the use of cardboard boxes for packaging certain low-level wastes for disposal. Another would be to minimize the number of mop heads going into the low-level job-control waste stream by replacing the current mop heads with a more efficient, longer-service-life mop head or a launderable mop head (Stone 1994d).

DOE would build on the beneficial reuse integrated demonstration program (Section 2.2.1.4.2) and help private industry establish a facility to recycle radioactively contaminated steel (Boettinger 1994a). The beneficial reuse program would recycle stainless steel and carbon steel from low-activity equipment
TC waste. An estimated 10,501 cubic meters (3.71×10^5 cubic feet) of low-activity equipment waste would
TE be recycled under this program (Hess 1995c). The low-activity equipment waste would include metal debris and bulk equipment that was originally mixed waste but had been cleared of hazardous constituents in the containment building. (One of the facilities proposed for alternative C is a mixed waste containment building where some hazardous wastes would also be treated. See Sections 2.5.4 and 2.5.5 and Appendix B.6 for more details.) Like the demonstration, the full-scale program would use an offsite smelter to decontaminate the steel; the steel would be fabricated into waste disposal containers for
TE return to and reuse by DOE. The offsite recycling process is described in Appendix B.19.

The containment building would also treat the following hazardous wastes: metal debris, bulk equipment, and waste equipment classified as hazardous due to lead content. The metal debris and bulk equipment would be decontaminated of hazardous constituents. The lead-bearing waste would be separated into pieces by metal type. The various scrap metals resulting from the decontamination and separation processes would then be reused by SRS as is, sent (if scrap lead) to the onsite lead melter for fabrication to a useful form (Section 2.2.1.4.2), or be sold as scrap metal to offsite recyclers. An estimated 13,743 cubic meters (4.85×10^5 cubic feet) of hazardous waste metal debris, bulk equipment, and lead-bearing material would be decontaminated or sorted, yielding an estimated 10,994 cubic meters
TE (3.88×10^5 cubic feet) (80 percent) of scrap metal for recycling (Hess 1995c).

TC Lead with surface radioactive contamination would be recycled. It is estimated that 3,010 cubic meters (1.10×10^5 cubic feet) of radioactively contaminated lead would be decontaminated, and an estimated
TC
TE 80 percent [2,408 cubic meters (85,000 cubic feet)] would be available for reuse (Hess 1995c).

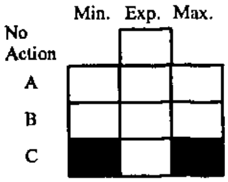
Mixed-waste lead that could not be decontaminated would be treated and disposed of onsite rather than recycled (DOE 1994d). See Section 2.4.1.1 for more information.

DOE would sort soil and associated rubble, including small pieces of concrete to reduce the amount of soils and concrete that would be disposed of. After separation, the contaminated soils would be disposed of rather than washed. Although considered as a treatment option, soil washing was not chosen for several reasons, including the fact that the contaminants would be transferred to the wash water. The secondary waste, contaminated wash water, could not be as easily treated and disposed of as other secondary wastes. Also, soil washing would be more expensive than other technologies, but would not result in a proportional decrease in the environmental risk posed by the residual waste and soil (Hess 1994j).

DOE would minimize the volume of low-activity soils, suspect soils, small pieces of concrete, and mixed | TE
waste soils and concrete that would require disposal by sorting them in the non-alpha vitrification
facility. The sorting process (described in Appendix B.18) would divert the materials with nondetectable | TE
levels of contamination to beneficial uses at SRS. The throughput is estimated to be 1.26×10^5 cubic
meters (4.43×10^6 cubic feet) [37,179 cubic meters (1.3×10^6 cubic feet) of low-level waste and
88,331 cubic meters (3.12×10^6 cubic feet) of mixed waste]. It is estimated that a total of 54,665 cubic | TC
meters (1.93×10^6 cubic feet) [19,333 cubic meters (6.83×10^5 cubic feet) from the low-level wastes and
35,332 cubic meters (1.25×10^6 cubic feet) from the mixed wastes] would be diverted for beneficial uses | TC
(Hess 1995c). Beneficial uses include backfill for shallow land disposal. | TE

DOE would not recycle large pieces of contaminated concrete as aggregate in construction or road-building projects because SRS would not have a need for the volume of aggregate that would be generated. The limited construction projects would have a large volume of uncontaminated concrete to draw from for "concrete to aggregate" recycling programs that DOE could initiate. Furthermore, recycling concrete would not pose a lower risk to the environment than disposing of the concrete, and recycling would be costly (Beaumier 1994).

DOE would also use waste minimization techniques to reduce the amount of waste generated by the waste management facilities. Liquids generated by the offgas systems in the non-alpha and alpha vitrification facilities would be recycled back into their processes in closed-loop systems. The features
of these facilities are further described in Appendixes B.1 and B.18. These liquid wastes would be | TE
treated and disposed of as mixed waste if they were not recycled into the process.



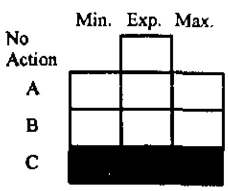
2.5.1.2 Pollution Prevention/Waste Minimization – Minimum and Maximum Waste Forecasts

For the minimum and maximum waste forecasts, DOE would continue to support the beneficial reuse program. The estimated volumes of low-activity equipment waste available for recycling under each waste forecast are indicated in Table 2-28.

DOE would implement decontamination and sorting processes for hazardous metal wastes (metal debris, bulk equipment, and waste equipment that are classified as hazardous due to lead content) to allow the recycling of scrap metal. These processes would yield scrap metal that would be offered for resale or reused onsite, as indicated in Table 2-28.

DOE would also recycle lead with surface radioactive contamination. The estimated volumes of radioactively contaminated lead that would be available for recycling under each waste forecast are indicated in Table 2-28.

TE | DOE would minimize the volume of low-activity soils, suspect soils and concrete, and mixed waste soils and concrete that would require disposal. The estimated volumes that would be available for beneficial reuse from the low-level and mixed waste soils are indicated in Table 2-28.



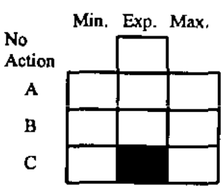
2.5.2 HIGH-LEVEL WASTE – EXPECTED, MINIMUM, AND MAXIMUM WASTE FORECASTS

Under alternative C, DOE would treat liquid high-level radioactive waste as it would be treated under the no-action alternative (see Section 2.2.2, Figure 2-9). For each waste forecast, DOE would continue current management activities, from receipt and storage of liquid high-level waste in tanks to preparation, processing, and treatment into forms suitable for final disposal. The high-level waste volumes that would be generated over the next 30 years in addition to the existing inventory of high-level waste in storage [approximately 1.31×10^5 cubic meters (3.45×10^7 gallons)] are given in Table 2-23.

These volumes are not additive because newly generated waste would be reduced approximately 75 percent via evaporation. These volumes would not require construction of new high-level waste tanks or facilities. Instead, DOE proposes to continue current management practices and to manage waste with the objective of emptying the tanks and immobilizing SRS's inventory of liquid high-level waste by 2018 (DOE 1994a).

DOE would not change the proposed high-level waste management practices as a result of the smaller volumes anticipated in the minimum forecast (45 percent less than the expected forecast). The only difference in management practices as a result of the larger volumes anticipated in the maximum forecast (23 percent more than the expected forecast) would be to operate the existing evaporators at higher rates to maintain adequate reserve tank capacity. TE

2.5.3 LOW-LEVEL WASTE



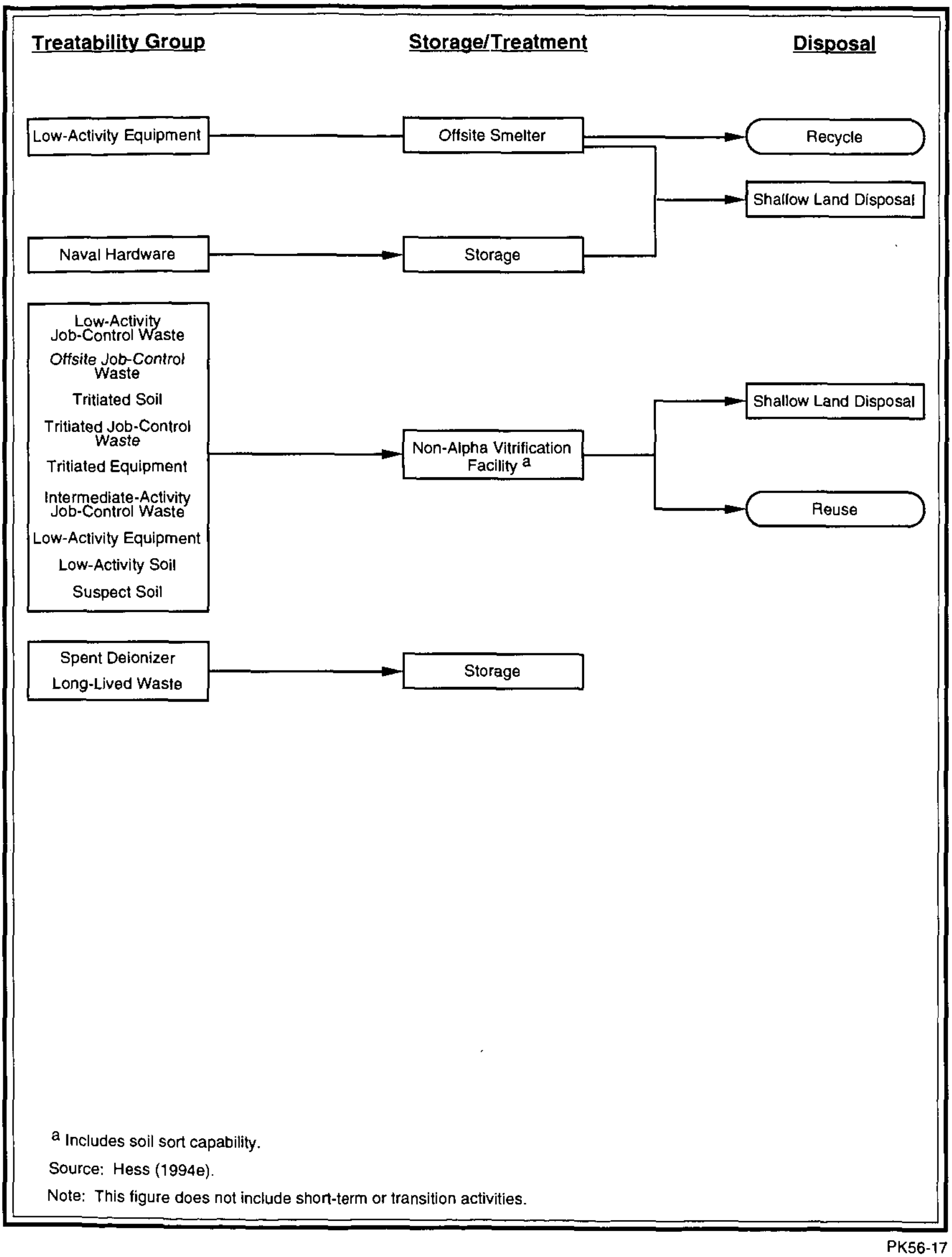
2.5.3.1 Low-Level Waste – Expected Waste Forecast

For alternative C – expected forecast, DOE would process low-level waste as in the no-action alternative presented in Section 2.2.3. Under alternative C, DOE also would implement extensive low-level waste treatment activities. Figure 2-24 summarizes the proposed management practices under alternative C, which are listed below. TE

- Decontaminate and recycle low-activity equipment waste (metals) offsite. Treatment residues would be returned to SRS for shallow land disposal.

- Complete construction of and operate the Consolidated Incineration Facility to incinerate low-activity and tritiated waste from 1996 through 2005.

- Construct and operate a non-alpha waste vitrification facility to replace the Consolidated Incineration Facility in 2006. The facility would include a soil sort capability to separate soil with contamination below detection limits from contaminated soil (contaminated soil would be treated in the vitrification process and clean soil would be used onsite as backfill material).



TE

Figure 2-24. Low-level waste management plan for alternative C expected waste forecast.

For the expected waste forecast, DOE would store process water deionizers (less than 1 percent of the forecast low-level waste) in long-lived waste storage buildings, as discussed in Section 2.2.3.3. The existing buildings would reach capacity by 2000, and 24 additional buildings would be needed over the 30-year period (Hess 1995c). TE TE

DOE would use various treatments to reduce and stabilize the low-level waste. DOE would begin operating the Consolidated Incineration Facility in 1996 to incinerate combustible low-activity and tritiated job-control waste until the non-alpha vitrification facility began operating in 2006. DOE would incinerate approximately 15 percent of the forecast low-level waste. DOE would send stabilized incinerator ash and blowdown wastes to shallow land disposal (Hess 1994e, 1995c). Refer to Appendix B.5 for a description of the Consolidated Incineration Facility. TE

DOE would construct and operate a non-alpha vitrification facility to vitrify low-activity and intermediate-activity wastes. Because vitrification provides a more stable long-term waste form, vitrification would replace incineration when the non-alpha vitrification facility began operating in 2006. DOE would vitrify low-activity and intermediate-activity job-control wastes from both onsite and offsite; low-activity equipment; tritiated soil; tritiated job-control and tritiated equipment wastes; and low-activity and suspect soils. These wastes constitute 54 percent of the forecast low-level waste and would be treated at the non-alpha vitrification facility (Hess 1994j, 1995c). TC TE

The non-alpha vitrification facility would provide a sorting capability to separate contaminated and uncontaminated soils. It is assumed that 60 percent of the incoming low-activity soil and 40 percent of the incoming suspect soil would be contaminated and would be vitrified. Uncontaminated soil (4 percent of the low-level waste) would be used onsite as backfill. Vitrified wastes would be sent to shallow land disposal (Hess 1994e, 1995c). Refer to Appendix B.18 for a description of the non-alpha vitrification facility. TE

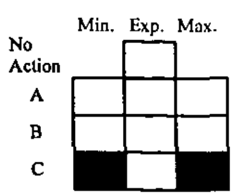
For alternative C – expected waste forecast, DOE would ship low-activity equipment waste (metals) to a commercial facility for decontamination by smelting. This material would account for only 2 percent of the forecast low-level waste. DOE anticipates that the offsite smelter would decontaminate 90 percent of the low-activity equipment waste for recycle and return 10 percent of the original waste volume to SRS for shallow land disposal (Hess 1994k). Refer to Appendix B.19 for a description of the smelter. For purposes of assessment, the facility was assumed to be located in Oak Ridge, Tennessee. In terms of transportation and surrounding population, this location is representative of the range of possible locations. TE TC

DOE would compact low-activity waste (approximately 4 percent of the total 30-year forecast low-level waste generation) in existing compactors from 1995 through 2005, as discussed in Section 2.2.3.1. DOE would operate compactors at maximum capacity in 1995 but reduce capacity in 1996, when the Consolidated Incineration Facility would begin operating. It is assumed that only 10 percent of the low-activity job-control waste generated each year from 1996 to 2005 would be compacted prior to disposal (Hess 1994e, 1995c).

A 70-percent reduction in disposal volume would be realized from the proposed treatment activities for alternative C – expected waste forecast. Suspect soils, naval hardware, stabilized ash and blowdown waste from the Consolidated Incineration Facility, smelter residuals, and vitrified wastes would be sent to shallow land disposal (33 percent of the disposed waste volume). All other low-level wastes would be disposed of in low-activity or intermediate-level waste vaults.

For this forecast, DOE would send naval hardware to shallow land disposal, as described in Section 2.2.3.4. DOE would also send stabilized ash and blowdown wastes from the Consolidated Incineration Facility and stabilized residuals from the offsite smelter to shallow land disposal. DOE would also send suspect soils to shallow land disposal from 1995 to 2005 until the non-alpha vitrification facility is available. After 2006, DOE would send the vitrified wastes from the non-alpha vitrification facility to shallow land disposal (Hess 1994e).

DOE would continue to dispose of suspect soils in the engineered low-level trench, as described in Sections 2.2.3.1. DOE would dispose of low-activity waste and intermediate-activity waste in the existing low-level waste vaults, as described in Sections 2.2.3.1 and 2.2.3.2. The existing low-activity and intermediate-activity waste vaults would reach capacity by 1998 and 1999, respectively. Additional vaults would be constructed as required. DOE would not dispose of low-level wastes in vaults after 2006. At that time, low-level wastes would go to shallow land disposal after treatment at either the non-alpha vitrification facility or the offsite smelter (Hess 1995c).



2.5.3.2 Low-Level Waste – Minimum and Maximum Waste Forecasts

For alternative C – minimum and maximum forecasts, DOE would change the way it manages some low-level waste (see Figure 2-24). The changes from waste management practices described under the expected forecast are primarily the result of the larger volume of soils in the maximum waste forecast.

Soils would comprise approximately 48 percent of the anticipated waste in that forecast (compared to 9 percent for the expected forecast). A 70-percent reduction in disposal volume would be realized from the proposed treatment activities in the expected forecast, a 71-percent reduction in the minimum forecast, and a 61-percent reduction in the maximum forecast. Table 2-29 describes the percentage of low-level waste distributed among the various treatment and disposal options under the minimum and maximum forecasts.

TE TC TE

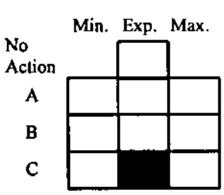
Table 2-29. Low-level waste treatment and disposal options for alternative C minimum and maximum waste forecasts.[a,b]

Minimum waste forecast	Maximum waste forecast
Treatment options	Treatment options
4 percent to compactors	1 percent to compactors
15 percent incinerated	5 percent incinerated
55 percent vitrified	50 percent vitrified
2 percent to offsite smelter	2 percent to offsite smelter
Disposal options	Disposal options
71 percent to vaults	32 percent to vaults
29 percent to shallow land disposal	68 percent to shallow land disposal

TC TC TE

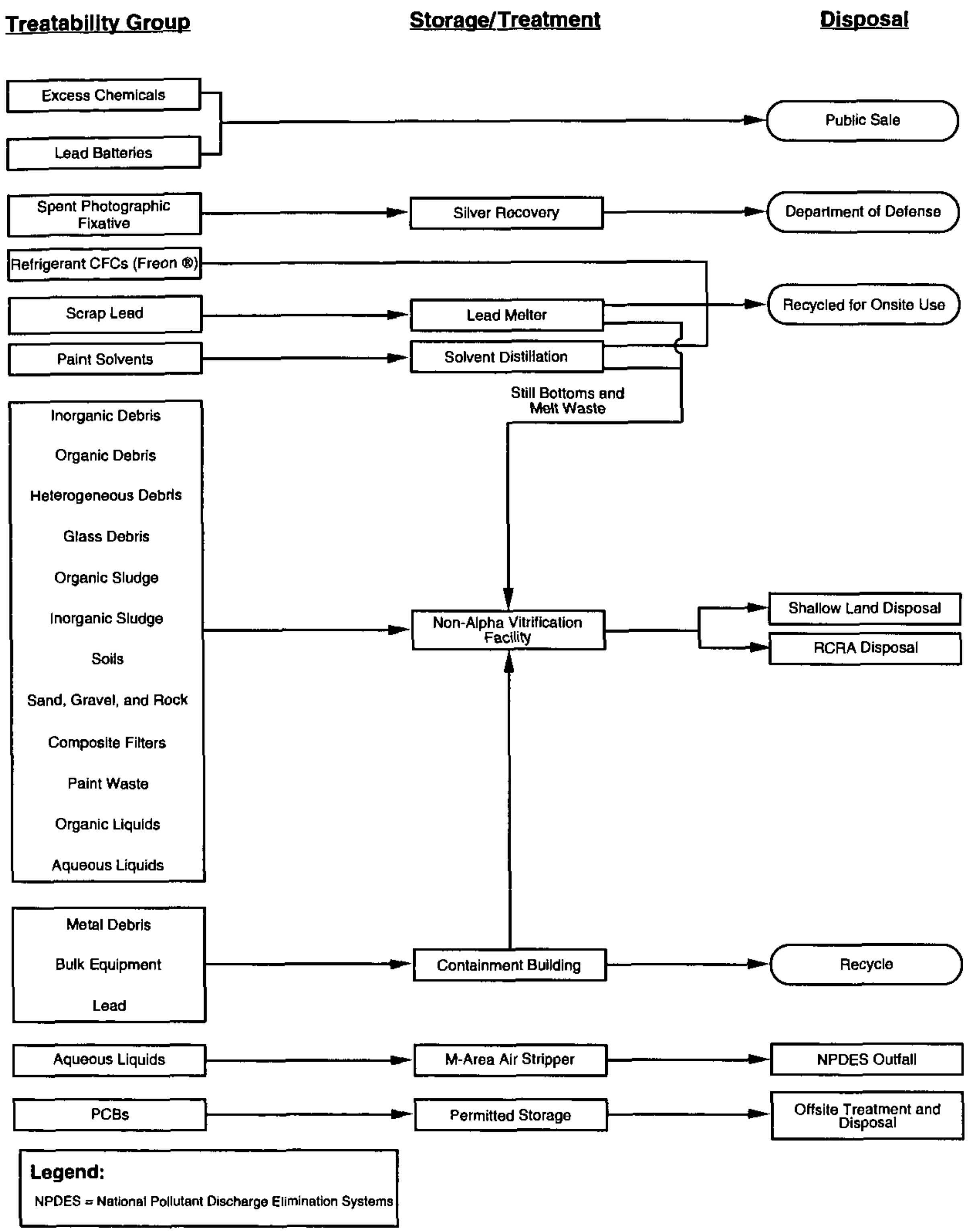
a. Source: Hess (1995c).
b. Percentages are approximate.

2.5.4 HAZARDOUS WASTE



2.5.4.1 Hazardous Waste – Expected Waste Forecast

Alternative C represents a more extensive application of treatment and stabilization than alternative A. As discussed in Section 2.4.4.1, DOE does not plan to construct facilities solely for the treatment of hazardous wastes. However, facilities that DOE plans to use for mixed waste could be used for hazardous wastes to the extent excess capacity is available. Figure 2-25 summarizes the proposed hazardous waste management activities for this alternative.



TE | Source: Hess (1994e, 1995a).
Note: This figure does not include short-term or transition activities.

PK56-15

Figure 2-25. Hazardous waste management plan for alternative C expected waste forecast.

In addition to the management practices for hazardous waste under the no-action alternative (Section 2.2.4), for alternative C – expected waste forecast, DOE would treat hazardous wastes onsite as follows: TE

- Construct and operate a containment building for decontamination of debris/metals for use onsite or to be sold as scrap.
- Treat a small quantity of reactive metals by wet chemical oxidation in the containment building.
- Complete construction of and operate the Consolidated Incineration Facility from 1996 to 2005 to treat selected hazardous wastes before the non-alpha vitrification facility is available. TE
- Construct and operate a non-alpha vitrification facility.
- Construct RCRA-permitted disposal vaults or use shallow land disposal to dispose of stabilized ash and blowdown waste from the incineration process and vitrified waste from the non-alpha vitrification facility.

For alternative C – expected forecast, DOE would continue to accumulate hazardous wastes for recycling onsite and offsite. DOE would also continue to store hazardous waste in the three RCRA-permitted hazardous waste storage buildings, the M-Area storage building, and on the three interim status solid waste storage pads. Most hazardous waste (approximately 46 percent of the forecast hazardous waste) would be sent offsite for treatment and disposal from 1995 to 2005. The only hazardous waste that would be sent offsite for treatment and disposal after 2005 would be PCB wastes, for which onsite treatment capability would not be available.

DOE would treat several hazardous wastes (composite filters, paint wastes, organic liquids, aqueous liquids) at the Consolidated Incineration Facility, assuming it begins operating in 1996. The stabilized ash and blowdown from the Consolidated Incineration Facility would be sent to RCRA-permitted disposal vaults or shallow land disposal. For purposes of this EIS, it is assumed that 70 percent of the stabilized ash and blowdown would require RCRA-permitted disposal and 30 percent could be sent to shallow land disposal (Hess 1994e, 1995c). TE

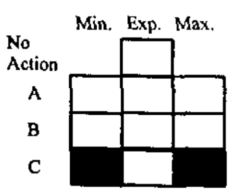
For the expected waste forecast, DOE would construct and operate a containment building, primarily to decontaminate mixed wastes, but hazardous waste (metal debris and bulk equipment comprising approximately 3 percent of the forecast hazardous waste) would also be decontaminated in the facility

(see Appendix B.6). Decontaminated metals would be reused onsite, decreasing the requirements for new products, or would be sold as scrap. Materials that could not be decontaminated would be sent to the non-alpha vitrification facility for treatment. It is assumed that 80 percent of the materials would be decontaminated. Spent decontamination solutions are assumed to constitute 50 percent of the volume of
TE the incoming waste feed and would be treated at the non-alpha vitrification facility (Hess 1994e, 1995c).

The containment building would also segregate and decontaminate lead components from disassembled equipment, as described in Section 2.5.1.1. Lead components that could not be segregated or decontaminated would be sent to the non-alpha vitrification facility for treatment. Due to the limited use of chemical decontamination methods, the spent decontamination solutions are assumed to constitute
TE 10 percent of the volume of the incoming lead waste (Hess 1994e).

TE DOE would construct and operate a vitrification facility for non-alpha wastes (see Appendix B.18). Hazardous waste metals that could not be decontaminated, spent decontamination solutions from the containment building, and other hazardous wastes (approximately 47 percent of the forecast hazardous wastes) (with the exception of aqueous liquids sent to the M-Area Air Stripper and PCB wastes) would be vitrified in the new facility. The non-alpha vitrification facility would have a dedicated wastewater treatment unit for treating scrubber and quench waters. This closed-loop system would return treated wastewater to the vitrification facility to be used in the treatment process. Vitrified waste would be sent to RCRA-permitted disposal or shallow land disposal. For purposes of this EIS, it is assumed that 50 percent of the vitrified wastes would require RCRA-permitted disposal and 50 percent would be sent
TE to shallow land disposal (Hess 1994e, 1995c).

Because the metal decontamination process and the non-alpha vitrification facility would not be operational until 2006, DOE would continue to send hazardous waste either offsite or to the Consolidated Incineration Facility for treatment and disposal until 2006.



2.5.4.2 Hazardous Waste – Minimum and Maximum Waste Forecasts

TE For alternative C – minimum and maximum forecasts, DOE would change the way it manages some of the hazardous waste (see Figure 2-25). In the minimum forecast, almost 80 percent of the anticipated
TE 30-year waste volume would be generated prior to 2006 (WSRC 1994d). Most of this hazardous waste
TC (75 percent of the minimum forecast) would be treated and disposed of offsite because onsite treatment

capability would be limited at that time. In the maximum forecast, most of the hazardous waste (57 percent) would be treated at the non-alpha vitrification facility. This change is due primarily to increases in the quantity of contaminated soils by approximately 10,000 cubic meters (3.53×10^5 cubic feet) per year over the expected forecast. TE TC

Table 2-30 describes the percentage of hazardous waste distributed among the various treatment options under the minimum and maximum waste forecasts.

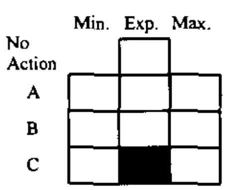
Table 2-30. Hazardous waste treatment options for alternative C minimum and maximum waste forecasts.[a,b]

Minimum waste forecast	Maximum waste forecast
75 percent sent offsite	34 percent sent offsite
3 percent incinerated	1 percent incinerated
17 percent vitrified	57 percent vitrified

TC

a. Source: Hess (1995c).
b. Percentages are approximate.

2.5.5 MIXED WASTE



2.5.5.1 <u>Mixed Waste – Expected Waste Forecast</u>

For alternative C – expected waste forecast, DOE would manage mixed waste as it would under the no-action alternative presented in Section 2.2.5. Under alternative C, DOE also would implement extensive treatments that stabilize and immobilize mixed waste to minimize long-term impacts to the environment. Figure 2-26 summarizes the proposed management practices for alternative C – expected waste forecast, which consist of the following: TE

- Store tritiated oil to allow time for radioactive decay.

- Send radioactive PCB wastes offsite for treatment; residuals would be returned to SRS for shallow land disposal. TC

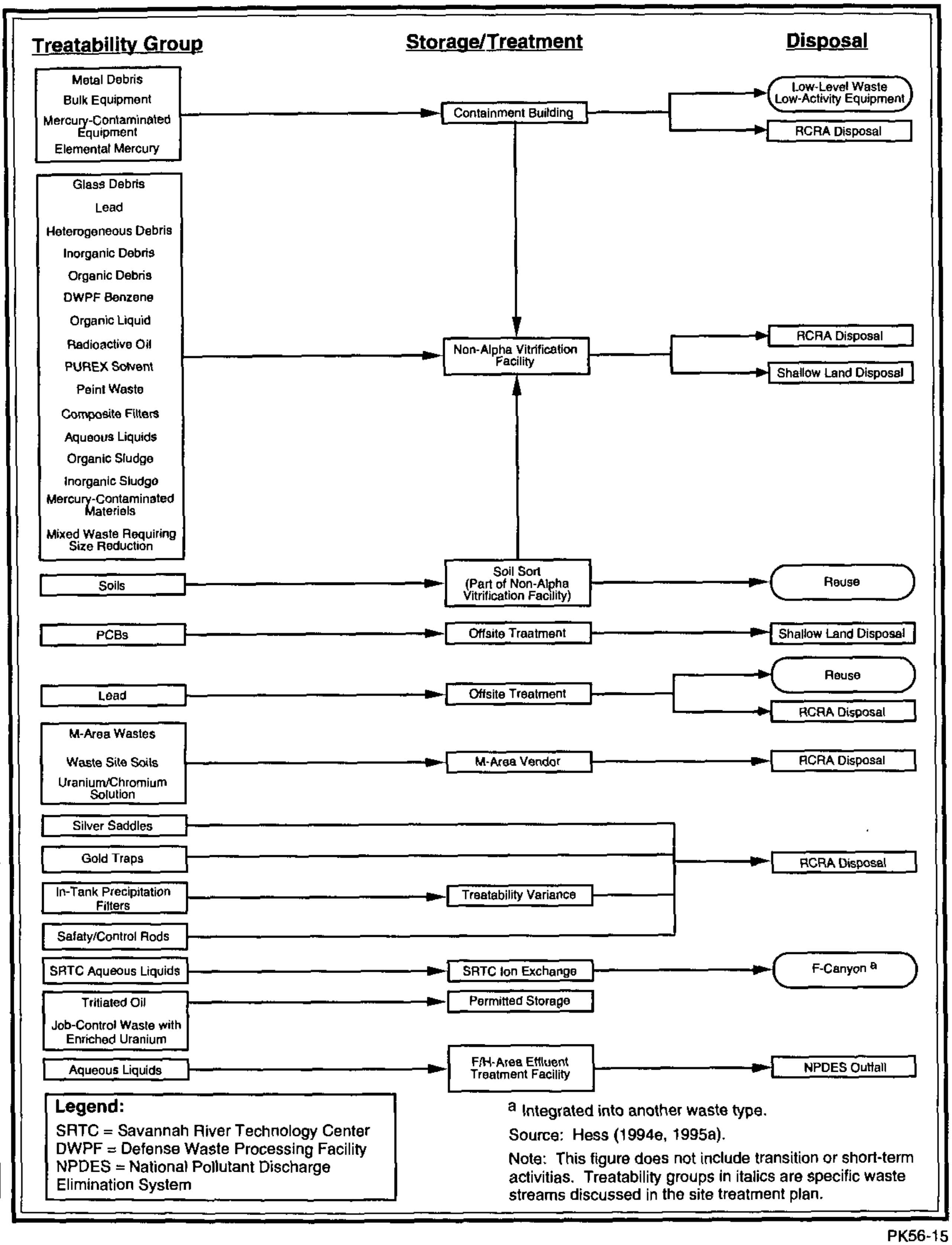


Figure 2-26. Mixed waste management plan for alternative C expected waste forecast.

- Send lead offsite for decontamination and recycling; treatment residuals would be returned for RCRA-permitted disposal at SRS.

In addition, DOE would:

- Construct a containment building to decontaminate metal debris and bulk equipment.

- Roast and retort contaminated process equipment to remove mercury and treat mercury by amalgamation at the containment building.

- Oxidize a small quantity of reactive metal waste at the containment building.

- Operate the Consolidated Incineration Facility from 1996 to 2005 to incinerate certain mixed wastes until the non-alpha vitrification facility begins operating, including benzene generated by the Defense Waste Processing Facility, organic and aqueous liquid wastes, PUREX solvent, radioactive oil, and organic and inorganic sludges.

- Construct and operate a non-alpha waste vitrification facility to replace the Consolidated Incineration Facility in 2006. The facility would include the capability to separate soil with nondetectable amounts of contamination from contaminated soil (contaminated soil would be treated in the vitrification process and clean soil would be used onsite as backfill material).

- Construct and operate the M-Area Vendor Treatment Facility to vitrify wastes generated by M-Area electroplating operations and the specific wastes identified in the *SRS Proposed Site Treatment Plan*. TE

2.5.5.1.1 Containerized Storage

For alternative C – expected waste forecast, DOE would continue to store mixed waste in the three mixed waste storage buildings, the M-Area storage building, and on three storage pads. The non-alpha mixed waste (i.e., waste with less than 10 nanocuries per gram of transuranics) that is now stored on the transuranic waste pads would be transferred to the mixed waste storage pads. To allow for storage of mixed waste while treatment facilities are being constructed, DOE would construct additional storage buildings as needed. Based on the usable capacity of Building 643-43E, DOE estimates that a maximum of 79 additional buildings would be required by 2005 (Hess 1995c). See Section 2.4.5.1.1 for additional information. TC

DOE would continue to store low-level PCB wastes in one of the mixed waste storage buildings pending treatment of the PCB component of the wastes at an offsite commercial facility. Once treated, the TE residuals would be returned to SRS for shallow land disposal (Hess 1994e).

DOE would continue to generate radioactive oil and store it in containers in the areas where it is generated at SRS. There would be sufficient radioactive oil storage capacity over the next 30 years. See Section 2.4.5.1.1 for additional information.

TC DOE would continue to store mercury-contaminated tritiated oil generated by SRS tritium facilities and job-control waste contaminated with solvents and enriched uranium at the mixed waste storage facilities for the duration of the 30-year analysis period. See Section 2.4.5.1.1 for additional information.

2.5.5.1.2 Treatment and/or Tank Storage

TE For alternative C – expected forecast, DOE would continue treatment and tank storage practices for Savannah River Technology Center aqueous wastes and PUREX solvent waste storage, as described in Section 2.2.5.2. In addition, the 568-cubic-meter (150,000-gallon) Organic Waste Storage Tank would be used to store mixed organic waste generated at the Defense Waste Processing Facility. DOE would begin to treat this waste at the Consolidated Incineration Facility, assuming it begins operating in 1996. If the Consolidated Incineration Facility begins operating, additional tank storage capacity would not be required.

DOE would continue to use the M-Area Process Waste Interim Treatment/Storage Facility tanks to store concentrated mixed wastes from the M-Area Liquid Effluent Treatment Facility. DOE plans to treat six TE types of wastes (listed in Appendix B.15) currently stored in the M-Area Process Waste Interim Treatment/Storage Facility tanks and the M-Area storage building by a vitrification process in the M-Area Vendor Treatment Facility. The M-Area Vendor Treatment Facility was identified as the TE TC preferred option for two additional wastes (listed in Appendix B.15) in the *SRS Proposed Site Treatment Plan*. See Section 2.4.5.1.2 for additional information. DOE has submitted a RCRA permit application requesting interim status for a pad in M-Area to store the vitrified wastes and stabilized ash and blowdown wastes from the Consolidated Incineration Facility.

TE For alternative C – expected waste forecast, DOE would construct and operate a containment building for decontaminating mixed metal debris and bulk equipment comprising approximately 10 percent of the forecast mixed waste generation. This facility would begin to operate in 2006. Decontaminated debris and equipment from which hazardous constituents were removed would be managed as low-activity equipment waste. Materials that could not be decontaminated and the secondary wastes from the decontamination process would be transferred to the non-alpha vitrification facility for treatment. It is assumed that 80 percent of the materials could be decontaminated. Spent decontamination solutions are assumed to constitute 50 percent of the original volume of the materials to be decontaminated (Hess 1994e). The containment building would also treat mercury-contaminated process equipment by TE roasting and retorting (i.e., heating the equipment to drive off the mercury as a vapor and collecting and condensing the mercury back to a liquid form). The mercury removed from the process equipment and elemental mercury wastes would be treated by amalgamation (i.e., alloying the liquid mercury with inorganic reagents such as copper, nickel, gold, or zinc to create a semi-solid amalgam). See Appendix B.6 for a description of the containment building.

DOE would begin operating the Consolidated Incineration Facility in 1996 to treat approximately TC 7 percent of the anticipated mixed waste volume, including benzene waste generated by the Defense TE Waste Processing Facility, organic and aqueous liquid wastes, PUREX solvent, paint waste, radioactive oil, and organic debris. Stabilized ash and blowdown waste from the Consolidated Incineration Facility would be sent to RCRA-permitted disposal or shallow land disposal. For purposes of this EIS, it is assumed that 70 percent of the stabilized ash and blowdown would require RCRA-permitted disposal and 30 percent would be sent to shallow land disposal (Hess 1994e, 1995c). See Section 2.4.5.1.2 for TE additional information.

DOE would construct and operate a non-alpha vitrification facility to treat approximately 55 percent of TC the forecast mixed waste, including glass, heterogeneous, inorganic, and organic debris; contaminated soils; organic and inorganic sludges; mercury-contaminated materials; composite filters; benzene waste generated by the Defense Waste Processing Facility; organic and aqueous liquids; PUREX solvent; paint waste; radioactive oil; organic and inorganic debris; and lead. Because the non-alpha vitrification facility would produce a more stable waste form, it would replace the Consolidated Incineration Facility, TE assuming the non-alpha vitrification facility begins operating in 2006 (Hess 1994e, 1995c). DOE would request a treatability variance to allow lead to be vitrified to produce a more stable waste form than would be achieved through macroencapsulation, the specified technology for lead under the land disposal restrictions treatment standards. This facility would provide a soil sort capability to separate uncontaminated and contaminated soils and concrete. It is assumed that 60 percent of the incoming soils and concrete would be contaminated and would require treatment by vitrification prior to disposal. Uncontaminated soils (16 percent of the forecast waste generation) would be used onsite as backfill material (Hess 1995c). Liquids from the offgas system would be sent to a dedicated wastewater TE treatment unit and the reclaimed water would be returned to the offgas system for recycling. The vitrified waste would be sent to RCRA-permitted disposal or shallow land disposal. For purposes of this

EIS, it is assumed that 50 percent of the vitrified waste would require RCRA-permitted disposal and 50 percent would be sent to shallow land disposal (Hess 1994e). See Appendix B.18 for a description of the non-alpha vitrification facility.

DOE would begin shipping low-level PCB wastes for treatment of the PCB fraction by a commercial facility. The treated residuals would be returned to SRS for shallow land disposal.

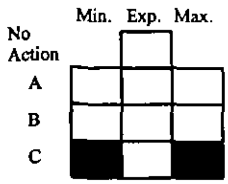
DOE would begin shipping lead to an offsite commercial facility for decontamination. It is assumed that 80 percent of the lead would be decontaminated. The commercial facility would return residuals from the decontamination process and the portion of the lead waste that could not be decontaminated to SRS for disposal (Hess 1994e).

2.5.5.1.3 Disposal

DOE submitted an application for a RCRA permit to SCDHEC for 10 Hazardous Waste/Mixed Waste Disposal Vaults. For purposes of this EIS, DOE based its proposed disposal vaults on the design of its current Hazardous Waste/Mixed Waste Disposal Vault. See Section 2.2.5.3 for additional information.

As described in Section 2.2.5.3 for the no-action alternative, DOE would construct and operate RCRA-permitted vaults for disposal of mixed wastes. In addition, under the alternative C expected waste forecast, DOE would manage hazardous wastes in these vaults and would also use them to dispose of 70 percent of the stabilized ash and blowdown from the Consolidated Incineration Facility, and 50 percent of the vitrified waste from the non-alpha vitrification facility. The first of the RCRA-permitted disposal vaults would begin accepting wastes in 2002, and DOE would construct additional vaults as needed (Hess 1994e, 1995c). Refer to Section 2.5.7 for mixed waste disposal capacity projections over the 30-year period.

Mixed wastes subject to RCRA because they exhibit a hazardous characteristic may be treated in a way that eliminates the characteristic (e.g., toxic metals may be immobilized). If mixed wastes are treated in this manner, they need not be disposed of in RCRA-permitted disposal vaults, and DOE would dispose of them as low-level wastes. DOE would send 30 percent of the stabilized ash and blowdown from the Consolidated Incineration Facility, 50 percent of the vitrified wastes from the non-alpha vitrification facility, and stabilized residuals from the treatment of radioactive PCB wastes to shallow land disposal (Hess 1994e, 1995c). Refer to Section 2.5.7 for projections of low-level waste disposal capacity over the 30-year period.



2.5.5.2 Mixed Waste – Minimum and Maximum Waste Forecasts

For alternative C – minimum and maximum waste forecasts, DOE would manage mixed waste somewhat differently than for the expected waste forecast (see Figure 2-26). The non-alpha vitrification facility would play a larger role in the minimum waste forecast (approximately 65 percent of the forecast waste volume would be vitrified) and a smaller role in the maximum forecast (approximately 49 percent of the forecast waste volume would be vitrified) than in the expected forecast. Table 2-31 describes the percentage of mixed waste distributed among the various treatment options under the minimum and maximum waste forecasts. TE TC

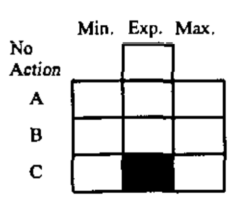
Table 2-31. Mixed waste treatment options for alternative C minimum and maximum waste forecasts.[a,b]

Minimum waste forecast	Maximum waste forecast
27 percent to soil sort facility	54 percent to soil sort facility
65 percent vitrified	49 percent vitrified
13 percent to containment building	11 percent to containment building
12 percent incinerated	9 percent incinerated

TC

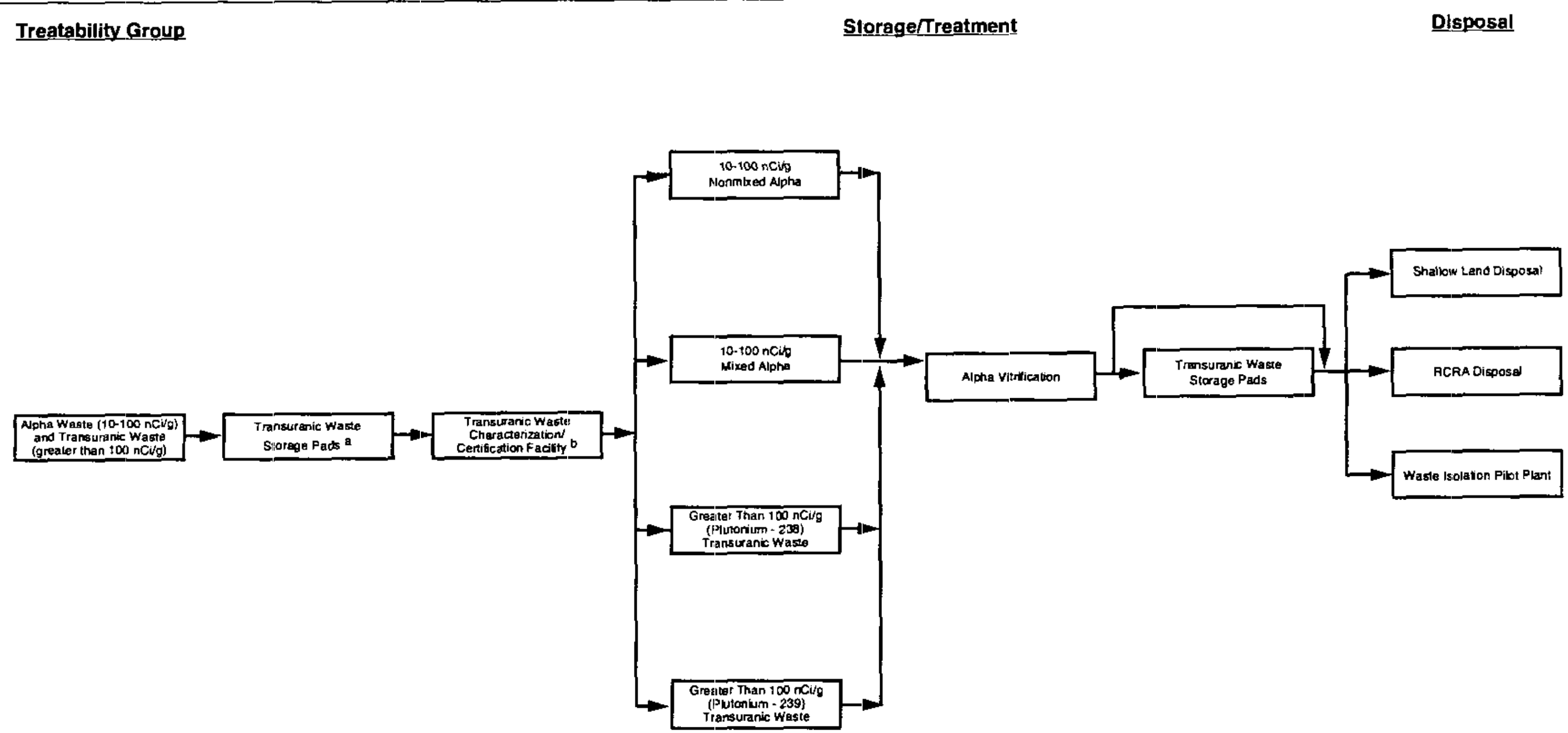
a. Source: Hess (1995c).
b. Percentages are approximate.

2.5.6 TRANSURANIC AND ALPHA WASTE



2.5.6.1 Transuranic and Alpha Waste – Expected Waste Forecast

For alternative C – expected waste forecast, DOE would perform more aggressive treatment activities to achieve the most stable long-term waste forms for alpha and transuranic waste. Figure 2-27 summarizes the proposed alpha and transuranic waste management practices under alternative C, which include the



[a] Other storage locations are being considered: this analysis is based on using transuranic waste storage pads only

[b] Waste certification activities consolidated with characterization/certification facility

Source: Hess (1994e).

PK56-15

Figure 2-27. Transuranic waste management plan for alternative C expected waste forecast.

TC

waste management activities under the no-action alternative described in Section 2.2.6. The additional management practices are:

- Construct and operate a transuranic waste characterization/certification facility to characterize, treat, repackage, and certify waste for disposal.

- Construct and operate an alpha vitrification facility to vitrify alpha wastes (10 to 100 nanocuries per gram) and transuranic wastes (greater than 100 nanocuries per gram).

- Operate the Consolidated Incineration Facility from 1996 to 2005 to burn some newly generated alpha wastes until the transuranic waste characterization/certification facility and alpha vitrification facility begin operating. TC

- Construct facilities to dispose of nonmixed and mixed alpha waste onsite in the low-activity waste vaults, RCRA-permitted disposal vaults, or shallow land disposal.

- Return Rocky Flats incinerator ash for consolidation and treatment with similar wastes at that facility. TC

- Send transuranic waste to the Waste Isolation Pilot Plant (Hess 1995a).

2.5.6.1.1 Storage

For alternative C – expected waste forecast, DOE would continue to accumulate alpha and transuranic waste in the same manner as described for the no-action alternative (Section 2.2.6). In the draft EIS, DOE assumed that alpha wastes generated between 1995 and 2006 would be stored for processing at the transuranic waste characterization/certification facility. However, facilities would be available during that time period that could accept these wastes. DOE proposes to use these facilities to treat or dispose of alpha wastes and reduce the need for additional storage capacity. Under alternative C, DOE would burn 50 percent of the alpha wastes (both mixed and nonmixed) generated each year from 1996 to 2005 in the Consolidated Incineration Facility. The remainder of the mixed and nonmixed alpha waste generated each year would be certified for disposal in the RCRA-permitted disposal vaults and low-activity waste vaults, respectively. DOE would package and store containers on transuranic waste storage pads to await processing; retrieve drums from mounded storage on Transuranic Waste Storage Pads 2 through 6; and construct new pads as needed. As a result of the reconfiguration of the transuranic TC waste storage pads (see Appendix B.30) and the addition of newly generated waste, 11 additional transuranic waste storage pads would be required by 2006 (Hess 1995c).

DOE assumed that the Waste Isolation Pilot Plant would operate from 1998 to 2018 and would accept SRS transuranic waste (WSRC 1995). The transuranic waste stored on transuranic waste storage pads or generated after 2018 would be vitrified and returned to a single pad for storage (Hess 1994e, 1995c). The disposition of these wastes has not yet been determined.

2.5.6.1.2 Treatment

DOE would return a small amount (0.1 cubic meter) of Rocky Flats incinerator ash currently stored at SRS to that facility for consolidation and treatment with similar wastes. The *SRS Proposed Site Treatment Plan* concluded that it was not cost effective to develop treatment at SRS for this small quantity of material. Rocky Flats is currently investigating alternatives for management of the ash.

Under alternative C, DOE would burn 50 percent of the mixed and nonmixed alpha wastes generated each year from 1996 to 2005 in the Consolidated Incineration Facility. These waste constitute approximately 3 percent of the anticipated waste. For purposes of this EIS, it is assumed that 70 percent of the stabilized ash and blowdown from treatment of mixed alpha wastes would require RCRA-permitted disposal and 30 percent would be sent to shallow land disposal. All stabilized ash and blowdown from incineration of nonmixed alpha wastes would be sent to shallow land disposal.

DOE would construct and operate the transuranic waste characterization/certification facility to perform assays and intrusive characterizations of the waste in drums, culverts, and boxes stored on transuranic waste storage pads. The facility would begin operating in 2007 to characterize the waste for separation into four categories (described in Section 2.4.6) to facilitate treatment and disposal. Bulk waste would be reduced in size to fit into 55-gallon drums. The facility would process the entire inventory of alpha and transuranic waste, all newly generated transuranic waste, and alpha waste generated after 2007 to meet the waste acceptance requirements of the alpha vitrification facility. These wastes constitute approximately 94 percent of the forecast volume (Hess 1994e, 1995c).

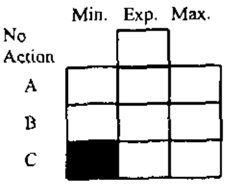
It is assumed that the transuranic waste characterization/certification facility would reduce the overall waste volume by 30 percent as a result of processing and repackaging (Hess 1994e). Waste characterization would segregate the incoming wastes (17 percent nonmixed alpha, 14 percent mixed alpha, 55 percent plutonium-238, and 14 percent plutonium-239) so the alpha vitrification facility could properly blend the waste for vitrification to achieve a high-quality vitrified form. Further details on these topics are in Appendix B.31 (Hess 1995a). TE

Beginning in 2008, DOE would vitrify the alpha waste before disposal because vitrification substantially reduces the volume of waste. The alpha waste would be blended with transuranic waste during vitrification, and most of the vitrified waste would be classified as transuranic waste. DOE would seek a treatability variance for vitrification of mixed alpha wastes when vitrification did not comply with the land disposal restrictions treatment standards (e.g., lead waste subject to specified technologies other than vitrification). The variance would have to demonstrate that vitrification achieved a final waste form equivalent to that otherwise required (Hess 1994e). TC TE

The vitrified waste produced by the alpha vitrification facility would be returned to the transuranic waste characterization/certification facility for disposal certification. The facility would certify the vitrified waste forms as nonmixed alpha, mixed alpha, or transuranic (Hess 1994e). A detailed description of the alpha vitrification facility can be found in Appendix B.1. TE

2.5.6.1.3 Disposal

A 92 percent reduction in transuranic and alpha waste volume would be realized for alternative C – expected waste forecast. Nonmixed alpha waste (30 percent of the processed volume) would be sent to shallow land disposal or low-activity waste vaults (5 and 25 percent of the processed volume, respectively), and treated mixed alpha waste (18 percent of the processed volume) would be sent to RCRA-permitted disposal. Half of the waste [73 cubic meters (2,600 cubic feet) per year] would be shipped to the Waste Isolation Pilot Plant for disposal as vitrified transuranic waste starting in 2008 and ending in 2018. By 2018, DOE would have shipped for disposal a quantity of transuranic waste equal to less than 1 percent of the total capacity of the Waste Isolation Pilot Plant. Two percent of the processed volume would be certified as transuranic waste and remain stored at SRS on one transuranic waste storage pad (Hess 1994e, 1995c). TC TC TE

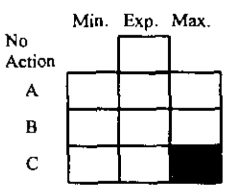


2.5.6.2 Transuranic and Alpha Waste – Minimum Waste Forecast

Because of the smaller volumes anticipated in the minimum waste forecast, DOE would manage
TC transuranic and alpha waste in a slightly different manner than in the expected waste forecast. To
accommodate the transuranic waste inventory and newly generated waste in alternative C minimum
TE waste forecast, DOE would need two additional transuranic waste storage pads by 2004 (Hess 1995c).

The characterization, treatment, and disposal methods would remain the same as in the expected waste
TC forecast; however, by 2018, more transuranic waste (57 percent of the processed volume) would have
been shipped to the Waste Isolation Pilot Plant for disposal. By 2024, DOE would have stored the
remaining vitrified transuranic waste (2 percent of the processed volume) on one transuranic waste
TE storage pad (Hess 1995c).

TC DOE would ship 53 cubic meters (1,900 cubic feet) per year of transuranic waste to the Waste Isolation
Pilot Plant between 2008 and 2018. The waste volume disposed of under this alternative would
TE constitute less than 1 percent of the repository's total capacity (Hess 1995c).

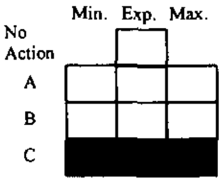


2.5.6.3 Transuranic and Alpha Waste – Maximum Waste Forecast

In alternative C – maximum waste forecast, DOE would manage transuranic and alpha waste differently because of the dramatic change in the volume of the transuranic waste (25 times that in the expected forecast) from increased environmental restoration. DOE would also experience an increase in mixed alpha waste (45 percent compared to 16 percent in the expected forecast) for processing and disposal as a result of the assumptions in the maximum forecast (WSRC 1994c).

TC By 2006, DOE would require 1,166 additional transuranic waste storage pads to store the newly
TE generated waste. The treatment and disposal methods would be the same as for the expected forecast;
however, the waste characteristics would differ from the expected forecast (9 percent non-mixed alpha,
47 percent mixed alpha, 35 percent plutonium-238, and 9 percent plutonium-239). Most of the waste

would be disposed of as transuranic waste (85 percent of the processed waste volume) (Hess 1995c). DOE would ship 2,164 cubic meters (76,400 cubic feet) per year of transuranic waste to the Waste Isolation Pilot Plant from 2008 through 2018. TC TE The transuranic waste volume disposed of under this case would constitute 14 percent of the repository's total capacity (Hess 1995c). By 2024, DOE would need only one transuranic waste storage pad to store the remaining processed and packaged vitrified transuranic waste.



2.5.7 SUMMARY OF ALTERNATIVE C FOR ALL WASTE TYPES

Under alternative C, DOE would continue the waste management activities listed in the no-action alternative (Section 2.2.7), including construction of additional storage capacity for mixed, transuranic, and alpha wastes. TE Less storage capacity would be needed for this alternative than is required for the no-action alternative. In addition, DOE would:

- Construct and operate a containment building to treat mixed and hazardous wastes.

- Roast and retort contaminated process equipment to remove mercury and treat mercury by amalgamation at the containment building.

- Oxidize a small quantity of reactive metal waste at the containment building.

- Construct and operate a non-alpha vitrification facility for hazardous, mixed, and low-level wastes to replace the Consolidated Incineration Facility in the year 2006. The facility would include low-level and mixed waste soil sort capability to separate soil with nondetectable amounts of contamination from contaminated soil (this would replace the mobile soil sort facility in alternative A).

- Decontaminate and recycle low-activity equipment waste (metals) offsite. Treatment residues would be returned to SRS for shallow land disposal.

- Send radioactive PCB wastes offsite for treatment; residuals would be returned to SRS for shallow land disposal.

TC

- Operate the Consolidated Incineration Facility for mixed (benzene generated by the Defense Waste Processing Facility, organic and aqueous liquid wastes, PUREX solvents, radioactive oil, and organic and inorganic sludges), hazardous, alpha, and low-level wastes until the non-alpha and alpha vitrification facilities became operational.

- Construct and operate a transuranic waste characterization/certification facility to characterize, treat, repackage, and certify waste for disposal.

- Construct and operate an alpha vitrification facility to vitrify alpha wastes (10 to 100 nanocuries per gram) and transuranic wastes (greater than 100 nanocuries per gram).

- Dispose of transuranic wastes at the Waste Isolation Pilot Plant.

- Construct RCRA-permitted disposal vaults or use shallow land disposal to dispose of stabilized ash and blowdown waste from the incineration process and vitrified waste from the non-alpha vitrification facility.

- Store tritiated oil to allow time for radioactive decay.

TC

- Construct and operate the M-Area Vendor Treatment Facility to vitrify wastes generated by M-Area electroplating operations and the specific wastes identified in the *SRS Proposed Site Treatment Plan* (WSRC 1995).

TC

- Construct facilities to dispose of nonmixed and mixed alpha wastes onsite in the low-activity waste vaults, RCRA-permitted disposal vaults, or by shallow land disposal.

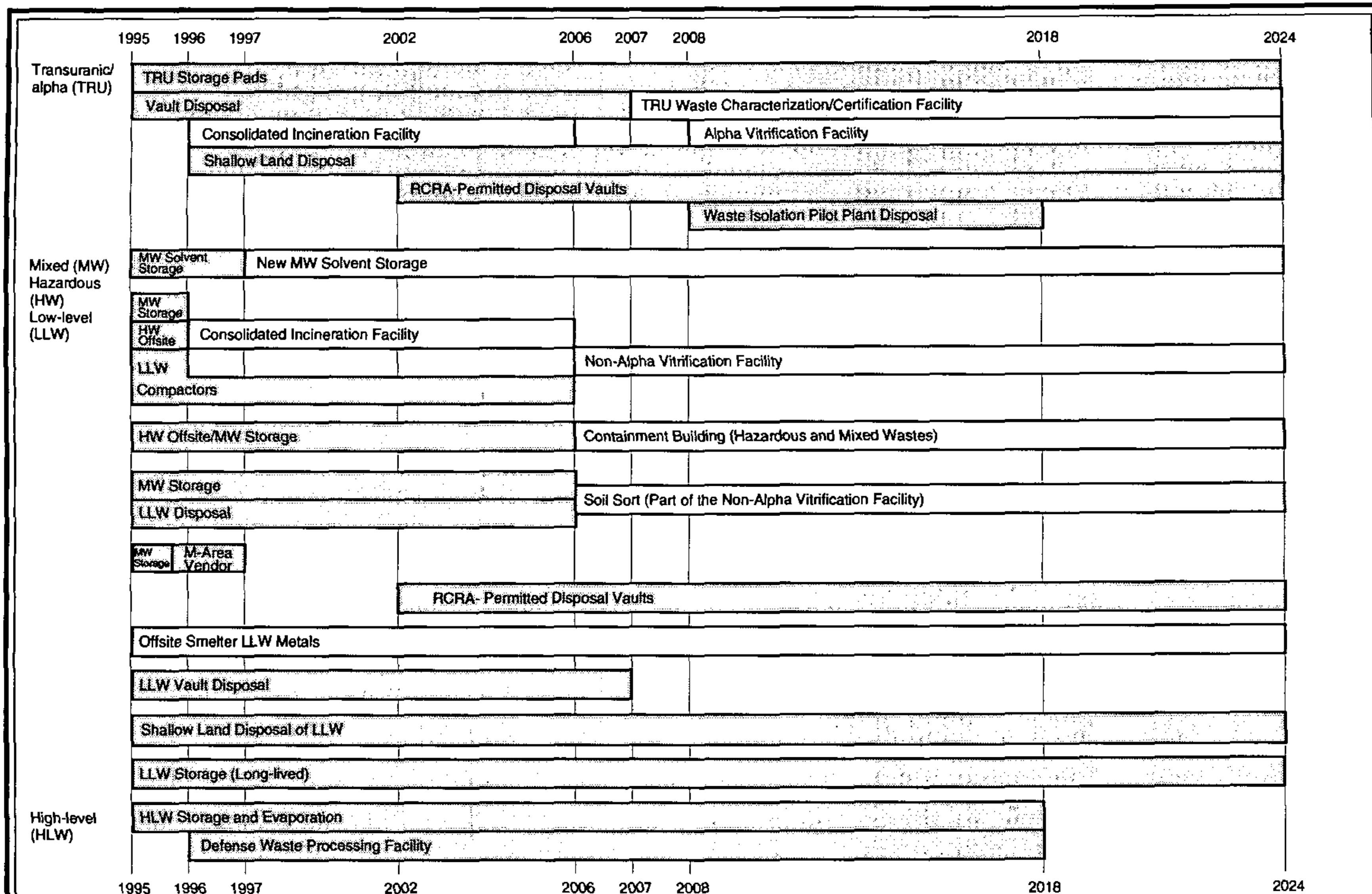
TC

The largest impacts to land outside of E-Area would occur for the maximum waste forecast (approximately 775 acres for alternative C). This land would be required for storage facilities until treatment begins in approximately 2006. However, by 2024, most of the waste would have been treated and disposed of and the land required outside of E-Area would be only 4 acres under alternative C. It is highly unlikely that the technology used to store the waste volumes under the minimum and expected forecasts would be suitable for the maximum forecast. However, to compare the different treatment configurations among the alternatives of this EIS, the comparison was made assuming the same technology would be applied for all three waste forecasts. For example, DOE would likely construct the 11 additional transuranic waste storage pads required for the expected case; however, DOE would probably elect not to use the same technology if it called for 1,166 pads under the maximum forecast.

A timeline for the ongoing and proposed waste management activities for alternative C is provided in Figure 2-28. DOE would operate the existing facilities until the proposed facilities could be designed, constructed, and begin operating. For all the waste types except high-level waste, the activities that would occur from 1995 to about 2006 are shown in Figure 2-29. The proposed waste management activities as they would occur after 2008 are shown in Figure 2-30. TE

The additional management facilities under alternative C and a comparison to those required under the no-action alternative are provided in Table 2-32.

TC



Source: Hess (1994e, 1995a); DOE (1994a).

TE

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Figure 2-28. Timeline for waste management facilities in alternative C.

Legend:

Activities or facilities that are part of the no-action alternative

Activities or facilities that would occur under alternative C

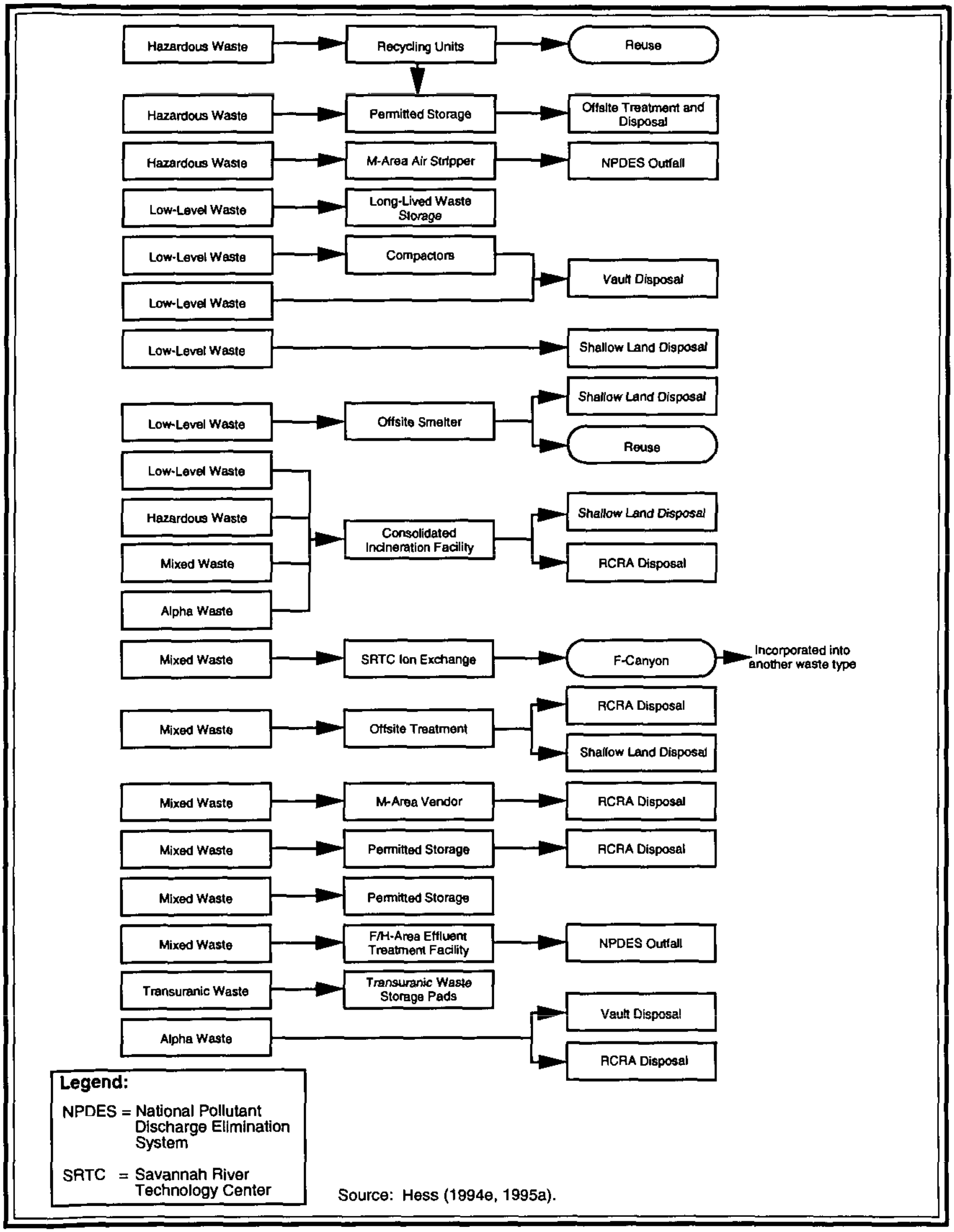

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Figure 2-29. Summary of waste management activities in alternative C until the year 2006.

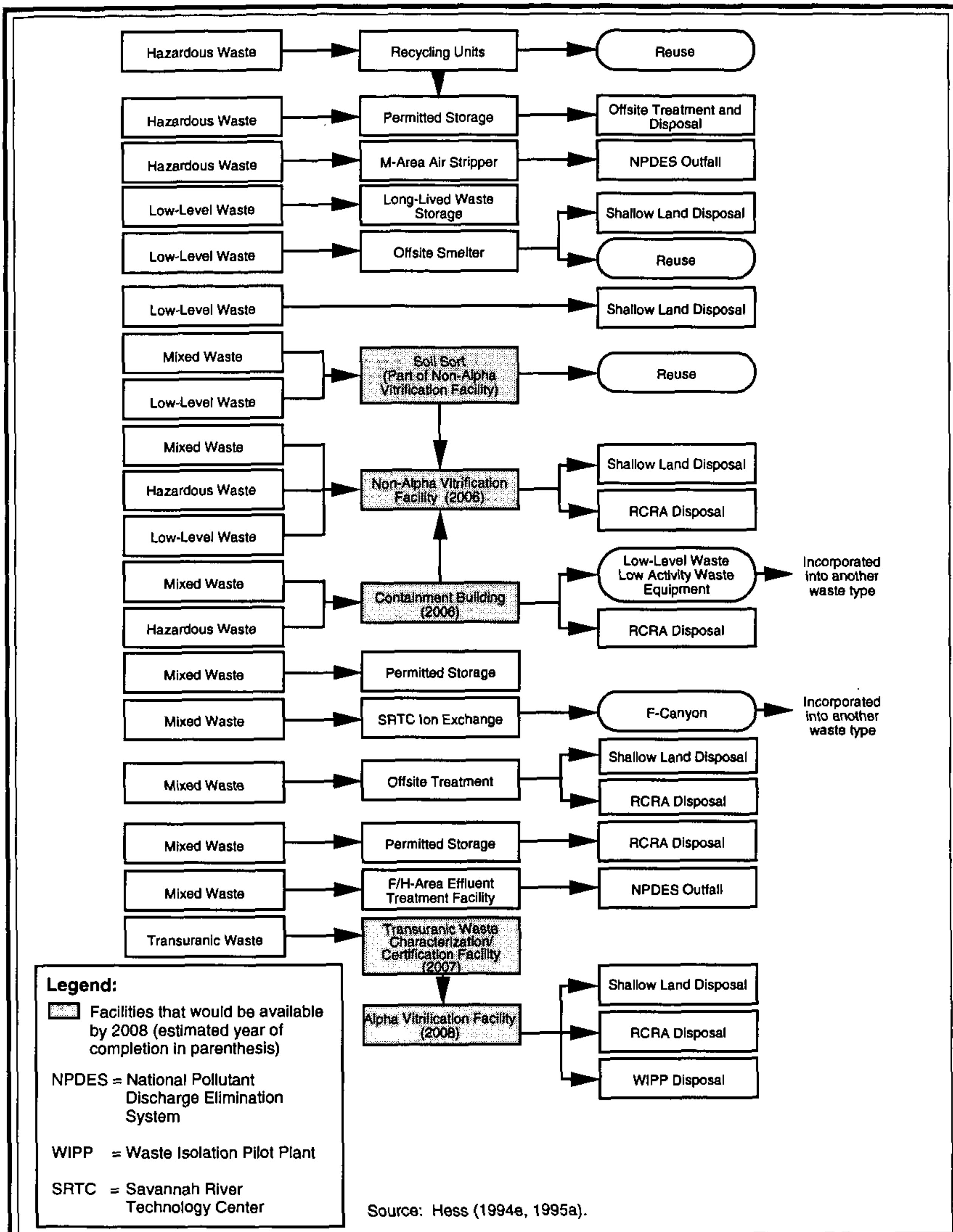

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Figure 2-30. Summary of waste management activities in alternative C after the year 2008.

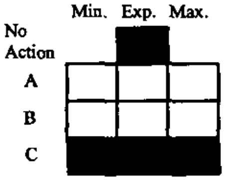
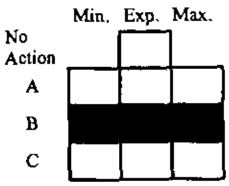


Table 2-32. Comparison of treatment, storage, and disposal facilities under alternative C and the no-action alternative.

	Minimum	Expected	Maximum
No action		**STORAGE:** Buildings 24 long-lived low-level waste 291 mixed waste Pads 19 transuranic and alpha waste Tanks 4 organic waste in S-Area 26 organic waste in E-Area 43 aqueous waste in E-Area **TREATMENT:** Continue ongoing and planned waste treatment activities **DISPOSAL:** 29 shallow land disposal trenches 10 low-activity waste vaults 5 intermediate-level waste vaults 1 RCRA disposal facility	
C	**STORAGE:** Buildings 7 long-lived low-level waste 39 mixed waste Pads 2 transuranic and alpha waste **TREATMENT:** Same as expected waste forecast **DISPOSAL:** 45 shallow land disposal trenches 2 low-activity waste vaults 1 intermediate-level waste vault 10 RCRA disposal facilities	**STORAGE:** Buildings 24 long-lived low-level waste 79 mixed waste Pads 11 transuranic and alpha waste **TREATMENT:** Continue ongoing and planned waste treatment activities; treat limited quantities of mixed and PCB wastes offsite; begin smelting low-activity equipment waste offsite; operate the Consolidated Incineration Facility for low-level, hazardous and mixed waste until vitrification facility is available; construct and operate a hazardous and mixed waste containment building; construct and operate a non-alpha vitrification facility for low-level, hazardous, and mixed wastes; construct and operate a transuranic waste characterization/certification facility; construct and operate an alpha vitrification facility **DISPOSAL:** 123 shallow land disposal trenches 2 low-activity waste vaults 2 intermediate-level waste vaults 40 RCRA disposal facilities	**STORAGE:** Buildings 34 long-lived low-level waste 652 mixed waste Pads 1,166 transuranic and alpha waste **TREATMENT:** Same as expected waste forecast **DISPOSAL:** 576 shallow land disposal trenches 5 low-activity waste vaults 3 intermediate-level waste vaults 111 RCRA disposal facilities

TC

TE



2.6 Alternative B – Moderate Treatment Configuration and DOE's Preferred Alternative

As described at the beginning of Chapter 2, DOE bases alternative B on a moderate treatment configuration that would balance the short-term and long-term impacts of waste management at SRS. This is DOE's preferred alternative. DOE believes that alternative B offers the best combination of treatment, storage, and disposal technologies to ensure cost-effective protection of the environment. This section discusses the activities and facilities that would be used for alternative B – expected waste forecast, and discusses changes in such activities and facilities that would be required to accommodate the minimum and maximum waste forecasts.

Alternative B is identical to the no-action alternative with respect to the management of liquid high-level waste. This section discusses changes, if any, necessary in alternative B to accommodate the minimum and maximum forecasts of this waste. Alternative B includes several treatment facilities for low-level, TC mixed, and transuranic wastes, including an offsite smelter, offsite volume reduction and repackaging, a mobile soil sort facility, and the Consolidated Incineration Facility for low-level wastes; the Consolidated Incineration Facility, containment building, and non-alpha vitrification facility for mixed wastes; and the transuranic waste characterization/certification facility and alpha vitrification facility for transuranic and alpha wastes. Hazardous waste would also be treated at SRS in the Consolidated Incineration Facility and containment building. By implementing these treatments, DOE would appreciably decrease the amount of additional storage capacity for mixed and transuranic wastes from that required under the no-action alternative. Mixed waste storage would peak in 2005 and transuranic and alpha waste storage in 2006; the number of storage facilities would then decrease as new treatment facilities begin to operate. Small quantities of mixed and PCB wastes would be sent offsite for treatment, and transuranic wastes would be sent to the Waste Isolation Pilot Plant for disposal when that facility becomes available. The waste volumes sent to shallow land disposal and to RCRA disposal facilities would increase from those projected for the no-action alternative due to the increased volume of treatment residuals. Sections 2.6.3, 2.6.4, 2.6.5, and 2.6.6, respectively, discuss the proposed treatment, storage, and disposal activities for low-level, hazardous, mixed, and transuranic wastes under alternative B. Section 2.6.7 summarizes the activities and facilities under alternative B and compares them to those required under the no-action alternative.

2.6.1 POLLUTION PREVENTION/WASTE MINIMIZATION

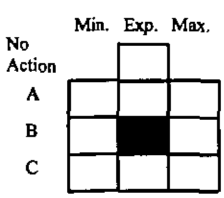
The ongoing waste minimization activities described under the no-action alternative (Section 2.2.1) would continue under alternative B for each waste forecast. In addition to ongoing waste minimization activities, DOE would initiate other activities to reduce low-level and mixed wastes, as summarized in Table 2-33. TE

Table 2-33. Waste minimization activities under alternative B.[a]

Minimization activity	Treatability group	Waste forecast	Estimated amount of reduction (cubic meters)[b]
Source reduction	Low-level job-control waste	Expected	850
		Minimum	850
		Maximum	850
Recycle metal into waste containers (beneficial reuse)	Low-activity waste metal	Expected	17,965
		Minimum	9,838
		Maximum	53,792
Reuse decontaminated lead	Mixed waste lead	Expected	2,408
		Minimum	1,053
		Maximum	6,140
Sort soil to divert for beneficial reuse	Mixed waste soils and concrete	Expected	35,332
		Minimum	9,549
		Maximum	176,024
Sort soil to divert for beneficial reuse	Low-activity and suspect soil and small concrete pieces	Expected	25,214
		Minimum	9,980
		Maximum	403,888

TC

a. Sources: Hess (1994e, 1995c).
b. *To convert to cubic feet, multiply by 35.31.*



2.6.1.1 Pollution Prevention/Waste Minimization – Expected Waste Forecast

The SRS high-volume disposables task team would initiate source reduction to prevent the generation of an estimated 850 cubic meters (30,000 cubic feet) of low-level job-control waste (Stone 1994d), as described in Section 2.5.1.1.

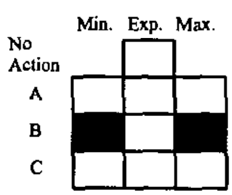
DOE plans to build on the beneficial reuse integrated demonstration program (Section 2.2.1.4.2) and help private industry establish a facility to recycle radioactively contaminated steel (Boettinger 1994a). Under the beneficial reuse program, stainless steel and carbon steel from low-activity equipment waste

TC would be recycled. An estimated 17,965 cubic meters (6.34×10^5 cubic feet) of low-activity equipment waste would be recycled under this program (including low-activity waste from the decontamination of TE mixed waste metal debris and bulk equipment) (Hess 1995c). See Section 2.5.1.1 for additional information.

TC TE An estimated 3,010 cubic meters (1.10×10^5 cubic feet) of lead that has radioactive contamination on its surface would be available for recycling (Hess 1995c). Because the recycling initiative is also part of alternative A, the reader can find additional information in Section 2.4.1.1.

DOE would minimize low-activity waste soil, suspect soil, and small pieces of concrete, and mixed waste soils and concrete by sorting and diverting the materials with contamination in amounts that cannot be detected to beneficial uses at SRS. A mobile unit would sort for low-level waste, and the non-alpha vitrification facility would use another process to sort for mixed waste (see Appendixes B.18 and B.28 for the descriptions). The throughput is estimated to be 136,820 cubic meters (4.83×10^6 cubic feet) [48,489 cubic meters (1.71×10^6 cubic feet) of low-level wastes and 88,331 cubic meters TC TE (3.12×10^6 cubic feet) of mixed wastes]. DOE estimates that a total of 60,546 cubic meters (2.14×10^6 cubic feet) [25,214 cubic meters (8.90×10^5 cubic feet) from the low-level and 35,332 cubic meters (1.25×10^6 cubic feet) from the mixed wastes] would be diverted for beneficial reuse (Hess 1995c).

DOE would not recycle large pieces of concrete with radioactive contamination (i.e., low-level waste) by reusing it as aggregate in construction or road-building projects. DOE would use waste minimization techniques to reduce the amount of waste generated by the waste management facilities. See Section 2.5.1.1 for additional information.

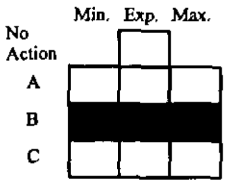


2.6.1.2 Pollution Prevention/Waste Minimization – Minimum and Maximum Waste Forecasts

For alternative B – minimum and maximum waste forecasts, DOE would continue to support the beneficial reuse program. Table 2-33 presents the estimated volumes of low-activity equipment waste available for recycling under each forecast.

DOE would also recycle lead with radioactive contamination on its surface. Table 2-33 presents the estimated volumes of radioactively contaminated lead that would be available for recycling under each forecast.

DOE would minimize the volume of low-activity waste soil, suspect soil and concrete, and mixed waste soils and concrete that would require disposal. Table 2-33 presents the estimated volumes that would be available for beneficial reuse from the low-level and mixed waste soils.



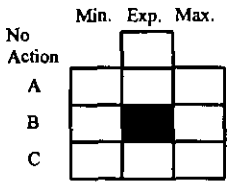
2.6.2 HIGH-LEVEL WASTE – EXPECTED, MINIMUM, AND MAXIMUM WASTE FORECASTS TE

Under alternative B, DOE would treat liquid high-level radioactive waste as it would under the no-action alternative (see Section 2.2.2, Figure 2-9). For each waste forecast, DOE would continue current management activities, from receipt and storage of liquid high-level waste in tanks to preparation, processing, and treatment into forms suitable for final disposal. The high-level waste volumes that would be generated over the next 30 years in addition to the existing inventory of high-level waste [approximately 1.31×10^5 cubic meters (3.45×10^7 gallons)] are given in Table 2-23. TE

These volumes are not additive because newly generated waste would be reduced approximately 75 percent via evaporation. These volumes would not require construction of new high-level waste tanks or facilities. Instead, DOE proposes to continue current management practices and manage waste with the objective of emptying the tanks and immobilizing SRS's inventory of liquid high-level waste by 2018 (DOE 1994a).

DOE would not change the proposed high-level waste management practices as a result of the smaller volumes anticipated in the minimum waste forecast (45 percent less than the expected forecast). The only difference in management practices as a result of the larger volumes anticipated in the maximum waste forecast (23 percent more than the expected forecast) would be to operate the existing evaporators at higher rates to maintain adequate reserve tank storage capacity. TE

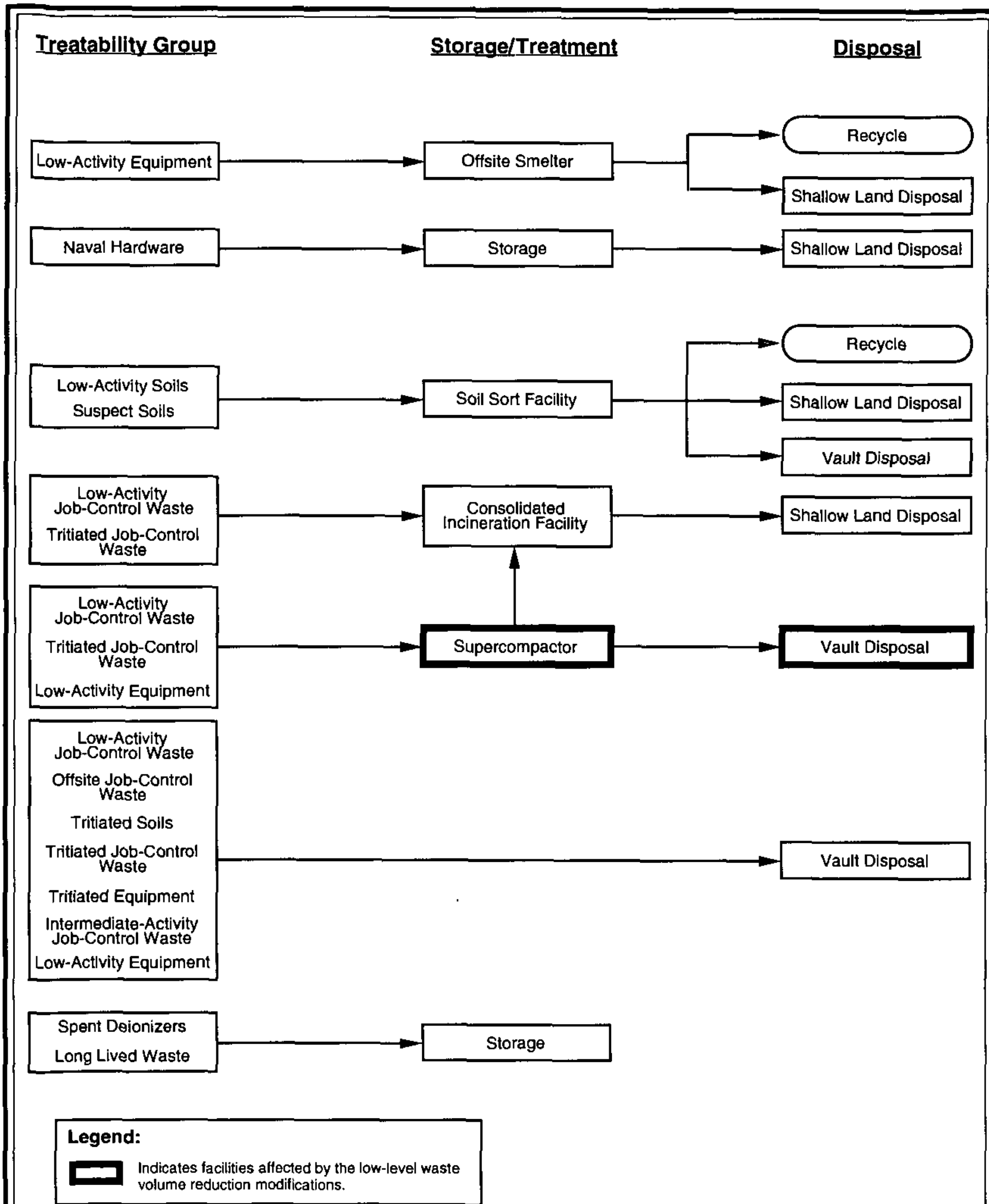
2.6.3 LOW-LEVEL WASTE



2.6.3.1 Low-Level Waste – Expected Waste Forecast

For alternative B – expected waste forecast, low-level waste would be managed in a manner similar to the no-action alternative presented in Section 2.2.3. Under alternative B, DOE also would implement moderate low-level waste treatment. The management practices proposed under alternative B of the draft EIS are summarized in Figure 2-31. In the draft EIS, DOE proposed to construct and operate a supercompactor at SRS to compact some low-activity equipment, low-activity job-control waste, and tritiated job-control waste. DOE proposed to continue operating the existing compactors from 1995 to 2005, until the supercompactor began operating in 2006. The existing compactors and proposed supercompactor would have received 4 percent and 21 percent, respectively, of the waste volume expected under alternative B of the draft EIS. Low-level wastes that could not be accepted at the three existing compactors before the supercompactor began to operate, such as bulk equipment, and TC job-control waste in excess of the available compactor capacity would have been disposed of in low-level waste vaults. Appendix B.29 provides a description of the supercompactor, the wastes that it would have processed, and impacts associated with operation of the supercompactor as proposed under alternative B in the draft EIS.

DOE has determined that low-level waste volume reduction technologies such as supercompaction are available at commercial facilities. Immediate utilization of commercial capacity in lieu of construction of a supercompactor at SRS would enable DOE to reduce its needs for low-level waste disposal vaults. Offsite waste treatment could also be used during maintenance periods of onsite treatment facilities. DOE would not use commercial capacity to reduce the volume of tritiated job-control waste. These wastes would be placed directly into intermediate-level waste vaults and DOE does not anticipate TE shortfalls in vault capacity to accommodate these wastes. The processing of tritiated job-control waste was the major contributor to the emissions from low-level waste supercompaction at SRS as evaluated in the draft EIS. Such emissions could be a greater concern at an offsite location because the facility would likely be closer to the site boundary than it would have been at SRS. DOE now proposes to ship only some low-activity job-control and equipment waste to a commercial facility for volume reduction beginning in fiscal year 1996. These low-activity wastes would be treated by supercompaction, size



Source: Hess (1994e, 1995a).

Note: This figure does not include short-term or transition activities.

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Figure 2-31. Low-level waste management plan for alternative B – expected waste forecast in the draft EIS. TC reduction (e.g., sorting, shredding, melting), and incineration. Figure 2-32 summarizes the proposed management practices for low-level waste as modified, which are listed below:

- Decontaminate and recycle low-activity equipment waste (metals) offsite. Treatment residues would be returned to SRS for shallow land disposal.
- Operate a mobile soil sort facility to segregate uncontaminated soils for beneficial reuse.
- Operate the Consolidated Incineration Facility to incinerate low-activity and tritiated wastes.
- Reduce the volume of low-activity job-control and equipment waste at commercial facilities; residuals would be returned to SRS for further treatment or disposal.

Under alternative B, DOE would store process water deionizers and other long-lived wastes (less than 1 percent of the forecast low-level waste) in long-lived waste storage buildings in E-Area, as discussed in Section 2.2.3.3. The existing building would reach capacity by 2000, and 24 additional buildings would be constructed over the 30-year analysis period (Hess 1995c).

Under alternative B, DOE would ship low-activity job-control and equipment waste (which constitute 36 and 5 percent, respectively, of the forecast low-level waste) to a commercial facility for volume reduction beginning in fiscal year 1996. Uncompacted wastes already in the low-activity waste vault would be retrieved and sent to a commercial facility. For purposes of assessment, the facility was assumed to be located in Oak Ridge, Tennessee. In terms of transportation and surrounding population, this location is representative of the range of possible locations. These low-activity wastes would be treated by volume reduction technologies. For purposes of analysis in the EIS, it is assumed that the waste would be treated offsite as follows:

- 60 percent supercompacted
- 20 percent reduced in size and repackaged for incineration in the Consolidated Incineration Facility
- 10 percent incinerated; the resulting ash would be supercompacted

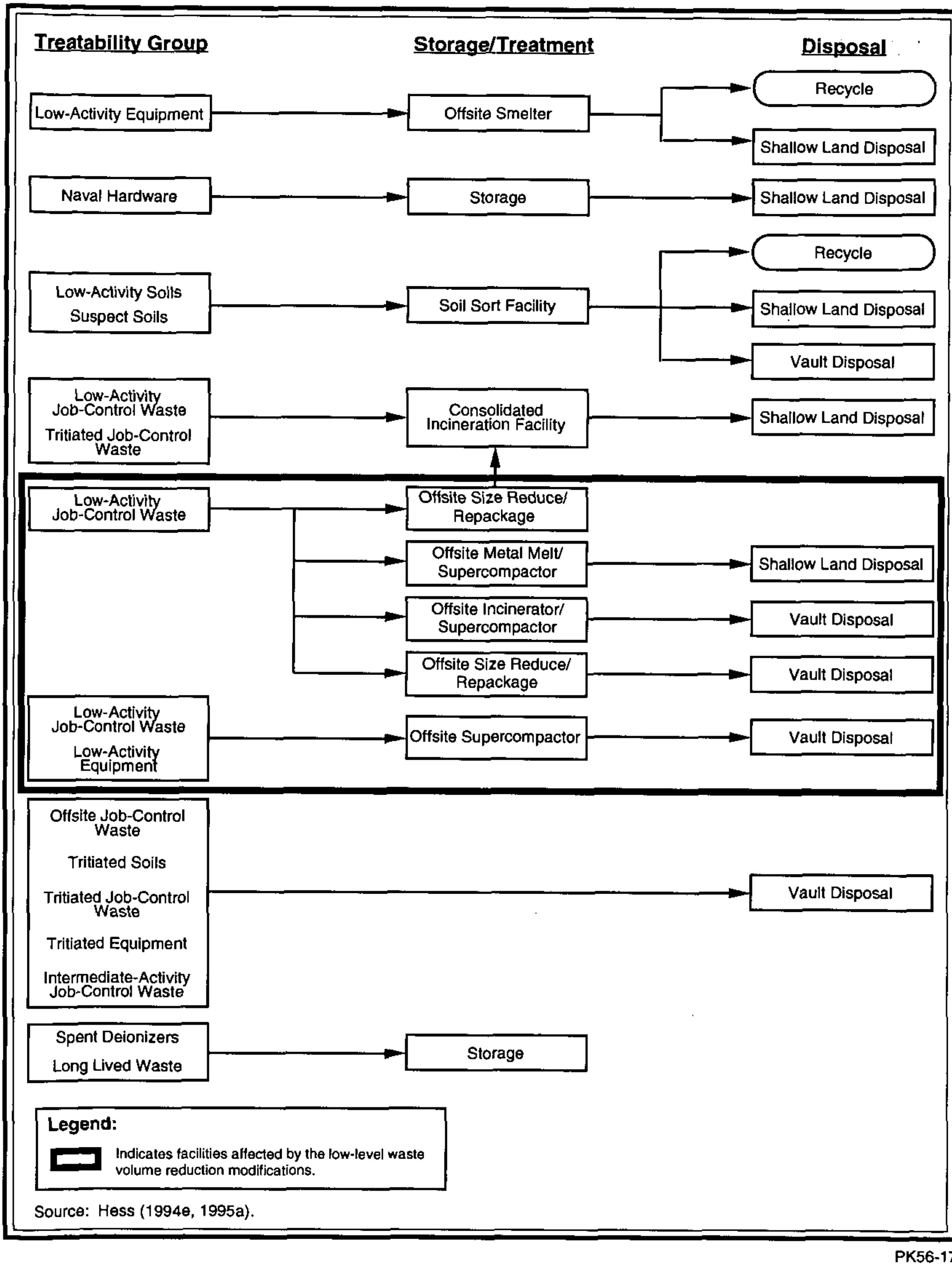

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Figure 2-32. Low-level waste management plan for alternative B – expected waste forecast.

- 5 percent reduced in size and repackaged for disposal
- 5 percent melted, the melt residue would be supercompacted

After treatment, the wastes would be repackaged and returned to SRS for further treatment (e.g., burned at the Consolidated Incineration Facility) or disposal. Treatment residuals would be placed in vaults for disposal, except for residuals from metal melting, which would be sent to shallow land disposal. Refer to Appendix B.20 for a description of commercial volume reduction and associated impacts.

Assuming operation of the Consolidated Incineration Facility in 1996, DOE would incinerate combustible low-activity and tritiated job-control wastes, which constitute approximately 41 percent of the forecast waste, including low-activity wastes repackaged by a commercial facility. DOE would send stabilized incinerator ash and blowdown wastes to shallow land disposal. Refer to Appendix B.5 for a description of the Consolidated Incineration Facility, the projected low-level waste throughputs, and the projected impacts of their treatment at that facility.

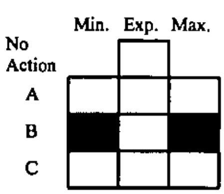
Under alternative B, DOE would operate a mobile soil sort facility to separate contaminated and uncontaminated soils. In the draft EIS, DOE proposed to begin operating the soil sort facility in 2006. However, since the soil sort facility would be a mobile unit, and such units are currently available, DOE now proposes to begin operating the facility in 1996. The facility would process low-activity and suspect soils, which constitute approximately 9 percent of the anticipated low-level waste. DOE would send suspect soil to shallow land disposal and low-activity soil to vault disposal in 1995, until the soil sort facility begins operating. It is assumed that 60 percent of the incoming low-activity soil and 40 percent of the incoming suspect soil would be contaminated and would require management as low-level waste (Hess 1994e). It is also assumed that 30 percent of the contaminated soil would require vault disposal because of radiological performance assessment restrictions, and 70 percent would be sent to shallow land disposal (Hess 1994e). Uncontaminated soil (5 percent of the low-level waste forecast) would be reused onsite as backfill. Refer to Appendix B.28 for a description of the soil sort facility.

Under alternative B, DOE would ship low-activity equipment waste (metals), constituting 3 percent of the low-level waste forecast, to a commercial facility for decontamination by smelting. DOE anticipates that the offsite smelter would decontaminate 90 percent of the low-activity equipment waste for recycle and return 10 percent of the original volume to SRS for shallow land disposal (Hess 1994k). Refer to Appendix B.19 for a description of the smelter.

A 75-percent reduction in low-level waste disposal volume would be realized from the treatment activities under alternative B. TC

DOE would send naval hardware to shallow land disposal, as described in Section 2.2.3.4. DOE would also send suspect soil to shallow land disposal in 1995 until the soil sort facility is available. After 1996, DOE would send a portion of the contaminated soil from the sort facility to shallow land disposal. DOE would also send stabilized ash and blowdown wastes from the Consolidated Incineration Facility and stabilized residuals from the offsite smelter to shallow land disposal. TC

DOE would continue to dispose of suspect soils in the engineered low-level trench as described in Section 2.2.3.1. DOE would dispose of low-activity waste and intermediate-activity waste in the existing low-level waste vaults, as described in Sections 2.2.3.1 and 2.2.3.2. As a result of the low-level waste volume reduction initiatives that would be implemented under alternative B, the existing low-activity waste vault would not reach capacity until the year 2011. The existing intermediate-level waste vault would reach capacity by 1999. Additional vaults would be constructed as required. DOE would dispose of intermediate-activity job-control waste, offsite job-control waste, tritiated soil, and tritiated equipment without treatment for the entire 30-year period. DOE would also dispose of a portion of tritiated job-control waste without treatment. Compacted and supercompacted wastes would also be disposed of at the low-level waste vaults. TC



2.6.3.2 Low-Level Waste – Minimum and Maximum Waste Forecasts

For alternative B – minimum and maximum waste forecasts, DOE would change the way it manages low-level waste (see Figure 2-32). The changes from waste management practices described for the expected forecast are primarily the result of the larger volume of soils anticipated in the maximum forecast. Low-activity and suspect soils would constitute approximately 48 percent of the maximum forecast (compared to 9 percent in the expected forecast). DOE would realize a 75 percent reduction in disposal volume from treatment in the expected waste forecast, a 79-percent reduction in the minimum waste forecast, and a 64-percent reduction in the maximum waste forecast. Table 2-34 lists the percentage of low-level waste distributed among the various treatment and disposal options under the minimum and maximum forecasts. TC

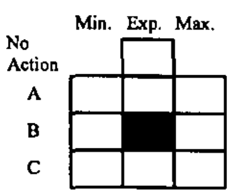
Table 2-34. Low-level waste treatment and disposal options for alternative B minimum and maximum waste forecasts.[a,b]

Minimum waste forecast	Maximum waste forecast
Treatment options	Treatment options
1 percent to compactors	<1 percent to compactors[c]
45 percent volume reduced offsite	19 percent volume reduced offsite
46 percent incinerated	20 percent incinerated
5 percent to soil facility	49 percent to soil facility
Disposal options	Disposal options
69 percent to vaults	47 percent to vaults
31 percent to shallow land disposal	53 percent to shallow land disposal

TC

a. Source: Hess (1995c).
b. Percentages are approximate.
TE c. "<" is read as "less than."

2.6.4 HAZARDOUS WASTE



2.6.4.1 Hazardous Waste – Expected Waste Forecast

As discussed in Section 2.4.4.1, DOE does not plan to construct facilities solely for the treatment of hazardous wastes. However, facilities that DOE plans to use for mixed waste could be used for hazardous wastes to the extent excess capacity is available. Figure 2-33 summarizes the proposed hazardous waste management practices under alternative B. In addition to the management practices for hazardous waste under the no-action alternative (Section 2.2.4), under alternative B DOE would treat hazardous wastes onsite as follows:

- Construct and operate a containment building for decontamination of debris/metals for use onsite or to be sold as scrap.

- Operate the Consolidated Incineration Facility and incinerate selected hazardous wastes.

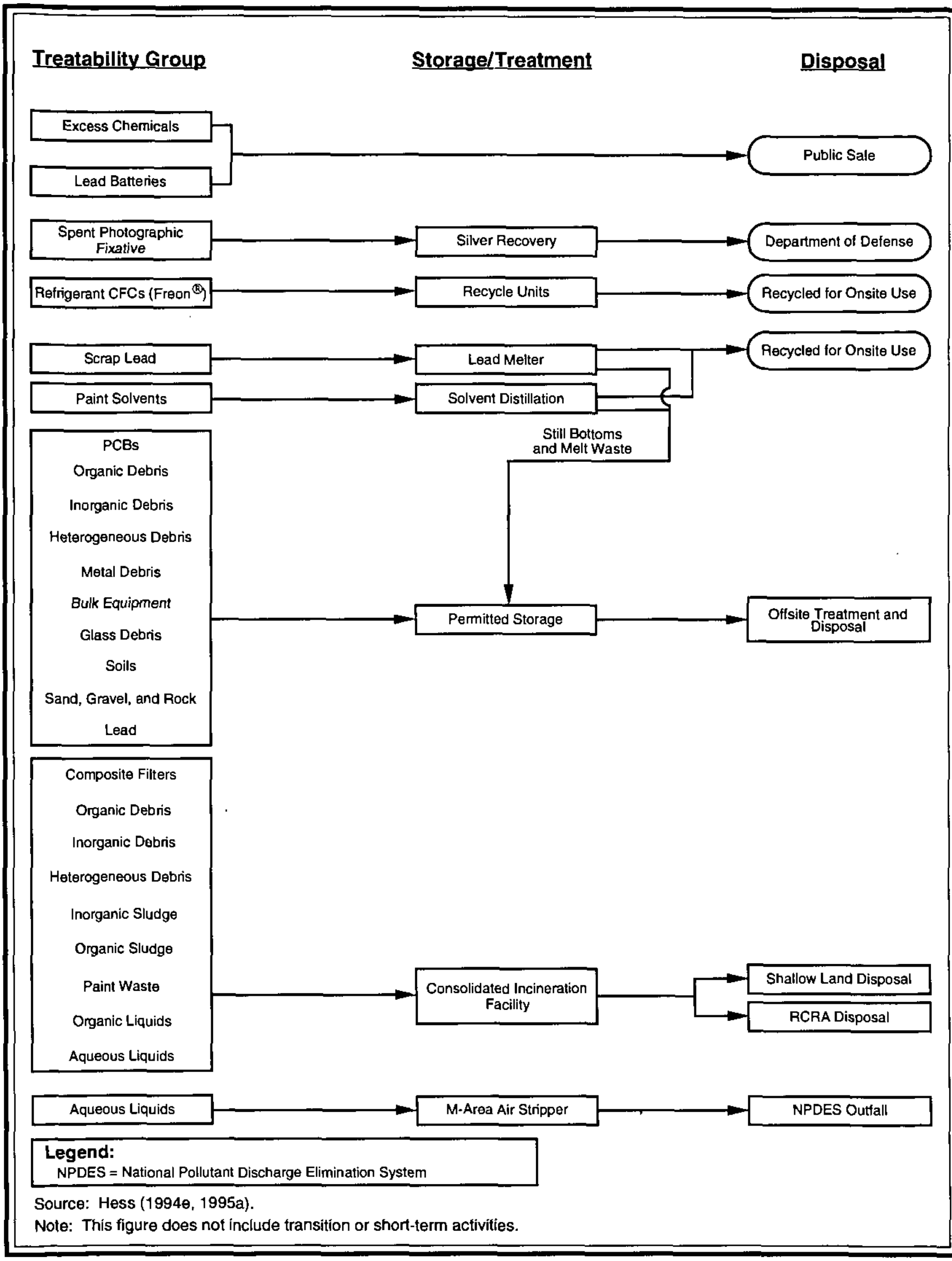


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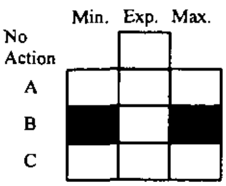
Figure 2-33. Hazardous waste management plan for alternative B – expected waste forecast.

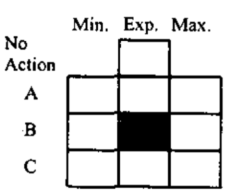
TC In the draft EIS, DOE proposed to burn only filters, paint waste, organic liquids, and aqueous liquids in the Consolidated Incineration Facility. To more fully use the treatment capacity of that facility, DOE proposes to also burn organic and inorganic sludges and 50 percent of the organic, inorganic, and heterogeneous debris under alternative B.



2.6.4.2 Hazardous Waste – Minimum and Maximum Waste Forecasts

For alternative B – minimum and maximum forecasts, DOE would manage hazardous waste the same as in the expected waste forecast. Most of the hazardous waste would continue to be sent offsite for treatment and disposal (85 percent for expected, 89 percent for minimum, and 87 percent for maximum TC waste forecasts). However, several hazardous wastes (composite filters, paint waste, organic liquids, aqueous liquids; inorganic, organic, and heterogeneous debris; inorganic and organic sludges) would be treated in the Consolidated Incineration Facility, assuming it begins operating in 1996. These wastes TC represent approximately 8 to 9 percent of the hazardous waste quantities forecast for the next 30 years for all cases (Hess 1995c).

2.6.5 MIXED WASTE



2.6.5.1 Mixed Waste – Expected Waste Forecast

TE For alternative B – expected waste forecast, DOE would manage mixed waste as under the no-action alternative presented in Section 2.2.5. Under alternative B, DOE also would implement moderate mixed waste treatments as summarized in Figure 2-34, which consist of the following:

- Store tritiated oil to allow time for radioactive decay.
- TE Send elemental mercury and mercury-contaminated materials to the Idaho National Engineering Laboratory for treatment; residuals would be returned to SRS for RCRA-permitted disposal or shallow land disposal.

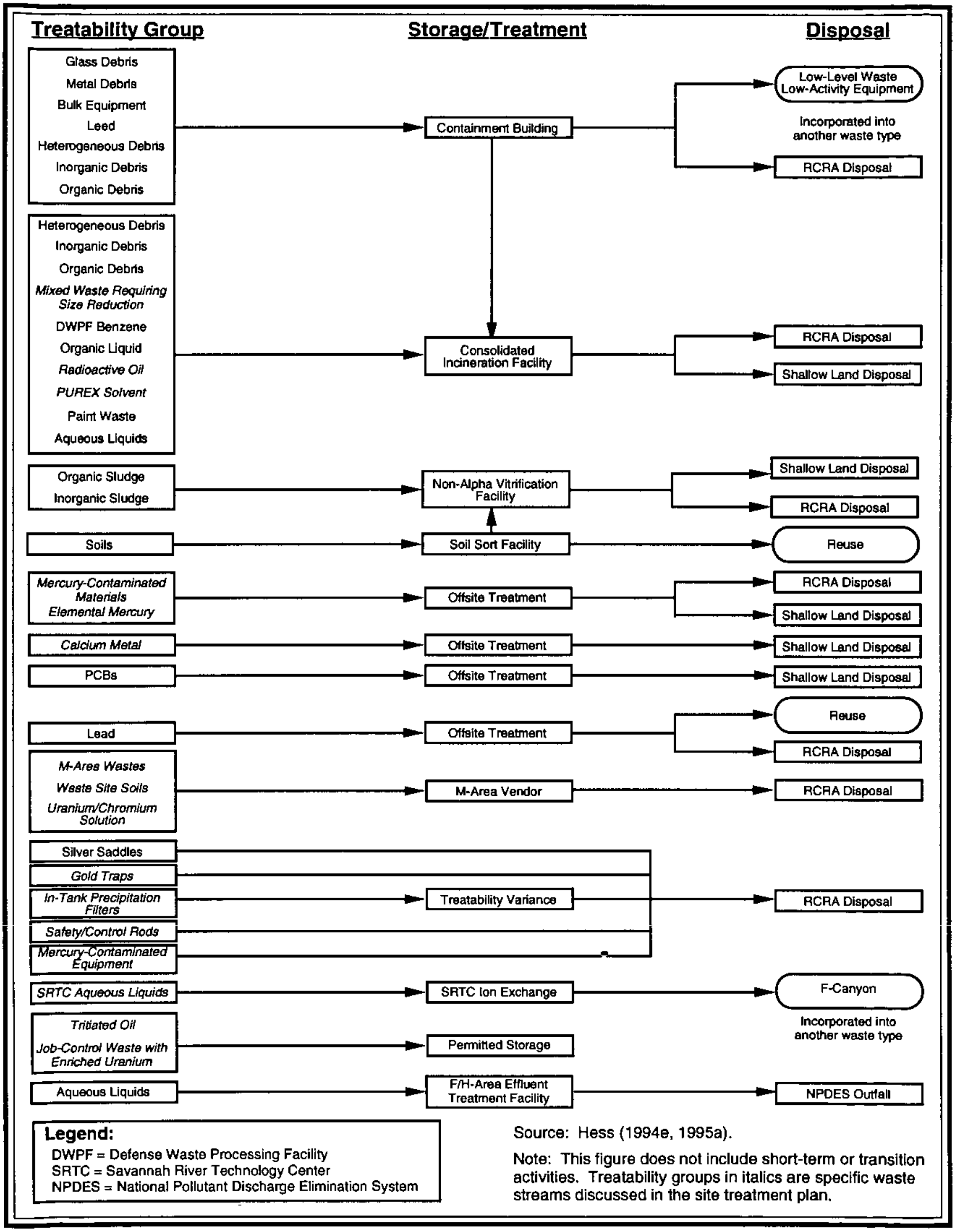


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Figure 2-34. Mixed waste management plan for alternative B – expected waste forecast

TC • Send calcium metal waste to the Los Alamos National Laboratory for treatment; residuals would be returned to SRS for shallow land disposal.

TE • Send radioactive PCB wastes offsite for treatment; residuals would be returned to SRS for shallow land disposal.

• Send lead offsite for decontamination and recycling; treatment residuals would be returned for RCRA-permitted disposal at SRS.

In addition, under alternative B DOE would:

• Construct a containment building to decontaminate mixed wastes (mostly debris) and macroencapsulate contaminated debris and lead wastes.

• Complete construction of and operate the Consolidated Incineration Facility to burn certain mixed wastes such as benzene generated by the Defense Waste Processing Facility, organic and aqueous liquid wastes, decontamination solutions from the containment building, PUREX solvent, and radioactive oil.

• Construct disposal vaults for stabilized ash and blowdown from the incineration process.

• Construct and operate a non-alpha vitrification facility to treat soils and organic and inorganic sludges. This vitrification facility would include a soil sort capability to separate clean soil from contaminated soil. Contaminated soil would be treated in the vitrification process and clean soil would be used onsite as backfill material.

• Construct disposal capacity for vitrified waste from the non-alpha vitrification facility.

• Construct and operate the M-Area Vendor Treatment Facility to vitrify wastes generated by
TE M-Area electroplating operations and the specific wastes in the *SRS Proposed Site Treatment Plan*.

TC

2.6.5.1.1 Containerized Storage

TE For alternative B – expected waste forecast, DOE would continue to store mixed waste in the three mixed waste storage buildings, the M-Area storage building, and on three storage pads. The non-alpha mixed waste (i.e., waste with less than 10 nanocuries per gram of transuranics) that is now stored on the transuranic waste pads would be transferred to the mixed waste storage pads. To accommodate future mixed waste storage needs prior to the availability of treatment facilities, DOE would build additional mixed waste storage buildings as needed. Based on the usable capacity of Building 643-43E, DOE estimates that a maximum of 79 additional buildings would be required by 2005 (Hess 1995c). See Section 2.4.5.1.1 for additional information. TC TE

DOE would manage low-level PCB wastes, radioactive oil, mercury-contaminated oil, and job-control waste contaminated with solvents and enriched uranium as described in alternative A (Section 2.4.5.1.1). TC

2.6.5.1.2 Treatment and/or Tank Storage

DOE would manage aqueous wastes in the Savannah River Technology Center tanks and the solvent tanks in E-Area, and aqueous liquids from groundwater monitoring wells as described in the no-action alternative (Section 2.2.5.2). TE

DOE would manage organic waste generated at the Defense Waste Processing Facility and wastes currently stored in the M-Area Process Waste Interim Treatment/Storage Facility tanks and M-Area storage building as described for alternative A (Section 2.4.5.1.2).

For alternative B – expected waste forecast, DOE would construct and operate a containment building for decontaminating approximately 23 percent of the mixed waste (glass, metal, organic, inorganic, and heterogeneous debris; bulk equipment) forecast. Decontaminated debris and equipment from which hazardous constituents were removed would be managed as low-activity equipment waste (see Section 2.6.3). Materials that could not be decontaminated would be macroencapsulated in welded stainless steel boxes or in a polymer coating and sent to RCRA-permitted disposal. Secondary wastes from the decontamination process would be collected for incineration at the Consolidated Incineration Facility. It is assumed that 80 percent of the materials could be decontaminated. DOE assumes that spent decontamination solutions would constitute 50 percent of the original volume of the materials to be decontaminated. The containment building would also provide macroencapsulation for lead wastes. The lead would be macroencapsulated in a polymer coating in accordance with RCRA treatment requirements (Hess 1994e, 1995c). See Appendix B.6 for a description of the containment building. TE TC TE TE

DOE would construct and operate a non-alpha vitrification facility to treat approximately 26 percent of the forecast mixed waste, including contaminated soil and organic and inorganic sludges. The vitrified TC waste would be sent to RCRA-permitted disposal or shallow land disposal. See Section 2.5.5.1.2 for additional information.

DOE would begin to operate the Consolidated Incineration Facility in 1996 for the treatment of approximately 20 percent of the mixed wastes anticipated under the expected forecast, including benzene waste generated by the Defense Waste Processing Facility, organic and aqueous liquid wastes, PUREX solvent, paint waste, radioactive oil, and heterogeneous, inorganic, and organic debris. Organic and inorganic sludges would be incinerated until 2006, when the non-alpha vitrification facility began to operate. The Consolidated Incineration Facility would also burn approximately 1,360 cubic meters (48,000 gallons) per year of spent decontamination solutions from the containment building. Stabilized ash and blowdown waste from the Consolidated Incineration Facility would be sent to RCRA-permitted disposal or shallow land disposal. See Section 2.4.5.1.2 for additional information.

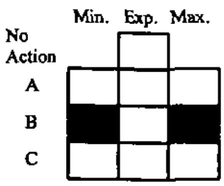
DOE would manage elemental mercury, mercury-contaminated waste, calcium metal waste, low-level PCB wastes, and lead as described for alternative A (Section 2.4.5.1.2).

2.6.5.1.3 Disposal

DOE submitted an application for RCRA permit to SCDHEC for 10 Hazardous Waste/Mixed Waste Disposal Vaults. For purposes of this EIS, DOE based its proposed disposal vaults on the design of its current Hazardous Waste/Mixed Waste Disposal Vault. See Section 2.2.5.3 for additional information.

As described in Section 2.2.5.3 for the no-action alternative, DOE would construct and operate RCRA-permitted vaults for disposal of mixed wastes. In addition, under the alternative B – expected waste forecast, DOE would manage hazardous waste in these vaults and would also use them to dispose of 70 percent of the stabilized ash and blowdown from the Consolidated Incineration Facility; 50 percent of the vitrified wastes from the non-alpha vitrification facility; elemental mercury waste from the Idaho National Engineering Laboratory; lead residuals from offsite decontamination; and macroencapsulated debris, bulk equipment, and lead from the containment building. The first of the RCRA-permitted disposal vaults would begin accepting wastes in 2002, and DOE would construct additional vaults as needed (Hess 1994e, 1995c). Refer to Section 2.6.7 for mixed waste disposal projections over the 30-year period.

Mixed wastes subject to RCRA because they exhibit a hazardous characteristic may be treated in a way that eliminates the characteristic (e.g., toxic metals may be immobilized). If mixed wastes are treated in this manner, they need not be disposed of at RCRA-permitted facilities, and DOE would dispose of them as low-level waste. DOE would send 30 percent of the stabilized ash and blowdown from the Consolidated Incineration Facility, 50 percent of the vitrified wastes from the non-alpha vitrification facility, stabilized residuals from the treatment of radioactive PCB wastes, calcium metal waste, and stabilized mercury waste from the Idaho National Engineering Laboratory to shallow land disposal (Hess 1994e, 1995c). Refer to Section 2.6.7 for projections of low-level waste disposal over the 30-year period. TC TE

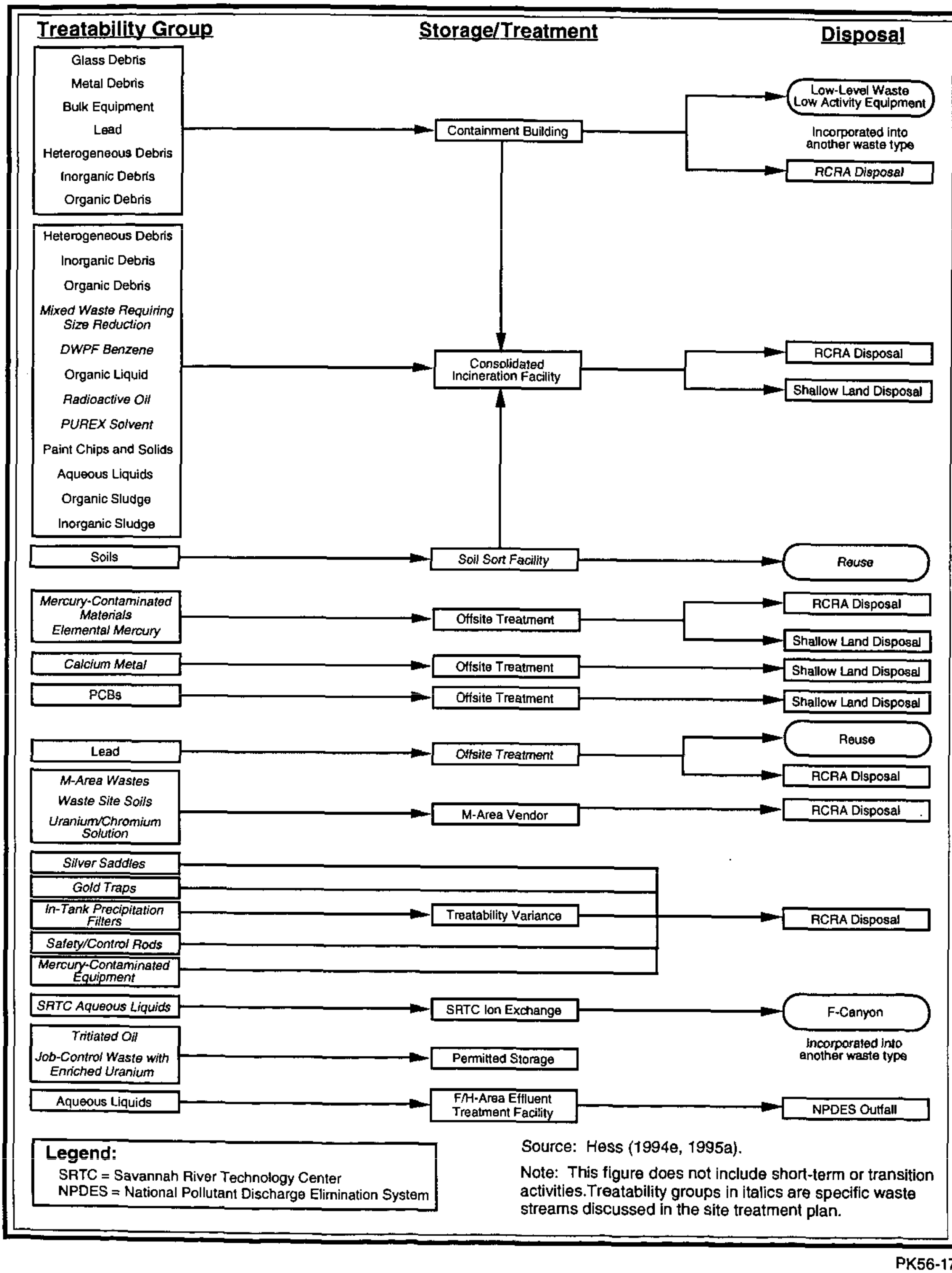


2.6.5.2 Mixed Waste – Minimum and Maximum Waste Forecasts

For alternative B – minimum and maximum waste forecasts, DOE would change the way it manages some mixed waste. These changes from waste management practices described for the expected waste forecast are attributed to the volume of soils anticipated in the minimum (27 percent) and maximum (54 percent) forecasts, compared to the expected (39 percent) forecast. Figure 2-35 shows the proposed management activities for the minimum forecast. Smaller quantities of mixed waste soils and sludges would mean that construction of a non-alpha vitrification facility might not be necessary. DOE would modify the Consolidated Incineration Facility to accept these types of materials. TC TE

In the maximum forecast, because of the large volume of debris that would be decontaminated at the containment building, DOE would construct a wastewater treatment unit to treat spent decontamination solutions (see Appendix B.6 for a discussion of the wastewater treatment unit). TE

Limited quantities of liquid and solid residuals from the wastewater treatment unit (approximately 6 percent of the influent wastewater volume) would be burned at the Consolidated Incineration Facility. Table 2-35 describes the percentage of mixed waste distributed among the various treatment options under the minimum and maximum waste forecasts.



TC

TE

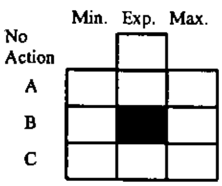
Figure 2-35. Mixed waste management plan for alternative B – minimum waste forecast.

Table 2-35. Mixed waste treatment options for alternative B minimum and maximum waste forecasts.[a,b]

Minimum waste forecast	Maximum waste forecast	
27 percent to soil sort facility	54 percent to soil sort facility	
30 percent to containment building	23 percent to containment building	TC
49 percent incinerated	14 percent incinerated	

a. Source: Hess (1995c). TE
b. Percentages are approximate.

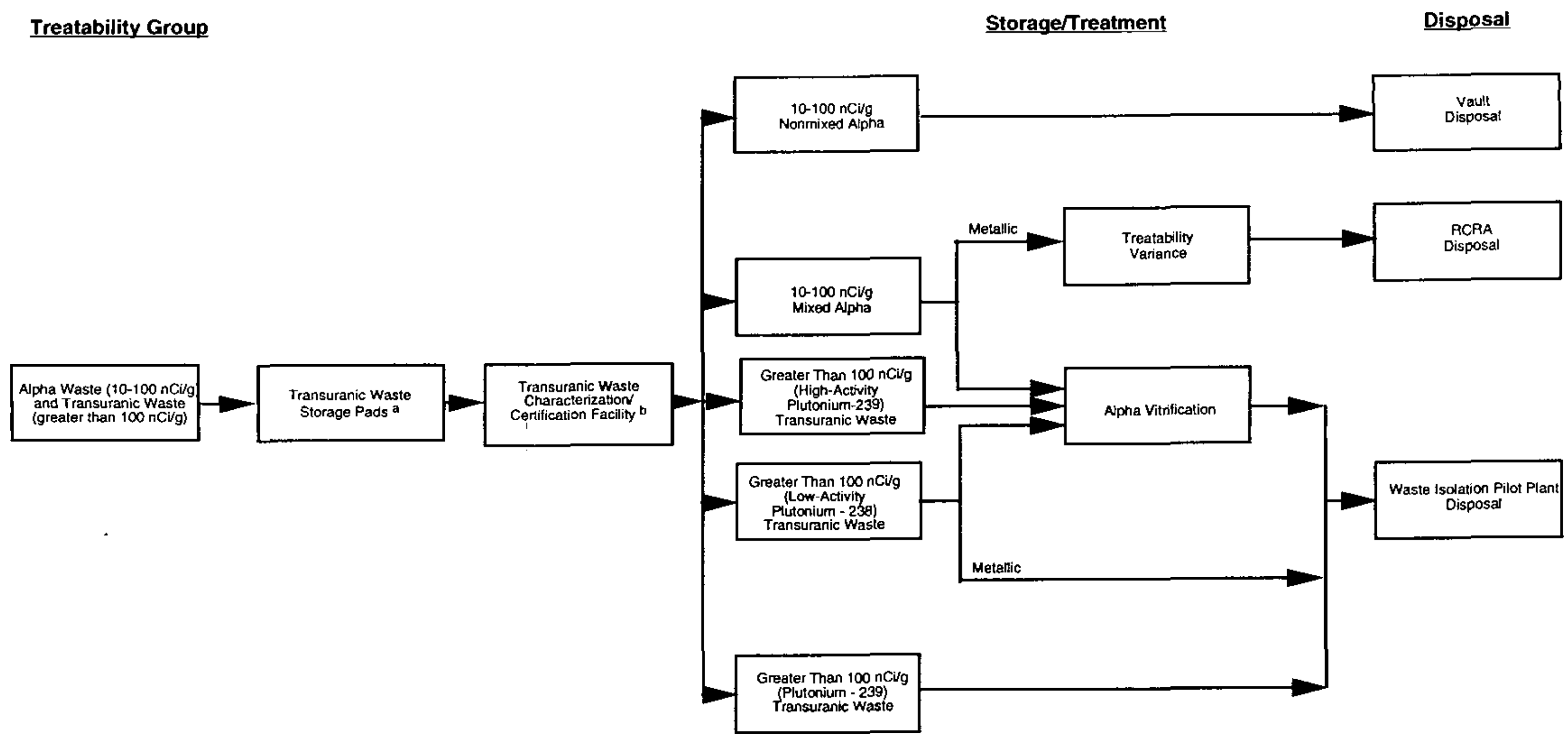
2.6.6 TRANSURANIC AND ALPHA WASTE



2.6.6.1 Transuranic and Alpha Waste – Expected Waste Forecast

For alternative B – expected waste forecast, DOE would provide moderate treatment that would allow disposal of alpha (10 to 100 nanocuries per gram) and transuranic (greater than 100 nanocuries per gram) wastes. Figure 2-36 summarizes the proposed alpha and transuranic waste management practices for alternative B, which include the waste management practices under the no-action alternative described in Section 2.2.6 and the following: TE

- Construct and operate the transuranic waste characterization/certification facility to characterize, treat, repackage, and certify waste for disposal.
- Construct and operate the alpha vitrification facility to vitrify mixed alpha waste (10 to 100 nanocuries per gram) and plutonium-238 waste (greater than 100 nanocuries per gram).
- Return Rocky Flats incinerator ash for consolidation and treatment with similar wastes at that facility. TC
- Dispose of nonmixed alpha waste in low-activity waste vaults and macroencapsulated mixed alpha waste metal debris at RCRA-permitted disposal vaults. TE
- Dispose of the vitrified and repackaged transuranic waste at the Waste Isolation Pilot Plant (Hess 1995a).



Legend:
nCi/g = Nanocuries per gram

[a] Alternate storage locations are being evaluated; this analysis is based on using transuranic waste storage pads only

[b] Waste certification activities consolidated with characterization/certification facility

Source: Hess (1994e).

PK56-17

Figure 2-36. Transuranic waste management plan for alternative B expected waste forecast.

TE

TE

2.6.6.1.1 Storage

For alternative B – expected waste forecast, DOE would continue to accumulate alpha and transuranic waste in the same manner as described under the no-action alternative (Section 2.2.6). In the draft EIS, DOE assumed that alpha wastes generated between 1995 and 2006 would be stored for processing at the transuranic waste characterization/certification facility. However, facilities would be available during that time period that could accept these wastes. DOE proposes to use these facilities to dispose of alpha wastes and reduce the need for additional storage capacity. Under alternative B, DOE would certify newly generated mixed and nonmixed alpha waste for disposal in the RCRA-permitted disposal vaults and low-activity waste vaults, respectively. DOE would package and store containers on transuranic waste storage pads to await processing; retrieve drums from mounded storage on Transuranic Waste Storage Pads 2 through 6; and construct new pads as needed. To meet RCRA storage requirements for storage of hazardous constituents and to accommodate newly generated transuranic waste, 10 additional transuranic waste storage pads (see Appendix B.30) would be required by 2006 (Hess 1994e, 1995c).

For purposes of this EIS it is assumed that the Waste Isolation Pilot Plant would operate from 1998 to 2018 and would accept SRS transuranic waste. Transuranic waste processed by the transuranic waste characterization/certification facility after 2018 would remain in storage at SRS. DOE would require one transuranic waste storage pad to store the processed and packaged transuranic waste remaining in 2024 (Hess 1994e, 1995c). DOE has not determined how these wastes will be disposed of.

2.6.6.1.2 Treatment

DOE would return a small amount (0.1 cubic meter) of Rocky Flats incinerator ash currently stored at SRS to that operations office for consolidation and treatment with similar wastes. The *SRS Proposed Site Treatment Plan* concluded that it was not cost effective to develop treatment at SRS for this small quantity of material. Rocky Flats is currently investigating alternatives for management of the ash.

DOE would construct and operate the transuranic waste characterization/certification facility to perform assays and intrusive characterizations of the waste in drums, culverts, and boxes stored on transuranic waste storage pads. The facility would begin operating in 2007 and would process 94 percent of the alpha and transuranic waste. DOE would segregate waste into one of four categories: nonmixed alpha, mixed alpha, plutonium-238, or plutonium-239. After segregation, the mixed alpha waste and plutonium-238 transuranic waste would each be further divided into metallic and nonmetallic waste categories. Of the charactrized waste, the mixed alpha waste (14 percent overall) would contribute 11 percent nonmetallic and 3 percent metallic, respectively. The plutonium-238 waste (55 percent of the

TC characterized waste) would contribute 33 percent nonmetallic and 22 percent metallic respectively to the
overall total (Hess 1995a). The plutonium-239 waste would be further segregated into high- and
low-activity categories. Bulk waste would be reduced in size to fit into 55-gallon drums. The
transuranic waste characterization/certification facility would reduce the overall waste volume by
TC 30 percent by processing and repackaging. Waste characterization would segregate the incoming waste
TE categories so the alpha vitrification facility could properly blend the waste for vitrification to achieve a
TC high-quality vitrified waste form. Further details on these topics are in the description of the transuranic
TE waste characterization/certification facility in Appendix B.31.

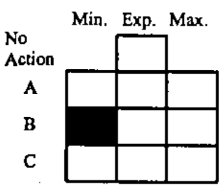
The nonmixed alpha and metallic plutonium-238 waste would be repackaged at the transuranic waste characterization/certification facility and certified for disposal. The nonmixed alpha waste would be disposed of in low-activity waste vaults. The metallic plutonium-238 waste and low-activity plutonium-239 waste would be packaged and certified for disposal at the Waste Isolation Pilot Plant in accordance with that facility's waste acceptance criteria. The metallic mixed alpha waste would be packaged into 55-gallon drums and macroencapsulated by welding the lid onto the drums. DOE recognizes that a portion of the metallic mixed alpha waste would not meet the definition of hazardous debris and would request a treatability variance from EPA to treat this waste by macroencapsulation. The metallic mixed alpha waste would be certified for onsite RCRA-permitted disposal. The nonmetallic mixed alpha waste and nonmetallic plutonium-238 waste would be packaged for vitrification
TE in the alpha vitrification facility (Hess 1994e).

The alpha vitrification facility would begin operating in 2008. Only nonmetallic mixed alpha,
TC nonmetallic plutonium-238, and high-activity plutounium-239 wastes would be vitrified (31 percent of
the forecast volume). DOE would vitrify the mixed alpha waste because of the substantial volume reduction (95 percent) that would be achieved. The mixed alpha waste would be blended with the plutonium-238 and plutonium-293 wastes during vitrification and the vitrified waste form would be classified as transuranic waste. The vitrified waste produced by the alpha vitrification facility would be returned to the transuranic waste characterization/certification facility for certification and disposal at the
TE Waste Isolation Pilot Plant (Hess 1994e, 1995c). A detailed description of the alpha vitrification facility
is in Appendix B.1.

2.6.6.1.3 Disposal

A 58 percent reduction in transuranic and alpha waste volume would be realized under alternative B
TC from repackaging and vitrification of the nonmetallic mixed alpha, nonmetallic plutonium-238, and
high-activity plutonium-239 waste. Nonmixed alpha waste (38 percent of the processed volume) would

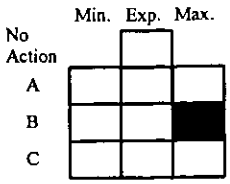
be disposed of in low-activity waste vaults and the macroencapsulated metallic mixed alpha waste
(11 percent of the processed volume) would be sent to RCRA-permitted disposal. Approximately half of
the waste (48 percent of the processed volume) would be shipped offsite for disposal as transuranic waste TC
(vitrified nonmetallic mixed alpha, nonmetallic plutonium-238, high-activity plutonium-239, and
repackaged low-activity plutonium-239 waste) at the Waste Isolation Pilot Plant starting in 2008 and
ending in 2018. DOE would ship 390 cubic meters (13,800 cubic feet) per year of transuranic waste to TC
the Waste Isolation Pilot Plant. By 2018, DOE would have shipped for disposal a quantity of transuranic
waste equal to approximately 3 percent of the total capacity of the Waste Isolation Pilot Plant TE
(Hess 1995c). Three percent of the processed waste volume would remain in storage at SRS on one TC
transuranic waste storage pad (Hess 1995c). TE



2.6.6.2 Transuranic and Alpha Waste – Minimum Waste Forecast

Because of the reduced volumes in the minimum waste forecast, DOE would make a minor change from
the expected waste forecast in the way it manages transuranic and alpha waste (Figure 2-35). With the
reconfiguration of the transuranic waste storage pads (see Appendix B.30) and newly generated waste, TE
two additional pads would be needed by 2005. By 2024, DOE would require only one transuranic waste TC
storage pad to store the remaining processed and packaged transuranic waste (Hess 1995c). TE

The characterization, treatment, and disposal methods would remain the same as in the expected waste
forecast; however, by 2018, DOE would have disposed of more transuranic waste (52 percent of the
processed volume) at the Waste Isolation Pilot Plant. Due to the accelerated treatment of transuranic
waste, only 1 percent of the processed volume would remain in storage on one transuranic waste storage TC
pad. DOE would ship 284 cubic meters (10,000 cubic feet) per year of transuranic waste to the Waste
Isolation Pilot Plant between 2008 and 2018. In 2018, DOE would have shipped for disposal a quantity
of transuranic waste equal to approximately 2 percent of the total capacity of the Waste Isolation Pilot
Plant (Hess 1995c). TE



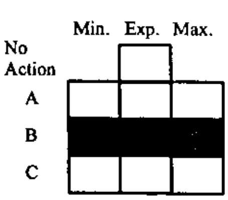
2.6.6.3 Transuranic and Alpha Waste – Maximum Waste Forecast

For alternative B – maximum waste forecast, DOE would manage transuranic and alpha waste somewhat differently than in the expected forecast because of the dramatic change in the volume of transuranic waste anticipated (25 times the expected waste forecast). DOE would also experience an increase in mixed alpha waste (45 percent compared to 16 percent in the expected waste forecast) for processing and disposal as a result of the assumptions made in the maximum forecast. By 2006, DOE would require 1,168 additional transuranic waste storage pads to store newly generated waste (Hess 1995c).

For alternative B – maximum waste forecast, DOE would use the same treatment and disposal methods as for the expected waste forecast; however, the waste characterization would differ (9 percent nonmixed alpha, 47 percent mixed alpha, 35 percent plutonium-238, and 9 percent plutonium-239 waste). DOE would send a slightly larger percentage of transuranic waste (50 percent of the processed volume) to the Waste Isolation Pilot Plant. Less than 1 percent of the processed volume would remain in storage on one transuranic waste storage pads at SRS (Hess 1995a, c).

DOE would ship 7,819 cubic meters (2.76×10^5 cubic feet) per year of transuranic waste to the Waste Isolation Pilot Plant between 2008 and 2018. The waste volume disposed of in this forecast would constitute 53 percent of the repository's total capacity (Hess 1995c).

2.6.7 SUMMARY OF ALTERNATIVE B FOR ALL WASTE TYPES



Under alternative B, DOE would continue the waste management activities at SRS listed for the no-action alternative (Section 2.2.7), including the construction of additional storage capacity for mixed wastes and transuranic and alpha wastes. Less capacity would be needed for this alternative than would be required for the no-action alternative. In addition, DOE would:

- Construct and operate a containment building to treat mixed waste.

- Construct and operate a non-alpha vitrification facility for mixed waste soils and sludges.

- Sort mixed waste soils at the non-alpha vitrification facility to separate uncontaminated soil for reuse.

- Operate a mobile low-level soil sort facility to separate uncontaminated soil for reuse and low-activity and suspect soils for disposal.

- Decontaminate and recycle low-activity equipment waste (metals) offsite. Treatment residues would be returned to SRS for shallow land disposal.

- Treat small quantities of mixed and PCB wastes offsite. Treatment residuals would be returned to SRS for disposal.

- Operate the Consolidated Incineration Facility for mixed (benzene generated by the Defense Waste Processing Facility, organic and aqueous liquid wastes, decontamination solutions from the containment building, PUREX solvent, radioactive oil, sludges, and debris), hazardous, and low-level wastes. TC

- Treat low-activity job-control and equipment wastes offsite; residuals would be returned to SRS for incineration at the Consolidated Incineration Facility or for disposal. TC

- Construct and operate a transuranic waste characterization/certification facility.

- Construct and operate an alpha vitrification facility.

- Dispose of transuranic wastes at the Waste Isolation Pilot Plant.

- Store tritiated oil to allow time for radioactive decay.

- Send elemental mercury and mercury-contaminated materials to the Idaho National Engineering Laboratory for treatment; residuals would be returned to SRS for RCRA-permitted disposal or shallow land disposal.

TE

- Send calcium metal waste to the Los Alamos National Laboratory for treatment; residuals would be returned to SRS for shallow land disposal.

- Send lead offsite for decontamination and recycling; treatment residuals would be returned for RCRA-permitted disposal at SRS.

- Construct disposal vaults for stabilized ash and blowdown from the incineration process (Hess 1995a).

TC

The largest impacts to land outside of E-Area would occur in the maximum waste forecast (approximately 756 acres for alternative B). This land would be required for storage facilities until treatment begins in approximately 2006. However, by 2024, most of the waste would have been treated and disposed of and no land would be required outside of E-Area for alternative B. It is highly unlikely that the technology used to store the waste volumes under the minimum and expected forecasts would be suitable for the maximum forecast. However, to compare the different treatment configurations among the alternatives of this EIS, the assumption was made that the same technology would be applied for all three waste forecasts. For example, DOE would likely construct the 10 additional transuranic waste storage pads required for the expected case; however, DOE would probably elect not to use the same technology if it called for 1,168 pads under the maximum forecast.

TE

Figure 2-37 shows a timeline for the ongoing and proposed waste management activities for alternative B. DOE would operate the existing waste management facilities until the proposed facilities could be designed, constructed, and begin operations. For all the waste types except high-level waste, the waste management activities that would occur from 1995 to 2007 are shown in Figure 2-38. Figure 2-39 shows the proposed waste management activities as they would occur after 2008.

TE

Table 2-36 shows the additional management facilities under alternative B and compares them to those required under the no-action alternative.

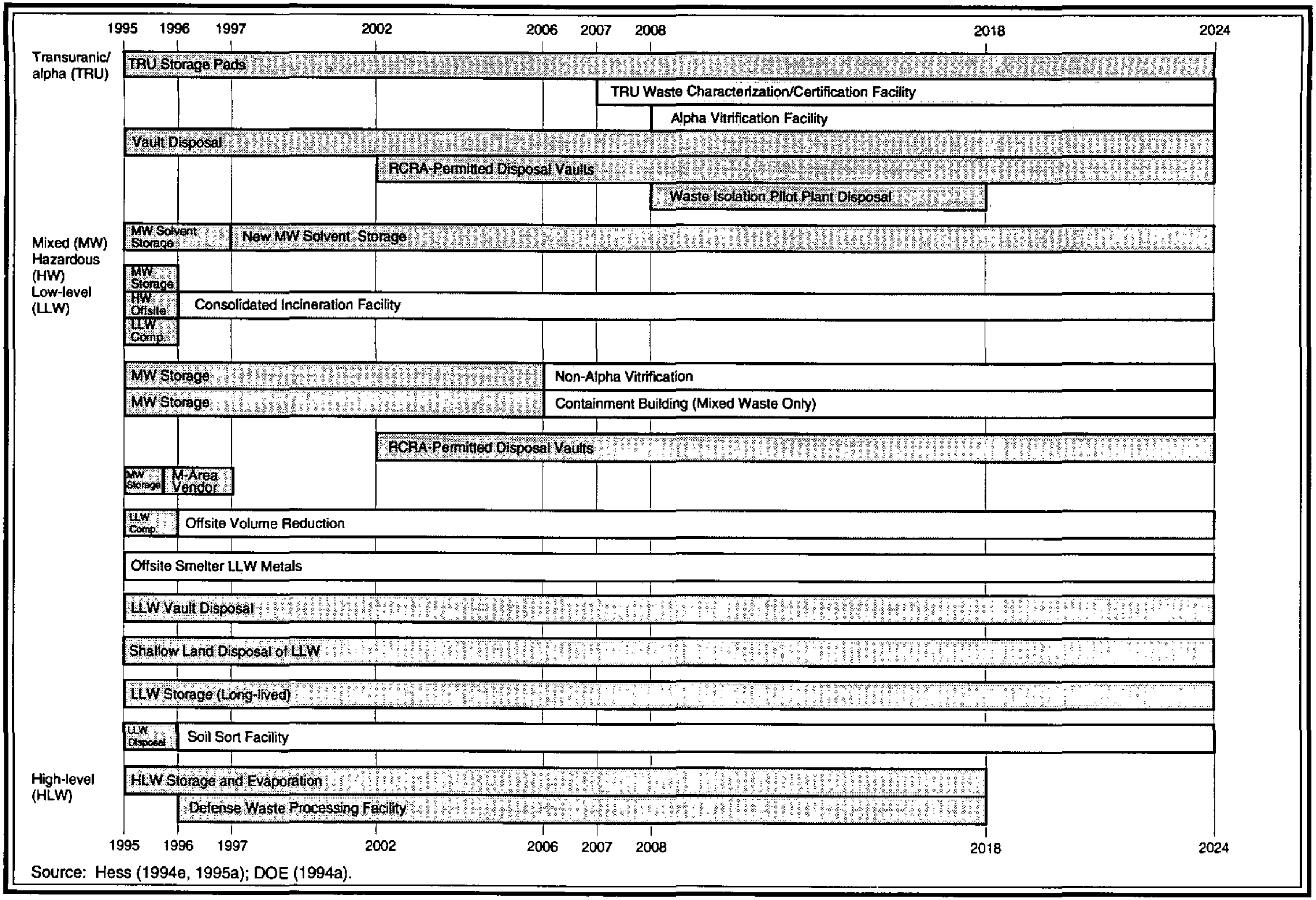


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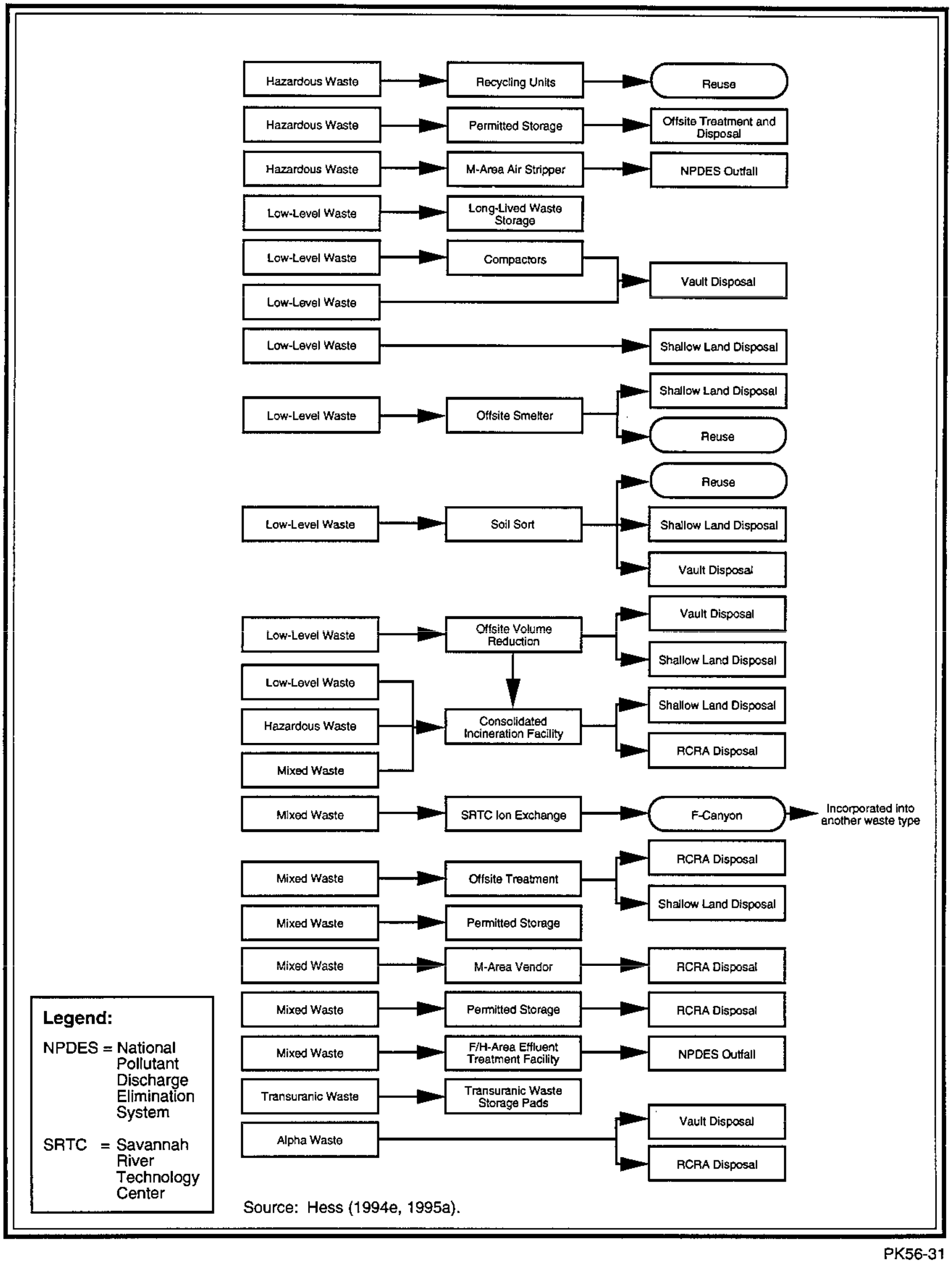
Figure 2-37. Timeline for waste management facilities in alternative B.

Legend:
- Activities or facilities that are part of the no-action alternative
- Activities or facilities that would occur under alternative B

TC

TE



TC
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TE **Figure 2-38.** Summary of waste management activities in alternative B until the year 2007.

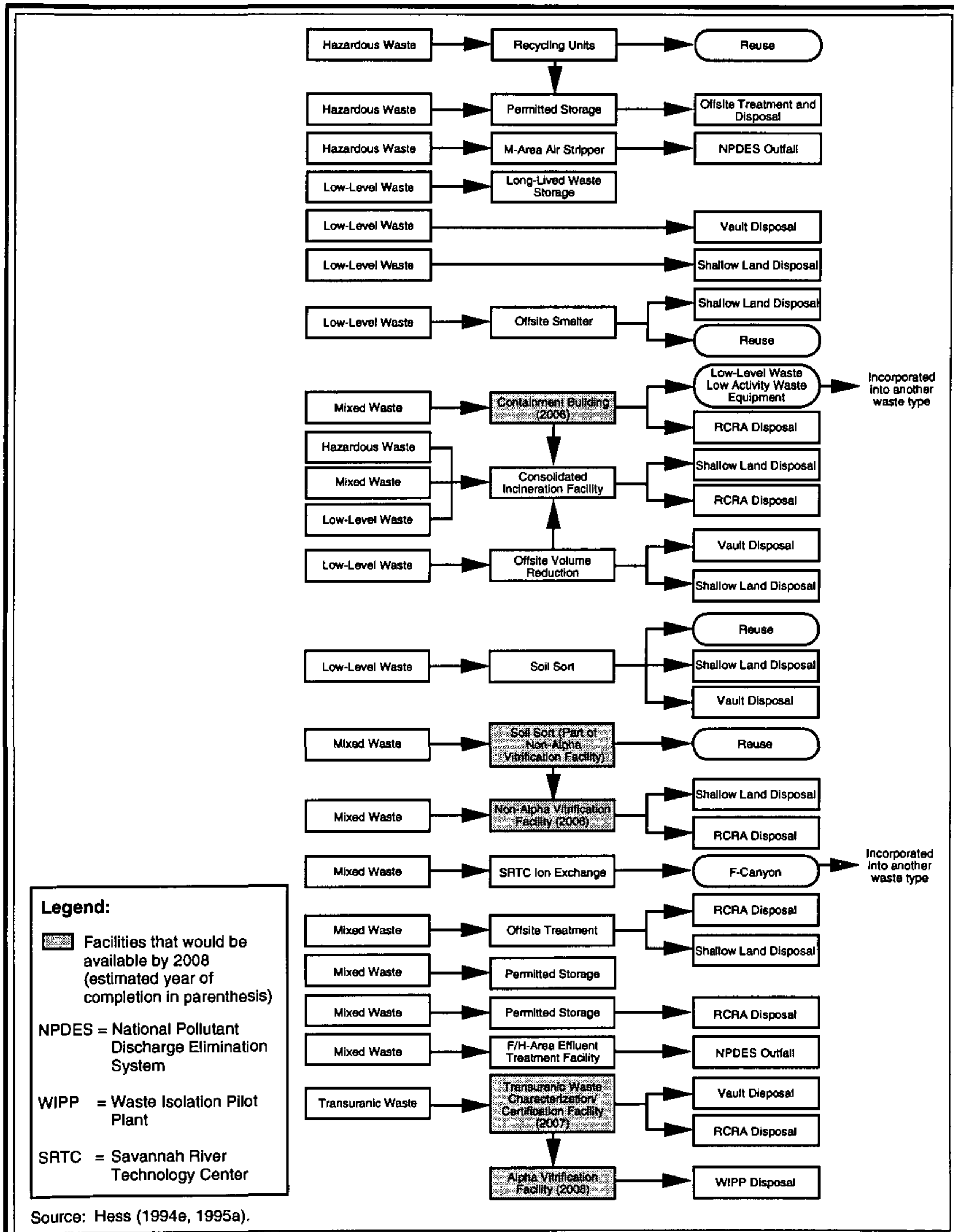

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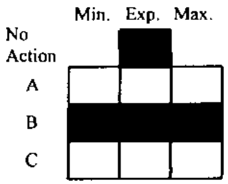
Figure 2-39. Summary of proposed waste management activities in alternative B after year 2008. TE



TC

Table 2-36. Comparison of treatment, storage, and disposal facilities under alternative B and the no-action alternative.

	Minimum	Expected	Maximum
No action		**STORAGE:** Buildings 24 long-lived low-level waste 291 mixed waste Pads 19 transuranic and alpha waste Tanks 4 organic waste in S-Area 26 organic waste in E-Area 43 aqueous waste in E-Area **TREATMENT:** Continue ongoing and planned waste treatment activities **DISPOSAL:** 29 shallow land disposal trenches 10 low-activity waste vaults 5 intermediate-level waste vaults 1 RCRA disposal facility	
B	**STORAGE:** Buildings 7 long-lived low-level waste 39 mixed waste Pads 2 transuranic and alpha waste **TREATMENT:** Same as expected waste forecast, except no non-alpha vitrification facility; modify Consolidated Incineration Facility to accept mixed waste soils and sludges **DISPOSAL:** 37 shallow land disposal trenches 1 low-activity waste vault 2 intermediate-level waste vaults 20 RCRA disposal facilities	**STORAGE:** Buildings 24 long-lived low-level waste 79 mixed waste Pads 10 transuranic and alpha waste **TREATMENT:** Continue ongoing and planned waste treatment activities; treat limited quantities of mixed and PCB wastes offsite; begin volume reduction of low-activity job-control and equipment waste offsite; begin smelting low-activity equipment waste offsite; operate the Consolidated Incineration Facility for low-level, hazardous, and mixed wastes; construct and operate a low-level waste soil sort facility; construct and operate a mixed waste containment building; construct and operate a non-alpha vitrification facility for mixed waste soils and sludges; construct and operate a transuranic waste characterization/certification facility; construct and operate an alpha vitrification facility **DISPOSAL:** 58 shallow land disposal trenches 1 low-activity waste vault 5 intermediate-level waste vaults 21 RCRA disposal facilities	**STORAGE:** Buildings 34 long-lived low-level waste 652 mixed waste Pads 1,168 transuranic and alpha waste **TREATMENT:** Same as expected waste forecast, except containment building modified to include wastewater treatment capability to treat spent decontamination solutions; treat its secondary waste at the Consolidated Incineration Facility **DISPOSAL:** 371 shallow land disposal trenches 8 low-activity waste vaults 9 intermediate-level waste vaults 96 RCRA disposal facilities

2.7 Comparison of Environmental Impacts

This EIS examines alternatives for managing several types of wastes at SRS: liquid high-level radioactive, low-level radioactive, hazardous, mixed, and transuranic. The impacts of those management alternatives are summarized in this section. TE

The EIS considered various configurations of volume reduction technologies for low-level radioactive wastes. These configurations included the continued compaction of low-level wastes in the no-action alternative and in alternative A; soil sorting and vitrification in alternative C; and soil sorting, supercompaction, size reduction, and incineration in alternative B. These configurations would result in the following volume reductions and disposal distributions for low-level wastes (Table 2-37): TC TE

Table 2-37. Volume reductions achieved for low-level waste.

Alternative A		Alternative B		Alternative C	
22	percent reduction in disposal volume	75	percent reduction in disposal volume	70	percent reduction in disposal volume
93	percent of waste volume disposed of in vaults	68	percent of waste volume disposed of in vaults	67	percent of waste volume disposed of in vaults
7	percent of waste volume sent to shallow land disposal	32	percent of waste volume sent to shallow land disposal	33	percent of waste volume sent to shallow land disposal

TC

Table 2-38 summarizes potential environmental impacts and costs of waste management activities, including the construction and operation of new facilities. For many parameters, existing environmental conditions would not change. Table 2-38 shows environmental impacts to various categories of resources. The evaluation of the environmental impacts of the alternatives considered in this EIS, which bound both the full range of reasonable waste management strategies and the quantities of waste that might be managed at SRS, indicates that many impacts are very small. Furthermore, the differences among management alternatives are minor for the same waste forecast. The major determinant of potential impacts is the amount of waste SRS would be required to manage. In other words, differences in waste volumes are more significant than differences in management strategies. The amount of waste SRS will manage depends in large part on the extent of environmental restoration and facility decontamination and decommissioning undertaken at SRS in the future. The receipt of wastes from other facilities and ongoing operations at SRS make much smaller contributions to waste volume. TE

In eight resource categories -- socioeconomics, groundwater, surface water, air, traffic, transportation, occupational health, and public health -- there would be very small impacts. Cleared and uncleared land would be disturbed by new facilities, which would impact ecological resources and future land-use options and could impact geologic and cultural resources. Specific impacts that would occur under each alternative include:

TC

- Impacts and benefits of alternative ways to reduce the volume of low-level waste were evaluated. Under alternative A and the no-action alternative, low-level wastes would be compacted, resulting in a 22 percent reduction in the disposal volume. The size reduction (e.g., sorting, shredding, and melting), supercompaction, and incineration proposed in alternative B would reduce the volume by 75 percent, although with an increased (but still minor) impact on the health risks to remote populations. Soil sorting and vitrification proposed in alternative C would reduce the volume of low-level waste by 70 percent.

- Construction and operation of facilities are required for each alternative. In general, waste treatment by facilities proposed for the alternative involving extensive treatment (alternative C) would produce higher operational impacts than those for the alternative involving limited treatment (alternative A) because more handling and processing of waste generally produces more emissions and greater worker exposure.

- Conversely, the limited treatment alternative (alternative A) would require more disposal capacity and disposal facilities with more sophisticated methods of containment (i.e., more vaults and less shallow land disposal), because alternative A would not reduce or immobilize wastes to the degree that alternative C (extensive treatment configuration) would.

TE

- The moderate treatment alternative (alternative B) uses options from alternative A and alternative C, depending on the type of waste and its characteristics and physical properties, to balance the trade-offs between extensive treatment and extensive disposal. Variations in the implementation of alternative B would result in impacts that would fall somewhere between those from the less stable waste forms produced under alternative A and those from the greater operational emissions produced in alternative C. Impacts would be very small for each of the alternatives.

- The no-action alternative would require more storage facilities at the end of the 30-year period of analysis than any other alternative. Under the no-action alternative, mixed and transuranic wastes would not have been treated or disposed of during the 30-year period considered in this EIS, increasing the risk of potential environmental impacts, including accidents and worker radiological exposure, above those of the other alternatives. Risks, treatments, and costs under the no-action alternative would be deferred, not avoided. In addition, some risk would be incurred during the 30-year storage period as a result of normal operations.

- Managing the maximum amount of waste in any of the alternatives would require clearing approximately 1,000 acres. It would be difficult to clear this much land in a heterogeneous landscape, such as occurs at SRS, without measurably affecting the ecological resources of the area. The loss of this much natural habitat would result in the loss of large numbers of individual animals. Although there are 181,000 acres (733 square kilometers) of forested land on SRS, committing 1,000 acres to waste management under the maximum waste forecast would more severely restrict future land-use options than would managing the minimum and expected waste forecasts, which would require less land. TE

- Groundwater impacts from shallow land and vault disposal would be very small. Exceedances of health-based standards that were identified in the draft EIS would not occur for two reasons. First, after the draft EIS was issued, DOE reevaluated the isotopic inventory of wastes and determined that curium-247 and -248 are not present at detectable concentrations in the wastes. Therefore, these radionuclides were removed from the waste inventories considered in the EIS groundwater analysis. Second, the draft EIS groundwater analysis did not account for the reduced mobility of the stabilized waste forms, such as ashcrete and glass, that might be placed in slit trenches. The analysis in this final EIS instead assumes that the performance of stabilized waste forms would conform with the performance objectives of DOE Order 5820.2A. TC

- Tritium releases to the Savannah River from groundwater beneath E-Area seeping into Upper Three Runs would reach their highest concentrations in 70 to 237 years. However, these concentrations would be very small and would remain well within drinking water standards under each alternative. TC

- Airborne emissions of nonradiological constituents would not increase appreciably over current emissions and would remain within applicable state and Federal standards for each alternative. Radiological emissions and resulting doses to the public and workers would remain within EPA standards. Over the 30-year evaluation period, these emissions would increase the risk of a fatal cancer to the maximally exposed member of the public by less than 2 in 100 million for the no-action alternative to about 6 in 100,000 under alternative C maximum waste forecast.

- Under each alternative, additional commuter traffic and truck shipments on SRS and nearby roads would not exceed the capacity of these roads.

- Risk of exposure to radiation from facility accidents to the population within 80 kilometers (50 miles) of SRS would be very small and similar under each alternative.

- Risk to workers at SRS and the public from exposure to toxic chemicals resulting from accidents would be very small and similar for each alternative. All workers follow stringent Occupational Safety and Health Administration requirements when handling toxic chemicals. Facilities where toxic chemicals are handled are some distance from the SRS boundaries, so the risk of exposure to the public is minimal.

- Projected facility cost and manpower requirements differ between the draft and final EIS. This is due to the following factors: a refinement of the parameters that determine operating manpower, building and equipment costs; a correction to the scope of the no-action alternative costs to make them consistent with the other alternative – waste forecast estimates; and new initiatives in alternative B that lowered facility costs for this alternative. In addition, the costing methodology bases construction manpower requirements on building and equipment costs; therefore, both operating and construction employment differ between draft and final EIS. This, in turn, affects projections of socioeconomic and traffic impacts. The cost analysis was changed to be consistent with the *Baseline Environmental Management Report* (DOE 1995) developed by DOE to ensure consistent reporting on estimating future facility construction and operation costs. This report is used to establish future budgetary requirements for the DOE complex.

- Costs for implementing each alternative were estimated for comparison purposes. Because detailed designs have not been developed for all facilities, these are only preliminary estimates of the likely costs. However, since they were developed for all alternatives from a consistent set of assumptions, they provide a reasonable basis for comparisons. As shown in Table 2-38, in terms of life-cycle costs, the implementation of the moderate treatment alternative for the minimum and expected waste forecast would be equal to implementation of the limited treatment alternative and more costly than the extensive treatment alternative. Implementation of the limited treatment alternative for the maximum waste forecast would be somewhat more costly than implementation of the moderate treatment alternative, which in turn would be more costly than the extensive treatment alternative.

Table 2-38 summarizes and compares the potential environmental impacts of the four waste management alternatives; these impacts result from land clearing and construction and operation of new facilities. The table focuses on the expected waste forecast, but it also presents the minimum and maximum waste forecasts when it is important for a full appreciation of the impacts.

Table 2-38. Comparison of the impacts of each alternative on environmental resources.

Alternative	Minimum	Expected	Maximum
	Additional treatment, storage, and disposal facilities for each alternative[a]		
	Waste forecast		
No action		**STORAGE:** Buildings 24 long-lived low-level waste 291 mixed waste Pads 19 transuranic and alpha waste Tanks 4 organic waste in S-Area 26 organic waste in E-Area 43 aqueous waste in E-Area **TREATMENT:** Continue ongoing and planned waste treatment activities **DISPOSAL:** 29 shallow land disposal trenches 10 low-activity waste vaults 5 intermediate-level waste vaults 1 RCRA[b] disposal facility **COST[c]:** 6.9×10^{9}[d]	
A	**STORAGE:** Buildings 7 long-lived low-level waste 45 mixed waste Pads 3 transuranic and alpha waste **TREATMENT:** Same as expected waste forecast **DISPOSAL:** 25 shallow land disposal trenches 9 low-activity waste vaults 2 intermediate-level waste vaults 21 RCRA disposal facilities **COST:** 4.2×10^{9}	**STORAGE:** Buildings 24 long-lived low-level waste 79 mixed waste Pads 12 transuranic and alpha waste **TREATMENT:** Continue ongoing and planned waste treatment activities; treat limited quantities of mixed and PCB waste offsite; operate the Consolidated Incineration Facility for hazardous and mixed waste, modify the facility to accept mixed waste soils and sludges; construct and operate a mixed waste containment building; construct and operate a mixed waste soil sort facility; construct and operate a transuranic waste characterization/certification facility **DISPOSAL:** 73 shallow land disposal trenches 12 low-activity waste vaults 5 intermediate-level waste vaults 61 RCRA disposal facilities **COST:** 6.9×10^{9}	**STORAGE:** Buildings 34 long-lived low-level waste 757 mixed waste Pads 1,168 transuranic and alpha waste **TREATMENT:** Same as expected waste forecast except containment building modified to include wastewater treatment capability to treat spent decontamination solutions; treat its secondary waste at the Consolidated Incineration Facility **DISPOSAL:** 644 shallow land disposal trenches 31 low-activity waste vaults 31 intermediate-level waste vaults 347 RCRA disposal facilities **COST:** 24×10^{9}

TC

Table 2-38. (continued).

Alternative	Waste forecast: Minimum	Waste forecast: Expected	Waste forecast: Maximum
	Additional treatment, storage, and disposal facilities for each alternative (continued)		
TC B	**STORAGE:** Buildings 7 long-lived low-level waste 39 mixed waste Pads 2 transuranic and alpha waste **TREATMENT:** Same as expected waste forecast, except no non-alpha waste vitrification facility; modify Consolidated Incineration Facility to accept mixed waste soils and sludges **DISPOSAL:** 37 shallow land disposal trenches 1 low-activity waste vault 2 intermediate-level waste vault 20 RCRA disposal facilities **COST:** $\$4.2 \times 10^9$	**STORAGE:** Buildings 24 long-lived low-level waste 79 mixed waste Pads 10 transuranic and alpha waste **TREATMENT:** Continue ongoing and planned waste treatment activities; treat limited quantities of mixed and PCB wastes offsite; begin volume reduction of low-activity job-control and equipment waste offsite; begin smelting low-activity equipment waste offsite; operate the Consolidated Incineration Facility for low-level, hazardous, and mixed wastes; construct and operate a low-level waste soil sort facility; construct and operate a mixed waste containment building; construct and operate a non-alpha vitrification facility for mixed waste soils and sludges; construct and operate a transuranic waste characterization/certification facility; construct and operate an alpha vitrification facility **DISPOSAL:** 58 shallow land disposal trenches 1 low-activity waste vaults 5 intermediate-level waste vault 21 RCRA disposal facilities **COST:** $\$6.9 \times 10^9$	**STORAGE:** Buildings 34 long-lived low-level waste 652 mixed waste Pads 1,168 transuranic and alpha waste **TREATMENT:** Same as expected waste forecast, except containment building modified to include wastewater treatment capability to treat spent decontamination solutions; treat its secondary waste at the Consolidated Incineration Facility **DISPOSAL:** 371 shallow land disposal trenches 8 low-activity waste vaults 9 intermediate-level waste vaults 96 RCRA disposal facilities **COST:** $\$20 \times 10^9$

Table 2-38. (continued).

Additional treatment, storage, and disposal facilities for each alternative (continued)			
Alternative	Waste forecast		
	Minimum	Expected	Maximum
C	**STORAGE:** Buildings 7 long-lived low-level waste 39 mixed waste Pads 2 transuranic and alpha waste **TREATMENT:** Same as expected waste forecast **DISPOSAL:** 45 shallow land disposal trenches 2 low-activity waste vaults 1 intermediate-level waste vault 10 RCRA disposal facilities **COST:** $\$3.8 \times 10^9$	**STORAGE:** Buildings 24 long-lived low-level waste 79 mixed waste Pads 11 transuranic and alpha waste **TREATMENT:** Continue ongoing and planned waste treatment activities; treat limited quantities of mixed and PCB wastes offsite; begin smelting low-activity equipment waste offsite; operate the Consolidated Incineration Facility for low-level, hazardous, and mixed waste until vitrification facility is available; construct and operate a hazardous and mixed waste containment building; construct and operate a non-alpha vitrification facility for low-level, hazardous, and mixed waste; construct and operate a transuranic waste characterization/certification facility; construct and operate an alpha vitrification facility **DISPOSAL:** 123 shallow land disposal trenches 2 low-activity waste vaults 2 intermediate-level waste vaults 40 RCRA disposal facilities **COST:** $\$5.6 \times 10^9$	**STORAGE:** Buildings 34 long-lived low-level waste 652 mixed waste Pads 1,166 transuranic and alpha waste **TREATMENT:** Same as expected waste forecast **DISPOSAL:** 576 shallow land disposal trenches 5 low-activity waste vaults 3 intermediate-level waste vaults 111 RCRA disposal facilities **COST:** $\$18 \times 10^9$

TC

a. Facilities identified are in addition to those currently constructed; activities are in addition to ongoing or planned activities.
b. Resource Conservation and Recovery Act.
c. Life-cycle costs are expressed as present worth in 1994 dollars with 3 percent escalation and 6 percent discount rate (refer to Appendix C for details).
d. Source: Cost for no-action (Hess 1995e); cost for other alternatives (Hess 1995f).

Table 2-38. (continued).

Geologic Resources

The impacts to the geologic resources of SRS can be evaluated by examining the amount of land that would be cleared to build facilities. The following amounts of developed and undeveloped land areas could experience erosion. Except for the maximum waste forecast, all clearing would take place in E-Area. Under the maximum waste forecast, the need for land exceeds that available in E-Area. The potential for erosion and sedimentation increases as the amount of land needed for construction increases, especially for previously uncleared land. Acreage shown is the largest cumulative amount of land needed for construction activities at any time during the 30-year period.

Alternative	Waste forecast: Minimum	Waste forecast: Expected	Waste forecast: Maximum
No action		Developed: 81 acres Undeveloped: 160 acres	
A	Developed: 41 acres Undeveloped: 73 acres	Developed: 65 acres Undeveloped: 96 acres	Developed: 70 acres Undeveloped: 184 acres (within E-Area) 802 acres (developed/undeveloped outside E-Area)
B	Developed: 25 acres Undeveloped: 90 acres	Developed: 51 acres Undeveloped: 117 acres	Developed: 70 acres Undeveloped: 184 acres (within E-Area) 756 acres (developed/undeveloped outside E-Area)
C	Developed: 32 acres Undeveloped: 111 acres	Developed: 59 acres Undeveloped: 128 acres	Developed: 70 acres Undeveloped: 184 acres (within E-Area) 775 acres (developed/undeveloped outside E-Area)

TC

Table 2-38. (continued).

Groundwater Resources

The impacts to the groundwater resources at SRS from implementing the alternative waste management scenarios were evaluated by examining the drinking water doses from a hypothetical well 100 meters away. Under all alternatives the total impact to groundwater resources would result in a dose not greater than 4 millirem per year. The values below represent the impacts resulting from low-level waste vaults (both low-activity and intermediate-level vaults) and from suspect soil disposal in slit trenches. TE TC

Alternative	Waste forecast: Minimum	Waste forecast: Expected	Waste forecast: Maximum
No action		Plutonium-239 peak dose 0.33 millirem per year. Less than one-tenth the 4 millirem per year drinking water standard. No impact.	
A	Plutonium-239 peak dose 0.24 millirem per year. Six hundredth (0.06) of the 4 millirem per year drinking water standard. No impact.	Same as no action.	Plutonium-239 peak dose 0.79 millirem per year. Less than one-fifth the 4 millirem per year drinking water standard. No impact.
B	Plutonium-239 peak dose 0.23 millirem per year. Less than six hundredth (0.06) of the 4 millirem per year drinking water standard. No impact.	Same as no action.	Plutonium-239 peak dose 0.43 millirem per year. Slightly over one-tenth the 4 millirem per year drinking water standard. No impact.
C	Plutonium-239 peak dose 0.15 millirem per year. Less than four hundredth (0.04) of the 4 millirem per year drinking water standard. No impact.	Plutonium-239 peak dose 0.21 millirem per year. Less than six hundredth (0.06) of the 4 millirem per year drinking water standard. No impact.	Plutonium-239 peak dose 0.25 millirem per year. Six hundredth (0.06) of the 4 millirem per year drinking water standard. No impact.

TC

Table 2-38. (continued).

Surface Water			
The impacts to surface water resources can be evaluated by examining the potential effects on people and the environment from both radiological and nonradiological constituents present in treated wastewater.			
Alternative	Waste forecast		
	Minimum	Expected	Maximum
No action		Construction: Potential erosion impacts to SRS streams would be very small. Operations: Tritium would peak in Savannah River in 70 to 237 years. Other radionuclides would peak in more than 1,000 years. Radionuclide concentrations are very small.	
A	Construction: Potential erosion impacts less than alternative A expected waste forecast. Operations: Same as alternative A expected waste forecast.	Construction: Same as no-action alternative. Operations: Same as no-action alternative.	Construction: Potential erosion impacts greater than alternative A expected waste forecast. Operations: Same as alternative A expected waste forecast.
B	Construction: Potential erosion impacts less than alternative B expected waste forecast. Operations: Same as alternative B expected waste forecast.	Construction: Same as no-action alternative. Operations: Same as no-action alternative.	Construction: Potential erosion impacts greater than alternative B expected waste forecast. Operations: Same as alternative B expected waste forecast.
C	Construction: Potential erosion impacts less than alternative C expected waste forecast. Operations: Same as alternative C expected waste forecast.	Construction: Same as no-action alternative Operations: Same as no-action alternative.	Construction: Potential erosion impacts greater than alternative C expected waste forecast. Operations: Same as alternative C expected waste forecast.

TC

Table 2-38. (continued).

Air Resources			
The impacts to the air in the vicinity of SRS can be evaluated by examining the emissions from construction activities and operating facilities.			
Alternative	Waste forecast		
	Minimum	Expected	Maximum
No action		Construction: Largest increase over baseline would be carbon monoxide (1-hour standard) at 1,919 micrograms per cubic meter. Operations: Radiological: MEI[a] dose would be 1.2×10^{-4} millirem/year and population dose would be 2.9×10^{-4} person-rem/year. Nonradiological: Criteria increments are very small. Largest increase would be carbon monoxide (1-hour standard) at 24 micrograms per cubic meter.	
A	Construction: Largest increase over baseline would be carbon monoxide (1-hour standard) at 394 micrograms per cubic meter. Operations: Radiological: MEI dose would be 0.0057 millirem/year and population dose would be 0.27 person-rem/year. Nonradiological: Same as alternative A expected waste forecast.	Construction: Largest increase over baseline would be carbon monoxide (1-hour standard) at 769 micrograms per cubic meter. Operations: Radiological: MEI dose would be 0.011 millirem/year and population dose would be 0.56 person-rem/year. Nonradiological: Same as no-action alternative.	Construction: Largest increase over baseline would be carbon monoxide (1-hour standard) at 7,751 micrograms per cubic meter. Operations: Radiological: MEI dose would be 0.080 millirem/year and population dose would be 3.4 person-rem/year. Nonradiological: Same as alternative A expected waste forecast.
B	Construction: Largest increase over baseline would be carbon monoxide (1-hour standard) at 323 micrograms per cubic meter. Operations: Radiological: MEI dose would be 0.02 millirem/year and population dose would be 0.98 person-rem/year. Nonradiological: Same as alternative B expected waste forecast.	Construction: Largest increase over baseline would be carbon monoxide (1-hour standard) at 673 micrograms per cubic meter. Operations: Radiological: MEI dose would be 0.032 millirem/year and population dose would be 1.5 person-rem/year. Nonradiological: Criteria increments would be very small. Largest incremental increase would be carbon monoxide (1-hour standard) at 31 micrograms per cubic meter. Air toxic increments would be very small.	Construction: Largest increase over baseline would be carbon monoxide (1-hour standard) at 6,645 micrograms per cubic meter. Operations: Radiological: MEI dose would be 0.33 millirem/year and population dose would be 14 person-rem/year. Nonradiological: Same as alternative B expected waste forecast.

TC

Table 2-38. (continued).

Air Resources (continued)			
The impacts to the air in the vicinity of SRS can be evaluated by examining the emissions from construction activities and operating facilities.			
Alternative	Waste forecast		
	Minimum	Expected	Maximum
C	Construction: Largest increase over baseline would be carbon monoxide (1-hour standard) at 330 micrograms per cubic meter. Operations: Radiological: MEI dose would be 0.09 millirem/year and population dose would be 4.9 person-rem/year. Nonradiological: Same as alternative C expected waste forecast.	Construction: Largest increase over baseline would be carbon monoxide (1-hour standard) at 737 micrograms per cubic meter. Operations: Radiological: MEI dose would be 0.18 millirem/year and population dose would be 10 person-rem/year. Nonradiological: Same as no-action alternative.	Construction: Largest increase over baseline would be carbon monoxide (1-hour standard) at 6,793 micrograms per cubic meter. Operations: Radiological: MEI dose would be 4.0 millirem/year and population dose would be 229 person-rem/year. Nonradiological: Same as alternative C expected waste forecast.

TC

a. MEI = offsite maximally exposed individual.

Table 2-38. (continued).

Ecological Resources			
The impact to the ecological resources of SRS can be evaluated by examining the amount of land that would be cleared. The more land required for the facilities, the more wildlife habitat destroyed. Indirect impacts to nearby streams (such as siltation and increased water temperatures) also increase with increasing acreage. The following amounts of undeveloped woodland would be cleared for each alternative.			
Alternative	Waste forecast		
	Minimum	Expected	Maximum
No action		160 acres	
A	73 acres	96 acres	986 acres
B	90 acres	117 acres	940 acres
C	111 acres	128 acres	959 acres

TC

Table 2-38. (continued).

Land Use			
Land-use impacts were evaluated on the basis of the amount of land that would be cleared to build facilities, that would otherwise be available for nonindustrial uses such as natural resource conservation, research, or other as yet undetermined uses. For the minimum and expected waste forecasts in all alternatives, using cleared acreage would not impact current land-use plans. For the maximum waste forecasts in all alternatives, land-use plans for areas outside of E-Area would potentially be impacted because uncleared land would be required. Acreage shown is the largest amount of land needed (developed and undeveloped) for waste management facilities at any one time.			
Alternative	Waste forecast		
	Minimum	Expected	Maximum
No action		241 acres in E-Area; no impact to current land-use plans.	
A	108 acres in E-Area	152 acres in E-Area	254 acres in E-Area and 802 acres elsewhere on SRS. Potential impacts to land-use plans outside of E-Area.
B	107 acres in E-Area	158 acres in E-Area	254 acres in E-Area and 756 acres elsewhere on SRS. Potential impacts to land-use plans outside of E-Area.
C	141 acres in E-Area	167 acres in E-Area	254 acres in E-Area and 775 acres elsewhere on SRS. Potential impacts to land-use plans outside of E-Area.

TC

Table 2-38. (continued).

Cultural Resources			
Potential impacts to cultural resources can be evaluated by identifying the known or expected significant resources in the areas of potential impact and activities that could directly or indirectly affect those significant resources. Potential impacts would vary by alternative relative to the amount of land that would be disturbed for construction and operation of waste management facilities. Acreage shown is the amount of land needed for construction activities over the 30-year period.			
Alternative	Waste forecast		
	Minimum	Expected	Maximum
No action		Disturbance of approximately 241 acres[a]	
A	Disturbance of approximately 114 acres	Disturbance of approximately 161 acres	Disturbance of approximately 1,056 acres
B	Disturbance of approximately 115 acres	Disturbance of approximately 168 acres	Disturbance of approximately 1,010 acres
C	Disturbance of approximately 143 acres	Disturbance of approximately 187 acres	Disturbance of approximately 1,029 acres

TC

a. In all forecasts, some additional surveying would be required. Potential indirect impacts to significant archaeological resources northwest of F-Area would vary by alternative relative to the amount of land to be disturbed. Potential impacts would be mitigated as appropriate.

Table 2-38. (continued).

Socioeconomics			
Impacts to socioeconomic resources can be evaluated by examining the potential effects from the construction and operation of waste management facilities on factors such as employment, income, population, and community resources.			
Alternative	Waste forecast		
	Minimum	Expected	Maximum
No action		Construction: Peak of 50 jobs; no net change in regional construction employment; no impact. Operations: Peak of 2,450 jobs; filled through the reassignment of existing workers; no impact.	
A	Construction: Peak of 70 jobs; no net change in regional construction employment; no impact. Operations: Peak of 1,680 jobs; filled through the reassignment of existing workers; no impact.	Construction: Peak of 80 jobs; no net change in regional construction employment; no impact. Operations: Peak of 2,560 jobs; filled through the reassignment of existing workers; no impact.	Construction: Peak of 260 jobs; no net change in regional construction employment; no impact. Operations: Peak of 11,200 jobs; 3,300 new jobs; 3% increase in regional employment; less than 3% increase in regional population; 4% increase in regional income.
B	Construction: Peak of 120 jobs; no net change in regional construction employment; no impact. Operations: Peak of 1,600 jobs; filled through the reassignment of existing workers; no impact.	Construction: Peak of 170 jobs; no net change in regional construction employment; no impact. Operations: Peak of 2,550 jobs; filled through the reassignment of existing workers; no impact.	Construction: Peak of 330 jobs; no net change in regional construction employment; no impact. Operations: Peak of 10,010 jobs; 2,110 new jobs; 2% increase in regional employment; less than 2% increase in population; less than 3% increase in regional income.
C	Construction: Peak of 130 jobs; no net change in regional construction employment; no impact. Operations: Peak of 1,470 jobs; filled through the reassignment of existing workers; no impact.	Construction: Peak of 160 jobs; no net change in regional construction employment; no impact. Operations: Peak of 1,940 jobs; filled through the reassignment of existing workers; no impact.	Construction: Peak of 350 jobs; no net change in regional construction employment; no impact. Operations: Peak of 10,060 jobs; 2,160 new jobs; 2% increase in regional employment; less than 2% increase in regional population; less than 3% increase in regional income.

TC

Table 2-38. (continued).

Traffic			
Traffic impacts are expressed as the increase in vehicles per hour and hazardous and radioactive waste shipments (by truck) per day.			
Alternative	Waste forecast		
	Minimum	Expected	Maximum
No action		Construction: 788 vehicles[a] per hour, an increase of 47 per day from baseline estimates. Trucks: 815 shipments[b] per day (no change from baseline).	
A	Construction: 809 vehicles per hour Trucks: 802 shipments per day	Construction: 824 vehicles per hour Trucks: 817 shipments per day	Construction: 999 vehicles per hour Trucks: 873 shipments per day
B	Construction: 856 vehicles per hour Trucks: 804 shipments per day	Construction: 907 vehicles per hour Trucks: 819 shipments per day	Construction: 1,068 vehicles per hour Trucks: 872 shipments per day
C	Construction: 873 vehicles per hour Trucks: 801 shipments per day	Construction: 896 vehicles per hour Trucks: 814 shipments per day	Construction: 1,089 vehicles per hour Trucks: 858 shipments per day

TC

a. Vehicles are presented as vehicles arriving at E-Area during the peak traffic hour. Additional construction worker vehicles are assumed to all arrive during the peak hour.
b. Truck traffic for this table includes trucks not involved in waste management activities (785 per day) (Swygert 1994) and radioactive and hazardous waste shipments. Details on truck traffic are provided in Section 3.11.2.1 of this EIS.

Table 2-38. (continued).

Transportation - Incident-free			
TE Transportation impacts can be evaluated by comparing additional latent cancer fatalities that might result from transport of waste.			
Alternative	Waste forecast		
	Minimum	Expected	Maximum
No action		Involved workers: 0.06 additional excess fatal cancer per year could develop. Uninvolved workers: 8.4×10^{-4} additional excess fatal cancer per year could develop.[a]	
A	Involved workers: 0.057 additional excess fatal cancer per year could develop. Uninvolved workers: 4.2×10^{-4} additional excess fatal cancer per year could develop. Remote population: 5.4×10^{-7} additional excess fatal cancer per year could develop.[b]	Involved workers: 0.12 additional excess fatal cancer per year could develop. Uninvolved workers: 8.8×10^{-4} additional excess fatal cancer per year could develop. Remote population: 1.2×10^{-6} additional excess fatal cancer per year could develop.	Involved workers: 0.3 additional excess fatal cancer per year could develop. Uninvolved workers: 0.0014 additional excess fatal cancer per year could develop. Remote population: 3.2×10^{-6} additional excess fatal cancer per year could develop.
B	Involved workers: 0.05 additional excess fatal cancer per year could develop. Uninvolved workers: 4.4×10^{-4} additional excess fatal cancer per year could develop. Remote population: 0.0026 additional excess fatal cancer per year could develop.	Involved workers: 0.098 additional excess fatal cancer per year could develop. Uninvolved workers: 8.9×10^{-4} additional excess fatal cancer per year could develop. Remote population: 0.0032 additional excess fatal cancer per year could develop.	Involved workers: 0.22 additional excess fatal cancer per year could develop. Uninvolved workers: 0.0013 additional excess fatal cancer per year could develop. Remote population: 0.0038 additional excess fatal cancer per year could develop.
C	Involved workers: 0.041 additional excess fatal cancer per year could develop. Uninvolved workers: 4.1×10^{-4} additional excess fatal cancer per year could develop. Remote population: 1.5×10^{-4} additional excess fatal cancer per year could develop.	Involved workers: 0. 079 additional excess fatal cancer per year could develop. Uninvolved workers: 8.6×10^{-4} additional excess fatal cancer per year could develop. Remote population: 2.7×10^{-4} additional excess fatal cancer per year could develop.	Involved workers: 0.15 additional excess fatal cancer per year could develop. Uninvolved workers: 0.0013 additional excess fatal cancer per year could develop. Remote population: 7.2×10^{-4} additional excess fatal cancer per year could develop.

TC

a. Remote population would not be affected because there are very few offsite shipments under the no-action alternative.
b. Remote population = members of the public along transportation routes that would be exposed to normal shipments and accidents.

Table 2-38. (continued).

Transportation - Accidents

Dose (person-rem), probability, and risk determine additional latent cancer fatalities from transportation accidents. Transportation impacts can be compared by evaluating additional latent cancer fatalities that might result from transport of waste. TE

Alternative	Waste forecast: Minimum				Expected				Maximum			
	Receptor	LCF	Probability	Risk	Receptor	LCF[a]	Probability[b]	Risk[c]	Receptor	LCF	Probability	Risk
No action[d]					Uninvolved workers[e]	124	2.6×10^{-6}	3.2×10^{-4}				
					Offsite Pop[e]	14	2.6×10^{-6}	3.5×10^{-5}				
A	Uninvolved workers	124	1.8×10^{-6}	2.2×10^{-4}	Uninvolved workers	124	2.6×10^{-6}	3.2×10^{-4}	Uninvolved workers	124	4.2×10^{-5}	0.0052
	Offsite Pop	14	1.8×10^{-6}	2.4×10^{-5}	Offsite Pop	14	2.6×10^{-6}	3.5×10^{-5}	Offsite Pop	14	4.2×10^{-5}	5.8×10^{-4}
	Remote Pop	2.4×10^{-6}	4.6×10^{-4}	1.1×10^{-9}	Remote Pop	2.4×10^{-6}	0.0011	2.5×10^{-9}	Remote Pop	2.4×10^{-6}	0.0027	6.5×10^{-9}
B	Uninvolved workers	124	1.8×10^{-6}	2.2×10^{-4}	Uninvolved workers	124	2.6×10^{-6}	3.2×10^{-4}	Uninvolved workers	124	4.2×10^{-5}	0.0052
	Offsite Pop	14	1.8×10^{-6}	2.4×10^{-5}	Offsite Pop	14	2.6×10^{-6}	3.5×10^{-5}	Offsite Pop	14	4.2×10^{-5}	5.8×10^{-4}
	Remote Pop	0.18	1.2×10^{-6}	2.2×10^{-7}	Remote Pop	0.18	1.6×10^{-6}	2.9×10^{-7}	Remote Pop	0.18	1.6×10^{-6}	2.9×10^{-7}
C	Uninvolved workers	124	1.8×10^{-6}	2.2×10^{-4}	Uninvolved workers	124	2.6×10^{-6}	3.2×10^{-4}	Uninvolved workers	124	4.2×10^{-5}	0.0052
	Offsite Pop	14	1.8×10^{-6}	2.4×10^{-5}	Offsite Pop	14	2.6×10^{-6}	3.5×10^{-5}	Offsite Pop	14	4.2×10^{-5}	5.8×10^{-4}
	Remote Pop	2.4×10^{-6}	4.6×10^{-4}	1.1×10^{-9}	Remote Pop	2.4×10^{-6}	0.0011	2.5×10^{-9}	Remote Pop	2.4×10^{-6}	0.0027	6.5×10^{-9}

TC

a. Latent cancer fatalities per accident.
b. Annual over 30-year period.
c. Annual risk of latent cancer fatalities.
d. There are very few offsite radioactive waste shipments under the no-action alternative.
e. DOE has adopted a dose-to-risk conversion factor of 0.0004 latent cancer fatalities per person-rem for uninvolved workers and 0.0005 latent cancer fatalities person-rem for the offsite population. The latter factor is slightly higher because of the presence of groups of people like infants or children who may be more susceptible to radiation than workers.

Table 2-38. (continued).

Occupational Health			
TE *The principal potential human health effect from exposure to low doses of radiation is cancer.* Human health effects from exposure to chemicals may be both toxic effects (e.g., nervous system disorders) and cancer. For the purpose of the analysis, radiological carcinogenic effects are expressed as the annual number of fatal cancers for population estimates and probability of death of the maximally exposed individual. Nonradiological carcinogenic effects are expressed as the number of nonfatal cancers.			
Alternative	Waste forecast		
	Minimum	Expected	Maximum
No action		**Radiological** Involved worker[a] (probability of fatal cancer): 1.0×10^{-5} (Involved worker in 1993 baseline[b] was 2.0×10^{-5}) All involved workers[c] (probability of fatal cancer): 0.021 (Value for all involved workers in 1993 baseline was 3.3) **Nonradiological**: Very small impacts[d]	
A	**Radiological** Involved worker[a] (probability of fatal cancer): 1.3×10^{-5} All involved workers[c] (number of lifetime cancers): 0.027 **Nonradiological**: Very small impacts	**Radiological** Involved worker[a] (probability of fatal cancer): 1.3×10^{-5} All involved workers[c] (number of lifetime cancers): 0.028 **Nonradiological**: Very small impacts	**Radiological** Involved worker[a] (probability of fatal cancer): 1.9×10^{-5} All involved workers[c] (number of lifetime cancers): 0.046 **Nonradiological**: Very small impacts
B	**Radiological** Involved worker[a] (probability of fatal cancer): 1.4×10^{-5} All involved workers[c] (number of lifetime cancars): 0.030 **Nonradiological**: Very small impacts	**Radiological** Involved worker[a] (probability of fatal cancer): 1.5×10^{-5} All involved workers[c] (number of lifetime cancers): 0.032 **Nonradiological**: Very small impacts	**Radiological** Involved worker[a] (probability of fatal cancer): 2.3×10^{-5} All involved workers[c] (number of lifetime cancers): 0.058 **Nonradiological**: Very small impacts
C	**Radiological** Involved worker[a] (probability of fatal cancer): 1.5×10^{-5} All involved workers[c] (number of lifetime cancers): 0.033 **Nonradiological**: Very small impacts	**Radiological** Involved worker[a] (probability of fatal cancer): 1.6×10^{-5} All involved workers[c] (number of lifetime cancers): 0.034 **Nonradiological**: Very small impacts	**Radiological** Involved worker[a] (probability of fatal cancer): 2.4×10^{-5} All involved workers[c] (number of lifetime cancers): 0.060 **Nonradiological**: Very small impacts

TC

a. Value for the involved worker represents the annual probability of the maximally exposed worker contracting a fatal cancer in his or her lifetime due to 30 years of radiation exposure from waste management activities.
b. Baseline values include all workers at SRS (for 30 years of exposure).
c. Value for all involved workers represents the annual number of lifetime fatal cancers expected in the waste management worker population due to 30 years of radiation exposure from waste management activities.
d. Employee exposure would be below Occupational Safety and Health Administration - permissible exposure limits and health impacts would be expected to be very small.

Table 2-38. (continued).

Public Health			
The principal potential human health effect from exposure to low doses of radiation is cancer. Human health effects from exposure to chemicals may be both toxic effects (e.g., nervous system disorders) and cancer. For the purpose of the analysis, radiological carcinogenic effects are expressed as the annual number of fatal cancers for population estimates and probability of death of the maximally exposed individual. Nonradiological carcinogenic effects are expressed as the probability of excess latent cancers over a 70-year lifetime. TC			
Alternative	Waste forecast		
	Minimum	Expected	Maximum
No action		**Radiological** Offsite MEI[a,b] (probability of fatal cancer): 4.1×10^{-10} (Offsite MEI in 1993 baseline[c] was 3.9×10^{-7}) Offsite Population[d] (number of fatal cancers): 3.5×10^{-6} (Offsite population in 1993 baseline was 0.11) **Nonradiological[e]** Probability of latent fatal cancers: 2.0×10^{-7}	
A	**Radiological** Offsite MEI (probability of fatal cancer): 3.2×10^{-9} Offsite Population (number of fatal cancers): 1.4×10^{-4} **Nonradiological** Probability of latent fatal cancers: 1.9×10^{-7}	**Radiological** Offsite MEI (probability of fatal cancer): 5.8×10^{-9} Offsite Population (number of fatal cancers): 2.8×10^{-4} **Nonradiological** Probability of latent fatal cancers: 2.0×10^{-7}	**Radiological** Offsite MEI (probability of fatal cancer): 4.1×10^{-8} Offsite Population (number of fatal cancers): 0.0017 **Nonradiological** Probability of latent fatal cancers: 2.0×10^{-7}
B	**Radiological** Offsite MEI (probability of fatal cancer): 1.2×10^{-8} Offsite Population (number of fatal cancers): 5.2×10^{-4} **Nonradiological** Probability of latent fatal cancers: 1.9×10^{-7}	**Radiological** Offsite MEI (probability of fatal cancer): 1.8×10^{-8} Offsite Population (number of fatal cancers): 8.0×10^{-4} **Nonradiological** Probability of latent fatal cancers: 2.0×10^{-7}	**Radiological** Offsite MEI (probability of fatal cancer): 1.8×10^{-7} Offsite Population (number of fatal cancers): 0.008 **Nonradiological** Probability of latent fatal cancers: 2.0×10^{-7}

TC

Table 2-38. (continued).

Public Health (continued)			
TC The principal potential human health effect from exposure to low doses of radiation is cancer. Human health effects from exposure to chemicals may be both toxic effects (e.g., nervous system disorders) and cancer. For the purpose of the analysis, radiological carcinogenic effects are expressed as the annual number of fatal cancers for population estimates and probability of death of the maximally exposed individual. Nonradiological carcinogenic effects are expressed as the probability of excess latent cancers over a 70-year lifetime.			
Alternative	Waste forecast		
	Minimum	Expected	Maximum
TC C	**Radiological** Offsite MEI (probability of fatal cancer): 4.6×10^{-8} Offsite Population (number of fatal cancers): 0.0025 **Nonradiological** Probability of latent fatal cancers: 2.1×10^{-7}	**Radiological** Offsite MEI (probability of fatal cancer): 9.0×10^{-8} Offsite Population (number of fatal cancers): 0.0050 **Nonradiological** Probability of latent fatal cancers: 2.2×10^{-7}	**Radiological** Offsite MEI (probability of fatal cancer): 2.0×10^{-6} Offsite Population (number of fatal cancers): 0.11 **Nonradiological** Probability of latent fatal cancers: 2.7×10^{-7}

a. MEI = maximally exposed individual.
b. Value for the MEI represents the annual probability of the offsite maximally exposed individual contracting a fatal cancer in his or her lifetime due to 30 years of radiation exposure from waste management activities.
c. Baseline values include impacts from all activities at SRS.
d. Value for offsite population represents the annual number of lifetime fatal cancers expected in the exposed population due to 30 years of radiation exposure from waste management activities.
e. Annual latent cancer probability adjusted for 30 years of waste management activities.

Table 2-38. (continued).

Accidents
The impacts to workers and the public from postulated radioactive accidents at SRS considered in the alternatives can be evaluated and compared by the increase in potential latent fatal cancers per year. The estimated latent fatal cancers per year are based on dose, dose-to-health effects conversion factor, and probability of an accident occurring. For hazardous chemical releases, impacts are assumed when threshold values of concentrations in air that could cause short-term effects to workers or the public are exceeded. The long-term health consequences of human exposure to hazardous chemicals are not as well understood, and thus more subjective, than those for radiation.

Alternative	Waste forecast		
	Minimum	Expected	Maximum
No action		LCF[a] / Frequency / Risk[b] CW100[c]: 0.052 / 0.02 / 0.001 CW640[c]: 9.2×10^{-4} / 0.02 / 1.8×10^{-5} MEI[c]: 1.7×10^{-5} / 0.02 / 3.3×10^{-7} OFFP[c]: 0.84 / 0.02 / 0.017 No chemical accidents exceed threshold for life-threatening health effects for maximally exposed individual; 7 release scenarios exceed this threshold for CW100; 1 release scenario exceeds this threshold for CW640.	
A	The accident scenario[d] providing the greatest impacts to the uninvolved workers at 100 and 640 meters, the maximally exposed offsite individual, and the population within 80 kilometers would require three fewer intermediate-level waste vaults than the expected waste forecast. DOE believes that the probability of this accident would be less than for the expected waste forecast. Chemical accident impacts would be the same as for the expected waste forecast.	LCF / Frequency / Risk CW100[c]: 0.052 / 0.02 / 0.001 CW640[c]: 9.2×10^{-4} / 0.02 / 1.8×10^{-5} MEI[c]: 1.7×10^{-5} / 0.02 / 3.3×10^{-7} OFFP[c]: 0.84 / 0.02 / 0.017 Chemical accident impacts would be the same as for the no-action alternative.	The accident scenario[d] providing the greatest impacts to the uninvolved workers at 100 and 640 meters, the maximally exposed offsite individual, and the population within 80 kilometers would require 26 more intermediate-level waste vaults than the expected waste forecast. DOE believes that the probability of this accident would be higher than for the expected waste forecast. Chemical accident impacts would be the same as for the expected waste forecast.
B	The accident scenario[d] providing the greatest impacts to the uninvolved workers at 100 and 640 meters, the maximally exposed offsite individual, and the population within 80 kilometers would require three fewer intermediate-level waste vaults than the expected waste forecast. DOE believes that the probability of this accident would be less than for the expected waste forecast. Chemical accident impacts would be the same as for the expected waste forecast.	LCF / Frequency / Risk CW100[c]: 0.052 / 0.02 / 0.001 CW640[c]: 9.2×10^{-4} / 0.02 / 1.8×10^{-5} MEI[c]: 1.7×10^{-5} / 0.02 / 3.3×10^{-7} OFFP[c]: 0.84 / 0.02 / 0.017 Chemical accident impacts would be the same as for the no-action alternative.	The accident scenario[d] providing the greatest impacts to the uninvolved workers at 100 and 640 meters, the maximally exposed offsite individual, and the population within 80 kilometers would require four more intermediate-level waste vaults than the expected waste forecast. DOE believes that the probability of this accident would be higher than for the expected waste forecast. Chemical accident impacts would be the same as for the expected waste forecast.

TE

Table 2-38. (continued).

Accidents (continued)

The impacts to workers and the public from postulated radioactive accidents at SRS considered in the alternatives can be evaluated and compared by the increase in potential latent fatal cancers per year. The estimated latent fatal cancers per year are based on dose, dose-to-health effects conversion factor, and probability of an accident occurring. For hazardous chemical releases, impacts are assumed when threshold values of concentrations in air that could cause short-term effects to workers or the public are exceeded. The long-term health consequences of human exposure to hazardous chemicals are not as well understood, thus more subjective, than those for radiation.

TE

Alternative	Waste forecast: Minimum	Waste forecast: Expected				Waste forecast: Maximum
			LCF	Frequency	Risk[a]	
C	The accident scenario[d] providing the greatest impacts to the uninvolved workers at 100 and 640 meters, the maximally exposed offsite individual, and the population within 80 kilometers would require one fewer intermediate-level waste vaults than the expected waste forecast. *DOE believes that the probability of this* accident would be less than for the expected waste forecast.	CW100[c]	0.052	0.02	0.001	The accident scenario[d] providing the greatest impacts to the uninvolved workers at 100 and 640 meters, and the maximally exposed offsite individual, and the population within 80 kilometers would require one more intermediate-level waste vaults than the expected waste forecast. DOE believes that the probability of this accident would be higher than for the expected waste forecast.
		CW640[c]	9.2×10^{-4}	0.02	1.8×10^{-5}	
		MEI[c]	1.7×10^{-5}	*0.02*	3.3×10^{-7}	
		OFFP[c]	0.84	0.02	0.017	
	Chemical accident impacts would be the same as for the expected waste forecast.	Chemical accident impacts would be the same as for the no-action alternative.				Chemical accident impacts would be the same as for the expected waste forecast.

a. Latent cancer fatalities per accident.

b. Point estimates of increased risk of latent cancer fatalities per year.

c. The impact for each receptor group is from the representative bounding accident with the greatest overall estimated risk of increased fatal cancers per year for all waste types considered.

d. This accident scenario is a container breach at the Intermediate-Level Non-Tritium Vault (see Appendix F, Section F.5.2.2.1).

CW100 = Uninvolved worker at 100 meters (328 feet) (in millirem).
CW640 = Uninvolved worker at 640 meters (2,100 feet) (in millirem).
MEI = Offsite maximally exposed individual (in millirem).
OFFP = Offsite population to 80 kilometers (50 miles) (in person-rem).

2.8 References

Beaumier, G. R., 1994, Westinghouse Savannah River Company, Aiken, South Carolina, Memorandum to M. L. Hess, Westinghouse Savannah River Company, Aiken, South Carolina, "Concrete Recycling, Revision 1," October 13.

Bignell, D. T., 1994a, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum, to M. N. Hoganson, Halliburton NUS Corporation, Aiken, South Carolina, "High-Level Waste Forecast," July 13.

Bignell, D. T., 1994b, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to M. N. Hoganson, Halliburton NUS Corporation, Aiken, South Carolina, "High-Level Waste Volumes in Tank Farm," June 20.

Blankenhorn, J. A., 1995, Westinghouse Savannah River Company, Aiken, South Carolina, All-in-One Memorandum to M. L. Hess, Westinghouse Savannah River Company, Aiken, South Carolina, "Cadmium HEPA Filter Frames," June 1.

Boettinger, W. L., 1994a, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to M. N. Hoganson, Halliburton NUS Corporation, Aiken, South Carolina, "Beneficial Reuse Integrated Demonstration Program," September 23.

Boettinger, W. L., 1994b, "Establishing a Stainless Steel Radioactive Scrap Metal Recycle Industry," *Proceedings from Spectrum '94 Nuclear and Hazardous Waste Management International Topical Meeting*, Westinghouse Savannah River Company, Aiken, South Carolina, August.

Boyter, N. C., 1994a, Westinghouse Savannah River Company, Aiken, South Carolina, Memorandum to A. D. Clark et al., Westinghouse Savannah River Company, Aiken, South Carolina, "Savannah River Site Pollution Prevention and Waste Minimization Quarterly Report," February 15.

Boyter, N. C., 1994b, Westinghouse Savannah River Company, Aiken, South Carolina, Letter to T. F. Heenan, U.S. Department of Energy, Savannah River Operations Office, Aiken, South Carolina, "Low Level Waste Disposal Avoidance at the Savannah River Site," January 31.

Crook, S. E., 1995, Westinghouse Savannah River Company, Interoffice Memorandum to A. A. Eckmyre, Halliburton NUS Corporation, Aiken, South Carolina, "CIF Construction Status and Completion Forecast," May 17.

Davis, N., 1994, "Tank Farm Forecast (without RHLWE)," Westinghouse Savannah River Company, Aiken, South Carolina, September 9.

DOE (U.S. Department of Energy), 1986, *Waste Isolation Pilot Plan No-Migration Variance Petition,* DOE/RW-0006, Revision 8, Savannah River Operations Office, Aiken, South Carolina, October.

DOE (U.S. Department of Energy), 1994a, *Final Supplemental Environmental Impact Statement, Defense Waste Processing Facility,* DOE/EIS-0082-S, Savannah River Operations Office, Aiken, South Carolina, November.

DOE (U.S. Department of Energy), 1994b, *Environmental Assessment, Treatment of M-Area Mixed Wastes at the Savannah River Site,* DOE/EA-0918, Savannah River Operations Office, Aiken, South Carolina.

DOE (U.S. Department of Energy), 1994c, *Treatment Selection Guides,* Federal Facility Compliance Act Task Force, Revision 0, Washington, D.C., March 14.

DOE (U.S. Department of Energy), 1994d, *Savannah River Site Draft Site Treatment Plan,* Savannah River Operations Office, Aiken, South Carolina, August 30.

DOE (U.S. Department of Energy), 1994e, *Draft Site Treatment Plan Development Framework,* Revision 7, Washington, D.C., April 7.

DOE (U.S. Department of Energy), 1994f, *Proposed Changes to the Draft Site Treatment Plan Mixed Waste Treatment Configuration*, Washington, D.C., November 15.

DOE (U.S. Department of Energy), 1995, *Baseline Environmental Management Report,* Office of Environmental Management, Washington, D.C.

EPA (U.S. Environmental Protection Agency), 1993a, Federal Facility Agreement between the U.S. Environmental Protection Agency, Region IV, the U.S. Department of Energy, and the South Carolina Department of Health and Environmental Control, Docket No. 89-05-FF, August 16.

EPA (U.S. Environmental Protection Agency), 1993b, Approval of Petition for a Treatability Variance from the Land Disposal Restrictions (LDR) Treatment Standards for In-Tank Precipitation Filters Submitted by the U.S. Department of Energy (DOE) Field Office, Savannah River, October 1.

Harvey, S. A., 1994a, Bechtel Savannah River Incorporated, Aiken, South Carolina, Interoffice Memorandum to M. N. Hoganson, Halliburton NUS Corporation, Aiken, South Carolina, "EIS Information," September 19.

Harvey, S. A., 1994b, Bechtel Savannah River Incorporated, Aiken, South Carolina, Interoffice Memorandum to M. N. Hoganson, Halliburton NUS Corporation, Aiken, South Carolina, "Waste Management EIS Information (Partial)," September 19.

Hess, M. L., 1994a, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to H. L. Pope, U.S. Department of Energy, Savannah River Operations Office, Aiken, South Carolina, "Draft In-depth Option Analysis for Review and Comments," ESH-NEP-94-0099, July 29.

Hess, M. L., 1994b, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to H. L. Pope, U.S. Department of Energy, Savannah River Operations Office, Aiken, South Carolina, "Waste Min/Decon Systems," ESH-NEP-94-0155, September 29.

Hess, M. L., 1994c, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to H. L. Pope, U.S. Department of Energy, Savannah River Operations Office, Aiken, South Carolina, "Tank Farm Volume Waste Forecast," ESH-NEP-94-0147, September 27.

Hess M. L., 1994d, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to H. L. Pope, U.S. Department of Energy, Savannah River Operations Office, Aiken, South Carolina, "NMPD Liquid Waste Forecast," ESH-NEP-94-0150, September 28.

Hess, M. L., 1994e, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to H. L. Pope, U.S. Department of Energy, Savannah River Operations Office, Aiken, South Carolina, "Complete Set of Flow Sheets," ESH-NEP-94-0241, November 15.

Hess, M. L., 1994f, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to H. L. Pope, U.S. Department of Energy, Savannah River Operations Office, Aiken, South Carolina, "Storage & Disposal Capabilities," ESH-NEP-94-0226, October 28.

Hess, M. L., 1994g, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to H. L. Pope, U.S. Department of Energy, Savannah River Operations Office, Aiken, South Carolina, "WSRC Data Transmittal - Revised Options Analysis Executive Summary," ESH-NEP-94-0214, October 21.

Hess, M. L., 1994h, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to H. L. Pope, U.S. Department of Energy, Savannah River Operations Office, Aiken, South Carolina, "Operational Scenarios for Experimental Transuranic Waste Assay Facility for Waste Management Spreadsheets," ESH-NEP-994-0218, October 26.

Hess, M. L., 1994i, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to H. L. Pope, U.S. Department of Energy, Savannah River Operations Office, Aiken, South Carolina, "Selection of Soil Technology," ESH-NEP-94-0220, October 26.

Hess, M. L., 1994j, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to H. L. Pope, U.S. Department of Energy, Savannah River Operations Office, Aiken, South Carolina, "WSRC Data Transmittal - Use of TRUPACT-II to Transport Untreated Pu-238 Wastes (U)," ESH-NEP-95-0002, January 5.

Hess, M. L., 1994k, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to H. L. Pope, U.S. Department of Energy, Savannah River Operations Office, Aiken, South Carolina, "Smelter Volume Reduction Factors," ESH-NEP-94-0185, Westinghouse Savannah River Company, Aiken, South Carolina, October 10.

Hess, M. L., 1995a, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to H. L. Pope, U.S. Department of Energy, Savannah River Operations Office, Aiken, South Carolina, "WSRC Data Transmittal - Summary of Changes Between Draft and Final WMEIS Forecasts and Alternatives," ESH-NEP-95-0084, May 15.

Hess, M. L., 1995b, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to H. L. Pope, U.S. Department of Energy, Savannah River Operations Office, Aiken, South Carolina, "WSRC Data Transmittal - Responses to BRE Questions on Vaults and CIF Fuel Oil Utilization," ESH-NEP-95-0076, May 4.

Hess, M. L., 1995c, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to H. L. Pope, U.S. Department of Energy, Savannah River Operations Office, Aiken, South Carolina, "WSRC Data Transmittal - Spreadsheets for Final EIS," ESH-NEP-95-0090, May 17.

Hess, M. L., 1995d, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to H. L. Pope, U.S. Department of Energy, Savannah River Operations Office, Aiken, South Carolina, "WSRC Data Transmittal - Table 2.3-6 WMEIS Ranking of Various Facilities/Technologies," ESH-NEP-95-0079, May 5.

Hess, M. L., 1995e, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to H. L. Pope, U.S. Department of Energy, Savannah River Operations Office, Aiken, South Carolina, "WSRC Data Transmittal - Revised Facility Costs for the No-Action Alternative and Revised Employees for Alternative A, Minimum Forecast (U)," ESH-NEP-95-0085, May 16.

Hess, M. L., 1995f, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to H. L. Pope, U.S. Department of Energy, Savannah River Operations Office, Aiken, South Carolina, "WSRC Data Transmittal - Complete Copy of Cost Model for WMEIS," ESH-NEP-95-0078, May 5.

Larkin, G. F., 1994, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to M. N. Hoganson, Halliburton NUS Corporation, Aiken, South Carolina, "1994 ALD/Special Projects Waste Minimization," September 21.

Martin Marietta (Martin Marietta Energy Systems), EG&G (EG&G - Idaho), and WSRC (Westinghouse Savannah River Company), 1994, *Radiological Performance Assessment for the E-Area Vaults Disposal Facility*, WSRC-RP-94-218, Westinghouse Savannah River Company, Aiken, South Carolina.

Miller, J. A., 1994, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to M. N. Hoganson, Halliburton NUS Corporation, Aiken, South Carolina, "Waste Management EIS," September 27.

Roberts, J. S., 1985, Westinghouse Savannah River Company, Aiken, South Carolina, Letter to S. R. Wright, U.S. Department of Energy, Savannah River Operations Office, Aiken, South Carolina, "Hazardous Waste Minimization Program," August 28.

Stone, K. A., 1994a, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to M. N. Hoganson, Halliburton NUS Corporation, Aiken, South Carolina, "Information Needs for the Waste Management EIS," September 15.

Stone, K. A., 1994b, Westinghouse Savannah River Company, Aiken, South Carolina, Memorandum to L. C. Thomas, Westinghouse Savannah River Company, Aiken, South Carolina, "Waste Minimization Initiatives," SWE-WGS-94-0211, September 16.

Stone, K. A., 1994c, Westinghouse Savannah River Company, Aiken, South Carolina, Memorandum to Distribution, "Savannah River Site Pollution Prevention and Waste Minimization Second Quarter CY 1994 Report," SWE-WGS-94-1062, August 4.

Stone, K. A., 1994d, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to M. N. Hoganson, Halliburton NUS Corporation, Aiken, South Carolina, October 5.

Swygert, R., 1994, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to E. M. Rollins, Halliburton NUS Corporation, Aiken, South Carolina, "Savannah River Site Truck Traffic," September 30.

Tuthill, B. J., 1994, Westinghouse Savannah River Company, Aiken, South Carolina, Letter to A. Harris, Continental Industrial Chemicals, Inc., Greenville, South Carolina, "Contract DE-AC09-89SR18035," July 28.

Ucak, M., and D. Noller, 1994, *Feasibility Study for a Solid Waste Treatment Complex*, WSRC-TR-90-353, Westinghouse Savannah River Company, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1990, *Savannah River Site Waste Minimization Plan*, WSRC-RP-90-263, Revision 2, Aiken, South Carolina, May 8.

WSRC (Westinghouse Savannah River Company), 1991, *Treatability Variance for In-Tank Precipitation Filters*, WSRC-RP-91-777, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1993a, *Savannah River Site Decontamination and Decommissioning Program Facilities Plan*, WSRC-IM-93-10, Revision 0, Aiken, South Carolina, February 25.

WSRC (Westinghouse Savannah River Company), 1993b, *Savannah River Site Solid Waste Management Program Plan - FY93*, WSRC-RP-93-89, Aiken, South Carolina, June.

WSRC (Westinghouse Savannah River Company), 1993c, *1992 RCRA Part B Permit Renewal Application - Savannah River Site*, Volume II, Book 1 of 1, Hazardous Waste Storage Facility, WSRC-IM-91-53, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1993d, *RCRA Part A Application for a Hazardous Waste Permit*, Tab AH, Liquid Waste Solvent Tanks S33-S36, Revision 9, Aiken, South Carolina. February 16.

WSRC (Westinghouse Savannah River Company), 1994a, *Thirty Year Solid Waste Generation Forecast for Facilities at SRS*, WSRC-RP-94-532, Revision 4, Aiken, South Carolina, July.

WSRC (Westinghouse Savannah River Company), 1994b, *Thirty Year Decontamination and Decommissioning Waste Generation Forecast for Facilities at SRS (U)*, WSRC-RP-94-496, Revision 0, Aiken, South Carolina, May 9.

WSRC (Westinghouse Savannah River Company), 1994c, *Thirty-Year Solid Waste Generation Forecast by Treatability Group (U)*, WSRC-RP-94-584, Revision 1, Aiken, South Carolina, June 14.

WSRC (Westinghouse Savannah River Company), 1994d, *Thirty-Year Solid Waste Generation Maximum and Minimum Forecast for SRS*, WSRC-RP-94-585, Revision 0, Aiken, South Carolina, July 29.

WSRC (Westinghouse Savannah River Company), 1994e, *Department of Energy, Savannah River Site Waste Minimization and Pollution Prevention Awareness Plan*, FY 1995, WSRC-RP-93-1494, Savannah River Site, Aiken, South Carolina, June 27.

WSRC (Westinghouse Savannah River Company), 1994f, *High Level Waste System Plan*, HLW-OVP-94-0077, Revision 3 (U), WSRC High Level Waste Management Division, Savannah River Site, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1994g, *DOE Directive Compliance Assessment and Implementation Report*, WSRC-RP-93-668-044, Revision 1, Aiken, South Carolina, September 20.

WSRC (Westinghouse Savannah River Company), 1994h, *RCRA Part A Application for a Hazardous Waste Permit,* Tab AF, Mixed Waste Storage Building 316-M, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1994i, *Solvent Storage Tanks (S23-S30) Interim Closure Plan,* SWE-SWE-94-0279, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1994j, *Strategy Proposal for Interim Storage of Hazardous, Mixed, and Non-Mixed TRU and Low-Level Mixed Wastes (U)*, WSRC-RP-94-767, Revision 0, Aiken, South Carolina, August.

WSRC (Westinghouse Savannah River Company), 1994k, *Technology Selection Methodology for the Waste Management EIS (U)*, WSRC-RP-94-1215, Revision 0, Aiken, South Carolina, December.

WSRC (Westinghouse Savannah River Company), 1995, *SRS Proposed Site Treatment Plan,* WSRC-TR-94-0608, Aiken, South Carolina.

CHAPTER 3. AFFECTED ENVIRONMENT

This chapter describes the existing environmental and socioeconomic characteristics of the Savannah River Site (SRS) and nearby region that could be affected by the proposed action or its alternatives. The data presented in this chapter are required to assess the consequences of the proposed action and its alternatives.

3.1 Introduction

SRS is located in southwestern South Carolina adjacent to the Savannah River, which forms the boundary between South Carolina and Georgia. It encompasses approximately 800 square kilometers (300 square miles) within the Atlantic Coastal Plain physiographic province. SRS is approximately 40 kilometers (25 miles) southeast of Augusta, Georgia, and 32 kilometers (20 miles) south of Aiken, South Carolina. Figure 3-1 shows the location of SRS within the South Carolina-Georgia region.

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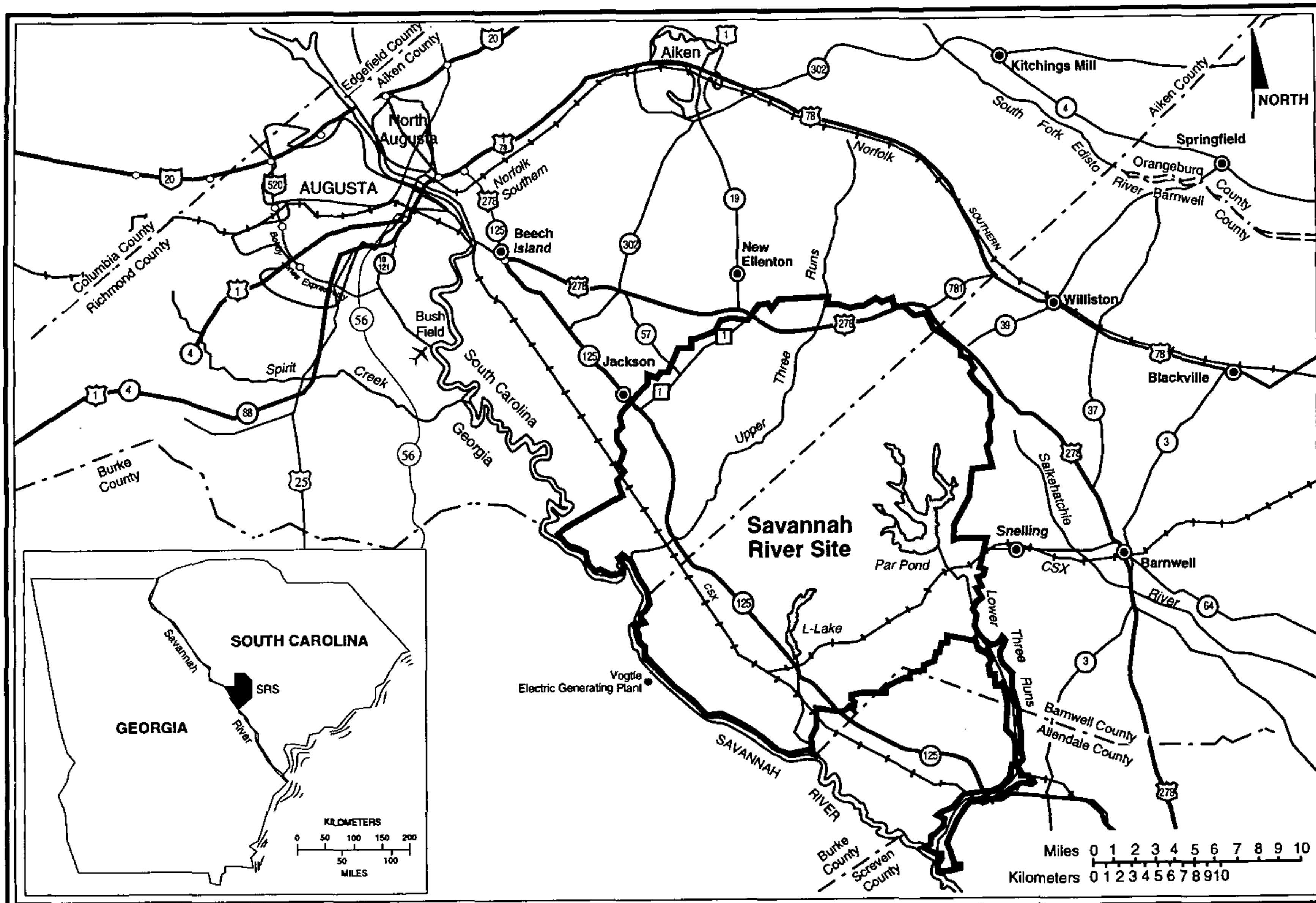
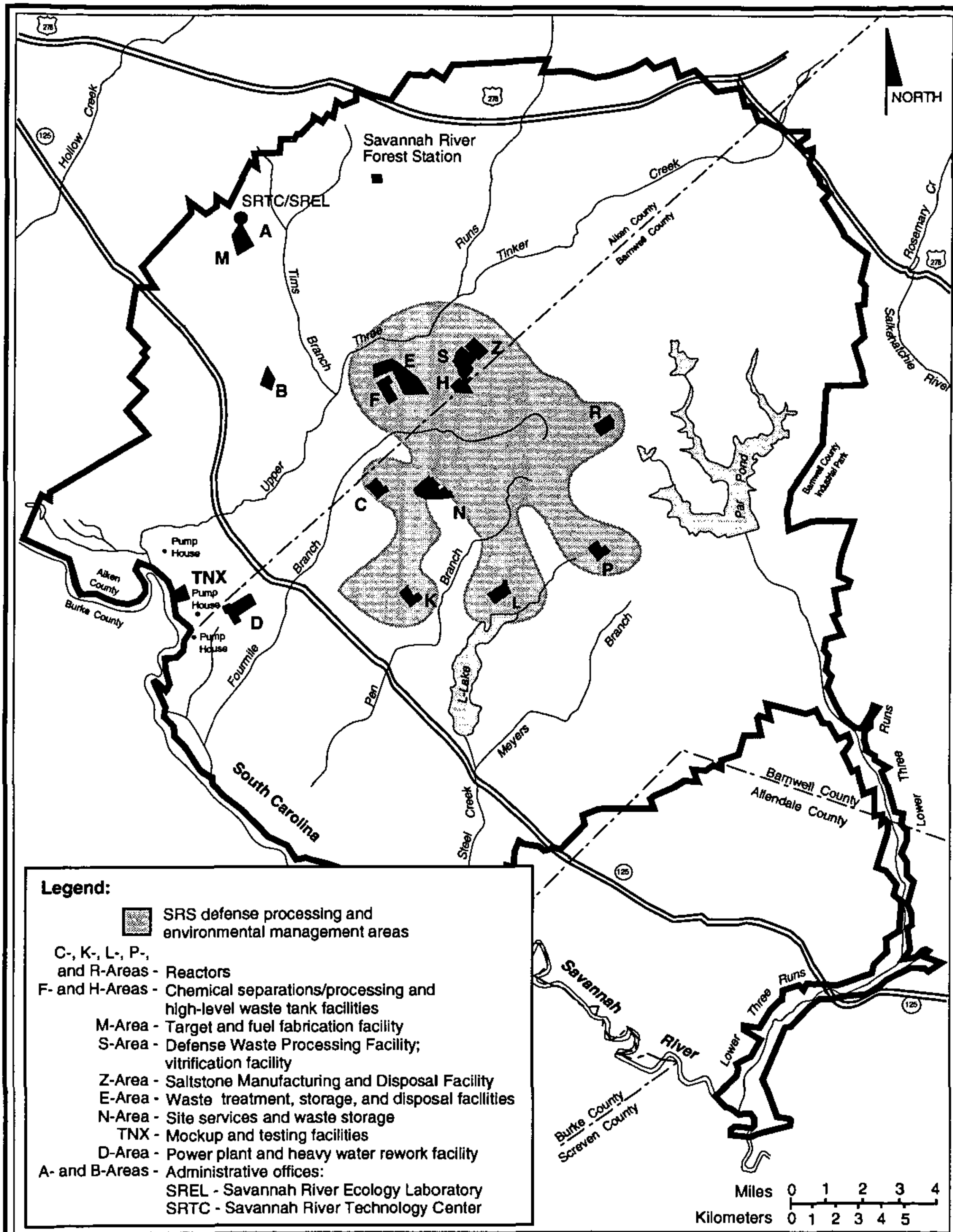
SRS is a controlled area with limited public access. Through traffic is allowed only on SC Highway 125, U.S. Highway 278, SRS Road 1, and CSX railroad corridors (Figure 3-1). Figure 3-2 shows SRS areas and facilities, which include five nuclear production reactors (C-, K-, L-, P-, and R-Reactors); a nuclear target and fuel fabrication facility (M-Area), which assembled the targets and fuel that went into the reactors; two chemical separations areas (F- and H-Areas), which processed irradiated targets and fuel assemblies to separate and recover various isotopes and which contain the liquid high-level radioactive waste tank farms; a waste vitrification facility (S-Area), which vitrifies liquid high-level radioactive waste; a saltstone facility (Z-Area), which solidifies low-level radioactive sludge into a cement-like matrix; N-Area, where some wastes are stored; E-Area, which includes waste treatment, storage, and disposal facilities; and various administrative, support, and research facilities. These facilities have generated a variety of liquid high-level radioactive, low-level radioactive, hazardous, mixed (hazardous and radioactive), and transuranic wastes. Section 3.13 provides photographs and descriptions of specific waste management facilities. Section 4.4.15 and Appendix B also describe facilities at SRS.



PK56-2

TE | **Figure 3-1.** Savannah River Site (SRS).



PK56-2

Figure 3-2. SRS areas and facilities.

TE

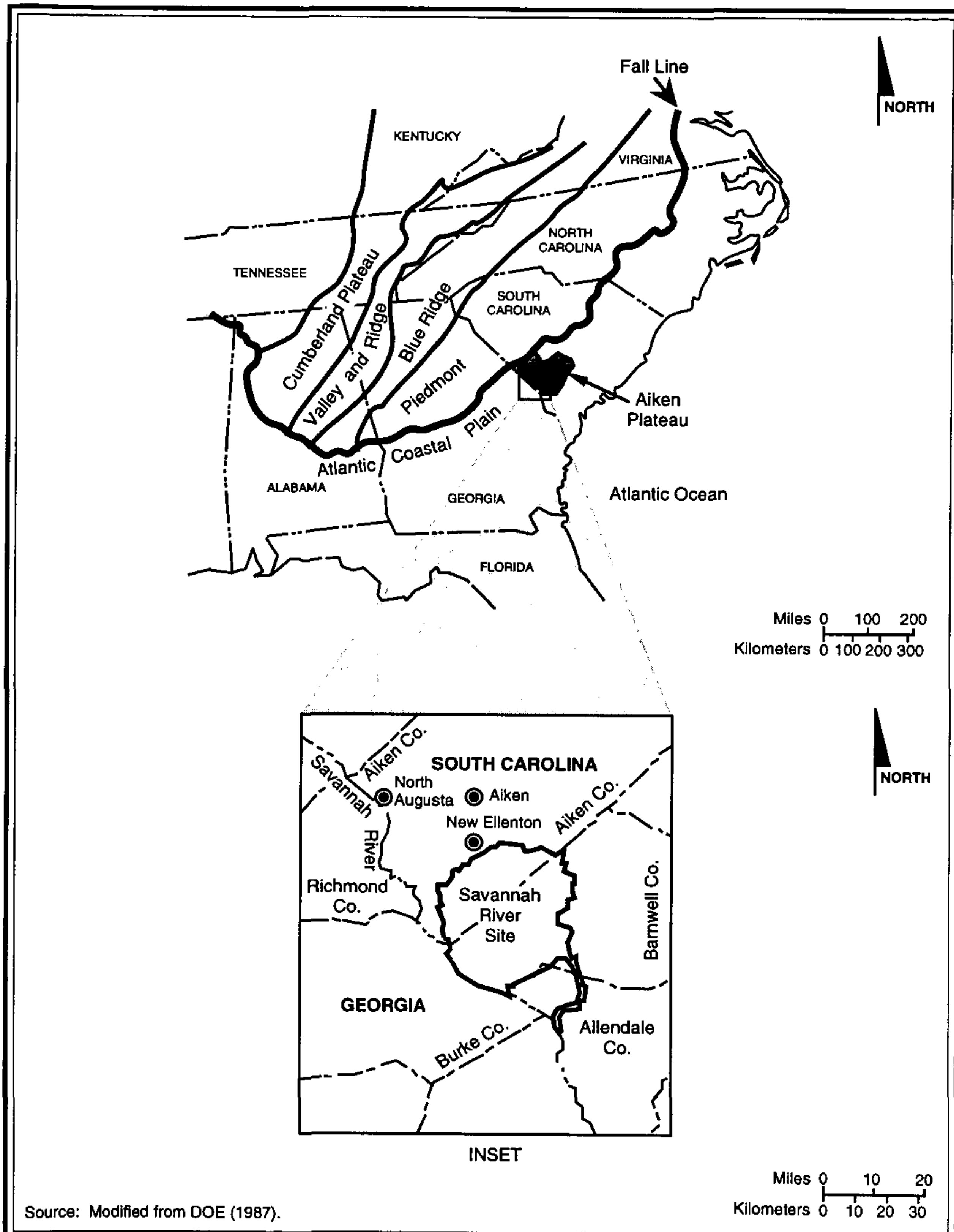
3.2 Geologic Resources

3.2.1 SOILS AND TOPOGRAPHY

SRS is located on the Aiken Plateau of the Upper Atlantic Coastal Plain physiographic province about 40 kilometers (25 miles) southeast of the Fall Line that separates the Atlantic Coastal Plain from the TE Piedmont physiographic province (Figure 3-3). The Aiken Plateau is highly dissected and consists of broad, flat areas between streams and narrow, steep-sided valleys. It slopes from an elevation of approximately 200 meters (650 feet) at the Fall Line to an elevation of about 75 meters (250 feet) on the southeast edge of the plateau. Because of SRS's proximity to the Piedmont province, it is somewhat more hilly than the near-coastal areas, with onsite elevations ranging from 27 to 128 meters (90 to 420 feet) above sea level. Relief on the Aiken Plateau is as much as 90 meters (300 feet) locally. The TE plateau is generally well drained, although small poorly drained depressions do occur. The *Final Environmental Impact Statement, Continued Operation of K-, L-, and P-Reactors, Savannah River Site, Aiken, South Carolina* (DOE 1990) contains a complete description of the geologic setting and the stratigraphic sequences at SRS.

Previously disturbed soils are mostly well drained and were taken from excavated areas, borrow pits, and other areas where major land-shaping or grading activities have occurred. These soils are found beside and under streets, sidewalks, buildings, parking lots, and other structures. Much of the soil in the existing waste management areas has been moved, so soil properties can vary within a few meters. Slopes of soils generally range from 0 to 10 percent and have a moderate erosion hazard. These disturbed soils range from a consistency of sand to clay, depending on the source of the soil material (USDA 1990).

Undisturbed soils at SRS generally consist of sandy surface layers above a subsoil containing a mixture of sand, silt, and clay. These soils are gently sloping to moderately steep (0 to 10 percent grade) and have a slight erosion hazard (USDA 1990). Some soils on uplands are nearly level, and those on bottomlands along the major streams are level. Soils in small, narrow drainage valleys are steep. Most of the upland soils are well drained to excessively drained. The well-drained soils have a thick, sandy surface layer that extends to a depth of 2 meters (7 feet) or more in some areas. The soils on bottomlands range from well drained to very poorly drained. Some soils on the abrupt slope breaks have a dense, brittle subsoil.



Source: Modified from DOE (1987).

PK56-2

Figure 3-3. General location of SRS and its relationship to physiographic provinces of the southeastern United States. TE

3.2.2 GEOLOGIC STRUCTURES

Several fault systems occur offsite, northwest of the Fall Line. DOE (1990) contains a detailed discussion of these offsite geologic features. A recent study (Stephenson and Stieve 1992) identified six faults under SRS: Pen Branch, Steel Creek, Advanced Tactical Training Area (ATTA), Crackerneck, TE Ellenton, and Upper Three Runs Faults. Identification of faults is important because earthquakes can occur along these faults. The location of faults must be considered when siting hazardous waste management facilities. South Carolina Department of Health and Environmental Control (SCDHEC) regulations specify a setback distance of at least 61 meters (200 feet) from a fault where displacement during the Holocene Epoch (approximately 35,000 years ago to the present) has occurred. None of the waste management areas occur within 61 meters (200 feet) of any faults, nor is there evidence that any of the identified faults have moved in the last 35,000 years. Based on information developed to date, none of the faults discussed in this section are considered "capable," as defined by the Nuclear Regulatory Commission in 10 CFR 100, Appendix A. The capability of a fault is determined by several criteria, one TE of which is whether the fault has moved at or near the ground surface within the past 35,000 years.

Several subsurface investigations conducted on SRS waste management areas encountered soft sediments classified as calcareous sands. These sands contain calcium carbonate (calcite), which can be dissolved by water. The calcareous sands were encountered in borings in S-, H-, and Z-Areas between 33 and 45 meters (110 to 150 feet) below ground surface. Preliminary information indicates that these calcareous zones are not continuous over large areas, nor are they very thick. If the calcareous material TE dissolved, possible underground subsidence could result in settling at the ground surface. No such settling has been reported at any of the waste management facilities; however, the U.S. Department of Energy (DOE) is currently investigating potential impacts of subsidence.

3.2.3 SEISMICITY

Two major earthquakes have occurred within 300 kilometers (186 miles) of SRS. The first was the Charleston, South Carolina, earthquake of 1886, which had an estimated Richter scale magnitude of 6.8 and occurred approximately 145 kilometers (90 miles) from SRS. The SRS area experienced an estimated peak horizontal acceleration of 10 percent of gravity (0.10*g*) during this earthquake (URS/Blume 1982). The second major earthquake was the Union County, South Carolina, earthquake of 1913, which had an estimated Richter scale magnitude of 6.0 and occurred about 160 kilometers (99 miles) from SRS (Bollinger 1973). Because these earthquakes have not been conclusively associated with a specific fault, researchers cannot determine the amount of displacement resulting from them.

Two earthquakes occurred during recent years inside the SRS boundary. On June 8, 1985, an earthquake with a local Richter scale magnitude of 2.6 and a focal depth of 0.96 kilometer (0.59 mile) occurred at SRS. The epicenter was west of C- and K-Areas (Figure 3-4). The acceleration produced by the earthquake did not activate seismic monitoring instruments in the reactor areas (which have detection limits of 0.002*g*). On August 5, 1988, an earthquake with a local Richter scale magnitude of 2.0 and a focal depth of 2.68 kilometers (1.66 miles) occurred at SRS. Its epicenter was northeast of K-Area (Figure 3-4). The seismic alarms in SRS facilities were not triggered. Existing information does not conclusively correlate the two earthquakes with any of the known faults on the site. TE TE

A report on the August 1988 earthquake (Stephenson 1988) reviewed the latest earthquake history. The report predicts a recurrence rate of 1 earthquake per year at a Richter scale magnitude of 2.0 in the southeast Coastal Plain. However, the report also notes that historic data that can be used to accurately calculate recurrence rates are sparse.

A Richter scale magnitude 3.2 earthquake occurred on August 8, 1993, approximately 16 kilometers (10 miles) east of the city of Aiken near Couchton, South Carolina. Residents reported feeling this earthquake in Aiken, New Ellenton (immediately north of SRS), and North Augusta, South Carolina [approximately 40 kilometers (25 miles) northwest of SRS]. Although detected by SRS instruments, no seismic alarms were triggered.

The current design basis earthquake that nuclear safety-related facilities are engineered to withstand is one that would produce a horizontal peak ground acceleration of 20 percent of gravity (0.2*g*). Based on current estimates, an earthquake of this magnitude or greater can be expected to occur about once every 5,000 years.

3.3 Groundwater

This section updates the detailed water resources information provided in the *Final Environmental Impact Statement, Waste Management Activities for Groundwater Protection, Savannah River Plant, Aiken, South Carolina* (DOE 1987) and in DOE (1990), and incorporates the latest aquifer terminology used at SRS.

3.3.1 AQUIFER UNITS

The most important hydrologic system underlying SRS occurs above the Piedmont hydrogeologic province in the Coastal Plain sediments, in which groundwater flows through porous sands and clays.

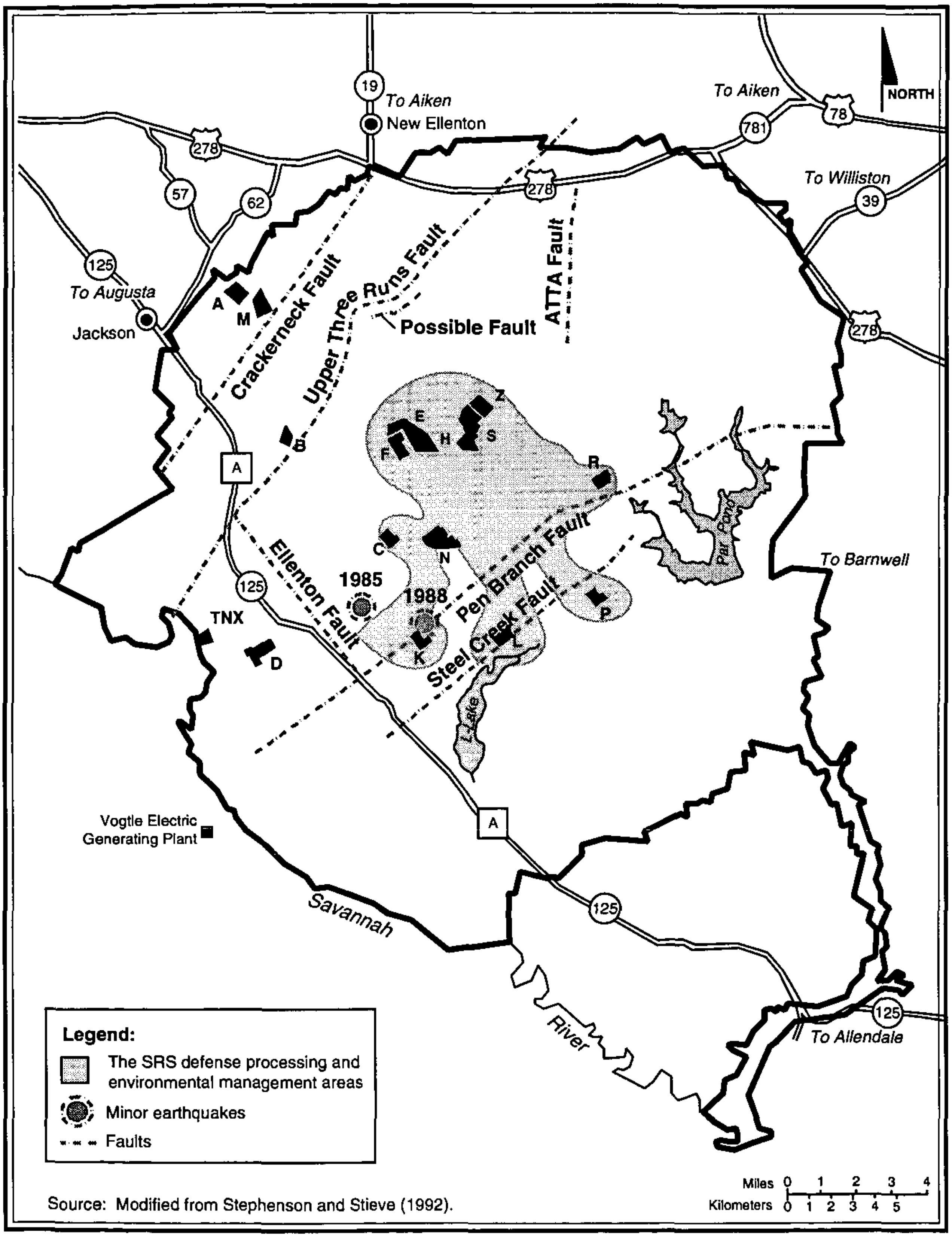


Figure 3-4. Geologic faults of SRS. | TE

Figure 3-5 names the geologic formations based on the physical character of the rocks (lithostratigraphy) and the corresponding names used to identify their water-bearing properties (hydrostratigraphy); this figure also identifies the shallow, intermediate, and deep aquifers. This EIS uses depth-based identification to simplify discussions of groundwater resources and consequences. More detailed discussions of SRS groundwater features are available in DOE (1987) and DOE (1990).

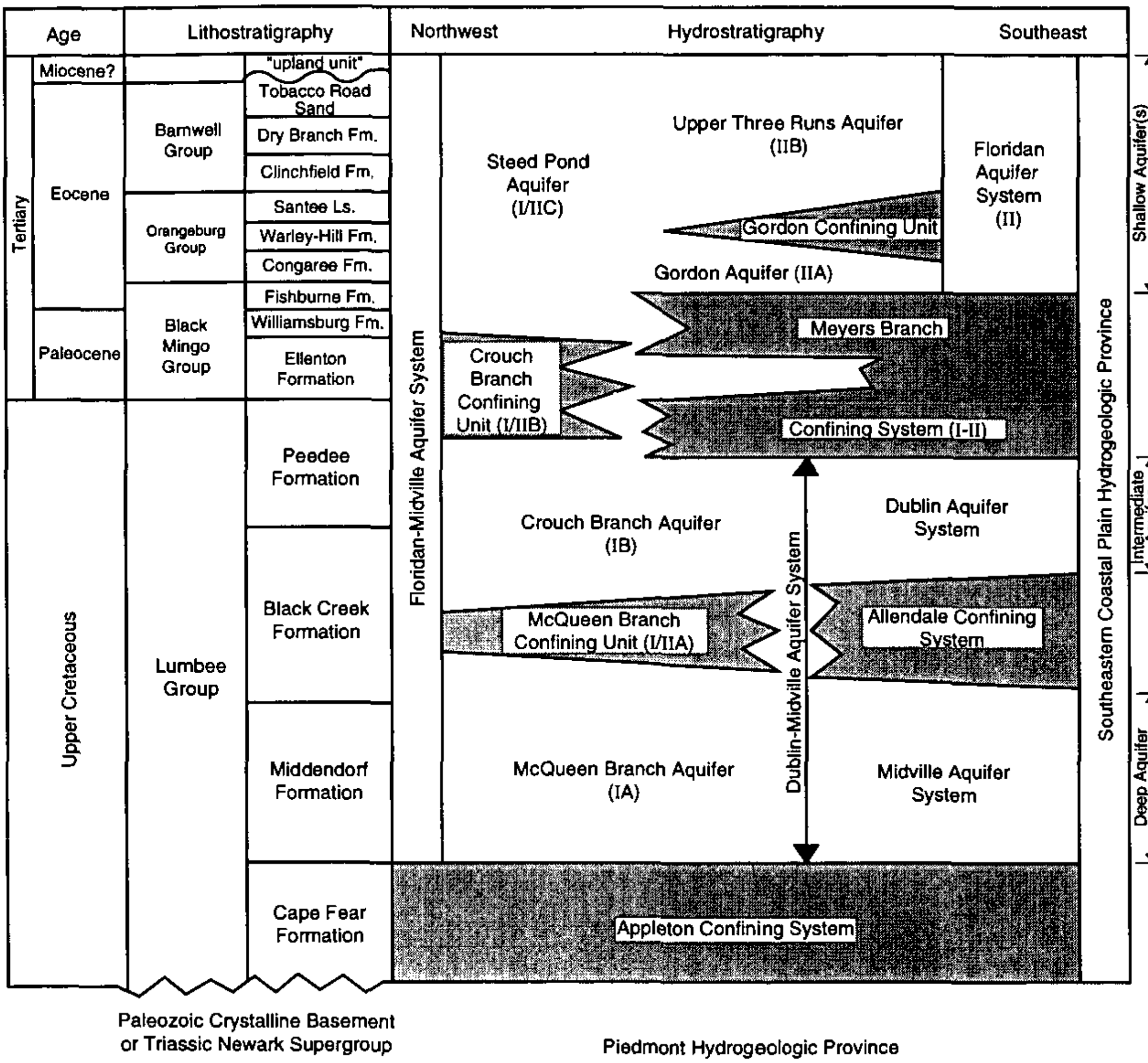
3.3.2 GROUNDWATER FLOW

Groundwater beneath SRS flows at rates ranging from a few centimeters (inches) per year to several hundred meters (feet) per year toward streams and swamps on the site and into the Savannah River.

At SRS, groundwater movement is controlled by the depths of the incisions of creeks and streams where water discharges to the surface. The valleys of the smaller perennial streams collect discharge from the shallow aquifers. Groundwater in the intermediate aquifer flows to Upper Three Runs or to the Savannah River. Water in the deep aquifer beneath SRS flows toward the Savannah River or southeast toward the coast. Beneath some of SRS, groundwater flow is predominantly downward from the upper to the lower parts of the shallow aquifer. This downward flow occurs under A-, M-, L-, and P-Areas. In other areas, groundwater flow is upward, from the lower to the upper parts of the shallow aquifer and from the deep aquifer to the lower part of the shallow aquifer. This upward flow occurs, for example, in the separations (F and H) areas and around C-Area. The upward flow increases near Upper Three Runs. TE

This section and Section 3.3.3 present groundwater flow and quality, respectively, associated with waste units with known or potential releases to the subsurface. Waste units discussed in these sections are listed in the SRS Federal Facility Agreement (EPA 1993a); Appendix G.1 of this EIS (Resource Conservation and Recovery Act (RCRA)/Comprehensive Environmental Response, Compensation and Liability Act Units List) - sites with known releases; Appendix G.2 of this EIS (RCRA Regulated Units) or Appendix G.3 of this EIS (Site Evaluation List) - sites with potential releases to be investigated. Table 3-1 lists these waste units by area and the known contaminants for each area (or group of waste units). Refer to Figure 3-6 for the location of these units. TE

Some SRS facilities that will be investigated in the future for potential groundwater remediation (and the horizontal flow directions of the groundwater beneath them) include the M-Area Metallurgical Laboratory (horizontal flow to the west-northwest in the shallow aquifer and to the south toward Upper Three Runs in the intermediate aquifer); K-Area seepage basin (flow to the southwest toward Indian



Note: Not to scale

Source: Modified from WSRC (1993a).

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Figure 3-5. Comparison of lithostratigraphy and hydrostratigraphy for the SRS region.

Table 3-1. Waste units associated with known or potential releases to the groundwater at SRS.[a]

Area	Waste Units	Contaminants
A- and M-Areas	• M-Area Hazardous Waste Management Facility • Metallurgical Laboratory Seepage Basin • Savannah River Technology Center (SRTC) Seepage Basins	Volatile organic compounds (VOCs), radionuclides, metals, nitrates
Reactor Areas	• Reactor Seepage Basins • Acid/Caustic Basins • K-Area Retention Basin • L-Area Oil/Chemical Basin	C-, K-, L-, and P-Areas: tritium, other radionuclides, metals, VOCs R-Area: radionuclides, cadmium
E-Area, Separations (F and H) Areas	• Burial Ground Complex • Mixed Waste Storage • F/H Seepage Basins • F/H Tank Farms • H-Area Retention Basin	Tritium, other radionuclides, metals, nitrate, sulfate, VOCs
G-Area	• Sanitary Landfill	Tritium, lead, VOCs
TNX	• Seepage Basins • Burying Ground	Radionuclides, VOCs, nitrate
D-Area	• Oil Disposal Basin	Metals, radionuclides, VOCs, sulfate

a. Source: Modified from Arnett, Karapatakis, and Mamatey (1993).

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Grave Branch); L-Area seepage basin (flow toward Pen Branch and L-Lake); and the P-Area seepage basin (flow toward Steel Creek). F- and H-Areas and vicinity are on a surface and groundwater divide; shallow groundwater flows toward either Upper Three Runs or Fourmile Branch.

For further technical discussions of groundwater flow beneath waste units of interest for this EIS, as well as beneath SRS in general, for the relationships of groundwater flow between the three main aquifers, and for values for aquifer properties that are useful in analysis of groundwater flow and consequences, see DOE (1987, 1990). TE

3.3.3 GROUNDWATER QUALITY

Groundwater of excellent quality is abundant in this region of South Carolina from many local aquifers. The water in Coastal Plain sediments is generally of good quality and suitable for municipal and industrial use with minimum treatment. The water is generally soft, slightly acidic (pH of 4.9 to 7.7),

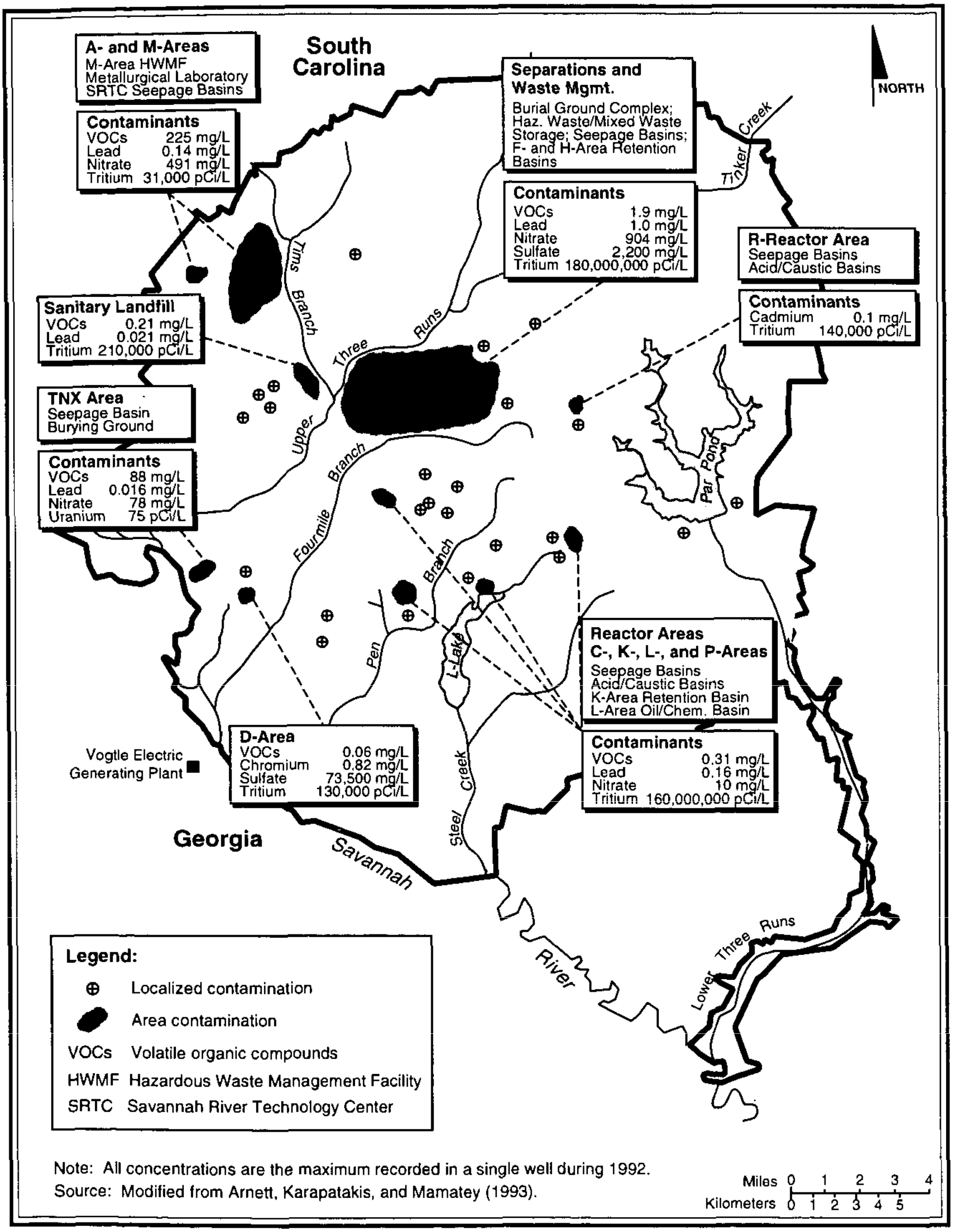

Figure 3-6. Groundwater contamination at SRS.

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and low in dissolved and suspended solids. High dissolved iron concentrations occur in some aquifers. Groundwater is the only source of domestic water at SRS and where necessary, it is treated to raise the pH and remove the iron.

Industrial solvents, metals, tritium, and other constituents used or generated at SRS have contaminated the shallow aquifers beneath 5 to 10 percent of SRS (Arnett, Karapatakis, Mamatey 1993). Localized contamination of groundwater in the deep aquifer was found in the early 1980s beneath M-Area. Low concentrations of trichloroethylene (11.7 milligrams per liter) have been detected in water from a production well in M-Area. Similarly, low trichloroethylene values have been detected in a few other wells used for process water (du Pont 1983). Groundwater contamination has not been detected outside SRS boundaries. Figure 3-6 shows (1) the locations of facilities where SRS monitors groundwater, (2) areas with constituents that exceeded drinking water standards (40 CFR Part 141) in 1992, and (3) waste units associated with known or potential releases that may require groundwater remediation. Most contaminated groundwater at SRS occurs beneath a few facilities; contaminants reflect the operations and chemical processes performed at those facilities. For example, contaminants in the groundwater beneath A- and M-Areas include chlorinated volatile organic compounds, radionuclides, metals, and nitrate. At F- and H-Areas, contaminants in the groundwater include tritium and other radionuclides, metals, nitrate, chlorinated volatile organic compounds, and sulfate. At the reactors (C-, K-, L-, and P-Areas), tritium, other radionuclides, and lead are present in the groundwater. At D-Area, contaminants in the groundwater include volatile organic compounds, chromium, nickel, lead, zinc, iron, sulfate, and tritium. A recent SRS annual environmental report (Arnett, Karapatakis, and Mamatey 1993) presents specific groundwater data from more than 1,600 monitoring wells at SRS, including approximately 120 wells in A- and M-Areas, 218 plume-definition wells in these areas, 8 wells in the areas of the reactors of interest, and more than 350 wells in F- and H-Areas. TE

After the discovery in 1981 that groundwater beneath A- and M-Areas was contaminated with volatile organic compounds, SRS established an assessment program to define the extent and migration rate of the contamination. A groundwater extraction system was installed in 1983 and modified in 1985. It consists of 11 wells which pump more than 1,890 liters (500 gallons) per minute from the lower section of the shallow aquifer and an air stripper process which removes the volatile organic compounds. The treated waste is discharged to Tims Branch and Upper Three Runs through permitted outfalls.

3.3.4 GROUNDWATER USE

Groundwater is a domestic, municipal, and industrial water source throughout the Upper Coastal Plain. Most municipal and industrial water supplies in Aiken County are from the deep aquifers. Domestic water supplies are primarily from the intermediate and shallow aquifers. In Barnwell and Allendale Counties, the intermediate zone and overlying units that thicken to the southeast supply some municipal users. At SRS, most groundwater production is from the deep aquifer, with a few lower-capacity wells pumping from the intermediate zone. Every major operating area at SRS has groundwater-producing wells. Total groundwater production at SRS is from 34,000 to 45,000 cubic meters (9 to 12 million gallons) per day, similar to the volume pumped for industrial and municipal production within 16 kilometers (10 miles) of SRS.

DOE has identified 56 major municipal, industrial, and agricultural groundwater users within 32 kilometers (20 miles) of the center of SRS (DOE 1987). The total amount pumped by these users, excluding SRS, is about 135,000 cubic meters (36 million gallons) per day.

3.4 Surface Water

3.4.1 SAVANNAH RIVER

The Savannah River is the southwestern border of SRS for about 32 kilometers (20 miles). SRS is approximately 260 river kilometers (160 river miles) from the Atlantic Ocean. At SRS, river flow averages about 283 cubic meters (10,000 cubic feet) per second. Three large upstream reservoirs, Hartwell, Richard B. Russell, and Strom Thurmond/Clarks Hill, moderate the effects of droughts and the impacts of low flows on downstream water quality and fish and wildlife resources in the river.

The Savannah River, which forms the boundary between Georgia and South Carolina, supplies potable water to several municipal users. Immediately upstream of SRS, the river supplies domestic and industrial water to Augusta, Georgia, and North Augusta, South Carolina. The river also receives sewage treatment plant effluents from Augusta, Georgia; North Augusta, Aiken, and Horse Creek Valley, South Carolina; and from a variety of SRS operations through permitted stream discharges. Approximately 203 river kilometers (126 river miles) downstream of SRS, the river supplies domestic and industrial water for the Port Wentworth (Savannah, Georgia) water treatment plant at river kilometer 47 (river mile 29) and for Beaufort and Jasper Counties in South Carolina at river kilometer 63 (river mile 39.2). In addition, Georgia Power's Vogtle Electric Generating Plant withdraws an average of 1.3 cubic meters (46 cubic feet) per second for cooling and returns an average of 0.35 cubic meters (12 cubic feet) per second. Also, the South Carolina Electric and Gas Company's Urquhart Steam Generating Station at Beech Island, South Carolina, withdraws approximately 7.4 cubic meters (261 cubic feet) per second of once-through cooling water.

In 1992, SCDHEC changed the classification of the Savannah River and the SRS streams from "Class B waters" to "Freshwaters." The definitions of Class B waters and Freshwaters are the same, but the Freshwaters classification imposes a more stringent set of water quality standards. Table 3-2 provides data on water quality in the Savannah River upstream and downstream of SRS during 1992. Comparison of the upstream and downstream concentrations shows little impact from SRS discharges on the water quality of the Savannah River, except for an increase in the tritium concentration. Constituents of SRS discharges are within the guidelines for drinking water established by the U.S. Environmental Protection Agency (EPA), SCDHEC, and DOE. TE

3.4.2 SRS STREAMS

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This section describes the pertinent physical and hydrological properties of the six SRS tributaries that drain to the Savannah River.

The five tributaries which discharge directly to the river from SRS are Upper Three Runs, Beaver Dam Creek, Fourmile Branch, Steel Creek, and Lower Three Runs (Figure 3-7). A sixth stream, Pen Branch, does not flow directly into the Savannah River but joins Steel Creek in the Savannah River floodplain swamp. These tributaries drain all of SRS with the exception of a small area on the northeast side. No development occurs in this area of SRS, which drains to an unnamed tributary of Rosemary Branch, a tributary of the Salkehatchie River. Each of these six streams originates on the Aiken Plateau in the Coastal Plain and descends 15 to 60 meters (50 to 200 feet) before discharging into the river. The streams, which historically have received varying amounts of effluent from SRS operations, are not commercial sources of water. The natural flow of SRS streams ranges from 0.3 cubic meter (11 cubic feet) per second in smaller streams such as Indian Grave Branch, a tributary to Pen Branch, to 6.8 cubic meters (240 cubic feet) per second in Upper Three Runs (Wike et al. 1994). TE

Upper Three Runs is a large, cool [annual maximum temperature of 26.1°C (79°F)] blackwater stream that discharges to the Savannah River in the northern part of SRS. It drains an area approximately 545 square kilometers (210 square miles), and during water year 1991 (a water year is October through September) had a mean discharge of 6.8 cubic meters (239 cubic feet) per second at the mouth of the creek (Wike et al. 1994). The 7-day, 10-year low flow (the lowest flow expected in any consecutive 7 days in any 10 years) is 2.8 cubic meters (100 cubic feet) per second. Upper Three Runs is approximately 40 kilometers (25 miles) long, with its lower 28 kilometers (17 miles) within the boundaries of the SRS. This creek receives more water from underground sources than other SRS streams and, therefore, has lower dissolved solids, hardness, and pH values. Upper Three Runs is the only major tributary on SRS that has not received thermal discharges. It receives surface water runoff

Table 3-2. Water quality in the Savannah River upstream and downstream from SRS (calendar year 1993).[a,b]

Parameter	Unit of measure[c]	MCL[d,e] or DCG[f]	Upstream Minimum[g]	Upstream Maximum[g]	Downstream Minimum	Downstream Maximum
Aluminum	mg/L	0.05-0.2[h]	0.174	0.946	0.182	0.838
Ammonia	mg/L	NA[i,j]	0.04	0.13	0.02	0.11
Cadmium	mg/L	0.005[d]	ND[k]	ND	ND	ND
Calcium	mg/L	NA	3.1	4.24	3.25	5.09
Chemical oxygen demand	mg/L	NA	ND	ND	ND	ND
Chloride	mg/L	250[h]	4	13	4	12
Chromium	mg/L	0.1[d]	ND	ND	ND	ND
Copper	mg/L	1.3[l]	ND	ND	ND	ND
Dissolved oxygen	mg/L	>5.0[m]	8.0	11.5	6.2	10.5
Fecal coliform	Colonies per 100 ml	1,000[m]	13	1,960	5	854
Gross alpha radioactivity	pCi/L	15[d]	<DL[n]	0.586	<DL	0.325
Iron	mg/L	0.3[h]	0.41	1.39	0.516	1.15
Lead	mg/L	0.015[l]	ND	0.002	ND	0.003
Magnesium	mg/L	NA	1.08	1.38	1.11	1.34
Manganese	mg/L	0.05[h]	0.067	0.088	0.04	0.064
Mercury	mg/L	0.002[d,e]	ND	ND	ND	ND
Nickel	mg/L	0.1[d]	ND	ND	ND	ND
Nitrite/Nitrate (as nitrogen)	mg/L	10[d]	0.17	0.31	0.18	0.31
Nonvolatile (dissolved) beta radioactivity	pCi/L	50[d]	0.393	3.17	0.959	3.12
pH	pH units	6.5-8.5[h]	6.0	6.8	6.0	6.7
Phosphate	mg/L	NA	ND	ND	ND	ND
Plutonium-238	pCi/L	1.6[f]	<DL	0.00086	<DL	0.00174
Plutonium-239	pCi/L	1.2[f]	<DL	0.000985	<DL	0.0012
Sodium	mg/L	NA	4.87	11.6	5.28	12.7
Strontium-90	pCi/L	8[f]	<DL	0.174	0.009	0.22
Sulfate	mg/L	250[h]	4.0	8.0	4.0	9.0
Suspended solids	mg/L	NA	5	17	5	16
Temperature	°C	32.2[o]	9.0	24.8	9.1	25.7
Total dissolved solids	mg/L	500[h]	48	75	49	90
Tritium	pCi/L	20,000[d,e]	<DL	726	66	1,920
Zinc	mg/L	5[h]	ND	ND	ND	0.012

a. Source: Arnett (1994).
b. Parameters are those DOE routinely measures as a regulatory requirement or as part of ongoing monitoring programs.
c. mg/L = milligrams per liter; a measure of concentration equivalent to the weight/volume ratio.
pCi/L = picocuries per liter; a picocurie is a unit of radioactivity; one trillionth of a curie.
d. Maximum Contaminant Level (MCL), EPA National Primary Drinking Water Standards (40 CFR Part 141). See glossary.
e. Maximum Contaminant Level (MCL): SCDHEC (1976a). See glossary.
f. DOE Derived Concentration Guides (DCGs) for water (DOE Order 5400.5, "Radiation Protection for the Public and the Environment"). DCG values are based on committed effective dose of 100 millirem per year for consistency with drinking water MCL of 4 millirem per year. See glossary.
g. Minimum concentrations of samples. The maximum listed concentration is the highest single result found during one sampling event.
h. Secondary Maximum Contaminant Level (SMCL). EPA National Secondary Drinking Water Regulations (40 CFR Part 143).
i. NA = none applicable.
j. Dependent upon pH and temperature.
k. ND = none detected.
l. Action level for lead and copper.
m. WQS = water quality standard. See glossary.
n. Less than (<) indicates concentration below analyses detection limit (DL).
o. Shall not exceed weekly average of 32.2°C (90°F) after mixing nor rise more than 2.8°C (5°F) in 1 week unless appropriate temperature criterion mixing zone has been established.

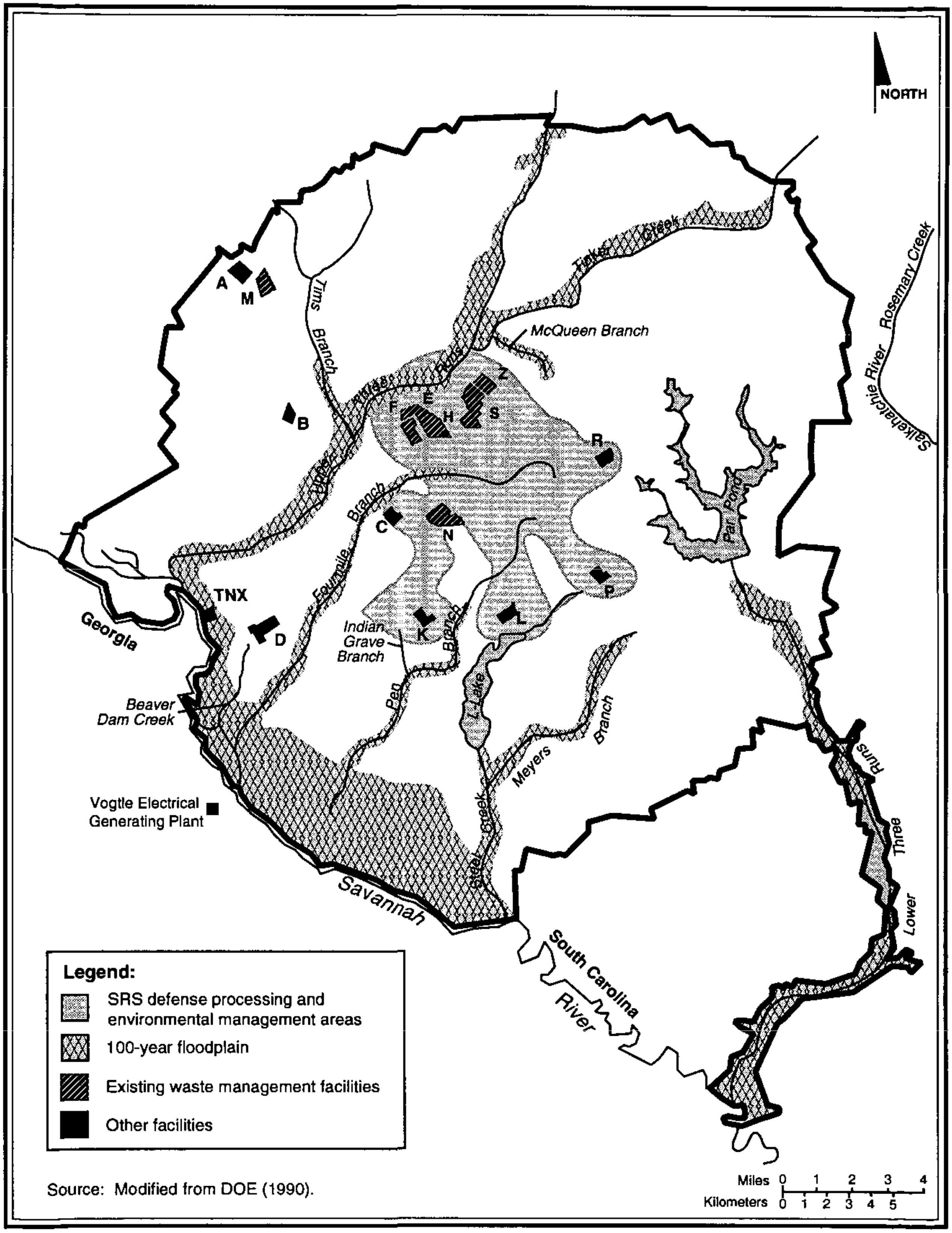

Figure 3-7. Major stream systems and facilities at SRS.

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TE and water from permitted discharges in A-, E-, F-, H-, M-, S-, and Z-Areas. Table 3-3 presents maximum and minimum values for water quality parameters for Upper Three Runs for 1993. Water quality parameters for other onsite streams are presented in Appendix E.

Table 3-3. Water quality in Upper Three Runs downstream from SRS discharges (calendar year 1993).[a,b]

Parameter	Unit of measure[c]	MCL[d,e] or DCG[f]	Minimum[g]	Maximum[g]
Aluminum	mg/L	0.05-0.2[h]	0.018	0.261
Ammonia	mg/L	NA[i,j]	ND[k]	0.04
Cadmium	mg/L	0.005[d]	ND	ND
Calcium	mg/L	NA	ND	ND
Chemical oxygen demand	mg/L	NA	ND	ND
Chloride	mg/L	250[h]	2	3
Chromium	mg/L	0.1[d]	ND	ND
Copper	mg/L	1.3[l]	ND	ND
Dissolved oxygen	mg/L	>5[m]	5.0	12.5
Fecal coliform	Colonies per 100 ml	1,000[m]	52	1,495
Gross alpha radioactivity	pCi/L	15[d]	<DL[n]	3.57
Iron	mg/L	0.3[h]	0.363	0.709
Lead	mg/L	0.015[l]	ND	0.002
Magnesium	mg/L	NA	0.034	0.356
Manganese	mg/L	0.05[h]	0.012	0.034
Mercury	mg/L	0.002[d,e]	ND	ND
Nickel	mg/L	0.1[d]	ND	ND
Nitrite/Nitrate (as nitrogen)	mg/L	10[d]	0.10	0.19
Nonvolatile (dissolved) beta radioactivity	pCi/L	50[d]	0.205	3.94
pH	pH units	6.5-8.5[h]	5.2	8.0
Phosphate	mg/L	NA	ND	ND
Sodium	mg/L	NA	1.44	2.01
Strontium-89/90	pCi/L	-	<DL	0.783
Sulfate	mg/L	250[h]	1	3
Suspended solids	mg/L	NA	1	20
Temperature	°C	32.2[o]	9.7	24.4
Total dissolved solids	mg/L	500[h]	19	47
Tritium	pCi/L	20,000[d,e]	<DL	17,900
Zinc	mg/L	5[h]	ND	ND

a. Source: Arnett (1994).
b. Parameters are those DOE routinely measures as a regulatory requirement or as a part of ongoing monitoring programs.
c. mg/L = milligrams per liter; a measure of concentration equivalent to the weight/volume ratio.
pCi/L = picocuries per liter; a picocurie is a unit of radioactivity; a trillionth of a curie.
d. Maximum Contaminant Level (MCL), EPA National Primary Drinking Water Standards (40 CFR Part 141). See glossary.
e. Maximum Contaminant Level; SCDHEC (1976a). See glossary.
f. DOE Derived Concentration Guides (DCGs) for water (DOE Order 5400.5). DCG values are based on committed effective doses of 4 millirem per year for consistency with drinking water MCL of 4 millirem per year. See glossary.
g. Minimum concentrations of samples taken at the downstream monitoring station. The maximum listed concentration is the highest single result during one sampling event.
h. Secondary Maximum Contaminant Level (SMCL), EPA National Secondary Drinking Water Regulations (40 CFR Part 143).
i. NA = none applicable.
j. Depends on pH and temperature.
k. ND = none detected.
l. Action level for lead and copper.
m. WQS = water quality standard. See glossary.
n. Less than (<) indicates concentration below analysis detection limit (DL).
o. Shall not exceed weekly average of 32.2°C (90°F) after mixing nor rise more than 2.8°C (5°F) in 1 week unless appropriate temperature criterion mixing zone has been established.

Beaver Dam Creek is approximately 5 kilometers (3.1 miles) long and drains approximately 2.2 square kilometers (approximately 1 square mile). Beaver Dam Creek originates at the effluent canal of D-Area and flows south, parallel to Fourmile Branch. Some of the discharges of Fourmile Branch and Beaver Dam Creek mix in the Savannah River floodplain swamp before entering the Savannah River. Prior to SRS operations, Beaver Dam Creek had only intermittent or low flow. It has received thermal effluents since 1952 as a result of the cooling water operations from the heavy water production facility (shut down in 1982) and a coal-fired power plant in D-Area. Currently, Beaver Dam Creek receives condenser cooling water from the coal-fired power plant, neutralization wastewater, sanitary wastewater treatment effluent, ash basin effluent waters, and various laboratory wastewaters. In water year 1991, the mean flow rate for Beaver Dam Creek taken approximately 1 kilometer (0.6 miles) south of D-Area was 2.6 cubic meters (93 cubic feet) per second. The mean temperature found during the comprehensive cooling water study (conducted between 1983 and 1985) (Gladden et al. 1985) was 25°C (77°F), with a maximum temperature of 34°C (93°F) (Wike et al. 1994). As required by a Record of Decision (DOE 1988), water from the Savannah River is added to the D-Area powerhouse condenser discharges during the summer months to maintain the temperature of the stream below 32.2°C (90°F) (DOE 1987).

Fourmile Branch is a blackwater stream that previous SRS operations have affected. It originates near the center of SRS and follows a southwesterly route for approximately 24 kilometers (15 miles). It drains an area of about 57 square kilometers (21 square miles), receiving effluents from F- and H-Areas. It received C-Reactor effluent until C-Reactor was placed on shutdown status in 1987; however, thermal discharges ceased in 1985. When C-Reactor was operating, its discharge resulted in water temperatures in excess of 60°C (140°F). Since the shutdown of C-Reactor, the maximum recorded water temperature has been 31°C (89°F), with a mean temperature of 18.5°C (65°F). With C-Reactor discharge, the flow in Fourmile Branch measured about 11.3 cubic meters (400 cubic feet) per second. The average flow at SRS Road A-12.2 (southwest of SC Highway 125) in water year 1991 was 1.8 cubic meters (63 cubic feet) per second (Wike et al. 1994). In its lower reaches, Fourmile Branch broadens and flows via braided channels through a delta formed by the deposition of sediments eroded from upstream during high flows. Downstream of the delta, the channels rejoin into one main channel. Most of the flow discharges into the Savannah River at river kilometer 245 (river mile 152.1), while a small portion of the creek flows west and enters Beaver Dam Creek. When the Savannah River floods, water from Fourmile Branch flows along the northern boundary of the floodplain swamp and joins with Pen Branch and Steel Creek, exiting the swamp via Steel Creek instead of flowing directly into the river.

Pen Branch and Indian Grave Branch drain an area of about 55 square kilometers (21 square miles). Pen Branch is approximately 24 kilometers (15 miles) long and follows a southwesterly path from its headwaters about 3.2 kilometers (2 miles) east of K-Area to the Savannah River Swamp. At the swamp, it flows parallel to the Savannah River for about 8 kilometers (5 miles) before it enters and mixes with the waters of Steel Creek. In its headwaters, Pen Branch is a largely undisturbed blackwater stream. Until K-Reactor shut down in 1988, Indian Grave Branch, a tributary of Pen Branch, received the thermal effluent from the reactor. When K-Reactor operated, Indian Grave Branch's average natural flow of 0.3 cubic meters (10 cubic feet) per second increased to about 11.3 cubic meters (400 cubic feet) per second. As required by a Record of Decision (DOE 1988), a recirculating cooling tower was completed in 1992 to cool water for K-Reactor. This system has not operated because K-Reactor was placed in cold standby in 1992. However, if it were to operate, the flow in Indian Grave Branch would be reduced to 1.6 cubic meters (55 cubic feet) per second with 1.3 cubic meters (45 cubic feet) per second coming from cooling tower blowdown (DOE 1987). This change would alter the water quality and temperature and flow regimes in Pen Branch. Currently, the Pen Branch system receives non-thermal effluents (e.g., non-process cooling water, ash basin effluent waters, powerhouse wastewater, and sanitary wastewater) from K-Area and sanitary effluent from the Central Shops (N-) Area. In water TE year 1991, the mean flow of Pen Branch at SRS Road A (SC 125) was 4.1 cubic meters (145 cubic feet) per second. During reactor operation, the mean water temperatures of Pen Branch ranged from 33.5 to 48°C (92 to 119°F). Since the shutdown of K-Reactor, the mean temperature of Pen Branch has been 22°C (72°F) (Wike et al. 1994).

The headwaters of Steel Creek originate near P-Reactor. The creek flows southwesterly about 3 kilometers (approximately 2 miles) before it enters the headwaters of L-Lake. The lake is 6.5 kilometers (4 miles) long and relatively narrow, with an area of about 4.2 square kilometers (1,034 acres). Flow from the outfall of L-Lake travels about 5 kilometers (3 miles) before entering the Savannah River swamp and then another 3 kilometers (approximately 2 miles) before entering the Savannah River. Meyers Branch, the main tributary of Steel Creek, flows approximately 10 kilometers (6.2 miles) before entering Steel Creek downstream of the L-Lake dam and upstream of SRS Road A. The total area drained by the Steel Creek-Meyers Branch system is about 91 square kilometers (35 square miles). In 1954 (before the construction of L-Lake or Par Pond), Steel Creek started to receive effluents from L- and P-Reactors. By 1961, a total of 24 cubic meters (850 cubic feet) per second of thermal effluents was being released to Steel Creek. From 1961 to 1964 P-Reactor partially used the Par Pond recirculating system. In 1964, all P-Reactor effluent was diverted to Par Pond, and in 1968 L-Reactor was put on standby. In 1981, DOE initiated activities to restart L-Reactor. L-Lake was constructed in 1985 along the upper reaches of Steel Creek to cool the heated effluent from L-Reactor, and it received these effluents for several years until L-Reactor was shut down in 1988. In addition to receiving the cooling water from L-Reactor, Steel Creek also received ash basins runoff, nonprocess cooling water, powerhouse wastewater, reactor process effluents, sanitary treatment plant effluents, and vehicle wash waters. From October 1990 to September 1991, the mean flow rate of Steel Creek at SRS

Road A was 4.7 cubic meters (185 cubic feet) per second, with an average temperature of 19°C (66°F) (Wike et al. 1994).

Lower Three Runs is a large blackwater creek draining about 460 square kilometers (286 square miles), with a 10-square kilometer (2,500-acre) impoundment, Par Pond, on its upper reaches. From the Par Pond dam, Lower Three Runs flows about 39 kilometers (24 miles) before entering the Savannah River. The SRS property includes Lower Three Runs and its floodplain from Par Pond to the river. The mean flow rate of Lower Three Runs in water year 1991 at Patterson Mill [8 kilometers (5 miles) below Par Pond] was 1.8 cubic meters (65 cubic feet) per second. The mean temperature at the Patterson Mill location during the period 1987 to 1991 was 18°C (64°F) (Wike et al. 1994).

Tables E.1-3 through E.1-7 present maximum and minimum values for water quality parameters for each of the remaining five major SRS tributaries that discharge to the Savannah River for 1993 (1992 for Beaver Dam Creek). The analytical results indicate that the water quality of SRS streams is generally acceptable, with the exception of the tritium concentrations. SCDHEC regulates the physical properties and concentrations of chemicals and metals in SRS effluents under the National Pollutant Discharge Elimination System program. SCDHEC also regulates chemical and biological water quality standards for SRS waters. TE

3.5 Air Resources

3.5.1 CLIMATE AND METEOROLOGY

The climate at SRS is temperate, with short, mild winters and long, humid summers. Throughout the year, the weather is affected by warm, moist maritime air masses (DOE 1991).

Summer weather usually lasts from May through September, when the area is strongly influenced by the western extension of the semi-permanent Atlantic subtropical "Bermuda" high pressure system. Winds are relatively light, and migratory low pressure systems and fronts usually remain well to the north of the area. The Bermuda high is a relatively persistent feature, resulting in few breaks in the summer heat. Climatological records for the Augusta, Georgia, area indicate that during the summer months, high temperatures were greater than 32.2°C (90°F) on more than half of all days. The relatively hot and humid conditions often result in scattered afternoon and evening thunderstorms (Hunter 1990).

The influence of the Bermuda high begins to diminish during the fall, resulting in relatively dry weather and moderate temperatures. Fall days are frequently characterized by cool, clear mornings and warm, sunny afternoons (Hunter 1990).

During the winter, low pressure systems and associated fronts frequently affect the weather of the SRS area. Conditions often alternate between warm, moist subtropical air from the Gulf of Mexico region and cool, dry polar air. The Appalachian Mountains to the north and northwest of SRS moderate the extremely cold temperatures associated with occasional outbreaks of arctic air. Consequently, less than one-third of all winter days have minimum temperatures below freezing, and temperatures below -7°C (20°F) occur infrequently. Snow and sleet occur on average less than once per year (Hunter 1990).

Outbreaks of severe thunderstorms and tornadoes occur more frequently during the spring than during the other seasons. Although spring weather is variable and relatively windy, temperatures are usually mild (Hunter 1990).

Data on severe weather conditions are important considerations in the selection of design criteria for buildings and structures at SRS. Information on the frequency and severity of past incidents provides a basis for predicting the probabilities and consequences of releases of airborne pollutants.

3.5.1.1 Occurrence of Violent Weather

The SRS area experiences an average of 55 thunderstorms per year, half of which occur during the summer months of June, July, and August (Shedrow 1993). On average, lightning flashes will strike six times per year on a square kilometer (0.39 square mile) of ground (Hunter 1990). Thunderstorms can
TE generate wind speeds as high as 64 kilometers (40 miles) per hour and even stronger gusts. The highest 1-minute wind speed recorded at Bush Field in Augusta, Georgia, between 1950 and 1990 was
TE 100 kilometers (62 miles) per hour (NOAA 1990).

TE Since SRS operations began, nine confirmed tornadoes have occurred on or close to SRS. Eight caused light to moderate damage. The tornado of October 1, 1989, caused considerable damage to timber resources on about 4.4 square kilometers (1,097 acres) and lighter damage on about 6 square kilometers (1,497 acres) over southern and eastern areas of the site. Winds produced by this tornado were estimated to have been as high as 240 kilometers per hour (150 miles per hour) (Parker and Kurzeja 1990). No tornado-related damage has occurred to SRS production facilities.

Based on tornado statistics for the SRS area, the average frequency of a tornado striking any given location in South Carolina was estimated to be 7.11×10^{-5} per year. This means that a tornado could strike any given location about once every 14,000 years (Bauer et al. 1989).

The nuclear materials processing facilities at SRS were built to withstand a maximum tornado wind speed of 451 kilometers per hour (280 miles per hour) (Bauer et al. 1989). The estimated probability of any location on SRS experiencing wind speeds equal to or greater than this is 1.2×10^{-7} per year. Such a tornado would occur about once every 10 million years (Bauer et al. 1989). TE

A total of 36 hurricanes have caused damage in South Carolina between 1700 and 1989. The average frequency of occurrence of a hurricane in the state is once every 8 years; however, the observed interval between hurricanes has ranged from as short as 2 months to as long as 27 years. Eighty percent of hurricanes have occurred in August and September.

Winds produced by Hurricane Gracie, which passed to the north of SRS on September 29, 1959, were as high as 121 kilometers (75 miles) per hour in F-Area. No other hurricane-force wind has been measured on SRS. Heavy rainfall and tornadoes, which frequently accompany tropical weather systems, usually have the greatest hurricane-related impact on SRS operations (Bauer et al. 1989). TE

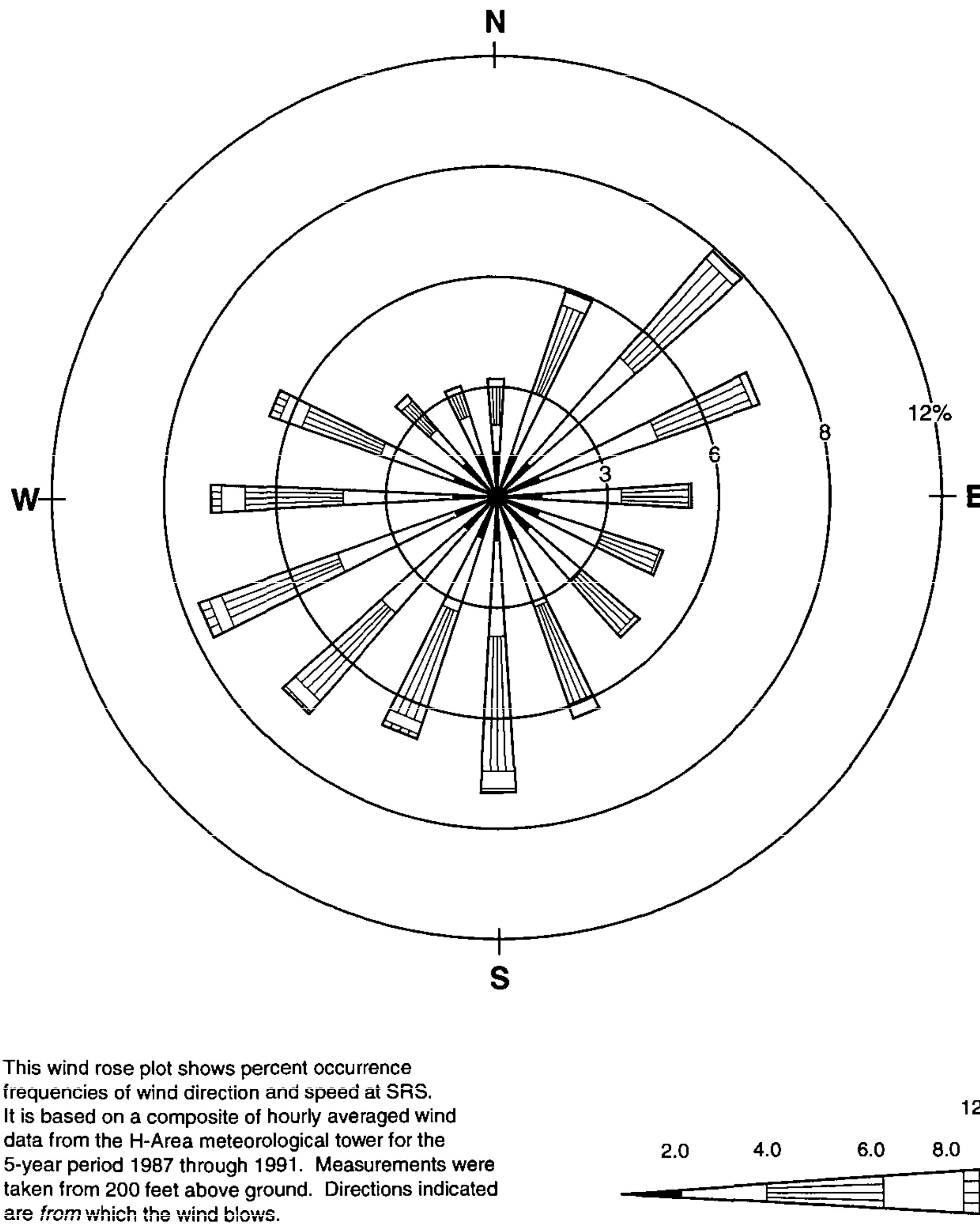
3.5.1.2 Wind Speed and Direction

A joint frequency summary (wind rose) of hourly averaged wind speeds and directions collected from the H-Area meteorological tower at a height of 61 meters (200 feet) during the 5-year period 1987 through 1991 is shown in Figure 3-8. This figure indicates that the prevailing wind directions are from the south, southwest, west, and northeast. Winds from the south, southwest, and west directions occurred during about 35 percent of the monitoring period (Shedrow 1993). TE

The average wind speed for the 5-year period was 13.7 kilometers (8.5 miles) per hour. Hourly averaged wind speeds less than 7.2 kilometers (4.5 miles) per hour occurred about 10 percent of the time. Seasonally averaged wind speeds were highest during the winter [14.8 kilometers (9.2 miles) per hour] and lowest during the summer [12.2 kilometers (7.6 miles) per hour] (Shedrow 1993). TE TE

3.5.1.3 Atmospheric Stability

Air dispersion models that predict downwind ground-level concentrations of an air pollutant released from a source are based on specific parameters such as stack height, wind speed, pollutant emission rate,



TE | This wind rose plot shows percent occurrence frequencies of wind direction and speed at SRS. It is based on a composite of hourly averaged wind data from the H-Area meteorological tower for the
TE | 5-year period 1987 through 1991. Measurements were taken from 200 feet above ground. Directions indicated are *from* which the wind blows.

Source: Arnett, Karapatakis, Mamatey (1993).

PK56-2

TE | **Figure 3-8.** Wind rose for SRS, 1987 through 1991.

and air dispersion coefficients. The air dispersion coefficients used in modeling are determined by atmospheric stability.

The ability of the atmosphere to disperse air pollutants is frequently expressed in terms of the seven Pasquill-Gifford atmospheric turbulence (stability) classes A through G. Occurrence frequencies for each of the stability classes at SRS have been determined using turbulence data collected from the SRS meteorological towers during the 5-year period 1987 through 1991. Relatively turbulent atmospheric conditions that increase atmospheric dispersion, represented by the unstable classes A, B, and C, occurred approximately 56 percent of the time. Stability class D, which represents conditions that are moderately favorable for atmospheric dispersion, occurred approximately 23 percent of the time. Relatively stable conditions that minimize atmospheric dispersion, represented by classes E, F, and G, occurred about 21 percent of the time (Shedrow 1993).

In the southeastern United States, high air pollution levels typically occur when the air is stagnant and there is little dispersion of pollutants. Stagnant episodes generally occur when atmospheric pressure is high (i.e., the area is under a high-pressure system). Under a stagnating high-pressure system, the maximum height of air mixing is less than 1,524 meters (5,000 feet), and the average wind speed is less than 4.0 meters per second (9 miles per hour). According to upper air data, episodes of poor dispersion in the vicinity of SRS lasted for at least 2 days on 12 occasions over a 5-year period (1960 through 1964). Episodes lasting at least 5 days occurred on two occasions. A stagnation episode is defined as limited dispersion lasting 4 or more days. Two stagnation episodes have occurred in the SRS area each year over the 40-year period from 1936 through 1975. The total number of stagnant days averaged about 10 per year (Bauer et al. 1989). TE

3.5.2 EXISTING RADIOLOGICAL CONDITIONS

3.5.2.1 Background and Baseline Radiological Conditions

Ambient air concentrations of radionuclides at SRS include nuclides of natural origins, such as radon from uranium in soils; man-made radionuclides, such as fallout from testing of nuclear weapons; and emissions from coal-fired and nuclear power plants. SRS operates a 35-station atmospheric surveillance program. Stations are located inside the SRS perimeter, on the SRS perimeter, and at distances up to 161 kilometers (100 miles) from SRS (Arnett, Karapatakis, and Mamatey 1994).

Routine SRS operations release quantities of alpha- and beta-gamma-emitting radioactive materials in the form of gases and particulates. Gross alpha and nonvolatile beta measurements are used as a screening method for determining the concentration of all radionuclides in the air.

The average 1990 to 1993 gross alpha radioactivity and nonvolatile beta radioactivity measured at SRS and at distances of 40 kilometers (25 miles) to 161 kilometers (100 miles) from SRS are shown in Table 3-4. The maximum levels of onsite gross alpha and gross beta radioactivity were found near production/processing areas. For each year, average onsite gross alpha and nonvolatile beta radioactivity concentrations were similar to the average concentrations measured in offsite air (Arnett, Karapatakis, and Mamatey 1994). Nonvolatile beta concentrations do not include tritium (which accounts for more than 99 percent of the airborne radioactivity released from SRS) or carbon-14.

Table 3-4. Average concentrations of gross alpha and nonvolatile beta radioactivity measured in air (1991 to 1993) (microcuries per milliliter of air).[a]

Location	Number of Locations	Average gross alpha radioactivity			Average nonvolatile beta radioactivity		
		1991	1992	1993	1991	1992	1993
Onsite	5	2.5×10^{-15}	1.8×10^{-15}	1.9×10^{-15}	1.8×10^{-14}	1.9×10^{-14}	1.8×10^{-14}
SRS perimeter	14	2.6×10^{-15}	1.8×10^{-15}	1.8×10^{-15}	1.8×10^{-14}	1.9×10^{-14}	1.9×10^{-14}
40-km[b] radius	12	2.5×10^{-15}	1.7×10^{-15}	1.8×10^{-15}	1.8×10^{-14}	1.8×10^{-14}	1.8×10^{-14}
161-km radius	4	2.6×10^{-15}	1.7×10^{-15}	2.0×10^{-15}	1.8×10^{-14}	1.7×10^{-14}	2.0×10^{-14}

a. Source: Arnett, Karapatakis, and Mamatey (1994).
b. Kilometer; to convert to miles, multiply by 0.621.

Tritium levels in 1993 are not directly comparable to those observed in previous years because the sampling protocol for atmospheric tritium oxide was changed in 1993. For 1993, the highest annual average concentration of tritium in air over SRS was 1.06×10^{-9} microcuries per milliliter. The maximum offsite tritium concentration was slightly higher than the 1992 level of 5.3×10^{-11} microcuries per milliliter (Arnett, Karapatakis, and Mamatey 1994).

3.5.2.2 Sources of Radiological Emissions

The major SRS production facilities and the types and quantities of radionuclides released during 1993 are presented in Table 3-5. The dose to a member of the public from these releases, calculated by the MAXIGASP computer model, was 0.11 millirem. This dose is 1.1 percent of the 10-millirem-per-year EPA limit (see 40 CFR 52.21). Tritium (H-3), in both elemental and oxide forms, constitutes more than 99 percent of the radioactivity released to the atmosphere from SRS operations (Arnett, Karapatakis, and Mamatey 1994).

Table 3-5. Atmospheric releases by source facility in 1993.[a] TE

Radionuclide[b]	Half-life	Curies[c] Reactors	Separations	Reactor materials	Heavy water	SRTC[d]	Diffuse and fugitive[e]	Total
Gases and Vapors								
H-3 (oxide)	12.3 yrs	3.85×10^{4}	9.39×10^{4}	NR[f]	448	NR	43.1	1.33×10^{5}
H-3 (elem.)	12.3 yrs	NR	5.82×10^{4}	NR	NR	NR	NR	5.82×10^{4}
H-3 Total	12.3 yrs	3.85×10^{4}	1.52×10^{5}	NR	448	NR	43.1	1.91×10^{5}
Carbon-14	5.7×10^{3} yrs	NR	0.0169	NR	NR	NR	4.00×10^{-6}	0.0169
Iodine-129	1.6×10^{7} yrs	NR	0.00496	NR	NR	NR	6.88×10^{-7}	0.00496
Iodine-131	8 days	NR	8.89×10^{-5}	NR	NR	5.92×10^{-5}	NR	1.48×10^{-4}
Iodine-133	20.8 hrs	NR	NR	NR	NR	0.00196	NR	0.00196
Xenon-135	9.1 hrs	NR	NR	NR	NR	0.0319	NR	0.0319
Particulates								
S-35	87.2 days	NR	NR	NR	NR	NR	2.00×10^{-6}	2.00×10^{-6}
Cobalt-60	5.3 yrs	NR	5.89×10^{-9}	NR	NR	NR	3.34×10^{-17}	5.89×10^{-9}
Ni-63	100 yrs	NR	NR	NR	NR	NR	2.00×10^{-7}	2.00×10^{-7}
Sr-89,90[g]	29.1 yrs	1.81×10^{-4}	0.00188	8.32×10^{-5}	7.19×10^{-5}	1.19×10^{-5}	1.11×10^{-4}	0.00227
Zr-95 (Nb-95)	64 days	NR	NR	NR	NR	NR	2.39×10^{-14}	2.39×10^{-14}
Ru-106	1.0 yrs	3.99×10^{-6}	5.76×10^{-9}	NR	NR	NR	4.96×10^{-12}	4.00×10^{-6}
Sb-125	2.8 yrs	NR	NR	NR	NR	NR	7.27×10^{-15}	7.27×10^{-15}
Cesium-134	2.1 yrs	NR	1.49×10^{-6}	NR	NR	NR	1.40×10^{-17}	1.49×10^{-6}
Cesium-137	30.2 yrs	1.04×10^{-4}	5.28×10^{-4}	NR	NR	1.51×10^{-6}	4.33×10^{-11}	6.34×10^{-4}
Cesium-144	285 days	NR	NR	NR	NR	NR	1.13×10^{-13}	1.13×10^{-13}
Eu-154	8.6 yrs	NR	NR	NR	NR	NR	3.44×10^{-13}	3.44×10^{-13}
Eu-155	4.7 yrs	NR	NR	NR	NR	NR	1.63×10^{-13}	1.63×10^{-13}
U-235,238	4.5×10^{9} yrs	NR	0.00186	1.55×10^{-5}	NR	2.89×10^{-8}	4.74×10^{-5}	0.00192
Pu-238	87.7 yrs	NR	0.00121	NR	NR	1.00×10^{-8}	4.63×10^{-12}	0.00121
Pu-239[h]	2.4×10^{4} yrs	4.11×10^{-6}	0.00106	3.50×10^{-6}	8.42×10^{-7}	9.41×10^{-6}	4.70×10^{-7}	0.00108
Am-241,243	7.4×10^{3} yrs	NR	1.42×10^{-4}	NR	NR	1.34×10^{-6}	8.86×10^{-13}	1.43×10^{-4}
Cm-242,244	18.1 yrs	NR	4.96×10^{-5}	NR	NR	6.83×10^{-6}	7.33×10^{-12}	5.64×10^{-5}

a. Source: Arnett, Karapatakis, and Mamatey (1994).
b. H-3 = tritium; S = sulfur; Ni = nickel; Sr = strontium; Zr = zirconium; Nb = niobium; Ru = rubidium; Sb = antimony; Eu = europium; U = uranium; Pu = plutonium; Am = americium; Cm = curium
c. One curie equals 3.7×10^{10} becquerels.
d. Savannah River Technology Center.
e. Estimated releases from minor unmonitored diffuse and fugitive sources (i.e., sources other than stacks or vents such as windows and doors).
f. NR = not reported.
g. Includes unidentified beta-gamma emissions.
h. Includes unidentified alpha emissions.

3.5.3 NONRADIOLOGICAL CONDITIONS

3.5.3.1 Background Air Quality

SRS is in an area that is designated an attainment area because it complies with National Ambient Air Quality Standards for criteria pollutants, including sulfur dioxide, nitrogen oxides (reported as nitrogen dioxide), particulate matter (less than or equal to 10 microns in diameter), carbon monoxide, ozone, and lead (see 40 CFR 81). The closest nonattainment area (an area that does not meet National Ambient Air Quality Standards) to SRS is the Atlanta, Georgia, air quality region, which is 233 kilometers (145 miles) to the west.

Sources in attainment areas must comply with Prevention of Significant Deterioration regulations. The regulations apply to new and modified sources of air pollution if the net increase in emissions from the new or modified source is determined to exceed the Prevention of Significant Deterioration annual threshold limit (see 40 CFR 52.21). Development at SRS has not triggered Prevention of Significant Deterioration permitting requirements, nor is it expected to trigger such requirements in the future.

3.5.3.2 Air Pollutant Source Emissions

DOE has demonstrated compliance with state and Federal air quality standards by modeling ambient air concentrations that would result from maximum potential emission rates using the calendar year 1990 (most recent available) air emissions inventory data as the baseline year. The compliance demonstration also included sources forecast for construction or operation through 1995 and permitted sources supporting the Defense Waste Processing Facility (WSRC 1993b). SRS based its calculated emission rates for the compliance demonstration sources on process knowledge, source testing, permitted operating capacity, material balance, and EPA air pollution emission factors (EPA 1985).

3.5.3.3 Ambient Air Monitoring

At present, SRS does not perform onsite ambient air quality monitoring. State agencies operate ambient air quality monitoring sites in Barnwell and Aiken Counties in South Carolina, and Richmond County in Georgia. These counties, which are near SRS, are in compliance with National Ambient Air Quality Standards for particulate matter, lead, ozone, sulfur dioxide, nitrogen oxides, and carbon monoxide (see 40 CFR 50).

3.5.3.4 Atmospheric Dispersion Modeling

SRS has modeled atmospheric dispersion of both maximum potential and actual emissions of criteria and toxic air pollutants using EPA's Industrial Source Complex Short Term Model (EPA 1992). This modeling was performed using the most recent (1991) quality-assured onsite meteorological data. The maximum potential emissions data included sources of air pollution at SRS that either existed or were permitted to operate as of December 1992. Emissions data for 1990 were used for the modeling of actual emissions (WSRC 1993b; Hunter and Stewart 1994). The results of this modeling are summarized in Tables 3-6 and 3-7, which list the maximum concentrations occurring at or beyond the SRS boundary. Actual SRS boundary concentrations are probably lower than values reported in these tables. TE

3.5.3.5 Summary of Nonradiological Air Quality

SCDHEC has air quality regulatory authority over SRS and determines compliance based on pollutant emission rates and estimates of ambient concentrations at the SRS perimeter based on modeling. SRS complies with National Ambient Air Quality Standards and the gaseous fluoride and total suspended particulate standards, as required by SCDHEC Regulation R.61-62.5, Standard 2 ("Ambient Air Quality Standards"). These standards are shown in Table 3-6. SRS complies with SCDHEC Regulation R.61-62.5, Standard 8 ("Toxic Air Pollutants"), which regulates the emission of 257 toxic air pollutants (EPA 1992). SRS has identified emission sources for 139 of the 257 regulated air toxics; the modeling results indicate that SRS complies with SCDHEC air quality standards. Table 3-7 lists concentrations of air toxics at the SRS boundary which exceed 1 percent of SCDHEC standards. Concentrations of all other air toxics are less than 1 percent of SCDHEC standards and are shown in Table E.2-1 in Appendix E. TE TE

3.6 Ecological Resources

The United States acquired the SRS property in 1951. At that time, the site was approximately 60 percent forest and 40 percent cropland and pasture (Wike et al. 1994). At present, more than 90 percent of SRS is forested. An extensive forest management program conducted by the Savannah River Forest Station, which is operated by the U.S. Forest Service under an interagency agreement with DOE, has converted many former pastures and fields to pine plantations. Except for SRS production and support areas, natural succession has reclaimed many previously disturbed areas. TE TE

TE | **Table 3-6.** Estimated ambient concentration contributions of criteria air pollutants from existing SRS sources and sources planned for construction or operation through 1995 (micrograms per cubic meter of air).[a,b]

Pollutant[c]	Averaging time	SRS maximum potential concentration (μg/m^3)	Concentrations based on actual emissions (μg/m^3)	Most stringent AAQS[d] (Federal or state) (μg/m^3)	Maximum potential concentration as a percent of AAQS[e]
SO_2	3 hours	1,514 (1,245)[f]	823	1,300[g,h]	96
	24 hours	449 (300)	196	365[g,h]	82
	Annual	22.9	14.5	80[g]	29
NO_x	Annual	14.8	5.7	100[g]	15
CO	1 hour	434	171	40,000[g]	1
	8 hours	57.8	22	10,000[g]	0.6
Gaseous fluorides (as HF)	12 hours	2.22	1.99	3.7[e]	60
	24 hours	1.16	1.04	2.9[e]	40
	1 week	0.44	0.39	1.6[e]	28
	1 month	0.11	0.09	0.8[e]	14
PM_{10}	24 hours	80.4	50.6	150[g]	54
	Annual	5.2	2.9	50[g]	10
O_3	1 hour	NA[i]	NA	235[g]	NA
TSP	Annual geometric mean	16.1	12.6	75[e]	21
Lead	Calendar quarter mean	0.001	0.0004	1.5[e]	0.07

a. Source: Stewart (1994).
b. The concentrations are the maximum values at the SRS boundary.
c. SO_2 = sulfur dioxide; NO_x = nitrogen oxides; CO = carbon monoxide; HF = hydrogen fluoride; PM_{10} = particulate matter $\leq$ 10 microns in diameter; O_3 = ozone; TSP = total suspended particulates.
d. AAQS = Ambient Air Quality Standard.
e. Source: SCDHEC (1976b).
f. The value in parentheses is the second highest maximum potential value.
g. Source: 40 CFR Part 50.
h. Concentration not to be exceeded more than once a year.
i. NA = not available.

SRS land management practices have maintained the biodiversity in the region. Satellite imagery reveals that SRS is a circle of wooded habitat surrounded by a matrix of cleared uplands and narrow forested wetland corridors. SRS provides more than 730 square kilometers (280 square miles) of contiguous

Table 3-7. SRS modeling results for toxic air pollutants that exceed 1 percent of SCDHEC air quality standards (micrograms per cubic meter of air).[a,b,c] TE

Pollutant	Maximum allowable concentration ($\mu g/m^3$)	Concentration at SRS boundary ($\mu g/m^3$)	Percent of standard[d]
Chlorine	75.00	7.63023	10.17
Formic Acid	225.00	2.41990	1.08
Nitric Acid	125.00	50.95952	40.77
Phosphoric Acid	25.00	0.46236	1.85
Acrolein	1.25	0.01585	1.27
Benzene	150.00	31.71134	21.14
Bis (chloromethyl) Ether	0.03	0.00180	6.00
Cadmium Oxide	0.25	0.02136	8.54
Chloroform	250.00	4.95658	1.98
Cobalt	0.25	0.20628	82.51
3,3-Dichlorobenzidine	0.15	0.00180	1.20
Manganese	25.00	0.82129	3.29
Mercury	0.25	0.01393	5.57
Nickel	0.50	0.27106	54.21
Parathion	0.50	0.00737	1.47

a. Source: WSRC (1993b).
b. Concentrations are based on maximum potential emissions.
c. See Table E.2-1 for a complete list of toxic pollutant results.
d. Percent of standard = $\frac{\text{Concentration at SRS boundary}}{\text{Maximum allowable concentration}} \times 100$

forest that supports plant communities in various stages of succession. Carolina bay depressional wetlands, the Savannah River swamp, and several relatively intact longleaf pine-wiregrass (*Pinus palustris-Aristida stricta)* communities contribute to the biodiversity of SRS and the region. Table 3-8 lists land cover in undeveloped areas of SRS. TE

The land used for production and support facilities is heavily industrialized and has little natural vegetation inside the fenced areas. These areas consist of buildings, paved parking lots, graveled construction areas, and laydown yards. While there is some landscaping around the buildings and some vegetation along the surrounding drainage ditches, most of these areas have little or no vegetation. Wildlife species common to the vegetated habitat surrounding the facilities often frequent the developed areas.

TE **Table 3-8.** Land cover of undeveloped areas of SRS.[a]

Types of land cover	Square kilometers	Square miles	Percent of total
Longleaf pine	150	58	20
Loblolly pine	258	100	35
Slash pine	117	45	16
Mixed pine/hardwood	23	9	3
Upland hardwood	20	8	3
Bottomland hardwood	117	45	16
Savannah River swamp	49	19	7
Total[b]	734	284	100

a. Source: USDA (1991a).
b. Excludes production areas; total reflects undeveloped land only.

Most new development needed to support waste management would be within previously disturbed areas and would occur on existing graveled or paved areas. Undeveloped land required for expanded waste management facilities is located in E-Area near the center of SRS and approximately 1.6 kilometers (1 mile) southeast of Upper Three Runs (Figure 3-2).

TE

Figure 3-9 shows the existing land cover of the area where most new waste management facilities would be located. The undeveloped land is comprised of 0.2 square kilometer (49 acres) of longleaf pine

TC planted in 1988; 0.4 square kilometer (99 acres) of slash pine (*P. elliotti*) planted in 1959; 0.36 square kilometer (88 acres) of loblolly pine planted in 1946; 0.73 square kilometer (180 acres) of white oak (*Quercus alba*), red oak (*Q. rubra*), and hickory (*Carya sp.*) regenerated in 1922; 0.64 square kilometer (158 acres) of longleaf pine regenerated in 1922, 1931, or 1936; 0.32 square kilometer (79 acres) of loblolly pine planted in 1987; and 0.12 square kilometer (30 acres) of recently harvested mixed pine

TE hardwood (see Figure 3-9).

3.6.1 TERRESTRIAL ECOLOGY

TE SRS is near the transition between northern oak-hickory-pine forest and southern mixed forest. Thus, species typical of both associations are found on SRS (Dukes 1984). Farming, fire, soil, and topography have strongly influenced SRS vegetation patterns.

A variety of plant communities occurs in the upland areas (Dukes 1984). Typically, scrub oak communities are found on the drier, sandier areas. Longleaf pine, turkey oak (*Quercus laevis*), bluejack oak (*Q. incana*), and blackjack oak (*Q. marilandica*) dominate these communities, which typically have understories of wire grass and huckleberry (*Vaccinium* spp.). Oak-hickory communities are usually located on more fertile, dry uplands; characteristic species are white oak, post oak (*Q. stellata*), red oak, mockernut hickory (*Carya tomentosa*), pignut hickory (*C. glabra*), and loblolly pine, with an understory of sparkleberry (*Vaccinium arboreum*), holly (*Ilex* spp.), greenbriar (*Smilax* spp.), and poison ivy (*Toxicodendron radicans*) (Dukes 1984; Wike et al. 1994).

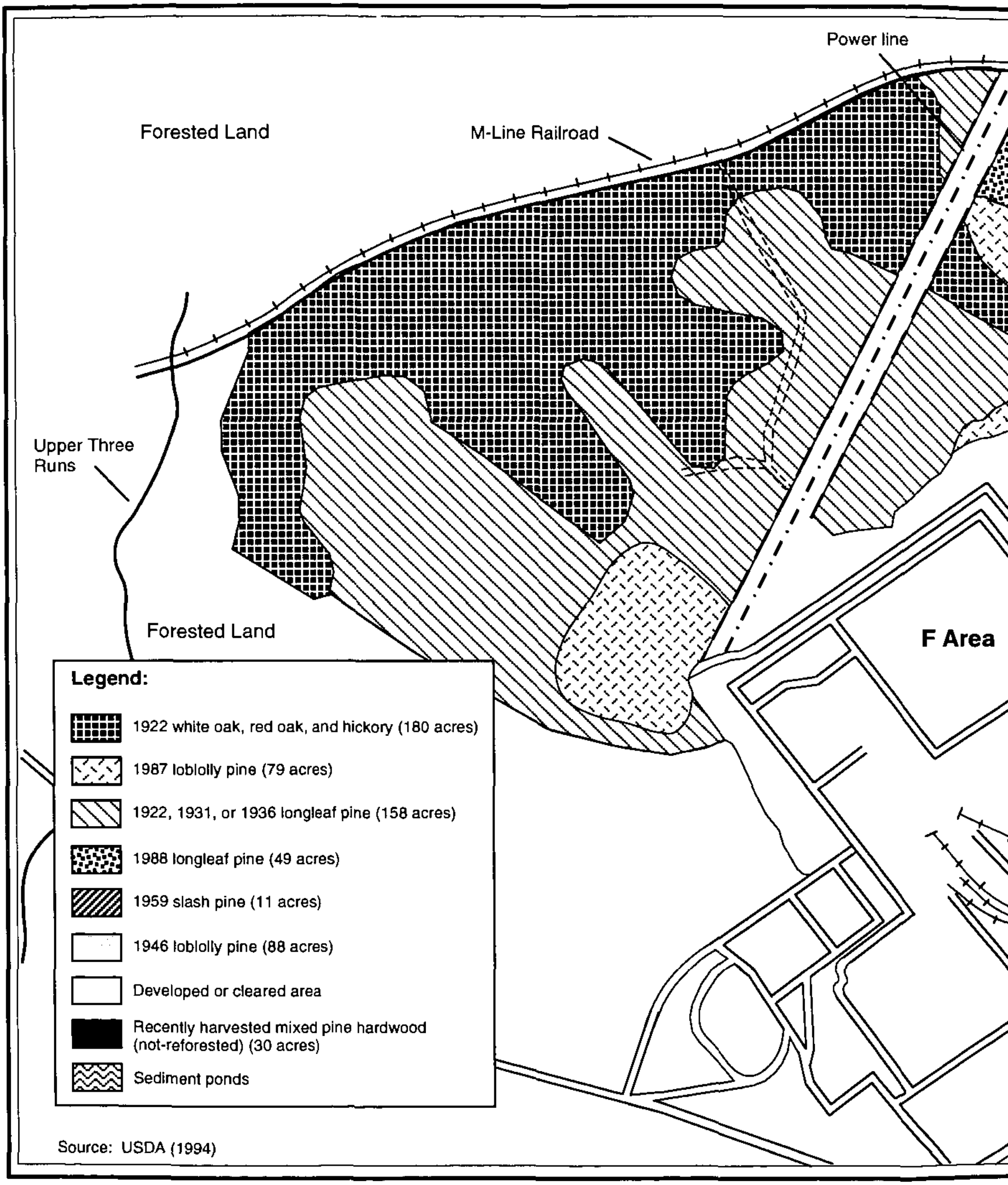
The departure of residents in 1951 and the subsequent reforestation have provided the wildlife of SRS with excellent habitat. Furbearers such as gray fox (*Urocyon cinereoargenteus*), opossum (*Didelphis virginiana*), and bobcat (*Felis rufus*) are relatively common throughout the site. Game species such as gray squirrel (*Sciurus carolinensis*), fox squirrel (*S. niger*), white-tailed deer (*Odocoileus virginianus*), eastern cottontail (*Sylvilagus floridanus*), mourning dove (*Zenaida macroura*), northern bobwhite (*Colinus virginianus*), and eastern wild turkey (*Meleagris gallopavo*) are also common (Cothran et al. 1991; Wike et al. 1994). Waterfowl are common on most SRS wetlands, ponds, reservoirs, and in the Savannah River swamp and have been studied extensively (Mayer, Kennamer, and Hoppe 1986a; Wike et al. 1994). The reptiles and amphibian species of SRS include 17 salamanders, 26 frogs and toads, 1 crocodilian, 12 turtles, 9 lizards, and 36 snakes. Gibbons and Semlitsch (1991) provides an overview, description, and identification keys to the reptiles and amphibians of SRS.

Undeveloped land in E-Area contains suitable habitat for white-tailed deer and feral hogs (*Sus scrofa*), as well as other animal species common to the mixed pine/hardwood forests of South Carolina.

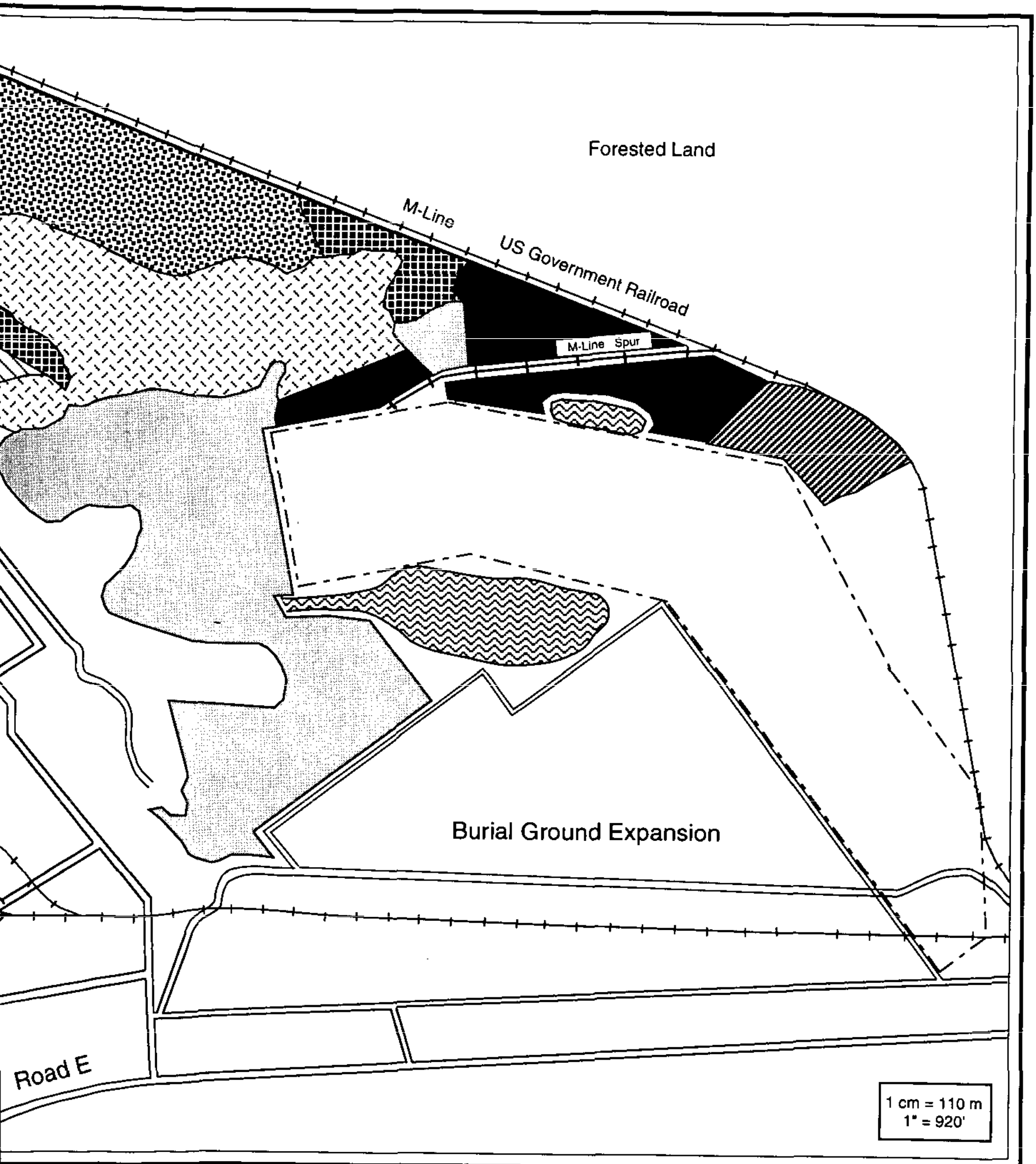
3.6.2 WETLANDS

SRS has extensive, widely distributed wetlands, most of which are associated with floodplains, creeks, or impoundments. In addition, approximately 200 Carolina bays occur on SRS (Shields et al. 1982; Schalles et al. 1989). Carolina bays are unique wetland features of the southeastern United States. They are isolated wetland habitats dispersed throughout the uplands of SRS. The more than 200 bays on SRS exhibit extremely variable hydrology and a range of plant communities from herbaceous marsh to forested wetland (Shields et al. 1982; Schalles et al. 1989).

The Savannah River bounds SRS to the southwest for approximately 32 kilometers (20 miles). The river floodplain supports an extensive swamp, covering about 49 square kilometers (19 square miles) of SRS; a natural levee separates the swamp from the river. Timber was cut in the swamp in the late 1800s. At present, the swamp forest consists of second-growth bald cypress (*Taxodium distichum*), black gum (*Nyssa sylvatica*), and other hardwood species (Sharitz, Irwin, and Christy 1974; USDA 1991a; Wike et al. 1994). TE



TE | **Figure 3-9.** Existing land cover of SRS area considered for expansion of waste management facilities.


Forested Land
M-Line
US Government Railroad
M-Line Spur
Burial Ground Expansion
Road E
1 cm = 110 m
1" = 920'

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Six streams drain SRS and eventually flow into the Savannah River. Each stream has floodplains with bottomland hardwood forests or scrub-shrub wetlands in varying stages of succession. Dominant species include red maple (*Acer rubrum*), box elder (*A. negundo*), bald cypress, water tupelo (*Nyssa aquatica*), sweetgum (*Liquidambar styraciflua*), and black willow (*Salix nigra*) (Workman and McLeod 1990).

Raccoon (*Procyon lotor*), beaver (*Castor canadensis*), and otter (*Lutra canadensis*) are relatively common throughout the wetlands of SRS. The Savannah River Ecology Laboratory has conducted extensive studies of reptile and amphibian use of the wetlands of SRS (Schalles et al. 1989).

Bottomland hardwood forest wetlands are located north of E-Area along Upper Three Runs. These wetlands, dominated by sweetgum and yellow poplar (*Liriodendron tulipifera*), are flooded during most winters.

3.6.3 AQUATIC ECOLOGY

The aquatic resources of SRS have been the subject of intensive study for more than 30 years. Research
TE | has focused on the flora and fauna of the Savannah River, the tributaries of the river that drain SRS, and the artificial impoundments on two of the tributary systems. Section 3.3.3 describes the water quality of those aquatic systems. In addition, several monographs (Patrick, Cairns, and Roback 1967; Dahlberg and Scott 1971; Bennett and McFarlane 1983), the eight-volume comprehensive cooling water study (du Pont 1987), and three EISs (DOE 1984, 1987, 1990) describe the aquatic biota (fish and macroinvertebrates) and aquatic systems of SRS.

Based on studies by the Academy of Natural Sciences of Philadelphia and others (Floyd, Morse, and McArthur 1993), Upper Three Runs has one of the richest aquatic insect faunas of any stream in North America. At least 551 species of aquatic insects, including at least 52 species and 2 genera new to science, have been identified (Wike et al. 1994). A recent study identified 93 species of caddisflies, including three species that had not previously been found in South Carolina and two species that are new to science (Floyd, Morse, and McArthur 1993). Other insect species found in the creek are considered endemic, rare, or of limited distribution (Floyd, Morse, and McArthur 1993). Between 1987 and 1991, the density and variety of insects collected from Upper Three Runs decreased for unknown reasons. Data from 1991 indicate that the insect communities may be recovering from this disturbance (Wike et al. 1994).

The American sandburrowing mayfly (*Dolania americana*), a relatively common mayfly in Upper Three Runs, is listed by the Federal government as a candidate species for protection under the Endangered Species Act. The species is sensitive to siltation, organic loading, and toxic releases (Wike et al. 1994). TE

A recent study (Davis and Mulvey 1993) has identified an extremely rare clam species (*Elliptio hepatica*) in the Upper Three Runs drainage.

3.6.4 THREATENED AND ENDANGERED SPECIES

Several threatened, endangered, or candidate plant and animal species are known to occur on SRS. Table 3-9 lists those species (Wike et al. 1994). SRS contains no designated critical habitat for any listed threatened or endangered species. TE

The smooth coneflower (*Echinacea laevigata*) is the only endangered plant species found on SRS. One colony is located on Burma Road approximately 5 kilometers (3 miles) south of the waste management sites. A second colony is located near the junctions of SRS Roads 9 and B (LeMaster 1994a). The habitat of smooth coneflower is open woods, cedar barrens, roadsides, clearcuts, and powerline rights-of-way. Optimum sites are characterized by abundant sunlight and little competition in the herbaceous layer (USFWS 1992). Suitable habitat for this species occurs throughout SRS, including undeveloped land near E-Area. TE

Botanical surveys performed during 1992 and 1994 by the Savannah River Forest Station located four populations of rare plants in the area northwest of F-Area (Figure 4-4). One population of *Nestronia* and three populations of Oconee azalea (*Rhododendron flammeum*) were located on the steep slopes adjacent to the Upper Three Runs floodplain (LeMaster 1994b). The Oconee azalea is a state-listed rare species. *Nestronia* was a Federally-listed Category 2 species that was found to be more abundant than previously believed; consequently, it was determined that listing as threatened or endangered was not warranted (USFWS 1993). TE

Wood storks (*Mycteria americana*) feed in the Savannah River Swamp and the lower reaches of Steel Creek, Pen Branch, Beaver Dam Creek, and Fourmile Branch. They foraged at Par Pond during the drawdown in 1991 (Bryan 1992). The undeveloped land in E-Area contains no suitable foraging habitat, and wood storks have not been reported in this area (Coulter 1993). Bald eagles (*Haliaeetus leucocephalus*) nest near Par Pond and L-Lake and forage on these reservoirs (USDA 1988; Brooks 1994). One bald eagle was reported flying near the junction of SRS Roads E and 4, south of H-Area, on November 15, 1985 (Mayer, Kennamer, and Hoppe 1986b). However, E-Area does not contain suitable

TE | **Table 3-9.** Threatened, endangered, and candidate plant and animal species of SRS.[a]

Common Name (Scientific Name)	Status[b]
Animals	
American sandburrowing mayfly (*Dolania americana*)	FC2
Shortnose sturgeon (*Acipenser brevirostrum*)	E
American alligator (*Alligator mississippiensis*)	T/SA
Southern hognose snake (*Heterodon simus*)	FC2
Northern pine snake (*Pituophis melanoleucus melanoleucus*)	FC2
Carolina crawfish (= gopher) frog (*Rana areolata capito*)	FC2
Loggerhead shrike (*Lanius ludovicianus*)	FC2
Bachman's sparrow (*Aimophila aestivalis*)	FC2
Bald eagle (*Haliaeetus leucocephalus*)	E
Wood stork (*Mycteria americana*)	E
Red-cockaded woodpecker (*Picoides borealis*)	E
Peregrine falcon (*Falco peregrinus*)	E
Kirtland's warbler (*Dendroica kirtlandii*)	E
Bewick's wren (*Thyromanes bewickii*)	FC2
Rafinesques (= southeastern) big-eared bat (*Plecotus rafinesquii*)	FC2
Plants	
Smooth coneflower (*Echinacea laevigata*)	E
Bog spice bush (*Lindera subcoriacea*)	FC2
Boykin's lobelia (*Lobelia boykinii*)	FC2
Loose watermilfoil (*Myriophyllum laxum*)	FC2
TE | Nestronia (*Nestronia umbellula*)	FC3
Awned meadowbeauty (*Rhexia aristosa*)	FC2
Cypress knee sedge (*Carex decomposita*)	FC2
Elliott's croton (*Croton elliottii*)	FC2

a. Source: Wike et al. (1994).
b. FC2 = under review (a candidate species) for listing by the Federal Government.
FC3 = found to be more abundant than previously believed.
E = Federal endangered species.
T/SA = threatened due to similarity of appearance.

nesting or foraging habitat for bald eagles. Peregrine falcons (*Falco peregrinus*) have been reported in the past as rare winter visitors to SRS near Par Pond. Kirtland's warbler (*Dendroica kirtlandii*) is also a rare temporary visitor (Wike et al. 1994). Shortnose sturgeon (*Acipenser brevirostrum*), typically residents of large coastal rivers and estuaries, have not been collected in the tributaries of the Savannah River that drain SRS. Sturgeon ichthyoplankton have been collected in the Savannah River near SRS (Wike et al. 1994).

The *Red-Cockaded Woodpecker Standards and Guidelines, Savannah River Site* (USDA 1991b) describes SRS management strategy for the red-cockaded woodpecker (*Picoides borealis*). The most important element of this management strategy is the conversion of slash (*P. elliottii*) (and some loblolly) pine in a designated red-cockaded woodpecker management area to longleaf pine, with a harvest rotation of 120 years. These birds inhabit and use open pine forests with mature trees (older than 70 years for nesting and 30 years for foraging) (Wike et al. 1994). While the undeveloped land surrounding E-Area contains no red-cockaded woodpecker nesting or foraging areas currently used by the species, it does contain unoccupied habitat of a suitable age (LeMaster 1994c). TE

As presented in Appendix J, DOE has consulted with the U.S. Fish and Wildlife Service to determine the potential for endangered species to be affected, as required by the Endangered Species Act. TC

3.7 Land Use

SRS occupies approximately 800 square kilometers (300 square miles) in a generally rural area in western South Carolina. Administrative, production, and support facilities make up about 5 percent of the total SRS area. Of the remaining land, approximately 70 percent is planted pine forest managed by the U.S. Forest Service (under an interagency agreement with DOE), which harvests about 7.3 square kilometers (2.8 square miles) of timber from SRS each year (DOE 1993a). Approximately 57 square kilometers (22 square miles) of SRS have been set aside exclusively for nondestructive environmental research (DOE 1993a) in accordance with SRS's designation as a National Environmental Research Park. Research in the set-aside areas is coordinated by the University of Georgia's Savannah River Ecology Laboratory. TE TE

A number of factors will determine the future development and use of SRS. Primary among these are:

- funding and priority of DOE defense programs and environmental management activities
- decisions on the disposition of nuclear materials at SRS and other sites, which DOE is currently evaluating under the National Environmental Policy Act (NEPA)
- the role of SRS in the reconfigured DOE weapons complex, which is also being evaluated through the NEPA process
- possible alternative uses of SRS land, facilities, and human resources
- compliance with regulatory requirements concerning environmental protection, worker safety and health, and nuclear facility safety

- public input and participation

- community support (DOE 1994a)

Decisions on future land uses at SRS will be made by DOE through the site development, land-use, and future-use planning processes. There will be a study of each DOE site to determine possible uses. The study will address DOE missions and the public's perspectives and interests; and it will aid in deciding the most appropriate use for each site (DOE 1994a). SRS has established a Land Use Technical Committee composed of representatives from DOE, Westinghouse Savannah River Company, and other SRS organizations. The committee is evaluating potential uses for SRS. DOE prepared an *FY 1994 Draft Site Development Plan* (DOE 1994a), which describes the current SRS mission and facilities, evaluates possible future missions of SRS and their requirements, and outlines a master development plan now being prepared. In addition, DOE has projected requirements for land and other SRS resource needs for the next 20 years. This planning process must consider activities that will involve all DOE sites (e.g., reconfiguration of the nuclear weapons complex and strategies for spent nuclear fuel management) and SRS-specific actions (e.g., waste management and environmental restoration activities). The plan will take into account risks, benefits, possible final disposition of nuclear materials, potential facility decontamination and decommissioning, land-use strategies, cleanup standards, and facilities required for potential future missions. Once decisions on the future use of SRS have been made, appropriate cleanup levels will be determined and remediation techniques will be selected and submitted for regulatory approval.

3.8 Socioeconomics

This section discusses existing socioeconomic conditions within the "region of influence" where
TE approximately 90 percent of the SRS workforce lived in 1992 (Figure 3-10). The SRS region of influence includes Aiken, Allendale, Bamberg, and Barnwell Counties in South Carolina, and Columbia and Richmond Counties in Georgia.

3.8.1 EMPLOYMENT

Between 1980 and 1990, total employment in the SRS region of influence increased from 139,504 to 199,161, an average annual growth rate of approximately 4 percent. The unemployment rates for 1980

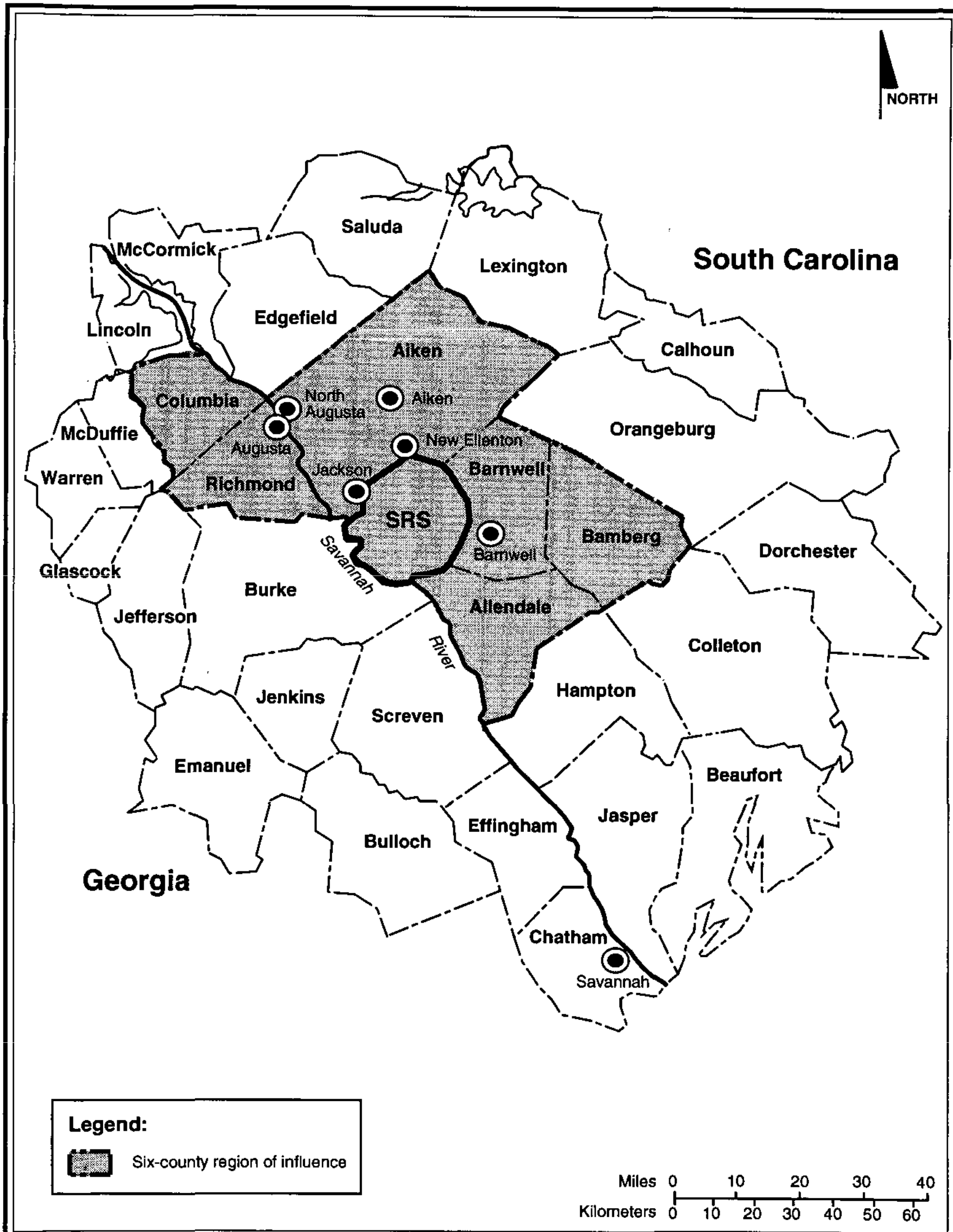

Figure 3-10. Counties and cities within the SRS vicinity. TE

TE and 1990 were 7.3 percent and 4.7 percent, respectively (HNUS 1992). Table 3-10 lists projected employment data for the six-county region of influence. By 2025, regional employment is forecast to increase to approximately 269,000 (HNUS 1994).

TE **Table 3-10.** Forecast employment, population, and personal income data for the SRS six-county region of influence.[a]

Year	Employment	Population	Personal Income (Billions)
1994	239,785	456,892	$8.259
1995	242,033	461,705	$8.770
2000	252,861	474,820	$11.645
2005	267,138	479,663	$15.608
2010	273,187	486,727	$21.297
2015	274,541	497,226	$28.771
2020	271,186	508,205	$37.927
2025	268,659	517,080	$50.194

a. Source: HNUS (1994).

In fiscal year 1992, employment at SRS was 23,351, approximately 10 percent of regional employment, TE with an associated payroll of more than $1.1 billion. SRS employment in 2000 is expected to decrease to approximately 15,800, representing 6 percent of regional employment, and it is expected to continue to decrease as a percent of regional employment in subsequent years.

3.8.2 INCOME

TE Personal income in the six-county region of influence increased from almost $2.9 billion in 1980 to approximately $6.9 billion in 1990. Together, Richmond and Aiken Counties accounted for 78 percent of personal income in the region of influence during 1991; these two counties provided most of the TE employment opportunities in the region. As listed in Table 3-10, personal income in the region is projected to increase 27 percent to almost $8.8 billion in 1995 and to approximately $50.2 billion by TE 2025 (HNUS 1994).

3.8.3 POPULATION

Between 1980 and 1990, population in the region of influence increased 13 percent, from 376,058 to 425,607. More than 88 percent of the 1990 population lived in Aiken (28.4 percent), Columbia

(15.5 percent), or Richmond (44.6 percent) counties. Table 3-10 also presents population forecasts for the region of influence to 2025 (HNUS 1994). According to census data, the average number of persons per household in the six-county region of influence was 2.72 in 1990, and the median age was 31.2 years (HNUS 1992). TE

3.8.4 COMMUNITY INFRASTRUCTURE AND SERVICES

Public education facilities in the six-county region of influence include 95 elementary or intermediate schools and 25 high schools. In addition to the public schools, there are 42 private and 16 post-secondary schools in the region (HNUS 1992). TE

The average number of students per teacher in 1988 was 16, based on a combined average daily attendance for elementary and high school students in the region of influence. The highest ratio was in Columbia County high schools, where there were 19 students per teacher (1987/1988 academic year). The lowest ratio occurred in Barnwell County's district 29 high school, which had 12 students per teacher (1988/1989 academic year) (HNUS 1992).

The six-county region of influence has 14 major public sewage treatment facilities with a combined design capacity of 302.2 million liters (79.8 million gallons) per day. In 1989, these systems were operating at approximately 56 percent of capacity, with an average daily flow of 170 million liters (44.9 million gallons) per day. Capacity utilization ranged from 45 percent in Aiken County to 80 percent in Barnwell County (HNUS 1992). TE

There are approximately 120 public water systems in the region of influence. About 40 of these county and municipal systems are major facilities, while the remainder serve individual subdivisions, water districts, trailer parks, or miscellaneous facilities. In 1989, the 40 major facilities had a combined total flow of 576.3 million liters (152.2 million gallons) per day. With an average daily flow rate of approximately 268.8 million liters (71 million gallons) per day, these systems were operating at 47 percent of total capacity in 1989. Facility utilization rates ranged from 13 percent in Allendale County to 84 percent in the City of Aiken (HNUS 1992).

Eight general hospitals operate in the six-county region of influence, with a combined capacity in 1987 of 2,433 beds (5.7 beds per 1,000 population). Four of the eight general hospitals are in Richmond County; Aiken, Allendale, Bamberg, and Barnwell Counties each have one general hospital. Columbia County has no hospital. In 1989, there were approximately 1,295 physicians serving the regional population, which represents a physician-to-population ratio of 3 to 1,000. This ratio ranged from 0.8 TE physician per 1,000 people in Aiken and Allendale counties to 5.4 physicians per 1,000 people in Richmond County (HNUS 1992).

Fifty-six fire departments provide fire protection in the region of influence. Twenty-seven of these are classified as municipal fire departments, but many provide protection to rural areas outside municipal limits. The average number of firefighters in the region in 1988 was 3.8 per 1,000 people, ranging from 1.6 per 1,000 in Richmond County to 10.2 per 1,000 in Barnwell County (HNUS 1992).

TE County sheriff and municipal police departments provide most law enforcement in the region of influence. In addition, state law enforcement agents and state troopers assigned to each county provide protection and assist county and municipal officers. In 1988, the average ratio in the region of influence of full-time police officers employed by state, county, and local agencies per 1,000 population was 2.0. This ratio ranged from 1.4 per 1,000 in Columbia County to 2.5 per 1,000 in Richmond County (HNUS 1992).

3.8.5 DEMOGRAPHIC CHARACTERISTICS

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," requires that Federal agencies identify and address, as appropriate, disproportionate adverse human health or environmental effects of their programs and activities on people of color and the poor. DOE is developing official guidance on the implementation of the Executive Order. This EIS's approach to implementing the Order is to identify the potential effects of waste management activities at SRS on people of color or those with low incomes. The following describes the analysis of environmental justice issues for the alternatives considered in this EIS. Potential offsite health impacts would result from releases to the air and to the Savannah River. For air releases, standard population dose analyses are based on an 80-kilometer (50-mile) radius from SRS
TE
L004-01 because expected dose levels beyond that distance are very small. Table 3-11 and Figure 3-11 provide data on the 1990 population distribution within a 80-kilometer (50-mile) radius of SRS. For releases to
TE water, the region of analysis includes areas along the Savannah River that draw on it for drinking water [Beaufort and Jasper Counties in South Carolina and Port Wentworth (Savannah), Georgia]. Therefore, the analysis examines populations in all census tracts that have at least 20 percent of their area within the 80-kilometer (50-mile) radius of SRS and all tracts from Beaufort and Jasper Counties in South Carolina and Effingham and Chatham Counties in Georgia. It should be noted that offsite health effects are based
L004-01 on the population within an 80-kilometer (50-mile) radius of SRS and those people who use the Savannah River for drinking water. The population considered in estimating drinking water dose is beyond the 80-kilometer (50-mile) radius. DOE used data from each census tract in this combined

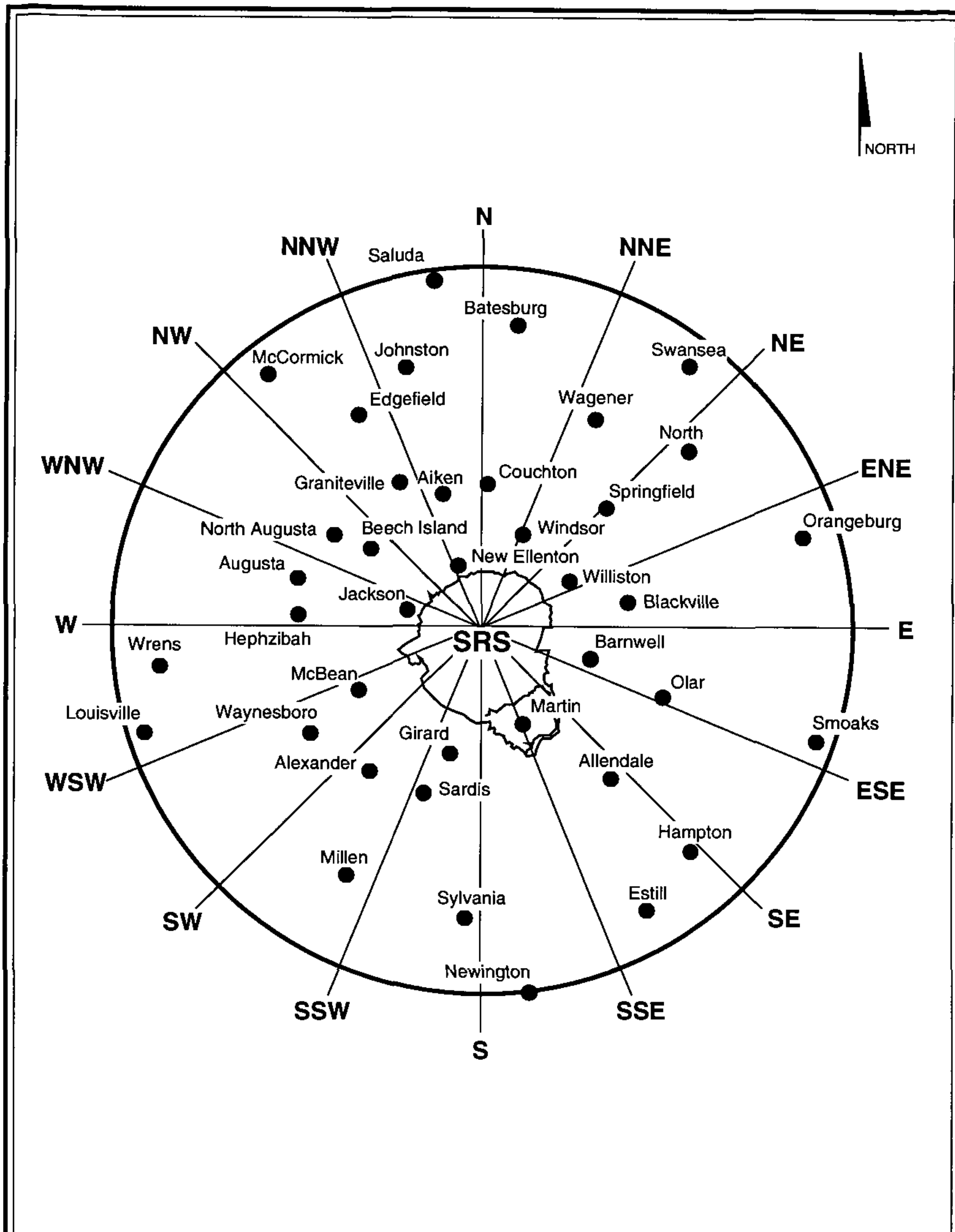

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Figure 3-11. Cities and towns within an 80-kilometer (50-mile) radius of SRS.

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TE **Table 3-11.** Population distribution in 1990 within an 80-kilometer (50-mile) radius of SRS.[a]

Direction	Kilometers[b] 0-8	8-16	16-32	32-48	48-64	64-80	Total
N	0	26	5,321	10,020	5,067	12,210	32,620
NNE	0	6	1,320	2,066	4,445	14,370	22,200
NE	0	1	2,945	2,928	5,269	10,200	21,340
ENE	0	27	3,126	4,483	5,337	40,770	53,740
E	0	155	6,743	5,305	8,812	4,334	25,350
ESE	0	36	1,556	1,931	2,711	3,253	9,487
SE	0	26	547	6,511	6,685	8,577	22,350
SSE	0	40	391	769	1,356	2,539	5,095
S	0	1	558	1,332	7,251	3,335	12,480
SSW	0	2	897	2,008	4,181	2,944	10,030
SW	0	17	944	2,240	2,606	2,660	8,467
WSW	0	60	1,103	7,112	2,285	5,818	16,380
W	0	55	3,314	7,941	7,994	6,780	26,080
WNW	0	449	3,342	106,900	50,310	11,550	172,500
NW	0	271	5,899	87,930	26,570	3,025	123,700
NNW	0	363	18,030	27,160	6,665	6,079	58,300
Total	0	1,535	56,040	276,600	147,500	138,400	620,100

a. Source: Arnett (1993).
b. To convert to miles, multiply by 0.6214.

region to identify the racial composition of communities and the number of persons characterized by the U.S. Bureau of the Census as living in poverty. The combined region of analysis contains 247 census tracts, 99 in South Carolina and 148 in Georgia.

TE Tables 3-12 and 3-13 list racial and economic characteristics of the population within the combined region. The total population in the combined area is more than 993,000. Of that total population, TE approximately 618,000 (62.2 percent) are white. Within the population of people of color (375,000), approximately 94 percent are African American; the remainder are Asian, Hispanic, or Native American. TE Figure 3-12 gives the distribution of people of color by census tract areas within the region of analysis.

TE **Table 3-12.** General racial characteristics of the population in the region of analysis.[a]

State	Total population	White	African American	Hispanic	Asian	Native American	Other	People of color	Percent people of color[b]
SC	418,685	267,639	144,147	3,899	1,734	911	335	151,046	36.08%
GA	574,982	350,233	208,017	7,245	7,463	1,546	478	224,749	39.09%
Total	993,667	617,872	352,164	11,144	9,197	2,457	833	375,795	37.82%

a. Source: U.S. Bureau of the Census (1990a).
b. Methodologies used to collect census data result in situations in which the total population does not equal the sum of the populations of the identified racial groups. In this table, people of color is calculated by subtracting the white population from the total population.

Table 3-13. Percentage of the population living in poverty in the region of analysis.[a] TE

Area	Total population	Persons living in poverty[b]	Percent living in poverty
SC	418,685	72,345	17.28%
GA	574,982	96,672	16.81%
Total	993,667	169,017	17.01%

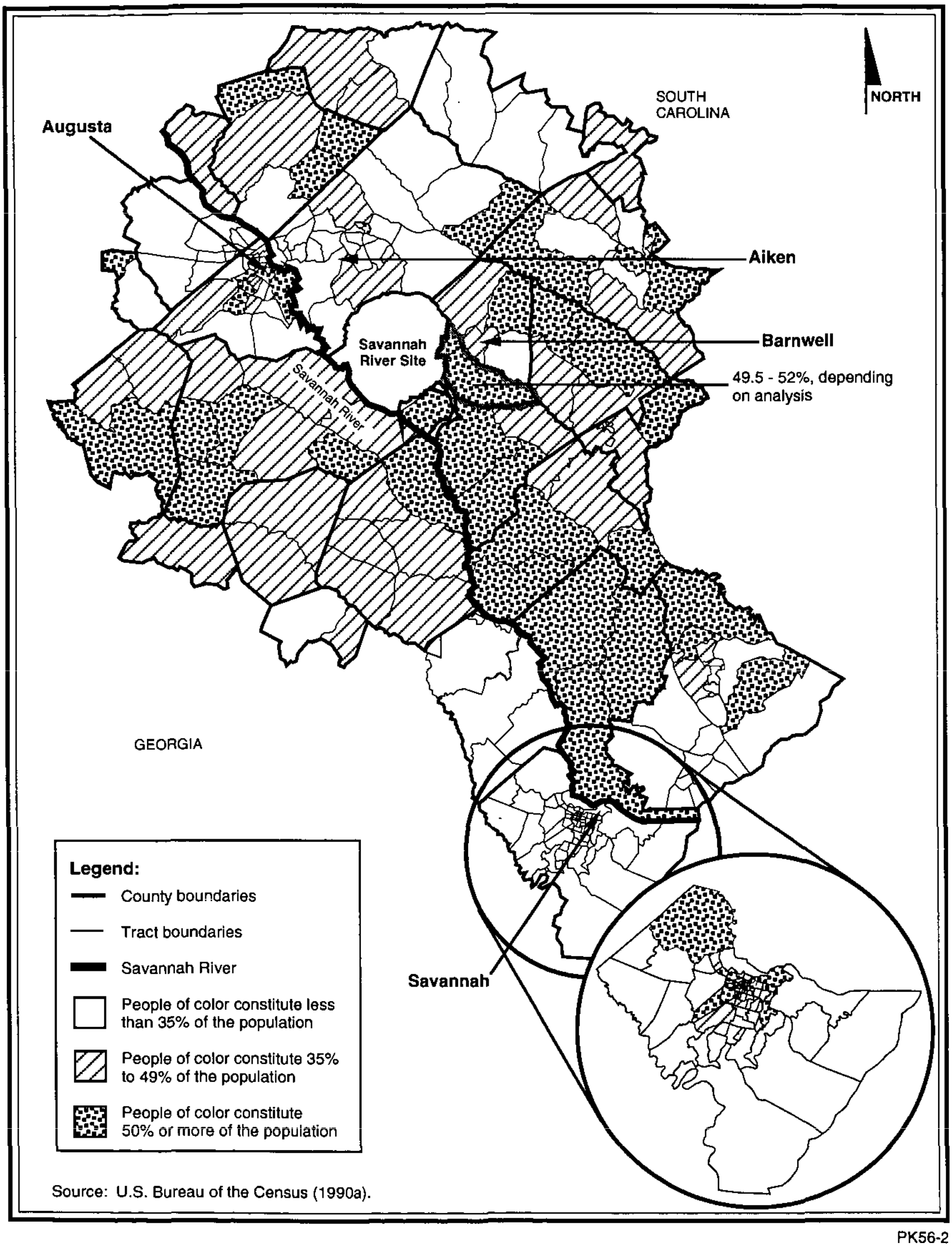
a. Source: U.S. Bureau of the Census (1990b).
b. Families with incomes less than $8,076 in 1989 for a family of two.

Executive Order 12898 does not define minority populations. However, one approach is to identify communities that contain a simple majority of people of color (greater than or equal to 50 percent of the total population of the community). A second approach, proposed by EPA, defines communities of people of color as those that have higher-than-average (over the region of analysis) percentages of people of color (EPA 1994). In Figure 3-12, two different shadings indicate census tracts where (1) people of color constitute 50 percent or more of the total population in the tract, or (2) people of color constitute between 35 percent and 50 percent of the total population in the tract. For purposes of this analysis, DOE adopted the second, more expansive, approach to identifying minority populations. TE TE TE

In the combined region, there are 80 tracts (32.4 percent) where the number of people of color are equal to or greater than 50 percent of the total population. In an additional 50 tracts (20.2 percent), people of color comprise between 35 and 49 percent of the population. These tracts are well distributed throughout the region, although there are more of them toward the south and in the immediate vicinities of Augusta and Savannah, Georgia. TE

Low-income communities are defined as those in which 25 percent or more of the population live in poverty (EPA 1993b). The U.S. Bureau of the Census defines persons in poverty as those with incomes less than a "statistical poverty threshold." This threshold is a weighted average based on family size and the age of the persons in the family. The baseline threshold for the 1990 census was an income of $8,076 for a family of two during the previous year, 1989. TC

In the region of analysis, more than 169,000 persons (17.0 percent of the total population) live in poverty (Table 3-13). In Figure 3-13, shaded census tracts identify low-income communities. In the region, 72 tracts (29.1 percent) are low-income communities. These tracts are distributed throughout the region of analysis, but are primarily to the south and west of SRS. TE



TE | **Figure 3-12.** Distribution of people of color by census tracts in the SRS region of analysis.

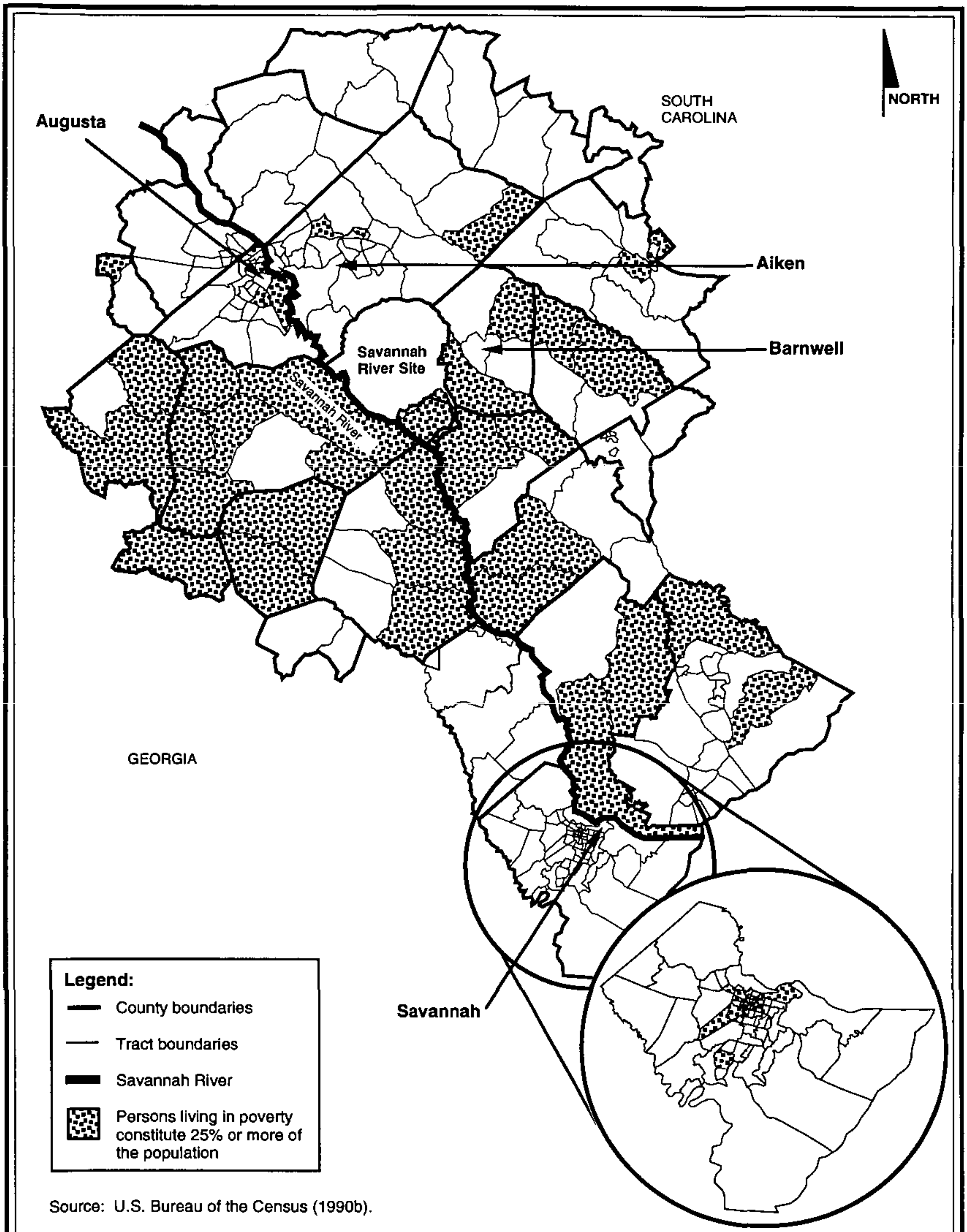


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Figure 3-13. Low-income census tracts in the SRS region of analysis. | TE

3.9 Cultural Resources

3.9.1 ARCHAEOLOGICAL SITES AND HISTORIC STRUCTURES

Field studies conducted over the past two decades by the South Carolina Institute of Archaeology and Anthropology of the University of South Carolina, under contract to DOE and in consultation with the South Carolina State Historic Preservation Officer, have provided considerable information about the distribution and content of archaeological and historic sites on SRS. By the end of September 1992, approximately 60 percent of SRS had been examined, and 858 archaeological (historic and prehistoric) sites had been identified. Of these, 53 have been determined to be eligible for the National Register of Historic Places; 650 have not been evaluated. No SRS facilities have been nominated for the National Register of Historic Places, and there are no plans for nominations at this time. The existing SRS nuclear production facilities are not likely to be eligible for the National Register of Historic Places, either because they lack architectural integrity, do not represent a particular style, or do not contribute to the broad historic theme of the Manhattan Project and the production of initial nuclear materials (Brooks 1993, 1994).

Archaeologists have divided SRS into three zones related to their potential for containing sites with multiple archaeological components or dense or diverse artifacts, and their potential for nomination to the National Register of Historic Places (SRARP 1989).

- Zone 1 is the zone of the highest archaeological site density, with a high probability of encountering large archaeological sites with dense and diverse artifacts, and a high potential for nomination to the National Register of Historic Places.

- Zone 2 includes areas of moderate archaeological site density. Activities in this zone have a moderate probability of encountering large sites with more than three prehistoric components or that would be eligible for nomination to the National Register of Historic Places.

- Zone 3 includes areas of low archaeological site density. Activities in this zone have a low probability of encountering archaeological sites and virtually no chance of encountering large sites with more than three prehistoric components; the need for site preservation is low. Some exceptions to this definition have been discovered in Zone 3; some sites in the zone could be considered eligible for nomination to the National Register of Historic Places.

S- and Z-Areas were extensively surveyed prior to construction of the Defense Waste Processing Facility. No archaeological or historic artifacts were found (DOE 1982). The construction of F- and H-Areas during the 1950's is likely to have destroyed any historic or archaeological resources in those areas (Brooks 1993).

3.9.2 NATIVE AMERICAN CULTURAL RESOURCES AND CONCERNS

In conjunction with studies in 1991 related to the New Production Reactor, DOE solicited the concerns of Native Americans about religious rights in the Central Savannah River Valley. During this study, three Native American groups, the Yuchi Tribal Organization, the National Council of Muskogee Creek, and the Indian People's Muskogee Tribal Town Confederacy, expressed general concerns about SRS and the Central Savannah River Area, but did not identify specific sites as possessing religious significance. The Yuchi Tribal Organization and the National Council of Muskogee Creek are interested in several plant species traditionally used in tribal ceremonies, such as redroot (*Lachnanthes carolinianum*), button snakeroot (*Eryngium yuccifolium*), and American ginseng (*Panax quinquefolium*) that may occur on SRS (NUS 1991a). Redroot and button snakeroot are known to occur on SRS (Batson, Angerman, and Jones 1985). DOE included all three tribal organizations on its mailing lists and sends them documents about SRS environmental activities. TE

3.10 Aesthetics and Scenic Resources

The dominant aesthetic settings in the vicinity of SRS are agricultural land and forest, with some limited residential and industrial areas. The reactors and most of the large facilities are located in the interior of SRS (Figure 3-2). Because of the distance to the SRS boundary, the rolling terrain, normally hazy atmospheric conditions, and heavy vegetation, SRS facilities are not usually visible from outside SRS or from roads with public access. The few locations that have views of some SRS structures (other than the administrative area) are distant from the structures [8 kilometers (5 miles) or more]; these views have low visual sensitivity levels because most of these structures were built as many as 40 years ago and are well established in the viewer's expectations. TE

SRS land is heavily wooded (predominantly pine forest, which minimizes seasonal differences), and developed areas occupy approximately 5 percent of the total land area. The facilities are scattered across SRS and are brightly lit at night. Typically, the reactors and principal processing facilities are large concrete structures as much as 30 meters (100 feet) tall adjacent to shorter administrative and support buildings and parking lots. These facilities are visible in the direct line-of-sight when approaching them on SRS access roads. The only structure visible from a distance is the recently completed K-Reactor TE

Cooling Tower. Since this tower will not be operated, the absence of a steam plume ensures no further visual impact. Otherwise, heavily wooded areas that border the SRS road system and public highways crossing the Site limit views of the facilities.

3.11 Traffic and Transportation

3.11.1 REGIONAL INFRASTRUCTURE

SRS is surrounded by a system of interstate highways, U.S. highways, state highways, and railroads. Barge traffic is possible on the Savannah River; however, neither SRS nor commercial shippers routinely use barges (DOE 1991). Figure 3-14 shows the regional transportation infrastructure.

TE

3.11.2 SRS TRANSPORTATION INFRASTRUCTURE

The SRS transportation infrastructure consists of more than 230 kilometers (143 miles) of primary roads, 1,931 kilometers (1,200 miles) of unpaved secondary roads, and 103 kilometers (64 miles) of railroad track (WSRC 1993c). These roads and railroads provide connections among the various SRS facilities and links to offsite transportation. Figure 3-15 shows the SRS network of primary roadways, access points, and the SRS railroad system.

3.11.2.1 SRS Roads

In general, heavy traffic occurs in the early morning and late afternoon when workers commute to and from SRS. Table 3-14 provides data on SRS roads during peak travel times, and Table 3-15 provides peak baseline traffic for the primary offsite access roads and Road E. During working hours, official vehicles and logging trucks constitute most of the traffic. As many as 30 logging trucks, which can impede traffic, may be operating simultaneously on SRS, with an annual average of 15 trucks per day (WSRC 1992a). A total of 785 trucks longer than about 8 meters (25 feet) enter and exit SRS daily (Swygert 1994a).

TE

3.11.2.2 SRS Railroads

The SRS rail yard is east of P-Reactor. This eight-track facility sorts and redirects rail cars. Deliveries of shipments to SRS occur at two rail stations in the former towns of Ellenton and Dunbarton. From these stations, an SRS engine moves the railcars to the appropriate facility. The Ellenton station, which is on the main Augusta-Yemassee line, receives coal for the large powerhouse located in D-Area. The

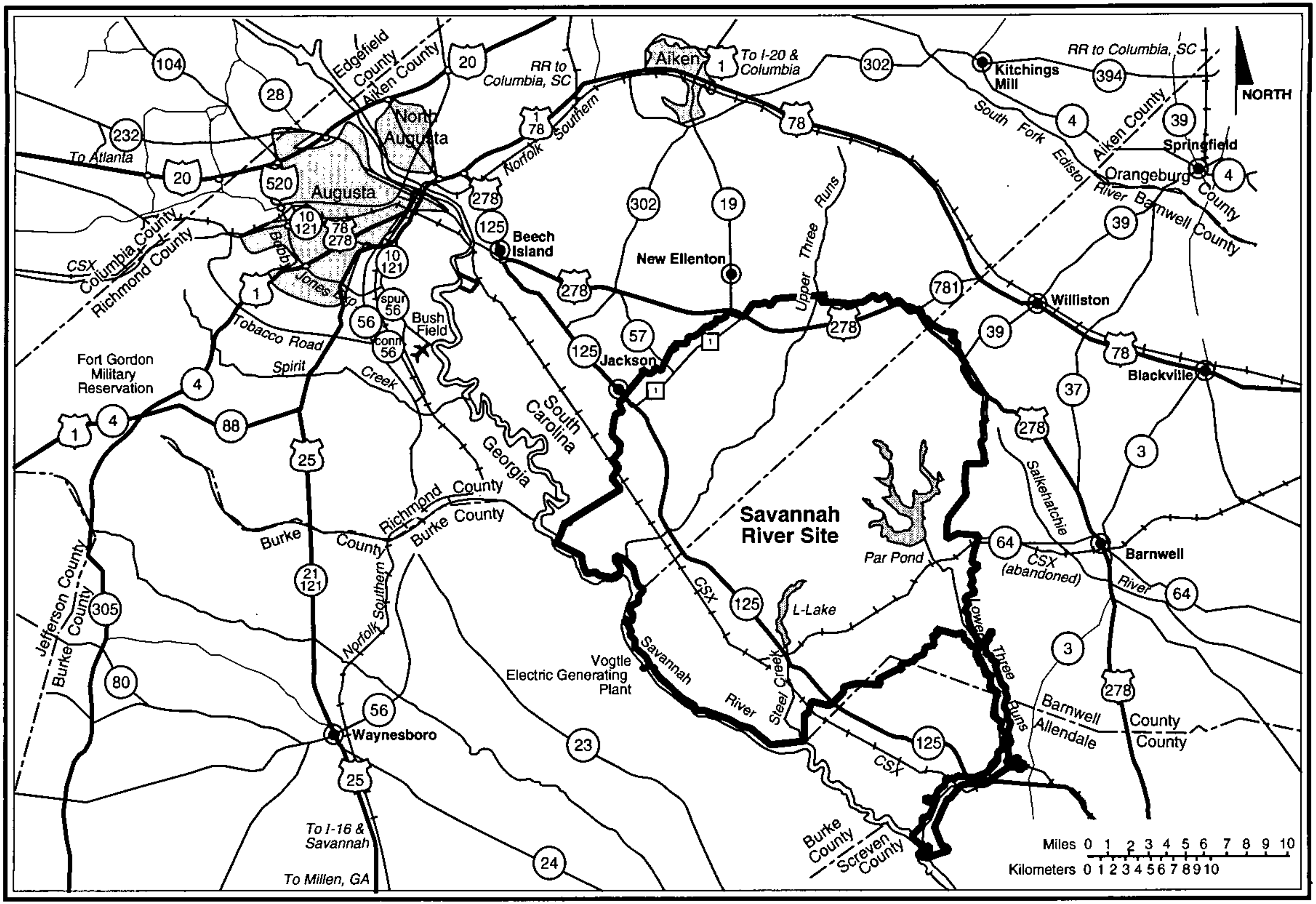

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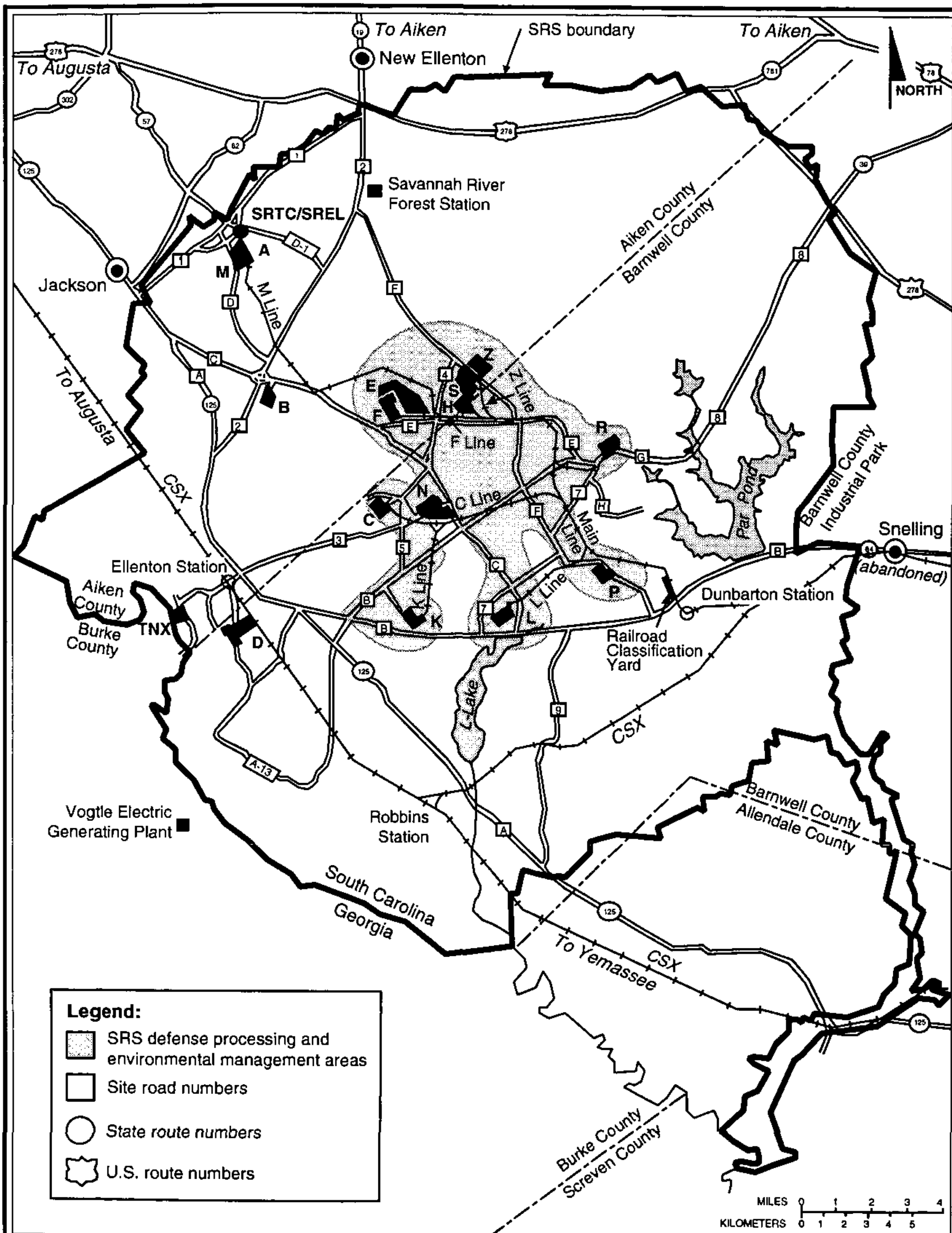
Figure 3-14. SRS regional transportation infrastructure.

TE



TE | **Figure 3-15.** Location of principal SRS facilities, roads, and railroads.

Table 3-14. Traffic counts on major SRS roads.[a]

TE

Measurement point	Date	Direction	Daily total	Peak[b]	Peak time[c]	Average speed (mph)[d]
Road 2 between Roads C and D	9-29-93	East	3,224	794	1530	52
	9-29-93	West	3,225	897	0630	47
Road 4 between Roads E and C	12-9-92	East	1,624	352	1530	NA[e]
	12-9-92	West	1,553	306	0615	NA
Road 8 at Pond C	2-23-92	East	634	274	1530	58
	2-23-92	West	662	331	0615	56
Road C between landfill and Road 2	12-16-92	North	6,931	2,435	1530	53
	12-16-92	South	6,873	2,701	0630	58
Road C north of Road 7	1-20-93	North	742	288	0630	45
	1-20-93	South	763	223	1530	47
Road D at old gunsite	9-29-93	North	1,779	218	1500	43
	9-29-93	South	1,813	220	0845	52
Road E at E-Area	8-25-93	North	3,099	669	1530	35
	8-25-93	South	3,054	804	0630	38
Road F at Upper Three Runs	2-2-93	North	3,239	1,438	1530	53
	2-2-93	South	3,192	1,483	0630	51
Road F north of Road 4	8-25-93	North	3,097	1,239	1530	NA
	8-25-93	South	255	75	0645	39
Road F south of Road 4	8-25-93	North	126	41	0645	29
	8-25-93	South	290	68	0645	35

a. Source: Swygert (1994b).
b. Number of vehicles in peak hour.
c. Start of peak hour.
d. mph = miles per hour; to convert to kilometers per hour, multiply by 1.6093.
e. NA = not available.

Table 3-15. Traffic counts on major SRS arteries during peak hours (vehicles per hour).

TE

Road	Design capacity	1994 baseline traffic[a]	Percent of capacity
		Offsite[a]	
SC 19	3,000[b]	2,800[b]	93
SC 125	3,200[b]	2,700[b]	84
SC 57	2,100[b]	700[c]	33
		Onsite[a,d]	
Road E at E-Area	2,300[c]	741[e]	32

a. Baseline traffic for 1994 was estimated from actual traffic counts measured in 1989 (offsite) and 1992/1993 (onsite) by adjusting total vehicles by the percent of change in SRS employment between the measured years and 1994.
b. Adapted from Smith (1989).
c. Adapted from TRB (1985).
d. Source: Swygert (1994b).
e. Morning traffic traveling to E-Area.

Dunbarton station receives the other rail shipments and coal for the smaller powerhouses located throughout SRS (McLain 1994).

Under normal conditions, about 13 trains per day use the CSX tracks through SRS (Burns 1993). Movement of coal and casks containing radioactive material constitutes the bulk of rail traffic (DOE 1991).

3.11.3 NOISE

Previous studies have assessed noise impacts of existing SRS operational activities (NUS 1991b; DOE
TE | 1990, 1991). These studies concluded that, because of the remote locations of the SRS operational areas, there are no known conditions associated with existing sources of noise at SRS that adversely affect individuals at offsite locations.

3.12 Occupational and Public Radiological Health and Safety

3.12.1 PUBLIC RADIOLOGICAL HEALTH

A release of radioactivity to the environment from a nuclear facility is an important issue for both SRS workers and the public. However, the environment contains many sources of radiation, and it is important to understand all the sources of ionizing radiation to which people are routinely exposed.

3.12.1.1 Sources of Environmental Radiation

Environmental radiation consists of natural background radiation from cosmic, terrestrial, and internal body sources; radiation from medical diagnostic and therapeutic practices; radiation from weapons tests fallout; radiation from consumer and industrial products; and radiation from nuclear facilities. All radiation doses mentioned in this EIS are "effective dose equivalents" (i.e., organ doses are weighted for biological effect to yield equivalent whole-body doses) unless specifically identified otherwise (e.g., "absorbed dose," "thyroid dose," "bone dose").

Releases of radioactivity to the environment from SRS account for less than 0.1 percent of the total
TE | annual average environmental radiation dose to individuals within 80 kilometers (50 miles) of SRS (Arnett, Karapatakis, and Mamatey 1994). Standard population dose analyses for air releases are based on an 80-kilometer (50-mile) radius because expected dose levels beyond that distance are very small.

Natural background radiation contributes about 82 percent of the annual dose of 357 millirem received by an average member of the population within 80 kilometers (50 miles) of SRS (Figure 3-16). Based on national averages, medical exposure accounts for an additional 15 percent of the annual dose, and the combined doses from weapons tests fallout, consumer and industrial products, and air travel account for about 3 percent of the total dose (NCRP 1987a). TE

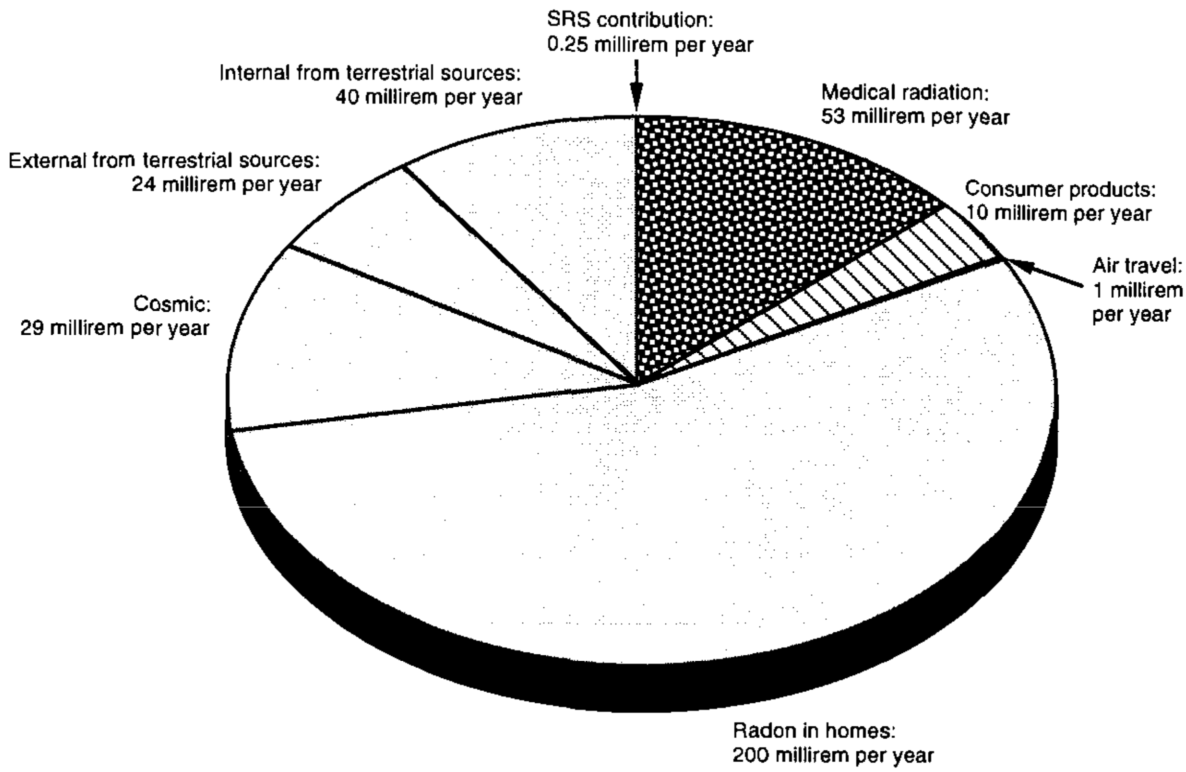
External radiation from natural sources comes from cosmic rays and emissions from natural radioactive materials in the ground. The radiation dose from external radiation varies with location and altitude.

Internal radiation from natural terrestrial sources consists primarily of potassium-40, carbon-14, rubidium-87, and daughter products of radium-226 that are consumed in food grown with fertilizers containing these radionuclides. The estimated average internal radiation exposure in the United States from natural radioactivity (primarily indoor radon daughter products) is 240 millirem per year (NCRP 1987b).

Medical radiation is the largest source of man-made radiation to which the population of the United States is exposed. The average dose to an individual from medical and dental x-rays, prorated over the entire population, is 39 millirem per year (NCRP 1987a). In addition, radiopharmaceuticals administered to patients for diagnostic and therapeutic purposes account for an average annual dose of 14 millirem when prorated over the population. Thus, the average medical radiation dose in the U.S. population is about 53 millirem per year. Prorating the dose over the population determines an average dose that, when multiplied by the population size, produces an estimate of population exposure. It does not mean that every member of the population receives a radiation exposure from these sources.

In 1980, the estimated average annual dose from fallout from nuclear weapons tests was 4.6 millirem (0.9 millirem from external gamma radiation and 3.7 millirem from ingested radioactivity). Because atmospheric nuclear weapons tests have not been conducted since 1980, the average annual dose from fallout is now less than 1 millirem. This decline is due principally to radioactive decay.

A variety of consumer and industrial products yield ionizing radiation or contain radioactive materials and, therefore, result in radiation exposure to the general population. Some of these sources are televisions, luminous dial watches, airport x-ray inspection systems, smoke detectors, tobacco products, fossil fuels, and building materials. The estimated average annual dose for the U.S. population from these sources is 10 millirem per year (NCRP 1987a). About one-third of this dose is from external exposure to naturally occurring radionuclides in building materials.



Notes:
1. Values are effective dose equivalent from NCRP (1987a) unless otherwise noted.
2. External terrestrial: NCRP (1987a) reports 26 millirem per year for sea level. Multiplying that value by 1.1 to correct for the altitude of 300 meters above sea level gives 29 millirem per year.
3. Internal terrestrial: NCRP (1987b) reports an absorbed dose rate for Augusta, Georgia, of 4 microrad/hr, which is 35 millirad per year. NCRP (1987b) uses a factor of 0.7 to convert absorbed dose in air to effective dose equivalent, so 35 x 0.7 = 24 millirem per year.
4. Value for SRS contribution is from Arnett, Karapatakis, and Mamatey (1994).

Legend:

☐ Natural Background

PK56-3

TE | **Figure 3-16.** Major sources of radiation exposure in the vicinity of SRS.

People who travel by aircraft receive additional exposure from cosmic radiation because at high altitudes the atmosphere provides less shielding from this source of radiation. The average annual airline passenger dose, when prorated over the entire U.S. population, amounts to 1 millirem (NCRP 1987b).

3.12.1.2 Radiation Levels in the Vicinity of SRS

Figure 3-16 summarizes the major sources of exposure for the population within 80 kilometers (50 miles) of SRS and for populations in Beaufort and Jasper Counties, South Carolina, and in Chatham County, Georgia, that drink water from the Savannah River. Many factors, such as natural background dose and medical dose, are independent of SRS. TE

Atmospheric testing of nuclear weapons deposited approximately 25,600,000 curies of cesium-137 on the earth's surface (United Nations 1977). About 104 millicuries of cesium-137 per square kilometer were deposited in the latitude band where South Carolina is located (30°N to 40°N). The total resulting deposition was 2,850 curies on the 27,400 square kilometers (10,580 square miles) of the Savannah River watershed and 80 curies on SRS. The cesium-137 attached to soil particles and has slowly been transported from the watershed. Results from routine health protection monitoring programs indicate that since 1963 about 1 percent of the 2,850 curies of cesium-137 deposited on the total Savannah River watershed has been transported down the Savannah River (du Pont 1983).

Onsite monitoring shows that an average of 50 millicuries of cesium-137 per square kilometer (1976 to 1982 average) are in the upper 5 centimeters (2 inches) of the soil column. This is one-half the original amount. Some of the cesium has moved down in the soil column, and some has been transported in surface water to the Savannah River.

Other nuclear facilities within 80 kilometers (50 miles) of SRS include a low-level waste burial facility operated by Chem-Nuclear Systems, Inc., near the eastern SRS boundary, and Georgia Power Company's Vogtle Electric Generating Plant, located directly across the Savannah River from SRS. In addition, Carolina Metals, Inc., which is northwest of Boiling Springs in Barnwell County, South Carolina, processes depleted uranium. The Chem-Nuclear facility, which began operating in 1971, releases essentially no radioactivity to the environment (Chem-Nuclear Systems, Inc. 1980), and the population dose from normal operations is very small. The 80-kilometer (50-mile) radius population receives an immeasurably small radiation dose from transportation of low-level radioactive waste to the burial site. Plant Vogtle began commercial operation in 1987, and its releases to date have been far below DOE guidance levels and Nuclear Regulatory Commission regulatory requirements (Davis, Martin, and Todd 1989). TE

In 1993, releases of radioactive material to the environment from SRS operations resulted in a site perimeter maximum dose from all pathways from atmospheric releases of 0.11 millirem per year (in the north-northwest sector), and a maximum dose from releases into water of 0.14 millirem per year, for a maximum total annual dose at the SRS perimeter of 0.25 millirem (Arnett, Karapatakis, and Mamatey 1994). The maximum dose to downstream consumers of Savannah River water was to users of the Port Wentworth public water supply, and was 0.05 millirem per year (Arnett, Karapatakis, and Mamatey 1994).

TE In 1990, the population within 80 kilometers (50 miles) of SRS was 620,100 (Arnett, Karapatakis, and Mamatey 1993 and Table 3-11). The collective effective dose equivalent to the 80-kilometer (50-mile) population in 1993 was 7.6 person-rem from atmospheric releases (Arnett, Karapatakis, and Mamatey 1994). The 1990 population of 65,000 people using water from Port Wentworth (Savannah), Georgia, and from Beaufort and Jasper Counties, South Carolina, received a collective dose equivalent of 1.5 person-rem (Arnett, Karapatakis, and Mamatey 1994).

Controlled deer and hog hunts are conducted annually at SRS to control their populations. Field measurements performed on each animal prior to release to the hunter determine the levels of cesium-137 present in the animal. Field measurements are subsequently verified by laboratory analysis, and dose calculations are performed to estimate dose to the maximally exposed individual among the hunters. In 1993, the maximally exposed individual hunter killed four deer and three hogs. The dose to this hunter was estimated based on the cesium-137 measurements of the deer and hog muscle taken from these animals and the conservative assumption that the hunter consumed all of the edible portions of these animals (337 pounds of meat). The dose to this maximally exposed individual was estimated to be 57 millirem (Arnett, Karapatakis, and Mamatey 1994), which represents 57 percent of the DOE annual limit of 100 millirem (DOE Order 5400.5).

In 1993, the maximally exposed individual fisherman was assumed to eat 19 kilograms (42 pounds) of fish per year. The dose to the fisherman was based on consumption of fish taken only from the mouth of
TE
L004-04 Steel Creek on SRS. The dose to this individual was estimated to be 1.30 millirem (WSRC 1994a) or 1.3 percent of the DOE annual limit (DOE 1993a).

The hunter population dose was estimated based on the fact that 1,553 deer and 147 hogs were killed in 1993. These deer and hogs contained average cesium-137 concentrations of 4.69 picocuries per gram and 5.64 picocuries per gram, respectively. The regional average of cesium-137 concentration in deer is 0.7 picocuries per gram (Fledderman 1994). The population dose due to the consumption of SRS animals is estimated to be 8.3 person-rem. The portion of this dose attributable to the presence of cesium-137 above the regional average concentration is 7.1 person-rem (Rollins 1994).

Gamma radiation levels, including natural background terrestrial, and cosmic radiation measured at 179 locations around the SRS perimeter during 1993, yielded a maximum dose rate of 102 millirem per year (Arnett, Karapatakis, and Mamatey 1994). This level is typical of normal background gamma levels measured in the general area (84 millirem per year measured by the EPA at Augusta, Georgia, in 1992). The maximum gamma radiation level measured onsite (N-Area) was 460 millirem per year (Arnett, Karapatakis, and Mamatey 1994). TE TC L004-05

Detailed summaries of releases to the air and water from SRS are provided in a series of annual environmental reports (e.g., Arnett, Karapatakis, and Mamatey 1994 for the year 1993). Each of these environmental reports also summarizes radiological and nonradiological monitoring and the results of the analyses of environmental samples. These reports also summarize the results of the extensive groundwater monitoring at SRS, which uses more than 1,600 wells to detect and monitor both radioactive and nonradioactive contaminants in the groundwater and drinking water in and around process operations, burial grounds, and seepage basins.

3.12.1.3 Radiation Levels in E-, F-, H-, N-, S-, and Z-Areas TE

Table 3-16 presents gamma radiation levels measured in E-, F-, H-, N-, S-, and Z-Areas in 1993. These values can be compared to the average dose rate of 35 millirem per year measured at the SRS perimeter. This difference is attributable to differences in geologic composition, as well as facility operations. TE

Table 3-16. External radiation levels (milliRoentgen per year) at SRS facilities.[a,b] TE

Location	Average	Maximum
E-Area	158	345
F-Area	91	126
H-Area	103	146
N-Area	178	460
S-Area	101	117
Z-Area	72	80

L004-05

a. Source: Arnett (1994).
b. One milliRoentgen is approximately 1 millirem.

Analyses of soil samples from uncultivated areas measure the amount of particulate radioactivity deposited from the atmosphere. Table 3-17 lists maximum measurements of radionuclides in the soil for 1993 at E-, F-, H-, S-, and Z-Areas, the SRS perimeter, and at background [160-kilometer (100-mile)] TE monitoring locations. Measured elevated concentrations of strontium-90 and plutonium-239 around F- and H-Areas reflect releases from these areas.

TE | **Table 3-17.** Maximum measurements of radionuclides in soil for 1993 [picocuries per gram; 0 to 8 centimeters (0 to 3 inches) depth].[a]

Location	Strontium-90	Cesium-137	Plutonium-238	Plutonium-239
F-Area	0.133	1.26	0.0784	0.360
H-Area	0.0863	1.57	0.0262	0.178
S-Area	0.0331	0.353	0.0355	0.0540
Z-Area	0.0825	0.820	0.00663	0.0504
E-Area	0.0264	0.271	(b)	(b)
Site perimeter	0.0095	0.652	0.00187	0.0201
Background [160-kilometer (100-mile) radius]	0.0772	0.352	0.00105	0.00835

a. Source: Arnett (1994).
b. No data available.

3.12.2 WORKER RADIATION EXPOSURE

The major goals of the SRS Health Protection Program are to keep the exposure of workers to radiation and radioactive material within safe limits and, within those limits, as low as reasonably achievable. An effective radiation protection program must minimize doses to individual workers and the collective dose to all workers in a given work group.

3.12.2.1 Sources of Radiation Exposure to Workers at SRS

Worker dose comes from exposure to external radiation or from internal exposure when radioactive material enters the body. In most SRS facilities, the predominant source of worker exposure is from external radiation. In the SRS facilities that process tritium, the predominant source of worker exposure is the internal dose from tritium that has been inhaled or absorbed into internal body fluids. On rare occasions, other radionuclides can contribute to internal dose if they have accidentally been inhaled or ingested.

External exposure comes mostly from gamma radiation emitted from radioactive material in storage containers or process systems (tanks and pipes). Neutron radiation, which is emitted by a few special radionuclides, also contributes to worker external radiation in a few facilities. Beta radiation, a form of external radiation, has a lesser impact than gamma and neutron radiation because it has lower penetrating energy and, therefore, produces a dose only to the skin, rather than to critical organs within the body. Alpha radiation from external sources does not have an impact because it has no penetrating power.

Internal exposure occurs when radioactive material is inhaled, ingested, or absorbed through the skin. Once the radioactive material is inside the body, low-energy beta and non-penetrating alpha radiation emitted by the radioactive material in close proximity to organ tissue can produce dose to that tissue. If this same radioactive material were outside the body, the low penetrating ability of the radiation emitted would prevent it from reaching the critical organs. For purposes of determining health hazards, organ dose can be converted to effective dose equivalents. The mode of exposure (internal versus external) is irrelevant when comparing effective dose equivalents.

3.12.2.2 Radiation Protection Regulations and Guidelines

The current SRS radiological control program implements Presidential Guidance issued to all Federal agencies on January 20, 1987. This guidance was subsequently codified (10 CFR 835) as a federal regulation governing all DOE activities (58 FR 238). Policies and program requirements, formulated to ensure the protection of SRS workers and visitors, are documented in the *SRS Radiological Control Procedure Manual, WSRC 5Q* (WSRC 1993d). DOE performs regular assessments to ensure the continuing quality and effectiveness of the SRS radiological control program by monitoring radiological performance indicators and by making periodic independent internal appraisals as required by 10 CFR 835.102. External appraisals are also conducted periodically by DOE and the Defense Nuclear Facilities Safety Board to provide additional assurance of continuing program effectiveness. TE

Appropriate control procedures, engineered safety systems, and worker training programs are established and implemented to ensure compliance with applicable regulations before beginning radioactive operation of any facility at the SRS.

3.12.2.3 SRS Worker Dose

The purpose of the radiation protection program is to minimize dose from external and internal exposure; it must consider both individual and collective dose. It would be possible to reduce individual worker dose to very low levels by using numerous workers to perform extremely small portions of the work task. However, frequent changing of workers would be inefficient and would result in a higher total dose received by all the workers than if fewer workers were used and each worker were allowed to receive a slightly higher dose. TE

Worker doses at SRS have consistently been well below the DOE worker exposure limits. Administrative exposure guidelines are set at a fraction of the exposure limits to help ensure doses are as low as reasonably achievable. For example, the current DOE worker exposure limit is 5 rem per year, TE and the SRS administrative exposure guideline was 1.5 rem per year in 1993. Table 3-18 shows the maximum and average individual doses and the SRS collective doses for 1988 through 1993.

TE **Table 3-18.** SRS annual individual and collective radiation doses.[a]

Year	Individual dose (rem)		SRS collective dose
	Maximum	Average[b]	(person-rem)
1988	2.040	0.070	864
1989	1.645	0.056	754
1990	1.470	0.056	661
1991	1.025	0.038	392
1992	1.360	0.049	316
1993	0.878	0.051	263

a. Adapted from: du Pont (1989), WSRC (1991, 1992b, 1993d, 1994a), Petty (1993).
TE b. The average dose is calculated only for workers who received a measurable dose during the year.

3.12.2.4 Worker Risk

In the United States, 23.5 percent of human deaths each year are caused by some form of cancer (CDC 1993). Any population of 5,000 people is expected to contract approximately 1,200 fatal cancers from non-occupational causes during their lifetimes, depending on the age and sex distribution of the population. Workers who are exposed to radiation have an additional risk of 0.0004 latent fatal cancers TE per person-rem of radiation exposure (NCRP 1993).

In 1993, 5,157 SRS workers received a measurable dose of radiation amounting to 263 person-rem TE (Table 3-18). Therefore, this group may experience up to 0.1 (0.0004×263) additional cancer death due to its 1993 occupational radiation exposure. Continuing operation of SRS could result in up to 0.1 additional cancer death each year of operation, assuming future annual worker exposure continues at the 1993 level. In other words, for each 10 years of operation, there could be one additional death from cancer among the work force that receives a measurable dose at the 1993 level.

3.12.3 WORKER NONRADIOLOGICAL SAFETY AND HEALTH

Industrial safety, industrial hygiene, medical monitoring, and fire protection programs have been TE implemented at SRS to ensure the nonradiological health and safety of SRS workers.

TE The Occupational Safety and Health Administration requires the use of incidence rates to measure worker safety and health (DOL 1986). Incidence rates relate the number of injuries and illnesses and the resulting days lost from work to exposure (i.e., the number of hours worked) of workers to workplace conditions that could result in injuries or illnesses. Incidence rates, which are based on the exposure of 100 full-time workers working 200,000 hours (100 workers times 40 hours per week times 50 weeks per year), automatically adjust for differences in the hours of worker exposure. The Occupational Safety and Health Administration also specifies the types of injuries and illnesses that must be recorded for inclusion in incidence rate calculations. Incidence rates are generally calculated for total number of recordable cases, total number of lost workday cases, and total number of lost workdays.

Each year, the Bureau of Labor Statistics reports the results of its annual survey of job-related injuries and illnesses in private industry. The injury and illness data supplied by the Bureau of Labor Statistics provide the most comprehensive survey data available on work-related injuries and illnesses in private industry. The Bureau of Labor Statistics estimates that in 1991, private industry employers experienced 8.4 work-related injuries and illnesses per 100 full-time workers (DOE 1993b). TE

Incidence rates provide an objective measure of the performance of SRS safety programs. The data in Table 3-19 compare the performance of SRS operations to that of general industry, the manufacturing industry, and the chemical industry (DOE 1993a). SRS safety programs have produced incidence rates that are far below comparable rates for general industry, the manufacturing industry, and the chemical industry. The numbers reported in Table 3-19 for SRS include only management and operating contractor employers because these are the only ones that would be involved in waste management. TE TE

Table 3-19. Comparison of 1992 illness and injury incidence rates for SRS operations to 1991 illness and injury incidence rates for general industry, the manufacturing industry, and the chemical industry (number of illnesses and injuries per 100 full-time workers). TE

Incidence rate	SRS M&O[a] operations	General industry	Manufacturing industry	Chemical industry
Total recordable cases	0.5	8.4	12.7	6.4
Lost workday cases	0.1	3.9	5.6	3.1
Lost workdays	2.0	86.5	121.5	62.4

a. M&O = management and operating contractor. TE

Occupational exposure to noise is controlled through the management and operating contractor hearing conservation program outlined in Industrial Hygiene Manual 4Q, Procedure 501. This program implements the contractor requirements for identifying, evaluating, and controlling noise exposures to meet the requirements of 29 CFR 1910.95, Occupational Noise Exposure. TE TE

3.13 Waste and Materials

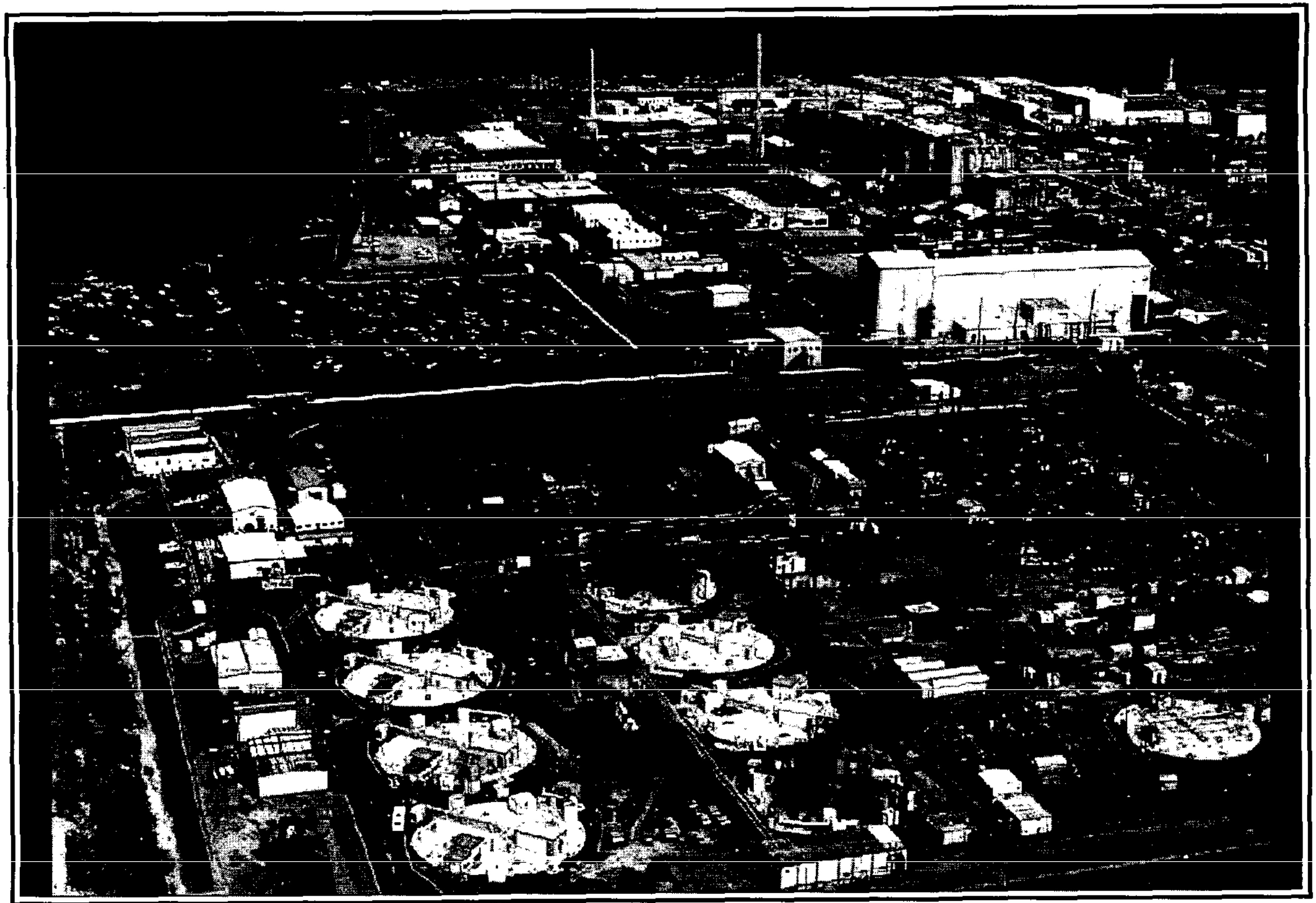
SRS activities in support of the national defense mission produced liquid high-level radioactive waste, low-level (low- and intermediate-activity) radioactive waste, hazardous waste, mixed waste (radioactive and hazardous combined), and transuranic waste. This section discusses current treatment, storage, and disposal of these wastes at SRS and management of wastes generated from facility operations discussed in Chapter 2.

Wastes at SRS were and continue to be generated both by facility operations and environmental restoration, with facility operations generating most of the waste. Facility operations include nuclear and non-nuclear research; material testing; laboratory analysis; high-level waste processing and nuclear fuel storage; manufacturing, repair, and maintenance; and general office work. Facility operations also include operating all waste management facilities for treatment, storage, and disposal of SRS-generated wastes.

DOE treats, stores, and disposes of wastes generated from all onsite operations in waste management facilities, most of which are located in E-, F-, H-, N-, S-, and Z-areas (Figure 3-2). Major facilities include the high-level waste tank farms; the Low-Level Radioactive Waste Disposal Facility; the F- and H-Area Effluent Treatment Facility; the Defense Waste Processing Facility (undergoing startup testing); and the Consolidated Incineration Facility (under construction).

The environmental restoration mission has increased in recent years and includes two programs: (1) the decontamination and decommissioning of surplus facilities (see Section 3.14) and (2) the remediation program, which identifies and, where necessary, arranges for cleanup of potential releases from inactive waste sites (see Section 3.15).

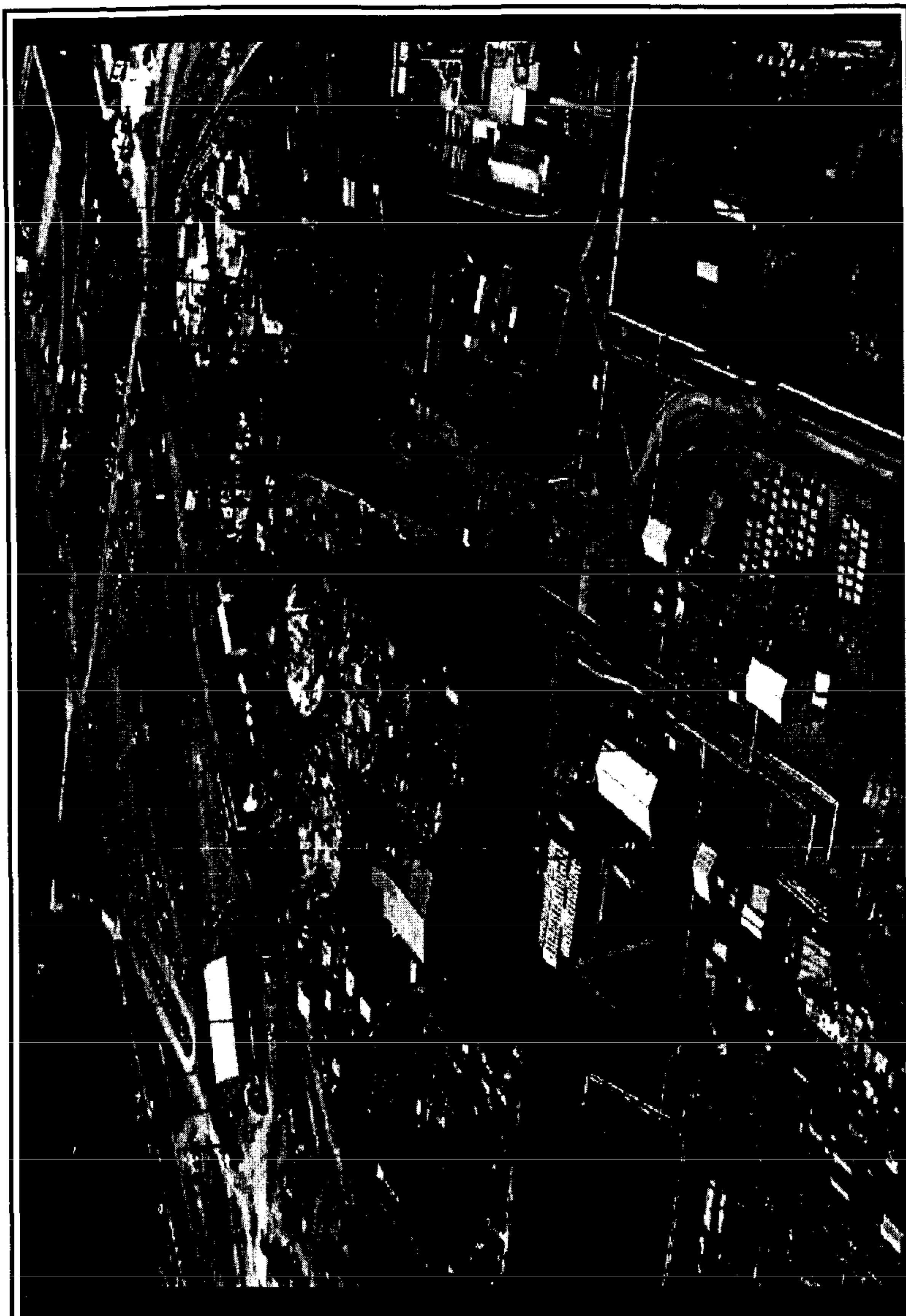
DOE stores liquid and solid wastes at SRS. Liquid high-level radioactive waste is stored in underground storage tanks in accordance with an SCDHEC wastewater treatment permit (Figures 3-17 and 3-18). The tanks are managed in accordance with federal laws, SCDHEC regulations, and DOE Orders. Figure 3-19 shows the management process for liquid high-level radioactive waste at SRS. Transuranic mixed waste is stored on interim-status storage pads in accordance with SCDHEC requirements and DOE Orders (Figure 3-20). Wastewater contaminated with low-level radioactivity is stored and treated at the F/H-Area Effluent Treatment Facility, a SCDHEC permitted facility (Figure 3-21). Hazardous and mixed wastes are stored in permitted or interim-status facilities, such as the hazardous waste storage facilities (buildings and pads) and in the mixed waste storage buildings (Figures 3-22 and 3-23, respectively). Figure 3-24 shows the process for handling other forms of waste at SRS.



PK56-27

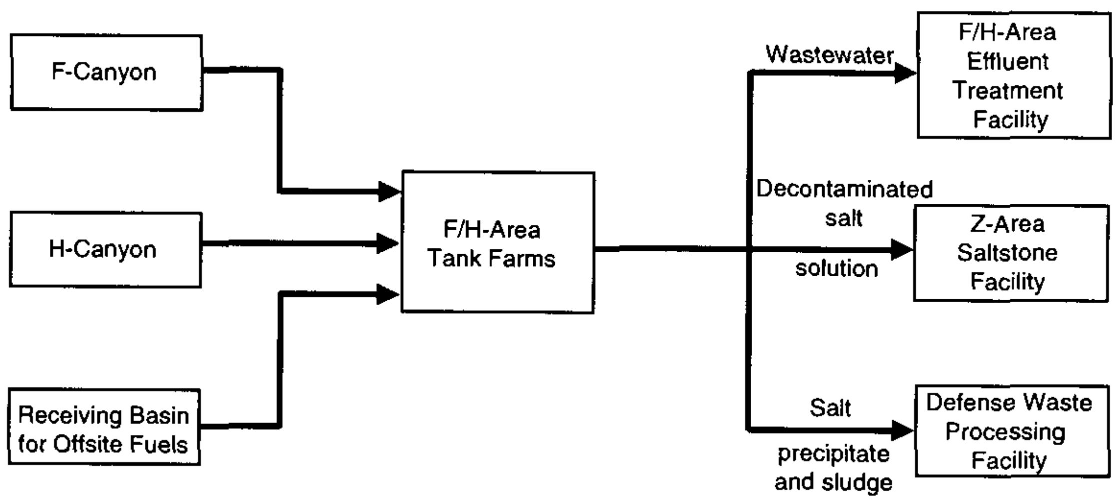
Figure 3-17. F-Area liquid high-level waste tank farm.

TE



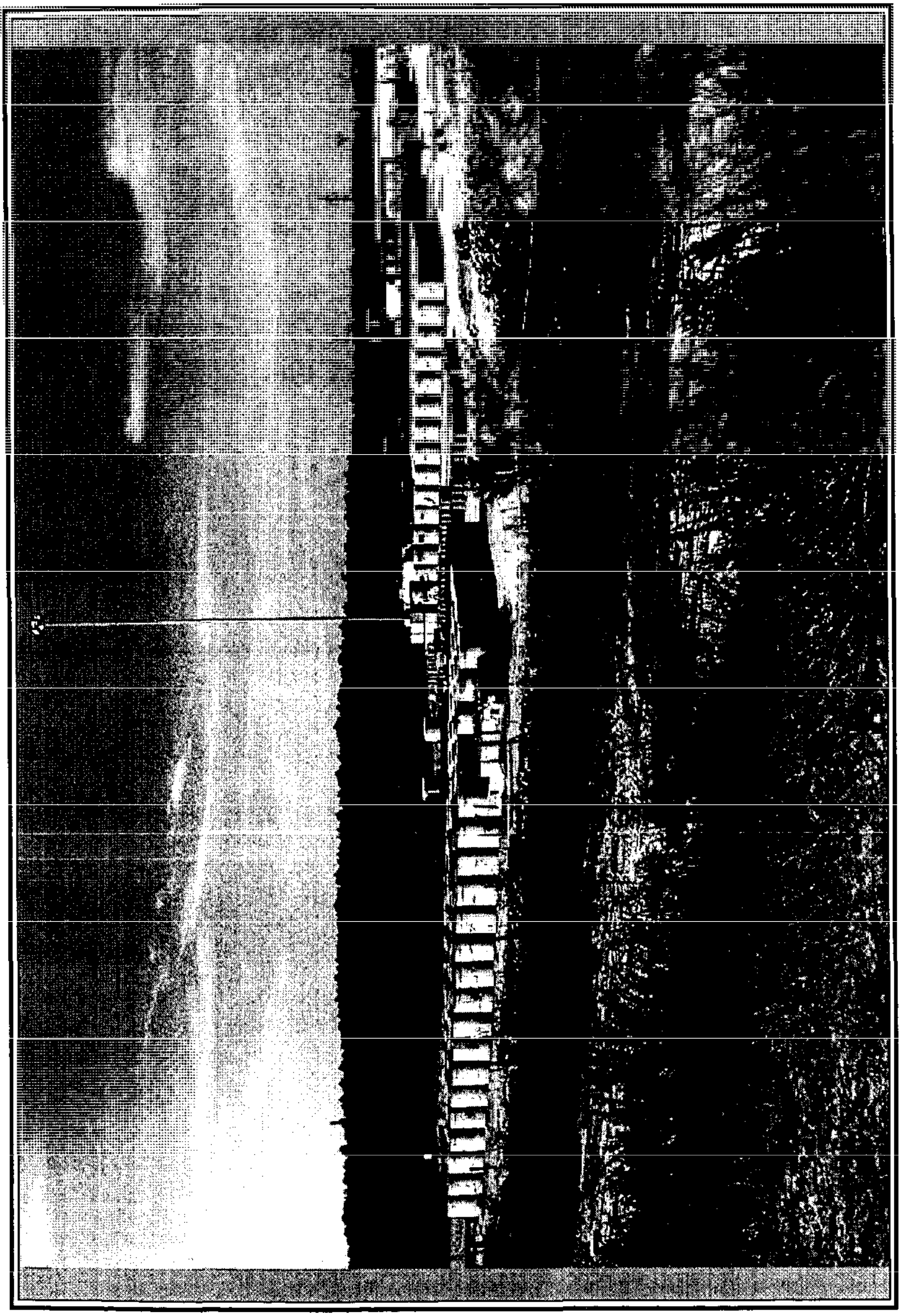
PK56-24

TE | **Figure 3-18.** H-Area liquid high-level waste tank farm.



PK56-3

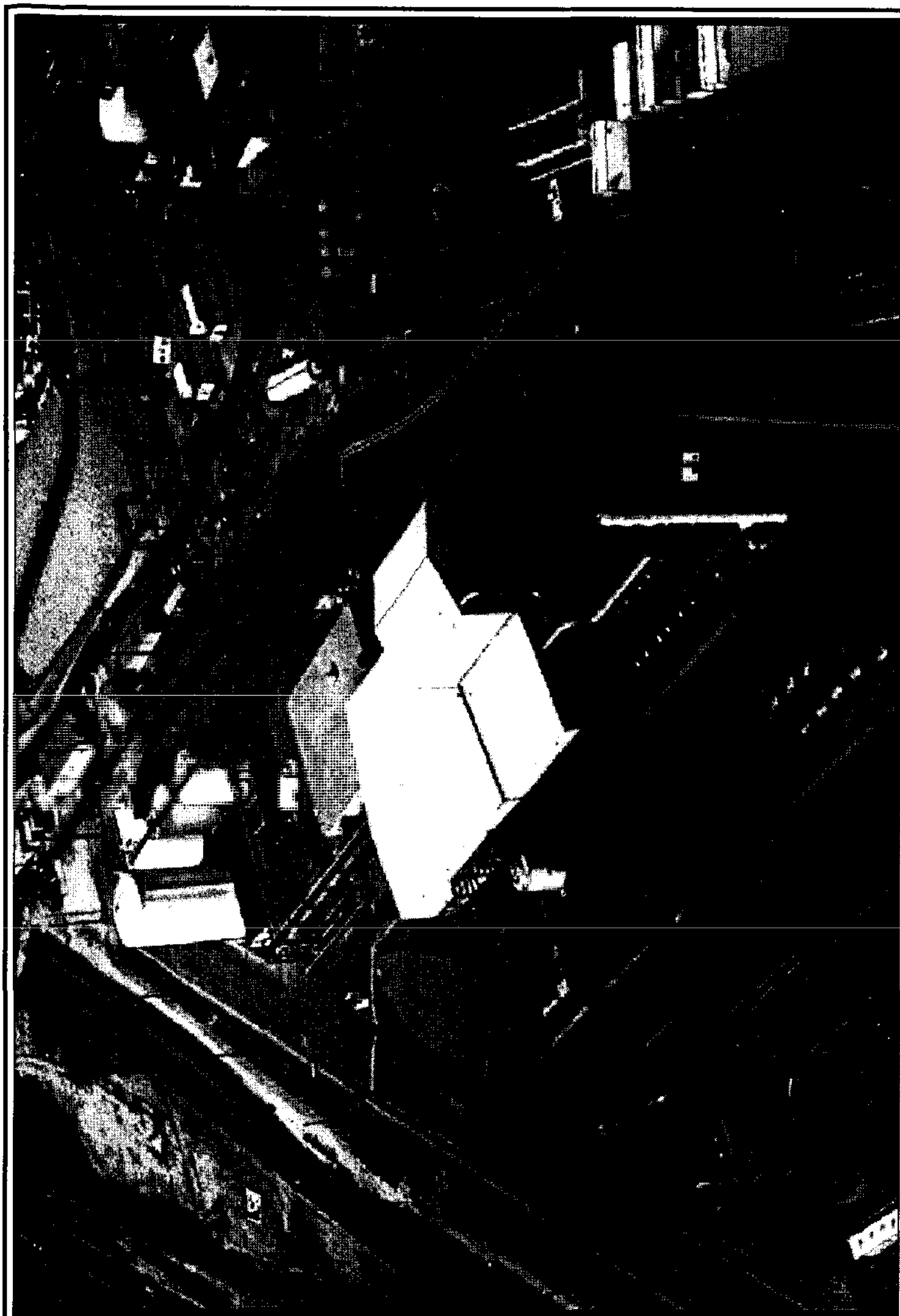
Figure 3-19. Management process for liquid high-level radioactive waste at SRS. TE



PK56-26

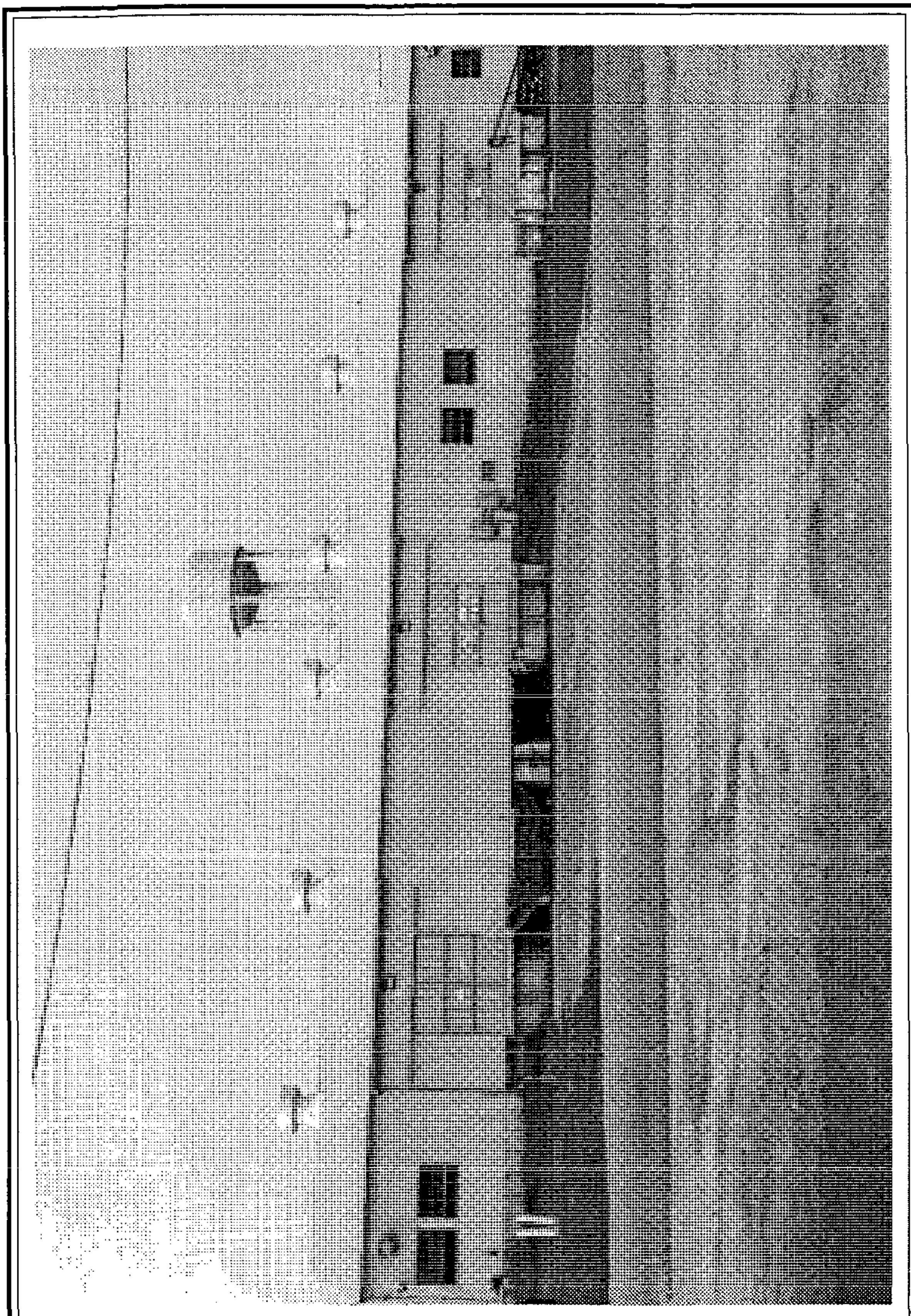
TE **Figure 3-20.** Transuranic mixed waste storage pads (E-Area).

TE



PK56-30

Figure 3-21. F/H-Area Effluent Treatment Facility (H-Area).



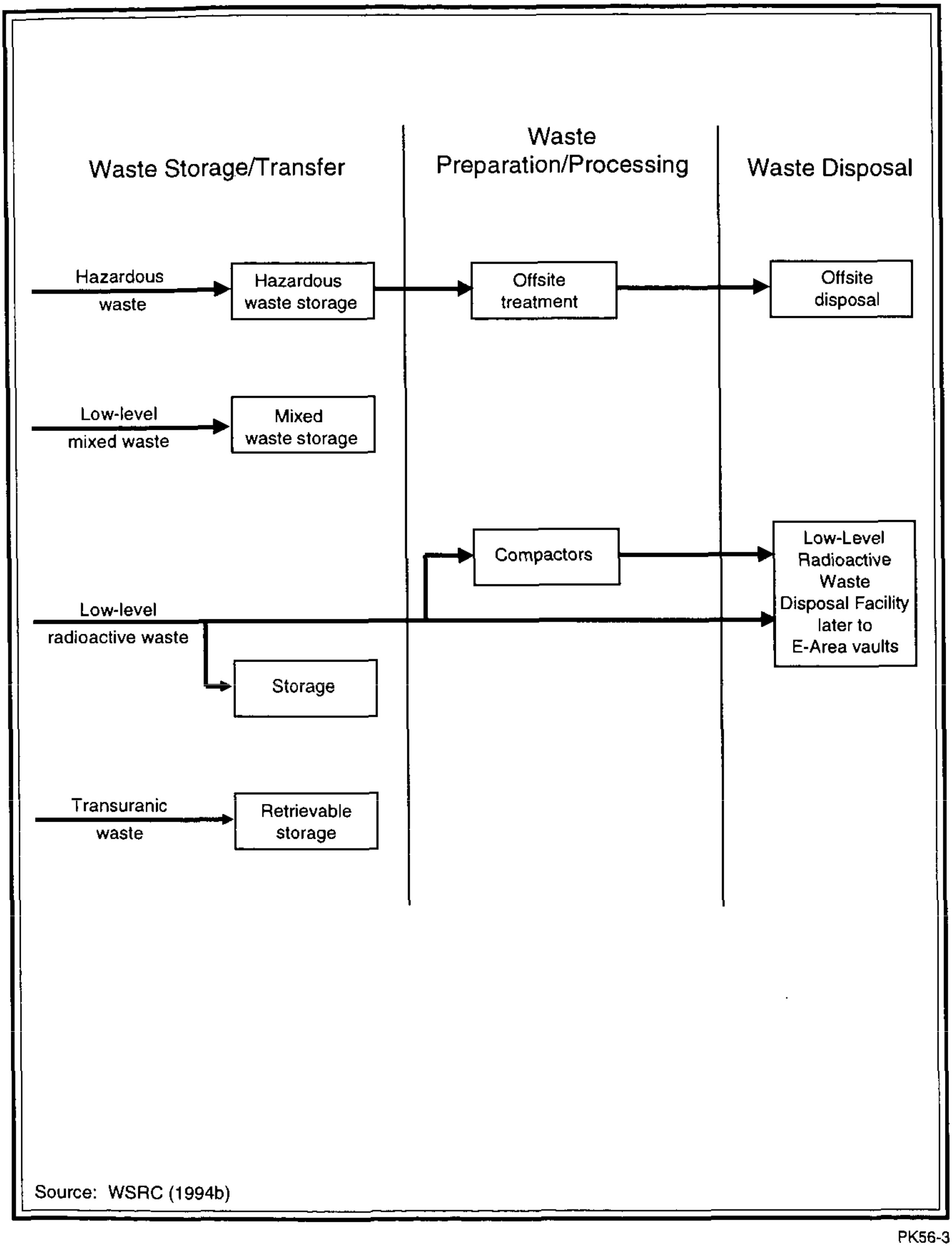
PK56-7

TE | **Figure 3-22.** Hazardous waste storage facility (B-Area).

TE

PK56-26

Figure 3-23. Mixed waste storage facility (E-Area).



TE | **Figure 3-24.** Flow diagram for waste management at SRS.

Through waste minimization and treatment programs, DOE continues to reduce the amount of waste generated, stored, and disposed of at SRS. DOE minimizes waste by reducing its volume, toxicity, or mobility before storage and disposal. Waste reduction includes intensive surveys, waste segregation, and the use of administrative and engineering controls.

3.13.1 LOW-LEVEL RADIOACTIVE WASTE

Low-level radioactive waste is defined as waste that contains radioactivity and is not classified as high-level waste, transuranic waste, spent nuclear fuel, or byproduct material.

SRS packages low-level waste for disposal onsite in the Low-Level Radioactive Waste Disposal Facility (Figure 3-25) according to its waste category and its estimated surface dose. DOE places low-activity wastes in carbon steel boxes and deposits them in low-activity waste vaults in E-Area. The vaults are concrete structures approximately 200 meters (643 feet) long by 44 meters (145 feet) wide by 8 meters (27 feet) deep.

DOE packages intermediate-activity waste according to its form and disposes of it in intermediate-level waste vaults in E-Area. Some intermediate-activity waste, such as contaminated pieces of equipment, is wrapped in canvas before disposal. TE

DOE will store long-lived wastes, such as resins, in the Long-Lived Waste Storage Building in E-Area until DOE develops treatment and disposal technologies for them (Figure 3-26).

The E-Area vaults began receiving low-level radioactive waste in September 1994. This facility includes low-activity, intermediate-level nontritium, and intermediate-level tritium vaults (Figures 3-27 and 3-28).

3.13.2 LIQUID HIGH-LEVEL RADIOACTIVE WASTE

Liquid high-level radioactive waste is highly radioactive material from the reprocessing of spent nuclear fuel that contains a combination of transuranic waste and fission products in concentrations requiring permanent isolation. It includes both the liquid waste produced by reprocessing and any solid waste derived from that liquid. The solid waste is also classified as liquid high-level radioactive waste.

PK56-25

TE | **Figure 3-25.** Low-Level Radioactive Waste Disposal Facility (E-Area).

TE

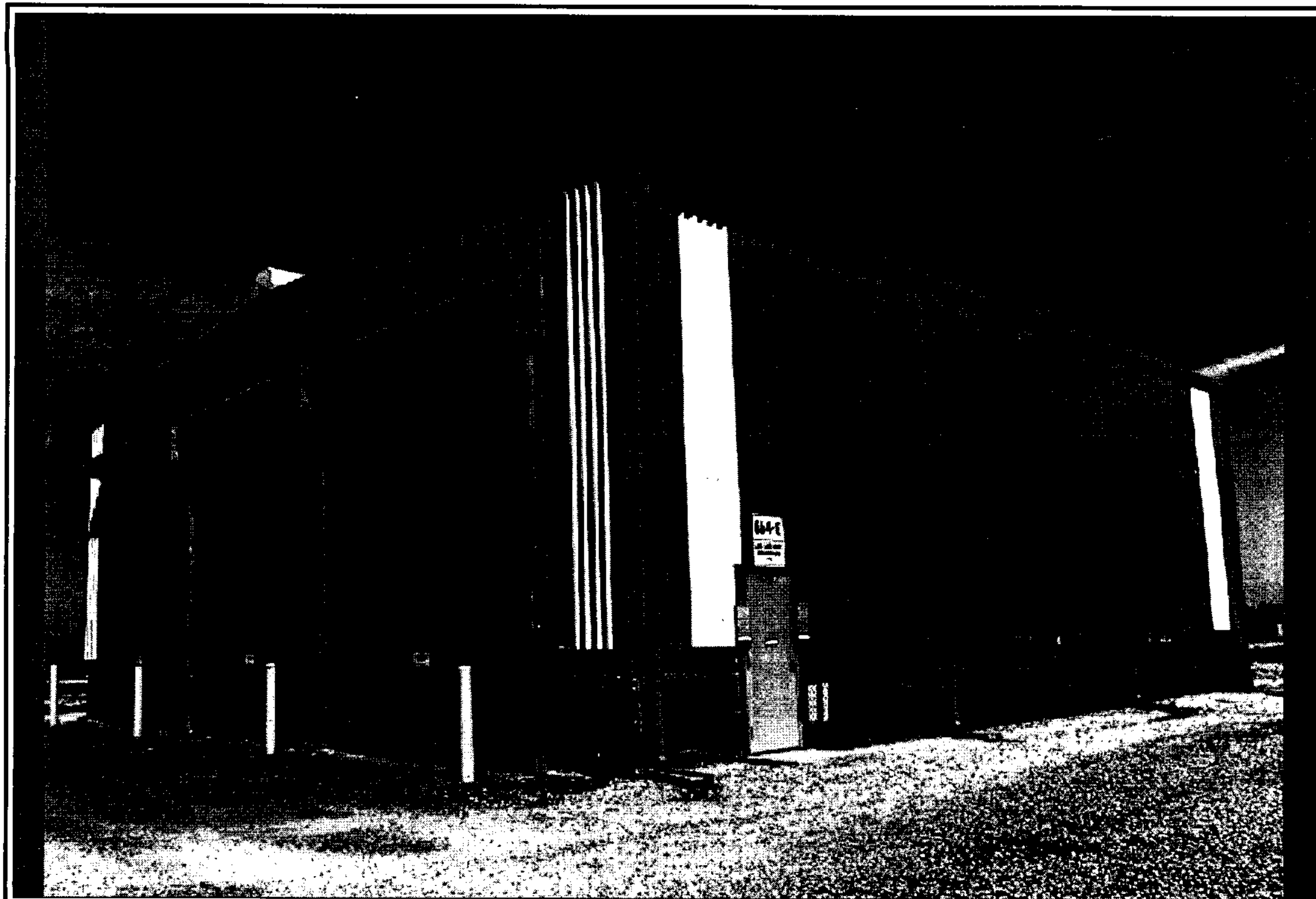

PK56-24

Figure 3-26. Long-lived waste storage facility (E-Area).

PK48-28

TE | **Figure 3-27.** Low-activity waste vault (E-Area).

TE

PK56-28

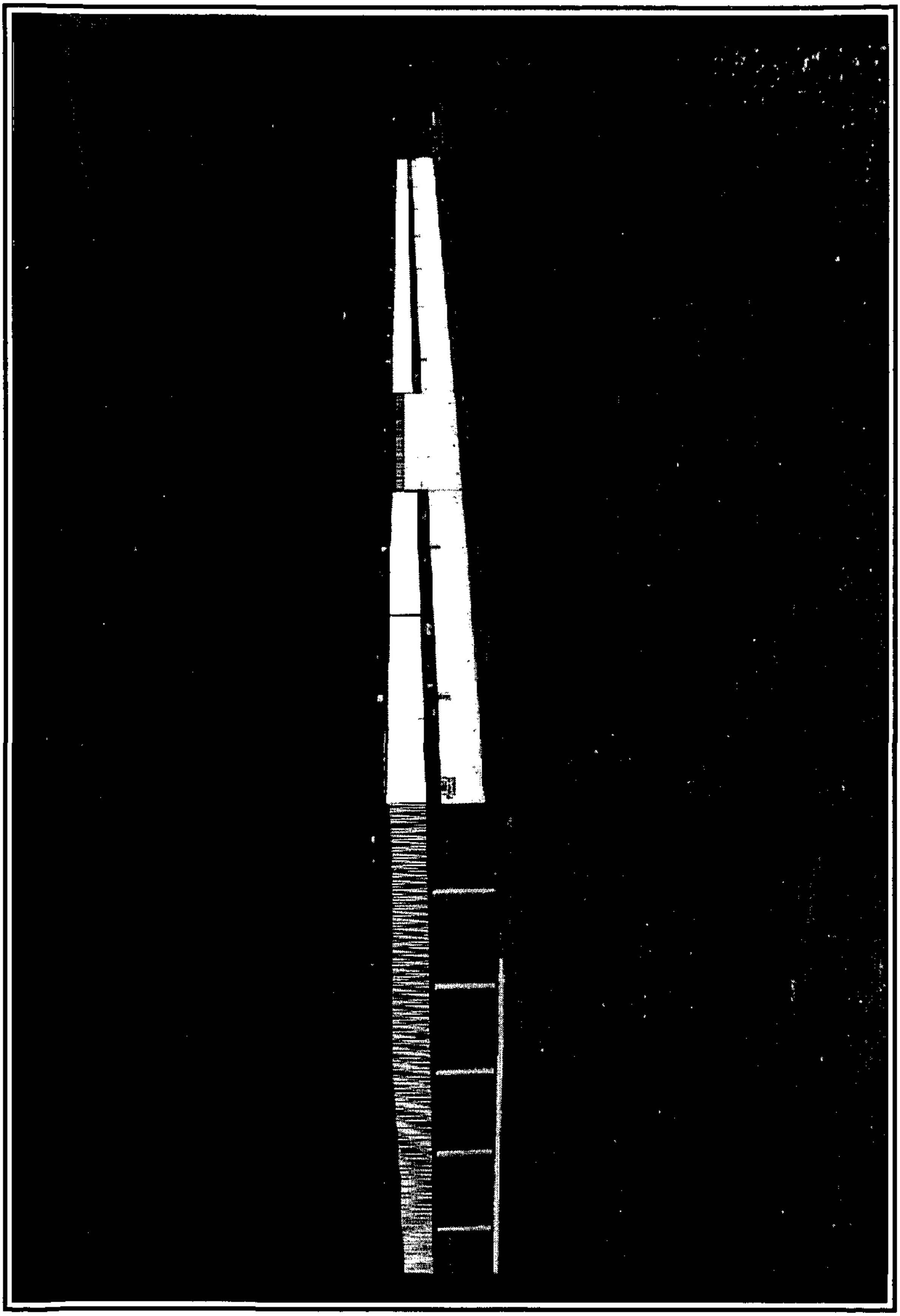


Figure 3-28. Intermediate-level nontritium and tritium waste vaults (E-Area).

SRS generates liquid high-level radioactive waste during the recovery of nuclear materials from spent fuel and targets in F- and H-Areas, and stores it in 50 underground tanks. Waste was previously stored in an additional tank; however, waste in that tank has been removed, and the tank is no longer in service. These tanks also contain other radioactive effluents (primarily low-level radioactive waste such as liquid process waste and purge water from storage basins for irradiated reactor fuel or fuel elements). The liquid high-level waste is neutralized and then stored in these tanks until short-lived radionuclides have decayed to inconsequential levels and insoluble components of the waste (about 5 to 10 percent) have settled out to form a sludge layer on the tank bottom. The liquid waste is then heated to evaporate the water, thereby reducing its volume and crystallizing the solids as salt. The *Final Supplemental Environmental Impact Statement Defense Waste Processing Facility* (DOE 1994b) provides details on this process. The evaporated liquid is transferred to the F/H-Area Effluent Treatment Facility, which is designed to decontaminate routine process effluents from F- and H-Areas. The salt fraction is further processed by in-tank precipitation to separate it into a highly radioactive portion for vitrification at the Defense Waste Processing Facility (when it becomes operational) and a low radioactive salt solution that is stabilized and disposed of at the Z-Area Saltstone Facility.

3.13.3 TRANSURANIC WASTE

Transuranic waste contains alpha-emitting radionuclides that have an atomic weight greater than uranium (92), half-lives greater than 20 years, and concentrations greater than 100 nanocuries per gram of waste. Before 1982, transuranic waste was defined as any waste containing transuranic radionuclides with concentrations in excess of 10 nanocuries per gram. Buried and stored wastes containing concentrations of transuranic radionuclides between 10 and 100 nanocuries per gram are now referred to as alpha-contaminated low-level waste (or "alpha waste" in this EIS). Alpha waste is managed like transuranic waste because its physical and chemical characteristics are similar and because similar procedures will be used to determine its final disposition. SRS stores waste containing 10 to 100 nanocuries of alpha activity per gram with transuranic wastes until disposal requirements can be determined. Currently, there are no treatment facilities or disposal capacities for transuranic waste; however, DOE plans to retrieve, repackage, certify, and ship all transuranic wastes offsite for final disposition.

Historically, DOE used three types of retrievable storage for transuranic waste at SRS. Transuranic waste generated before 1974 is buried in approximately 120 below-grade concrete culverts in the Low-Level Radioactive Waste Disposal Facility. Transuranic waste generated between 1974 and 1986 is stored on five concrete pads and one asphalt pad that have been covered with approximately 1.2 meters (4 feet) of native soil. DOE stores waste generated since 1986 on 13 concrete pads that are not covered with soil. Transuranic waste includes waste mixed with hazardous waste which is stored on Pads 1 through 17 that operate under interim status approved by SCDHEC (Figures 3-20 and 3-29). DOE currently uses Pads 18 and 19 to manage nonhazardous transuranic wastes only. DOE filed for approval under a RCRA Part A permit application (to describe the waste and facilities) for additional storage of transuranic mixed waste on Pads 20 through 22, which are currently empty. All of these pads are located in the Low-Level Radioactive Waste Disposal Facility. TE

3.13.4 HAZARDOUS WASTE

Hazardous waste is defined as any discarded materials that are either characteristically hazardous or are listed as hazardous under RCRA. Characteristically hazardous materials are corrosive, ignitable, reactive, or toxic. Wastes listed as hazardous include certain process wastes, solvents, and discarded commercial chemicals.

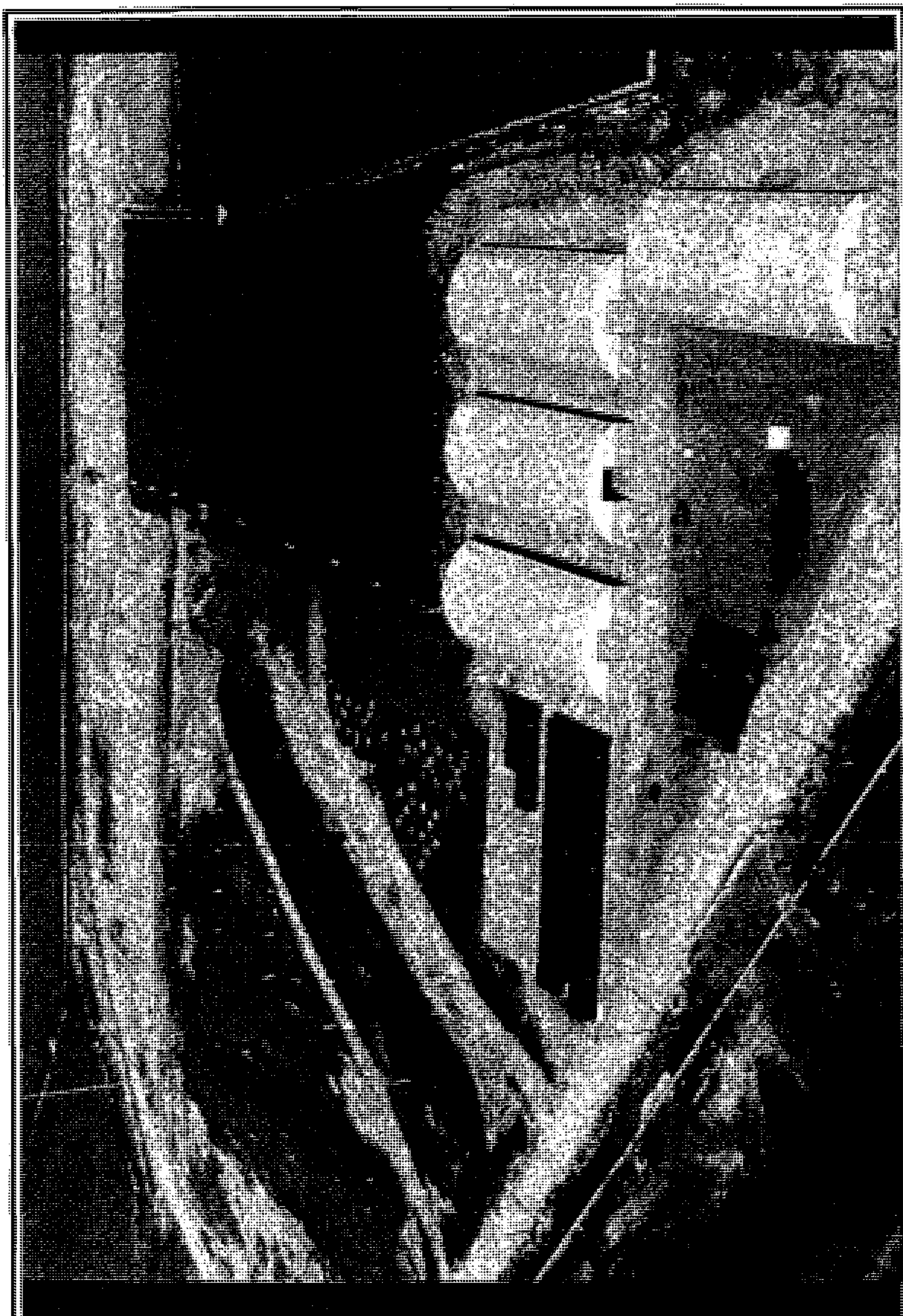
At SRS, hazardous waste is generated by routine facility operations and environmental restoration projects. Hazardous waste is temporarily stored at storage facilities (Figure 3-22) located in new buildings in B- and N-Areas, prior to shipment to permitted treatment, storage, and disposal facilities. TE

DOE began offsite shipments of hazardous wastes to treatment and disposal facilities in 1987. In 1990, DOE imposed a moratorium on shipments of hazardous waste that came from radiological materials areas or that had not been proven to be nonradioactive. SRS continues to send hazardous waste that is confirmed as not subject to the moratorium (e.g., recyclable solvents) offsite for recycling, treatment, or disposal.

3.13.5 MIXED WASTE

Mixed waste contains both hazardous waste (subject to RCRA), and source, special nuclear, or byproduct material (subject to the Atomic Energy Act of 1954). Mixed waste is classified according to its radioactive component. Low-level mixed waste is managed with its hazardous components as its primary consideration, while high-level and transuranic mixed wastes are managed with their radioactive component as the primary consideration.

The SRS mixed waste program consists primarily of safely storing mixed wastes until treatment and disposal facilities are available. Mixed waste storage facilities are located in E-Area (Figure 3-23), N-Area, M-Area, S-Area, and A-Area. These facilities include Burial Ground Solvent Tanks S23 through S30, M-Area Process Waste Interim Treatment/Storage Facility (Figure 3-30), Savannah River Technology Center Mixed Waste Storage Tanks, and the Organic Waste Storage Tank (Figure 3-31). TE



PK56-25

TE | **Figure 3-29.** Transuranic waste storage pads (E-Area).

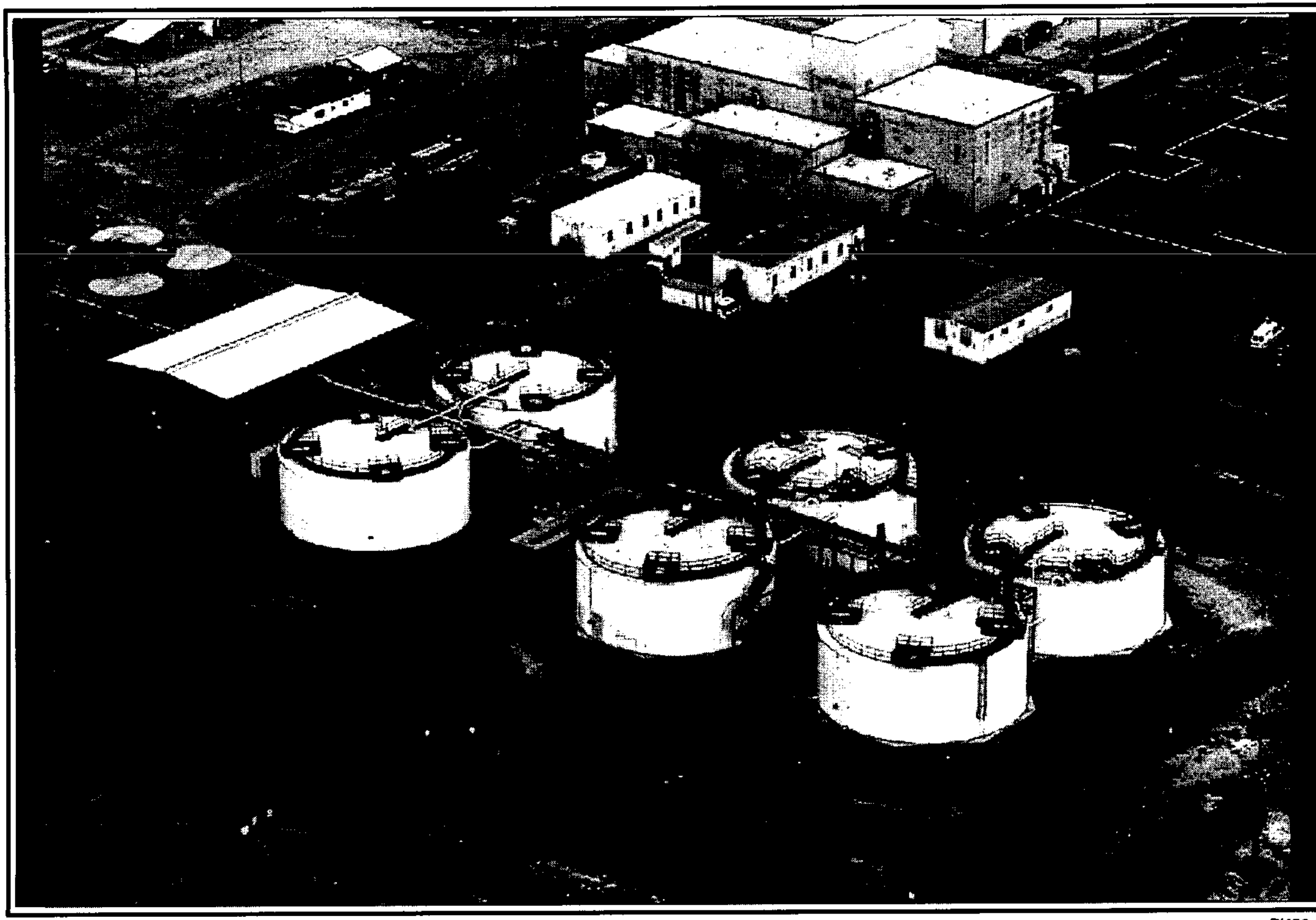


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Figure 3-30. M-Area Process Waste Interim Treatment/Storage Facility.

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PK56-29

TE | **Figure 3-31.** Organic Waste Storage Tank (S-Area).

DOE has also requested approval under RCRA for interim storage capacity at a pad in M-Area for treated M-Area sludge and stabilized ash and blowdown waste from the Consolidated Incineration Facility.

DOE is constructing the Consolidated Incineration Facility in H-Area to treat mixed, low-level, and hazardous waste. The Consolidated Incineration Facility is designed to annually process approximately 17,830 cubic meters (630,000 cubic feet) of solid waste (e.g., boxed mixed, low-level, or hazardous waste) at 50 percent utility and approximately 4,630 cubic meters (163,610 cubic feet) of liquid waste (e.g., liquid hazardous, mixed, and low-level waste) at 70 percent utility (Figure 3-32). TE TE

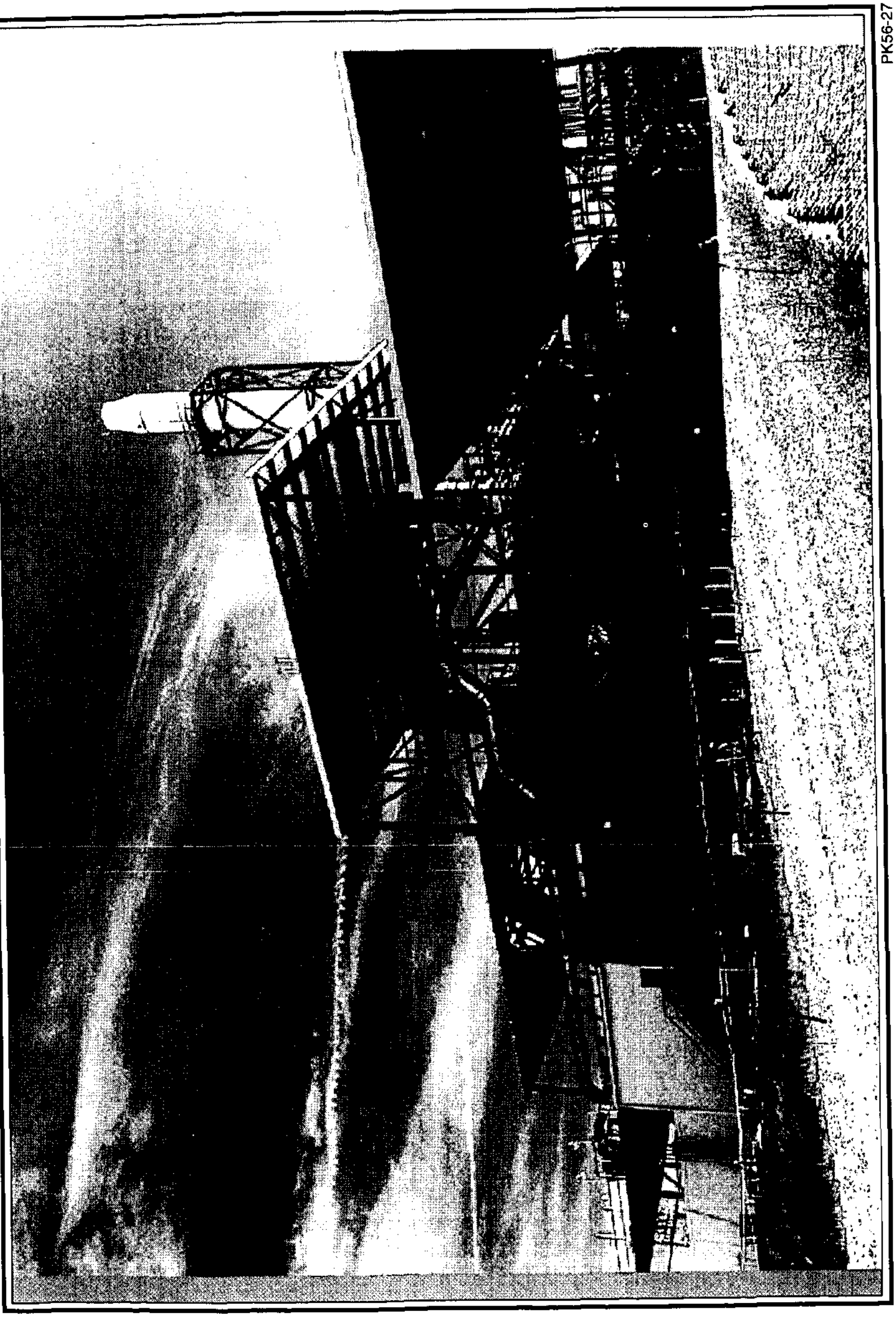
3.13.6 HAZARDOUS MATERIALS

The *SRS Tier Two Emergency and Hazardous Chemical Inventory Report* (WSRC 1994b) for 1993 lists more than 225 hazardous chemicals that were present at some time during the year in excess of their respective minimum threshold level (10,000 pounds for hazardous chemicals and 500 pounds or less for extremely hazardous substances). Ten of these hazardous chemicals are designated as extremely hazardous substances under the Emergency Planning and Community Right-to-Know Act of 1986. The actual number and quantity of hazardous chemicals present on SRS, as well as at individual facilities, change daily as inventories are used and replenished. The annual reports filed under the Superfund Amendments and Reauthorization Act for the SRS facilities include year-to-year inventories of these chemicals.

3.14 Decontamination and Decommissioning

3.14.1 DECONTAMINATION AND DECOMMISSIONING PROGRAMS

The objective of the decontamination and decommissioning programs at SRS is to plan and implement the surveillance, maintenance, and cleanup of contaminated areas that are no longer needed by DOE. The program's goal is to ensure that risks to human health and safety and to the environment posed by these areas are eliminated or reduced to safe levels in a timely and cost-effective manner. This goal will be accomplished by cleaning up and reusing facilities, returning sites to greenfield conditions (in which the facility, its foundation, and the contaminated soil would be removed), or entombing facilities in concrete. The methods selected will determine the quantities of waste materials needing disposal. Decontamination and decommissioning methods have not been identified for most SRS facilities; the selection process would be subject to separate NEPA review. This section describes the surplus areas TE TE



TE | **Figure 3-32.** Consolidated Incineration Facility (H-Area).

that will eventually be decontaminated and decommissioned and estimates the amount of waste that will be generated by decontamination and decommissioning.

There are more than 6,000 buildings at SRS that will eventually be declared surplus and will need to be decommissioned. As of April 1994, 2,862 of these facilities had been identified as surplus (WSRC 1994c). Two-hundred-thirty-four of the buildings are now surplus or will be within 5 years. Some of these facilities may be used in new missions, but others pose risks unless they are properly maintained and decommissioned.

SRS prepared a 30-year forecast of the amounts of wastes that would be generated by decontamination and decommissioning (WSRC 1994d). This forecast was based on a 5-year forecast that identified 53 facilities to be decontaminated and decommissioned between 1995 and 1999. Both forecasts relied on the Surplus Facility Inventory and Assessment Database dated March 4, 1994, which contains information on SRS facilities such as building size, type of construction, radiological characterization, and hazardous material characterization. The database is continuously updated as new information becomes available.

Facilities that need to be decontaminated and decommissioned have been categorized according to the types of work required (WSRC 1994e). These categories will ensure incorporation of on-the-job lessons learned and assignment of specialized work crews to similar projects across SRS. The following sections describe some tentative categories of facilities with common traits or factors. TE

3.14.1.1 Asbestos Abatement Program

Two-hundred-eleven buildings contain asbestos, including 142 buildings for which asbestos is the only contaminant present. The R-Area surplus buildings are the first ones scheduled for asbestos removal. Experience at these facilities will improve asbestos abatement at other SRS facilities.

3.14.1.2 Decommissioning Program for Higher-Risk Facilities

Most of the surplus buildings have only small amounts of contamination. However, a few surplus facilities have more contamination, pose risks of releasing contaminants under special circumstances, or are located near large numbers of employees or near the SRS boundary. These facilities have been given a priority for immediate decontamination and decommissioning and are assigned to the higher risk facilities decommissioning program. Facilities in this program include the Separations Equipment

Development Facility, the 235-F Plutonium Fabrication Facility, and the 232-F Tritium Manufacturing Building.

3.14.1.3 Decommissioning Program for Nuclear Reactor Facilities

The buildings associated with nuclear reactors are included in the nuclear reactor facilities decommissioning program. The Heavy Water Component Test Reactor is the prototype for this
TE program. By starting with a small facility, DOE can learn from experience and develop methods and procedures which will then be applied to the larger reactors.

3.14.1.4 Decommissioning Program for High-Level Waste Storage Tanks

Fifty-one high-level waste storage tanks and their ancillary equipment will eventually be decommissioned. Type I, II, and IV tanks will be closed in place once the waste (supernatant, saltcake, and sludge) stored in the tanks has been removed, prior to decontamination and decommissioning. Decontamination and decommissioning activities will include stabilizing residual waste, removing associated equipment and small buildings, and abandoning in place underground transfer lines and
TE diversion boxes. Type III tanks, which have secondary containment, will be used during the waste vitrification process at the Defense Waste Processing Facility, which is expected to continue for 24 years. To date, waste has been removed from one high-level waste storage tank.

3.14.1.5 Decommissioning Program for Separations Facilities

The separations facilities present the greatest challenge for decontamination and decommissioning because of their size, high levels of contamination, need for security, and process complexity. The transition of these facilities from operational status to one suitable for final disposition will require a long and expensive sequence of activities. The Separations Equipment Development facility (located within the Savannah River Technology Center) was shut down in 1978 and transferred to the DOE environmental restoration decontamination and decommissioning program in 1982 (see Section 3.14.1.2). Lessons learned from the decontamination and decommissioning of this facility will be used to develop procedures for the larger chemical separations facilities in F- and H-Areas.

3.14.1.6 Decommissioning Program for Waste Handling Facilities

Waste handling facilities will process waste generated by decontamination and decommissioning. The decontamination and decommissioning of these facilities cannot begin until this processing has been completed. However, there are a number of obsolete waste handling facilities that can be decommissioned sooner.

3.14.1.7 Decommissioning Program for Miscellaneous Facilities

Facilities that do not fit into other categories are included in the miscellaneous facilities category. At this time only a few facilities (in M-, N-, and Z-Areas) have been assigned to this category. Other unique facilities will probably be added to the miscellaneous facilities category. Decontamination and decommissioning of these areas is not scheduled to begin until 1998.

3.14.2 DECONTAMINATION AND DECOMMISSIONING WASTE GENERATION

Decontamination and decommissioning will generate large amounts of waste for a long period of time. These wastes will include equipment, rubble, contaminated clothing, and tools. Most of the quantitative data regarding waste generated by decontamination and decommissioning have been collected during the dismantling of plutonium production and processing facilities. The volumes of waste generated by decontaminating and decommissioning these facilities is expected to represent an upper estimate of the amount of waste generated because of the high contamination levels and special packaging requirements inherent in transuranic waste. TE

For plutonium-238 facilities, approximately 13 cubic meters (459 cubic feet) of solid waste per square meter (10.76 square feet) of contaminated floor area are generated by decontamination and decommissioning. Of this, approximately 50 percent is transuranic waste; the rest is low-level waste. Less than 0.03 cubic meters (1.05 cubic feet) is mixed waste (primarily lead shielding) per square meter of area (Smith and Hootman 1994; Hootman and Cook 1994).

For plutonium-239 processing facilities, approximately 4 cubic meters (141 cubic feet) of transuranic waste and 5 cubic meters (177 cubic feet) of low-level waste are generated per square meter (10.76 square feet) of contaminated floor during decontamination and decommissioning (Hootman and Cook 1994).

3.15 Environmental Restoration

The fundamental goal of environmental restoration at SRS is to ensure that the environment is protected from further degradation caused by past activities, and that the safety and health of people exposed to the environment are protected. This goal is met through the cleanup of inactive facilities. "Cleanup" refers to actions taken to prevent the release or potential release of hazardous substances to the environment. These actions may involve complete removal of the substances from the environment; or stabilizing, containing, or treating the substances so that they do not affect human health or the environment.

In accordance with Section 120 of the Comprehensive Environmental Response, Compensation and Liability Act, DOE negotiated a Federal Facility Agreement with EPA and SCDHEC that organizes remedial activities at SRS into one comprehensive strategy that fulfills both RCRA corrective action requirements, including closure and post-closure of RCRA-regulated units, and Comprehensive Environmental Response, Compensation, and Liability Act investigation and remedial action requirements. Environmental restoration of inactive waste sites at SRS is controlled by the Federal Facility Agreement. The number of sites to be assessed and considered for cleanup under the Federal Facility Agreement is estimated to be 420. Newly identified sites are still being added to Appendix G of the Federal Facility Agreement. Sites are listed in the following Federal Facility Agreement appendixes:

- Appendix C - Sites with known releases
- Appendix G - Sites with potential releases to be investigated
- Appendix H - Sites subject to RCRA

Each of these lists appears in Appendix G of this EIS.

To date, DOE has prepared approximately 55 work plans detailing the proposed investigations for RCRA/Comprehensive Environmental Response, Compensation, and Liability Act units identified in Appendix C of the Federal Facility Agreement. These work plans must be approved by EPA and SCDHEC prior to implementation. Eleven of the work plans have been approved. Additional site characterization and field sampling is underway at these units.

Of the 304 areas identified on the original Site Evaluation List (Appendix G of the Federal Facility Agreement), DOE has prepared site evaluation reports for 36 and received EPA and SCDHEC concurrence on 17 of the proposed response actions. Six closures of RCRA-regulated units (Appendix H of the Federal Facility Agreement) have been completed and approved by SCDHEC.

Each cleanup and closure will generate significantly different quantities of waste materials. Specific cleanup methods have not been identified for most of the SRS waste sites. The methods will be selected in accordance with procedures established by the Federal Facility Agreement and will be subject to separate NEPA review. The remainder of this section discusses the extent and type of site contamination in E-Area and hazardous and mixed waste sites.

3.15.1 SURFACE AND GROUNDWATER QUALITY

Contamination of the shallow groundwater aquifers beneath the SRS with industrial solvents, metals, tritium, and other constituents, and contamination of the surface waters with tritium are discussed in Sections 3.3 and 3.4, respectively.

3.15.2 HAZARDOUS AND MIXED WASTE SITES

Six types of waste units are common to SRS. The descriptions for these waste sites are derived from Arnett, Karapatakis, and Mamatey (1993).

3.15.2.1 Acid/Caustic Basins

The acid/caustic basins found in F-, H-, K-, L-, P-, and R-Areas are unlined earthen pits, approximately 15 meters by 15 meters by 2 meters (50 feet by 50 feet by 7 feet) deep, that received dilute sulfuric acid and sodium hydroxide solutions used to regenerate ion-exchange units. Other wastes discharged to the basins included water rinses from the ion-exchange units, steam condensate, and runoff from containment enclosures for storage tanks. The dilute solutions are mixed and neutralized in the basins before they are discharged to nearby streams. Constituents identified as exceeding standards in monitoring wells near the acid/caustic basins include lead, cadmium, sulfates, nitrates, tritium, gross alpha radioactivity, nonvolatile beta radioactivity, technetium-99, and total dissolved solids (Arnett, Karapatakis, and Mamatey 1993).

The basins were constructed between 1952 and 1954. The R-Area basin was abandoned in 1964, the L-Area basin in 1968, and the H-Area basin not until 1985. The other basins remained in service until new neutralization facilities became operational in 1982. The basins will be remediated in accordance with requirements of the Federal Facility Agreement; however, SRS and SCDHEC have not determined the level of cleanup that will be required.

3.15.2.2 Burning/Rubble Pits

From 1951 to 1973, wastes such as paper, wood, plastics, rubber, oil, degreasers, and drummed solvents were burned in one of the burning/rubble pits in A-, C-, D-, F-, K-, L-, N- (Central Shops), P-, or R-Areas. In 1973, the burning of waste stopped, and the bottoms of the pits were covered with soil. Rubble wastes including paper, wood, concrete, and empty galvanized-steel barrels and drums were then disposed of in the pits until they reached capacity and were covered with soil. All dumping into burning/rubble pits stopped by 1982, and all are covered except the R-Area pit, which has not been backfilled. These pits will be remediated in accordance with requirements of the Federal Facility Agreement. Work plans to fully characterize the extent of contamination at all of the pits have been submitted to EPA and SCDHEC. Constituents identified as exceeding standards in monitoring wells near the burning/rubble pits include lead and volatile organics (Arnett, Karapatakis, and Mamatey 1993).

3.15.2.3 Coal Pile Runoff Containment Basins

Electricity and steam at SRS are generated by burning coal, which is stored in open piles. The coal is generally moderate-to-low sulfur coal (1 to 2 percent), which is received by rail, placed on a hopper, sprayed with water to control dust, and loaded onto piles. Coal piles originally existed in A-, C-, D-, F-, H-, K-, L-, P-, and R-Areas. The coal pile in R-Area was removed in 1964, the L-Area coal pile was removed in 1968, and the coal piles in C- and F-Areas were removed in 1985. In 1991, the K-Area coal pile was reduced to a 2-inch base, and 75 percent of the P-Area coal pile was also removed. Constituents identified as exceeding standards in monitoring wells near the former coal piles include gross alpha radioactivity, nonvolatile beta radioactivity, volatile organics, sulfates, tritium, total dissolved solids, and lead (Arnett, Karapatakis, and Mamatey 1993).

The coal piles generally contained a 90-day reserve of coal, which was not rotated; this resulted in long-term exposure to the weather. Chemical and biological oxidation of sulfur compounds in the coal during this weathering resulted in the formation of sulfuric acid.

To comply with the National Pollutant Discharge Elimination System permit issued in 1977, DOE built runoff containment basins around the coal piles in A- and D-Areas in October 1978, and around the coal piles in the C-, F-, H-, K-, and P-Areas in March 1981.

Currently, rainwater runoff from the remaining coal piles in several areas (A, D, H, K, and P) flows into the coal pile runoff containment basins via ditches and sewers. The basins allow mixing of the water runoff with seepage below the surface, thus preventing the discharge of large surges of low pH (acidic) runoff into streams. All the basins are functional, including those in C- and F-Areas which still collect runoff, although no coal remains at either location. These basins will be remediated in accordance with requirements of the Federal Facility Agreement.

3.15.2.4 Disassembly Basins

Disassembly basins were constructed adjacent to each reactor to store irradiated reactor fuel and target rods prior to their shipment to the separations areas. The disassembly basins are concrete-lined tanks containing water. Although the irradiated assemblies were rinsed before being placed in the basins, some radioactivity was released to the water from the film of liquid on the irradiated components, the oxide corrosion film on the irradiated components, and infrequently, from leaks in porous components. Sand filters were used to remove radioactive particulates from the disassembly basin water. Filtered basin water was circulated through chemical filters (deionizers) to remove additional constituents and was periodically purged through regenerated deionizers to the reactor seepage basins. The disassembly basin then was filled with clean water.

Constituents identified as exceeding standards in monitoring wells near the disassembly basins include lead, tritium, and alkalinity (as calcium carbonate) (Arnett, Karapatakis, and Mamatey 1993). The disassembly basins will be remediated in accordance with the Federal Facility Agreement.

3.15.2.5 Reactor Seepage Basins

Since 1957, active reactor seepage basins have received purged water with low-level radioactivity from disassembly basins. This water purge is necessary to keep the tritium concentration in disassembly basin water within safe levels for operating personnel. Although many radionuclides have been discharged to the basins, almost all of the radioactivity is due to tritium and small amounts of strontium-90, cesium-137, and cobalt-60. Constituents identified as exceeding standards in monitoring wells near the reactor seepage basins include alkalinity (as calcium carbonate), lead, tritium, gross alpha radioactivity, nonvolatile beta radioactivity, nitrates, volatile organics, mercury, potassium-40, and strontium-90 (Arnett, Karapatakis, and Mamatey 1993).

Before the use of sand filters began in the 1960s (see Section 3.15.2.4), purge water was pumped directly from the disassembly basins to the seepage basins. From 1970 to 1978, the seepage basins for active reactors were bypassed, and the filtered, deionized purge water was discharged directly into nearby streams. In 1978, the seepage basins for C-, L-, and P-Reactors were reactivated. The K-Reactor Seepage Basin was used from 1957 to 1960 only. The R-Area seepage basins have been filled and covered with asphalt. The K- and R-Area Reactor seepage basins will be remediated in accordance with the Federal Facility Agreement.

3.15.2.6 Sewage Sludge Application Sites

Beginning in 1980, the sewage sludge application sites were the subject of a research program using domestic sewage sludge to reclaim borrow pits and to enhance forest productivity. After sludge was applied to the sites according to the provisions of a SCDHEC permit, hardwoods and pines were planted to determine whether sludge could be used as a fertilizer and soil amendment to increase wood production. Constituents identified as exceeding standards in monitoring wells near these sites include gross alpha radioactivity, nonvolatile beta radioactivity, radium-226, radium-228, and lead (Arnett, Karapatakis, and Mamatey 1993). These sludge application sites will be remediated in accordance with the Federal Facility Agreement. Work plans to fully characterize the extent of contamination at the K-Area and Par Pond sites have been submitted to EPA and SCDHEC.

3.15.3 BURIAL GROUND COMPLEX

The Burial Ground Complex (E-Area) occupies about 1.3 square kilometers (330 acres) in the central part of SRS between F- and H-Areas. The Burial Ground Complex is divided into a northern area containing 1 square kilometer (254 acres) and a southern area containing 0.3 square kilometer (76 acres). The southern area is known as the Old Radioactive Waste Burial Ground; it was a trench disposal area that began receiving waste in 1952 and was filled in 1972. After 1973, wastes were disposed of in the
TE | northern disposal area (Figure 3-33).

Disposal in the northern area of the Burial Ground Complex, referred to as the Low-Level Radioactive Waste Disposal Facility, continues. In 1986, it was determined that hazardous wastes may have been placed in certain areas of the Low-Level Radioactive Waste Disposal Facility. These areas were
TE | designated as the Mixed Waste Management Facility (Figure 3-33). Since that time, DOE has determined that additional areas of the Low-Level Radioactive Waste Disposal Facility contain solvent rags; these areas have been added to the Mixed Waste Management Facility. The Mixed Waste Management Facility includes shallow, unlined trenches in which various low-level radioactive wastes containing solvents and metals were placed. A RCRA Closure Plan was approved by SCDHEC for the original Mixed Waste Management Facility in 1987; closure was completed in December 1990, and SCDHEC issued the closure certification in April 1991. Closure of the portions of the Mixed Waste Management Facility that contain the solvent rags is pending.

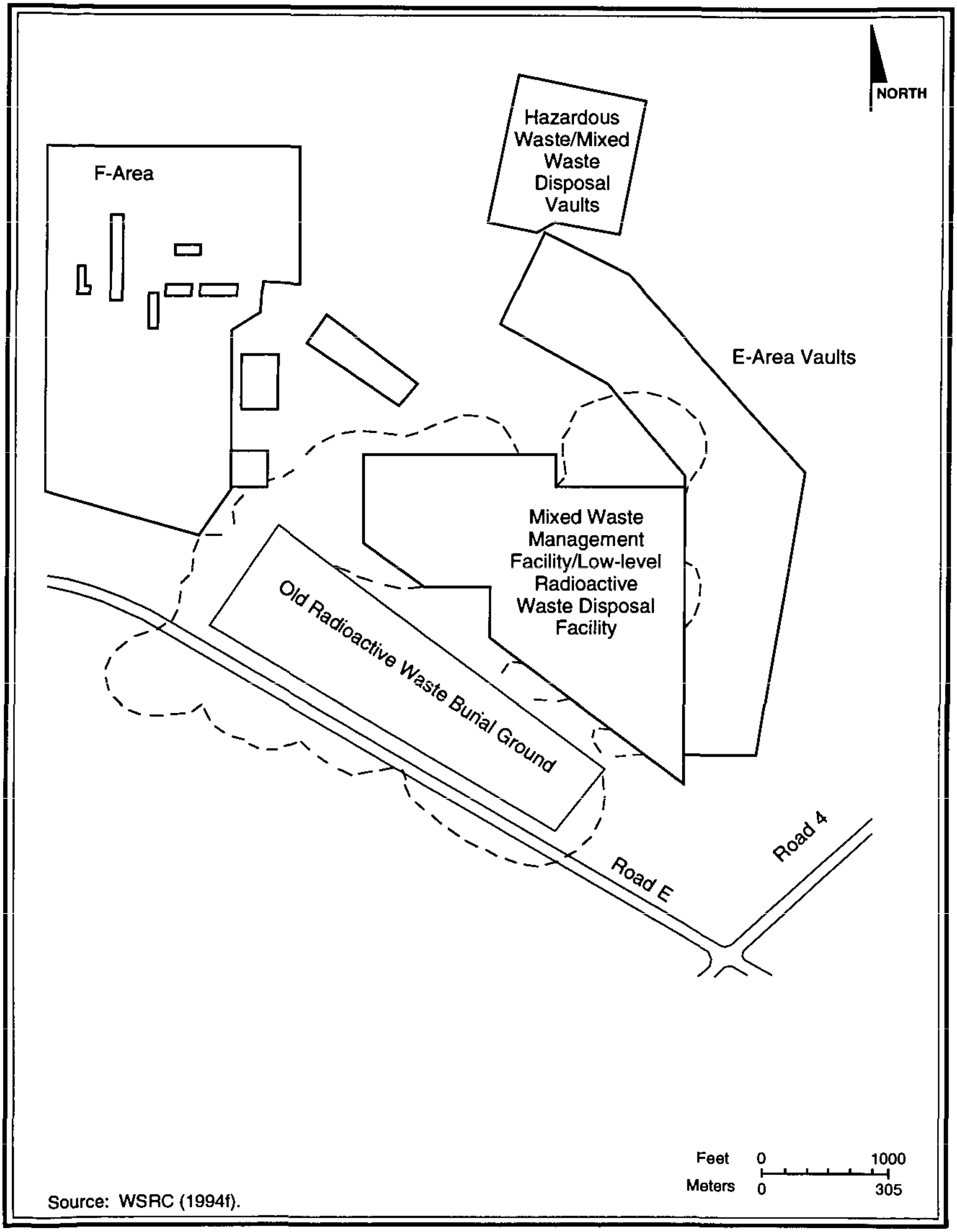
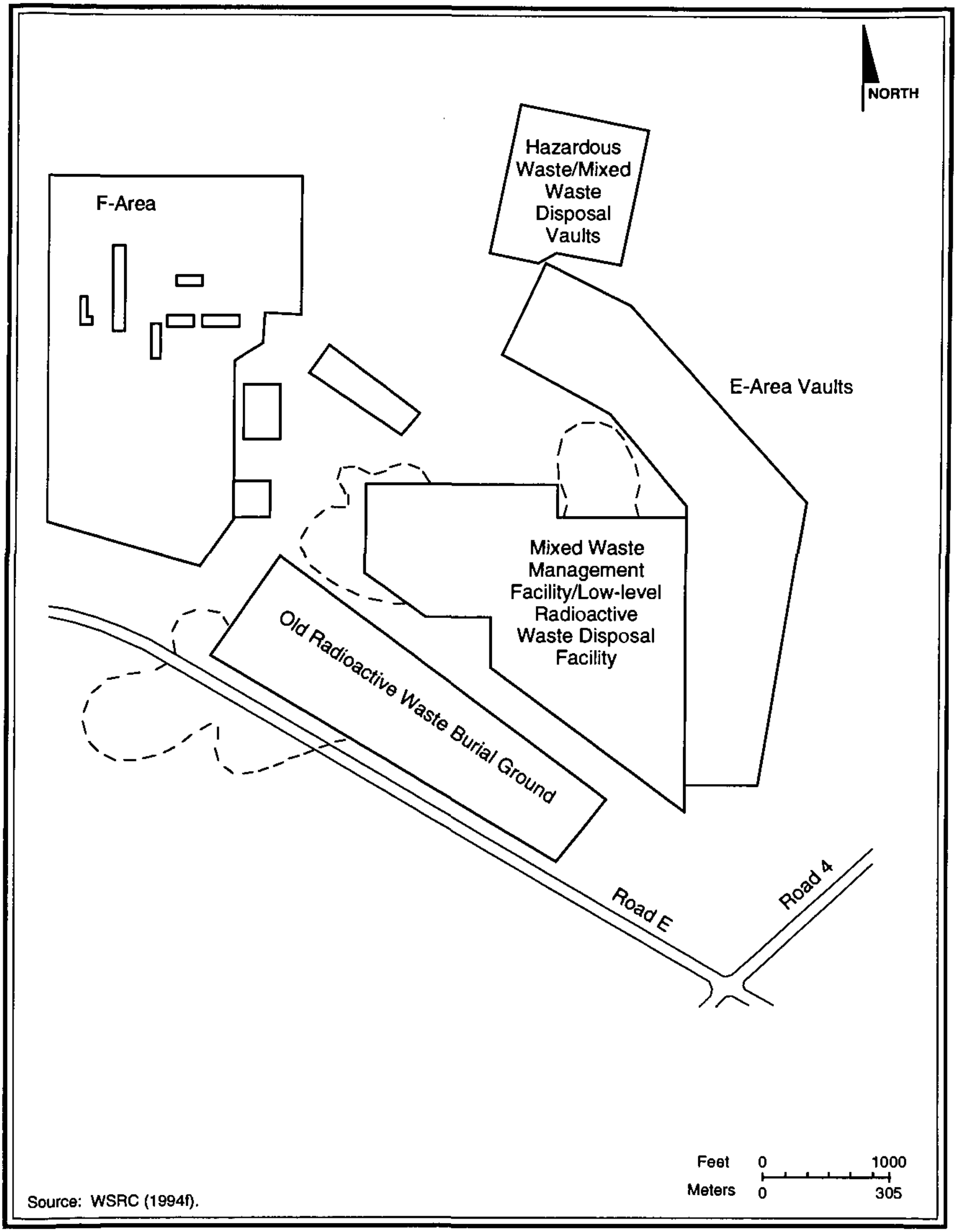


Figure 3-33. Tritium contamination in the shallow aquifer under the E-Area complex. | TE

Hazardous substances, including cadmium, lead, mercury, tritium, and volatile organic compounds, have been detected in groundwater beneath the Mixed Waste Management Facility. The shallow aquifer contains levels of tritium, trichloroethylene, and tetrachloroethylene that exceed EPA's primary drinking water standards (Figures 3-33 and 3-34).

TE



PK56-3

Figure 3-34. Trichloroethylene and tetrachloroethylene contamination in the shallow aquifer under the E-Area complex. TE

3.16 References

Arnett, M. W., 1993, *Savannah River Site Environmental Data for 1992*, WSRC-TR-93-077, Westinghouse Savannah River Company, Aiken, South Carolina.

Arnett, M. W., 1994, *Savannah River Site Environmental Data for 1993*, WSRC-TR-94-077, Westinghouse Savannah River Company, Aiken, South Carolina.

Arnett, M. W., L. K. Karapatakis, and A. R. Mamatey, 1993, *Savannah River Site Environmental Report for 1992*, WSRC-TR-93-075, Westinghouse Savannah River Company, Aiken, South Carolina.

Arnett, M. W., L. K. Karapatakis, and A. R. Mamatey, 1994, *Savannah River Site Environmental Report for 1993*, WSRC-TR-94-075, Westinghouse Savannah River Company, Aiken, South Carolina.

Batson, W. T., J. S. Angerman, and J. T. Jones, 1985, *Flora of the Savannah River Plant: An Inventory of the Vascular Plants on the Savannah River Plant, South Carolina*, Savannah River Plant National Environmental Research Park Program, Aiken, South Carolina.

Bauer, L. R., D. W. Hayes, C. H. Hunter, W. L. Marter, and R. A. Moyer, 1989, *Reactor Operation Environmental Information Document - Meteorology, Surface Hydrology, Transport and Impacts*, WSRC-RP-89-817, Volume III, Westinghouse Savannah River Company, Aiken, South Carolina.

Bennett, D. H. and R. W. McFarlane, 1983, *The Fishes of the Savannah River Plant: National Environmental Research Park*, SRO-NERP-12, Savannah River Ecology Laboratory, Aiken, South Carolina.

Bollinger, G. A., 1973, "Seismicity of the Southeastern United States," *Bulletin of the Seismological Society of America, 63*, 5, pp. 1785-1808.

Brooks, F., 1994, Savannah River Forest Station, Aiken, South Carolina, personal communication with R. K. Abernethy, Halliburton NUS Corporation, Aiken, South Carolina, "Bald Eagle Nests on SRS," May 17.

Brooks, R. D., 1993, Savannah River Archaeology Research Program, South Carolina Institute of Archaeology and Anthropology, University of South Carolina, Columbia, South Carolina, personal communication with L. S. Moore, Halliburton NUS Corporation, Aiken, South Carolina, "SRS Sites Eligible for Historical Register of Historic Places," November 15.

Brooks, R. D., 1994, Savannah River Archaeology Research Program, South Carolina Institute of Archaeology and Anthropology, University of South Carolina, Columbia, South Carolina, personal communication with L. S. Moore, Halliburton NUS Corporation, Aiken, South Carolina, "SRS Archeological Sites and National Register of Historic Places Status," January 24.

Bryan, L., 1992, Savannah River Ecology Laboratory, Aiken, South Carolina, personal communication with R. K. Abernethy, Halliburton NUS Corporation, Aiken, South Carolina, "Recent Work with Natural Resource Trusteeship Concerning Wood Storks," October 27.

Burns, C., 1993, CSX Transportation, Jacksonville, Florida, personal communication with S. J. Connor, Halliburton NUS Corporation, Aiken, South Carolina, "Train Movement through Millet, SC."

CDC (Centers for Disease Control and Prevention), 1993, "Advance Report of Final Mortality Statistics, 1990," *Monthly Vital Statistics Report, 41,* No. 7 Supplement, U.S. Public Health Service, Department of Health and Human Services, Washington, D.C., January 7.

Chem-Nuclear Systems, Inc., 1980, *Environmental Assessment for Barnwell Low-Level Radioactive Waste Disposal Facility,* Columbia, South Carolina.

Cothran, E. G., M. H. Smith, J. O. Wolff, and J. B. Gentry, 1991, *Mammals of the Savannah River Site*, SRO-NERP-21, Savannah River Site National Environmental Research Park, Aiken, South Carolina.

Coulter M. C., 1993, *Wood Storks of the Birdsville Colony and Swamps of the Savannah River Site*, SREL-42, Savannah River Ecology Laboratory, Aiken, South Carolina.

Dahlberg, M. D. and D. C. Scott, 1971, "The Freshwater Fishes of Georgia," *Bulletin of the Georgia Academy of Science, 29*, 1, pp. 1-64.

Davis, G. M. and M. Mulvey, 1993, *Species Status of Mill Creek Elliptio*, SRO-NERP-22, Savannah River Site National Environmental Research Park, Savannah River Ecology Laboratory, Aiken, South Carolina.

Davis, H. A., D. K. Martin, and J. L. Todd, 1989, *Savannah River Site Environmental Report for 1988*, WSRC-RP-89-59-1, Westinghouse Savannah River Company, Aiken, South Carolina.

DOE (U.S. Department of Energy), 1982, *Final Environmental Impact Statement, Defense Waste Processing Facility, Savannah River Plant, Aiken, South Carolina*, DOE/EIS-0082, Savannah River Operations Office, Aiken, South Carolina.

DOE (U.S. Department of Energy), 1984, *Final Environmental Impact Statement, L-Reactor Operation, Savannah River Plant, Aiken, South Carolina*, DOE/EIS-0108, Savannah River Operations Office, Aiken, South Carolina.

DOE (U.S. Department of Energy), 1987, *Final Environmental Impact Statement, Waste Management Activities for Groundwater Protection, Savannah River Plant, Aiken, South Carolina*, DOE/EIS-0120, Savannah River Operations Office, Aiken, South Carolina.

DOE (U.S. Department of Energy), 1988, 53 FR 29, "Alternative Cooling Water Systems, Savannah River Plant, Aiken, South Carolina, Record of Decision," p. 4203, February 12.

DOE (U.S. Department of Energy), 1990, *Final Environmental Impact Statement, Continued Operation of K-, L-, and P-Reactors, Savannah River Site, Aiken, South Carolina*, DOE/EIS-0147, Savannah River Operations Office, Aiken, South Carolina.

DOE (U.S. Department of Energy), 1991, *Draft Environmental Impact Statement for the Siting, Construction, and Operation of New Production Reactor Capacity*, DOE/EIS-0144D, Office of New Production Reactors, Washington, D.C.

DOE (U.S. Department of Energy), 1993a, *Introduction to Natural Resources Management at the Savannah River Site*, Savannah River Operations Office, Aiken, South Carolina.

DOE (U.S. Department of Energy), 1993b, *Occupational Injury and Property Damage Summary, January - December 1992*, DOE/EH/10570-H1, SPMS Maintenance and Operations, EG&G Idaho, Inc., Idaho Falls, Idaho.

DOE (U.S. Department of Energy), 1994a, *FY 1994 Draft Site Development Plan,* Savannah River Operations Office, Aiken, South Carolina.

DOE (U.S. Department of Energy), 1994b, *Final Supplemental Environmental Impact Statement for the Defense Waste Processing Facility*, DOE/EIS-0082-S, Savannah River Operations Office, Aiken, South Carolina.

DOL (U.S. Department of Labor), 1986, *Recordkeeping Guidelines for Occupational Injuries and Illnesses,* Bureau of Labor Statistics, Washington, D.C.

du Pont (E. I. du Pont de Nemours and Company, Inc.), 1983, *Technical Summary of Groundwater Quality Protection Program at Savannah River Plant,* DPST-83-829, Aiken, South Carolina.

du Pont (E. I. du Pont de Nemours and Company, Inc.), 1987, *Comprehensive Cooling Water Study - Final Report, Volumes I-VIII,* DP-1739, Aiken, South Carolina.

du Pont (E. I. du Pont de Nemours and Company, Inc.), 1989, *Radiation Exposure Report, Annual Report for 1988,* DPSPU-89-11-1, Aiken, South Carolina.

Dukes, E. K., 1984, *The Savannah River Plant Environment*, DP-1642, E. I. du Pont de Nemours and Company, Inc., Aiken, South Carolina.

EPA (U.S. Environmental Protection Agency), 1985, *Compilation of Air Pollutant Factors - Stationary Point and Area Sources, Volume 1,* Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

EPA (U.S. Environmental Protection Agency), 1992, *Industrial Source Complex (ISC) Dispersion Mode 1 User's Guide*, Second Edition (Revised), Volume I, II, National Technical Information Service, Springfield, Virginia.

EPA (U.S. Environmental Protection Agency), 1993a, Federal Facility Agreement between the U.S. Environmental Protection Agency, Region IV, the U.S. Department of Energy, and the South Carolina Department of Health and Environmental Control, Docket No. 89-05-FF, August 16.

EPA (U.S. Environmental Protection Agency), 1993b, "Office of Environmental Equity Grants Program; Solicitation Notice for Fiscal Year (FY) 1994, Environmental Justice Grants to Community Groups," 58 FR 63955, December 8.

EPA (U.S. Environmental Protection Agency), 1994, *Environmental Justice Initiatives 1993*, EPA 200-R-93-001, Washington, D.C.

Fledderman, P. D., 1994, Westinghouse Savannah River Company, Aiken, South Carolina, personal communication with E. M. Rollins, Halliburton NUS, Corporation, Aiken, South Carolina, "Wildlife Data."

Floyd, M. A., J. C. Morse, and J. V. McArthur, 1993, "Aquatic Insects of Upper Three Runs Savannah River Site, South Carolina - Part IV: Caddisflies (Trichoptera) of the Lower Reaches," *Journal of Entomological Science 28*, 1, pp. 85-95.

Gibbons, J. W. and R. D. Semlitsch, 1991, *Guide to the Reptiles and Amphibians of the Savannah River Site,* University of Georgia Press, Athens, Georgia.

Gladden, J. B., M. W. Lower, H. E. Mackey, W. L. Specht, and E. W. Wilde, 1985, *Comprehensive Cooling Water Study Annual Report*, DP-1697, E. I. du Pont de Nemours and Company, Aiken, South Carolina.

HNUS (Halliburton NUS Environmental Corporation), 1992, *Socioeconomic Characteristics of Selected Counties and Communities Adjacent to the Savannah River Site*, Aiken, South Carolina.

HNUS (Halliburton NUS Corporation), 1994, *Computer printouts generated from the Regional Economic Models, Inc. (REMI), Economic and Demographic Forecasting and Simulation Model for the SRS Region of Influence*, Aiken, South Carolina.

Hootman, H. E. and J. R. Cook, 1994, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to T. H. Gould, Westinghouse Savannah River Company, Aiken, South Carolina, "Transuranic Waste Projections at SRS for Long Range Planning (U)," EDD-MPS-94-0018, Aiken, South Carolina.

Hunter, C. H., 1990, *A Climatological Description of the Savannah River Site*, WSRC-RP-89-313, Westinghouse Savannah River Company, Aiken, South Carolina.

Hunter, C. H. and J. Stewart, 1994, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to C. B. Shedrow, Westinghouse Savannah River Company, Aiken, South Carolina, "Air Quality Calculations for DWPF Supplemental Environmental Impact Statement," SRT-ETS-940891, Aiken, South Carolina, June 17.

LeMaster, E. T., 1994a, Savannah River Forest Station, Aiken, South Carolina, personal communication with R. K. Abernethy, Halliburton NUS Corporation, Aiken, South Carolina, Location of a second colony of "Smooth Coneflower," on SRS, June 21.

LeMaster, E. T., 1994b, Savannah River Forest Station, Aiken, South Carolina, personal communication with R. K. Abernethy, Halliburton NUS Corporation, Aiken, South Carolina, "Locations of rare plants located during 1992 and 1994 surveys of E-Area," September 27.

LeMaster, E. T., 1994c, Savannah River Forest Station, Aiken, South Carolina, personal communication with R. K. Abernethy, Halliburton NUS Corporation, Aiken, South Carolina, "Red-cockaded woodpecker survey of compartment 49 stands 6 and 8," November 3.

Mayer, J. J., R. A. Kennamer, and R. T. Hoppe, 1986a, *Waterfowl of the Savannah River Plant, Comprehensive Cooling Water Study, Final Report*, SREL-22, Savannah River Ecology Laboratory, Aiken, South Carolina.

Mayer, J. J., R. A. Kennamer, and R. T. Hoppe, 1986b, *Bald and Golden Eagles of the SRP,* SREL-21, Savannah River Ecology Laboratory, Aiken, South Carolina.

McLain, A. R., 1994, Westinghouse Savannah River Company, personal communication with E. M. Rollins, Halliburton NUS Corporation, Aiken South Carolina, "SRS Railroad Information," May 12.

NCRP (National Council on Radiation Protection and Measurements), 1987a, *Ionizing Radiation Exposure of the Population of the United States, Report Number 93,* Washington, D.C.

NCRP (National Council on Radiation Protection and Measurements), 1987b, *Exposure of the Population in the United States and Canada from Natural Background Radiation, Report Number 94,* Washington, D.C.

NCRP (National Council on Radiation Protection and Measurements), 1993, *Limitation of Exposure to Ionizing Radiation, Report No. 116,* Washington, D.C.

NOAA (National Oceanic and Atmospheric Administration), 1990, *Local Climatological Data Annual Summary for Augusta, Georgia*, National Climatic Data Center, Asheville, North Carolina.

NUS (NUS Corporation), 1991a, *American Indian Religious Freedom Act (AIRFA) Compliance at the Savannah River Site*, Aiken, South Carolina.

NUS (NUS Corporation), 1991b, Update to the *Air Quality, Cooling Tower, and Noise Impact Analyses in Support of The New Production Reactor Environmental Impact Statement*, Aiken, South Carolina.

Parker, M. J. and R. J. Kurzeja, 1990, *The October 1, 1989 Tornado at the Savannah River Site*, WSRC-RP-90-1288, Westinghouse Savannah River Company, Aiken, South Carolina.

Patrick, R., J. Cairns, Jr., and S. S. Roback, 1967, "An ecosystematic study of the fauna and flora of the Savannah River Plant," *Proceedings of the Academy of Natural Sciences of Philadelphia, 118,* 5, pp. 109-407.

Petty, K. R., 1993, Westinghouse Savannah River Company, Interoffice Memorandum to Distribution, "Health Protection Department 1992 Annual Report," WSRC-ESH-HPD-9200035, Aiken, South Carolina.

Rollins, E. M., 1994, Calculation Worksheet WMEIS-001, "Sportsman Dose," Halliburton NUS Corporation, Aiken, South Carolina.

SCDHEC (South Carolina Department of Health and Environmental Control), 1976a, "State Safe Drinking Water Act of 1976," South Carolina Code of Laws, Section 61-58.

SCDHEC (South Carolina Department of Health and Environmental Control), 1976b, "Air Pollution Control Regulations and Standards," South Carolina Code of Laws, Regulations 61-62.

Schalles, J. F., R. R. Sharitz, J. W. Gibbons, G. J. Leversee, and J. N. Knox, 1989, *Carolina Bays of the Savannah River Plant,* SRO-NERP-18, Savannah River Ecology Laboratory, Aiken, South Carolina.

Sharitz, R. R., J. E. Irwin, and E. J. Christy, 1974, "Vegetation of swamps receiving reactor effluents," *Oikos*, *25*, pp. 7-13.

Shedrow, C. B., 1993, *SRS Affected Environment*, WSRC-TR-93-667, Westinghouse Savannah River Company, Aiken, South Carolina.

Shields, J. D., N. D. Woody, A. S. Dicks, G. J. Hollod, J. Schalles, and G. J. Leversee, 1982, *Locations and Areas of Ponds and Carolina Bays at the Savannah River Plant,* DP-1525, Revision 1, E. I. du Pont de Nemours and Company, Inc., Aiken, South Carolina.

Smith, R. H. and H. E. Hootman, 1994, *Dismantlement and Decontamination of a Plutonium-238 Facility at SRS (U)*, WSRC-RP-93-1376, Westinghouse Savannah River Company, Aiken, South Carolina.

Smith, W. B., 1989, *Draft Traffic Services Report, Savannah River Plant*, Wilbur B. Smith Associates, Columbia, South Carolina, March 24.

SRARP (Savannah River Archaeological Research Program), 1989, *Archaeological Resource Management Plan of the Savannah River Archaeological Research Program*, Savannah River Archaeological Research Program, South Carolina Institute of Archaeology and Anthropology, University of South Carolina, December 1989.

Stephenson, D. E., 1988, *August 1988 Savannah River Plant Earthquake,* DPST-88-841, E. I. du Pont de Nemours and Company, Inc., Aiken, South Carolina.

Stephenson, D. E. and A. L. Stieve, 1992, Structural Model of the Basement in the Central Savannah River Area, South Carolina and Georgia, WSRC-TR-92-120, Westinghouse Savannah River Company, Aiken, South Carolina.

Stewart, J., 1994, *Air Dispersion Modeling for Waste Management Environmental Impact Statement (U)*, WSRC-RP-94-1271, Westinghouse Savannah River Company, Aiken, South Carolina.

Swygert, R. W., 1994a, Westinghouse Savannah River Company, Aiken, South Carolina, personal communication with E. M. Rollins, Halliburton NUS Corporation, Aiken, South Carolina, "SRS Truck Traffic," September 30.

Swygert, R. W., 1994b, Westinghouse Savannah River Company, Aiken, South Carolina, personal communication with E. M. Rollins, Halliburton NUS Corporation, Aiken, South Carolina, "Site Traffic Counts," March 21.

TRB (Transportation Research Board), 1985, "High Capacity Manual," *National Research Council Special Report 209*, Washington, D.C.

URS/Blume (URS/John Blume and Associates, Engineers), 1982, *Update of Seismic Criteria for the Savannah River Plant, Volume I: Geotechnical,* DPE-3699, prepared for E. I. du Pont de Nemours and Company, Inc., Aiken, South Carolina.

U.S. Bureau of the Census, 1990a, *Summary Tape File 1B*, Table P8, Washington, D.C.

U.S. Bureau of the Census, 1990b, *Summary Tape File 1B*, Table 117, Washington, D.C.

USDA (U.S. Department of Agriculture), 1988, *Eagle Bay Management Plan,* Savannah River Forest Station, New Ellenton, South Carolina.

USDA (U.S. Department of Agriculture), 1990, *Soil Survey of Savannah River Plant Area, Parts of Aiken, Barnwell, and Allendale Counties, South Carolina,* Soil Conservation Service, Washington, D.C.

USDA (U.S. Department of Agriculture), 1991a, *Savannah River Site Wildlife, Fisheries, and Botany Operation Plan,* Savannah River Forest Station, New Ellenton, South Carolina.

USDA (Forest Service), 1991b, *Red-cockaded Woodpecker Management Standards and Guidelines, Savannah River Site*, Savannah River Forest Station, New Ellenton, South Carolina.

USDA (U.S. Department of Agriculture), 1994, "Stand Prescription Summary Data for Compartment 49," U.S. Department of Agriculture, Forest Service, Savannah River Forest Station, New Ellenton, South Carolina.

USFWS (U.S. Fish and Wildlife Service), 1992, 57 FR 196, "50 CFR Part 17, Endangered and Threatened Wildlife and Plants; *Echinacea laevigata* (Smooth Coneflower) Determined to be Endangered," p. 46340.

USFWS (U.S. Fish and Wildlife Service), 1993, 58 FR 188, "50 CFR Part 17, Endangered and Threatened Wildlife and Plants; Review of Plant Taxa for Listing as Endangered or Threatened Species," p. 51144-51190.

United Nations, 1977, "Sources and Effects of Ionizing Radiation," United Nations Scientific Committee on the Effects of Atomic Radiation, Report to the General Assembly, with Annexes, United Nations Sales Section, New York, New York.

Wike, L. D., R. W. Shipley, J. A. Bowers, A. L. Bryan, C. L. Cummins, B. R. del Carmen, G. P. Friday, J. E. Irwin, H. E. Mackey, J. J. Mayer, E. A. Nelson, M. H. Paller, V. A. Rogers, W. L. Specht, and E. W. Wilde, 1994, *SRS Ecology Environmental Information Document*, WSRC-TR-93-496, Westinghouse Savannah River Company, Aiken, South Carolina.

Workman, S. W. and K. W. McLeod, 1990, *Vegetation of the Savannah River Site: Major Community Types,* SRO-NERP-19, Savannah River Ecology Laboratory, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1991, *Radiation Protection and Industrial Hygiene Annual Report 1989,* ESH-QIS-910027, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1992a, *Evaluation of Accident Risks in the Transportation of Hazardous Materials by Truck and Rail at the Savannah River Site (U),* WSRC-RP-89-715, Revision 1, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1992b, *1990 Health Protection Annual Report*, ESH-HPD-92-0072, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1993a, *Draft Environmental Information Document: Geology and Hydrogeology of the Savannah River Site*, WSRC-TR-93-147, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1993b, *SCDHEC Regulation No. 62.5 Standard No. 2 and Standard No. 8, Compliance Modeling Input/Output Data*, ESH-ESS-93-0531, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1993c, *Savannah River Site Development Plan*, Revision 1, WSRC-RP-93-477, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1993d, *Savannah River Site Radiological Control Procedure Manual 5Q*, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1994a, *Savannah River Site Radiological Performance, 4th Quarter 1993*, ESH-PAS-94-0018, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1994b, *Savannah River Site Tier Two Emergency and Hazardous Chemical Inventory Report (U)*, Aiken, South Carolina, March.

WSRC (Westinghouse Savannah River Company), 1994c, *Savannah River Surplus Facility Inventory and Assessment Project - Phase 2 (U)*, SWE-TDD-940074, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1994d, *Thirty Year Decontamination and Decommissioning Waste Generation Forecast for Facilities at SRS*, WSRC-RP-94-496, Revision 0, Aiken, South Carolina, May 9.

WSRC (Westinghouse Savannah River Company), 1994e, *Westinghouse Savannah River Company Decontamination and Decommissioning Program Facilities Plan*, WSRC-IM-93-10, Aiken, South Carolina.

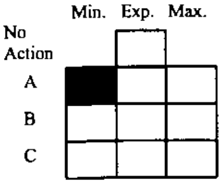
WSRC (Westinghouse Savannah River Company), 1994f, *Solid Waste Management Plan*, Predecisional Draft, WSRC-RP-93-1448, Revision 2, Aiken, South Carolina, March 29.

CHAPTER 4. ENVIRONMENTAL CONSEQUENCES

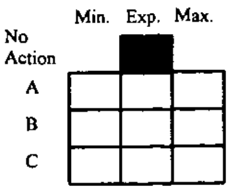
This chapter describes the impacts of waste management activities on the environment (described in Chapter 3) at the Savannah River Site (SRS), including the construction and operation of new facilities TE (described in Chapter 2). As described in Chapter 2, 10 scenarios are evaluated. The no-action alternative (see Section 2.2) is evaluated first (Section 4.1). In Section 4.2, alternative A (limited treatment configuration; see Section 2.4) is evaluated for the expected, minimum, and maximum amounts of waste forecast for SRS. In Section 4.3, alternative C (extensive treatment configuration; see Section 2.5) is evaluated for the same three forecasts. Section 4.4 analyzes alternative B (moderate treatment configuration; see Section 2.6), which incorporates a mix of technologies being considered by the U.S. Department of Energy (DOE) for the different waste types. The three alternatives place different degrees of emphasis on the objectives of the proposed action. DOE believes that these alternatives represent the full range of reasonable alternatives and has identified alternative B as the preferred alternative.

This chapter also discusses potential cumulative impacts from alternative B when it is added to impacts TE from past, present, and reasonably foreseeable actions and presents the unavoidable adverse impacts and irreversible or irretrievable commitment of resources under alternative B. Cumulative impacts were assessed only for the moderate treatment configuration alternative B – expected waste forecast because the impacts for it generally fall between those for the other alternatives, and because impacts do not vary greatly between alternatives. Despite some variation in impacts, this approach allowed for an assessment TE of the likely magnitudes of the cumulative impacts of the other alternatives based on the cumulative impacts of alternative B. Appendix B.5 examines the impacts of processing low-level, hazardous, and mixed wastes in the Consolidated Incineration Facility under alternatives A, B, and C. TE

Impacts are assessed in terms of direct physical disturbance or consumption of affected resources and as the effects of effluents and emissions on the chemical and physical quality of the environment. When TE annual data (such as annual doses) are presented, they are based on the calendar year rather than the fiscal year. Assessments focus on impacts to such natural resources as air, water, and plants and animals, as well as on human resources, including the health of workers and the public, and socioeconomics.



To aid the reader, the same stacked-box symbol used in Chapter 2 is used in Chapter 4. For example, a section that begins with the symbol shown at left is discussing alternative A – minimum waste forecast.



4.1 No Action

This section discusses the effects of the no-action alternative described in Section 2.2.

4.1.1 INTRODUCTION

Under the no-action alternative, which continues current practices to manage waste, DOE would:

- Continue waste minimization activities as described in Section 2.2.1.
- Continue receiving and storing liquid high-level waste in the F- and H-Area tank farms and begin removing it for treatment at the Defense Waste Processing Facility and associated facilities.
- Continue operating the existing liquid high-level waste evaporators and operate the Replacement High-Level Waste Evaporator presently under construction.
- Operate the Defense Waste Processing Facility and associated liquid high-level waste management facilities as described in *Final Supplemental Environmental Impact Statement,* TC *Defense Waste Processing Facility* (DOE/EIS-0082S) and its Record of Decision (60 FR 18589).
- Continue to compact some low-level waste using the three existing compactors.
- Continue to dispose of low-level wastes in vaults and by shallow land disposal.
- Store certain low-level wastes in long-lived waste storage buildings.
- Continue to store naval hardware on pads in E-Area with possible shallow land disposal.
- Continue to store hazardous wastes until they are sent for offsite treatment and disposal.
- Continue to treat aqueous hazardous wastes collected from groundwater monitoring well operations (investigation-derived wastes) in the M-Area Air Stripper.

- Continue offsite treatment and disposal of PCB wastes.
- Continue to store mixed wastes and construct additional storage for them.
- Continue to treat mixed wastes by ion exchange in the tanks at the Savannah River Technology Center.
- Construct and operate the M-Area Vendor Treatment Facility and use it to vitrify mixed wastes from M-Area electroplating operations, as discussed in the *Environmental Assessment, Treatment of M-Area Mixed Wastes at the Savannah River Site* (DOE/EA-0918).
- Continue to treat aqueous mixed wastes collected from groundwater monitoring wells (investigation-derived waste) in the F/H-Area Effluent Treatment Facility.
- Continue to store radioactive PCB wastes with planned offsite treatment of the PCB fraction and onsite shallow land disposal of the radioactive residuals.
- Construct and operate Resource Conservation and Recovery Act (RCRA)-permitted disposal vaults for disposal of residuals from the treatment of mixed waste, as evaluated in *Final Environmental Impact Statement, Waste Management Activities for Groundwater Protection, Savannah River Plant* (DOE/EIS-0120).
- Continue to store transuranic and alpha wastes on transuranic waste storage pads, retrieve waste drums from mounded storage pads, and construct additional waste storage capacity.
- Perform facility upgrades and continue to operate the Experimental Transuranic Waste Assay Facility/Waste Certification Facility to characterize transuranic and alpha wastes.
- Dispose of newly-generated nonmixed alpha waste in low-activity waste vaults.
- Continue to construct the Consolidated Incineration Facility.

The locations of these waste management facilities are identified in Figure 4-1.

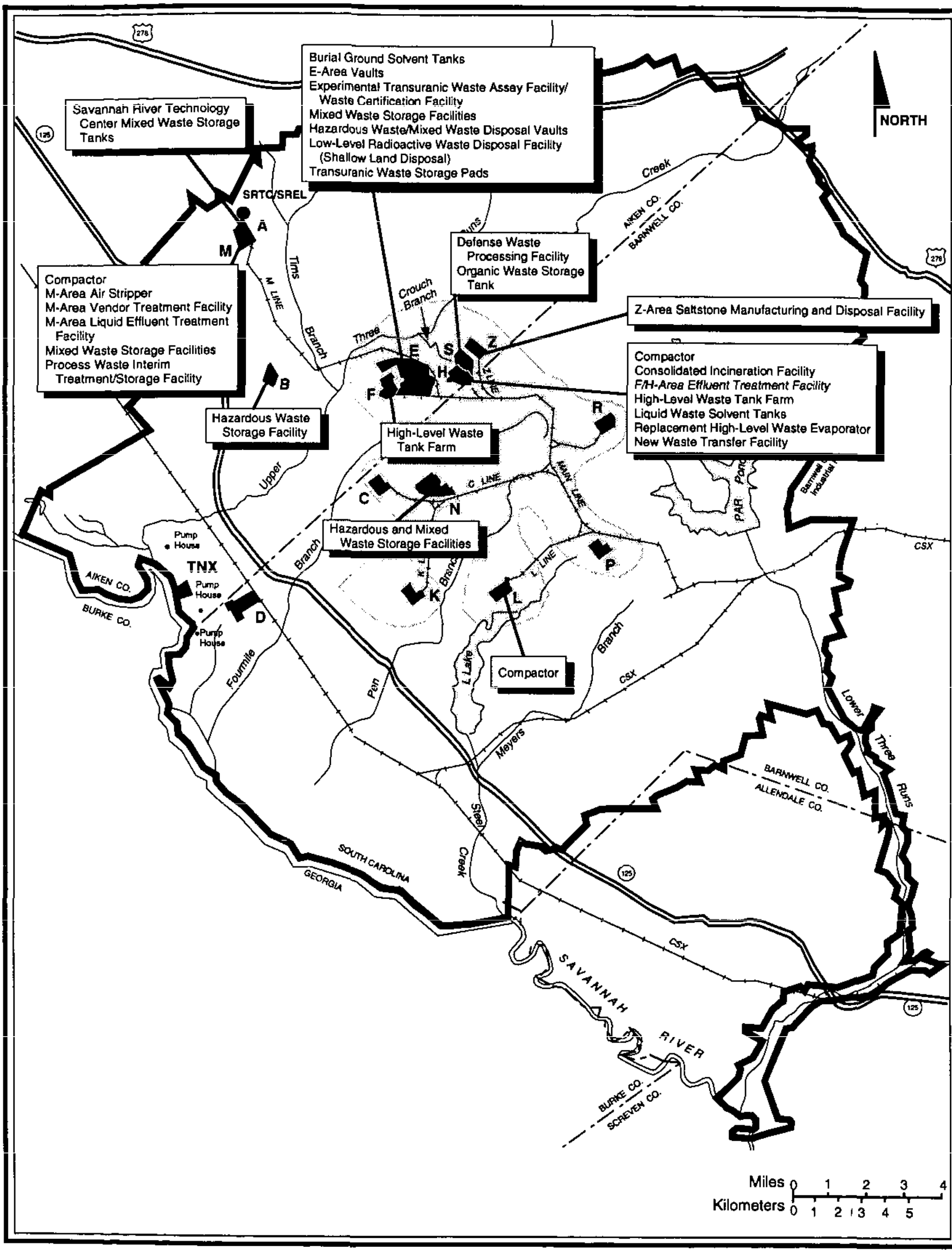
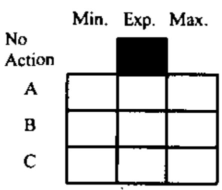


Figure 4-1. Location of SRS waste management facilities under the no-action alternative.

The no-action alternative requires additional storage facilities for transuranic and alpha waste and additional disposal areas for low-level radioactive waste and mixed waste in the vicinity of the existing vaults in E-Area. New mixed waste storage facilities would be constructed in the area between the Low-Level Radioactive Waste Disposal Facility and the M-Line railroad. A portion of this area has been cleared, graded, and stabilized with vegetation to prevent erosion. Additional undisturbed lands located (1) adjacent to and south of the M-Line railroad and (2) northwest of F-Area would be required for the remainder of the mixed waste storage facilities (Figure 4-2).

Construction for the no-action alternative would require 0.35 square kilometer (86 acres) of undeveloped land northwest of F-Area and 0.30 square kilometer (74 acres) of undeveloped land between the Low-Level Radioactive Waste Disposal Facility and M-Line railroad. Other construction would be on previously cleared and developed land in the eastern part of E-Area. TC



4.1.2 GEOLOGIC RESOURCES

Under the no-action alternative, impacts to geologic resources can be evaluated by comparing the amounts of land needed to build the facilities for this alternative. The more land required for the facilities, the greater the impacts, namely soil erosion, on these resources. TE

Except for some small gravel deposits, there are no economically valuable minerals or unique geologic features located in the vicinity of the waste management areas considered in this alternative, or any of the other alternatives. Waste management activities in the no-action alternative would mainly impact soils in the uncleared parts of E-Area. Construction would have less impact on soils in those parts of E-Area where the land has been cleared of trees and already disturbed by the construction of existing buildings. In E-Area, approximately 0.33 square kilometer (81 acres) has been cleared and developed, and approximately 0.65 square kilometer (160 acres) would be cleared to build additional vaults, storage pads, tanks, and buildings (Figure 4-2). TC

The undisturbed soils in E-Area have a slight to moderate erosion hazard rating (USDA 1990). That is, erosion could occur if site preparation activities, such as grading, expose these soils and no precautions are taken to prevent erosion. Most of the soils in the cleared parts of E-Area consist of spoil from excavated areas, borrow pits, and previous grading activities; these soils also have a slight to moderate

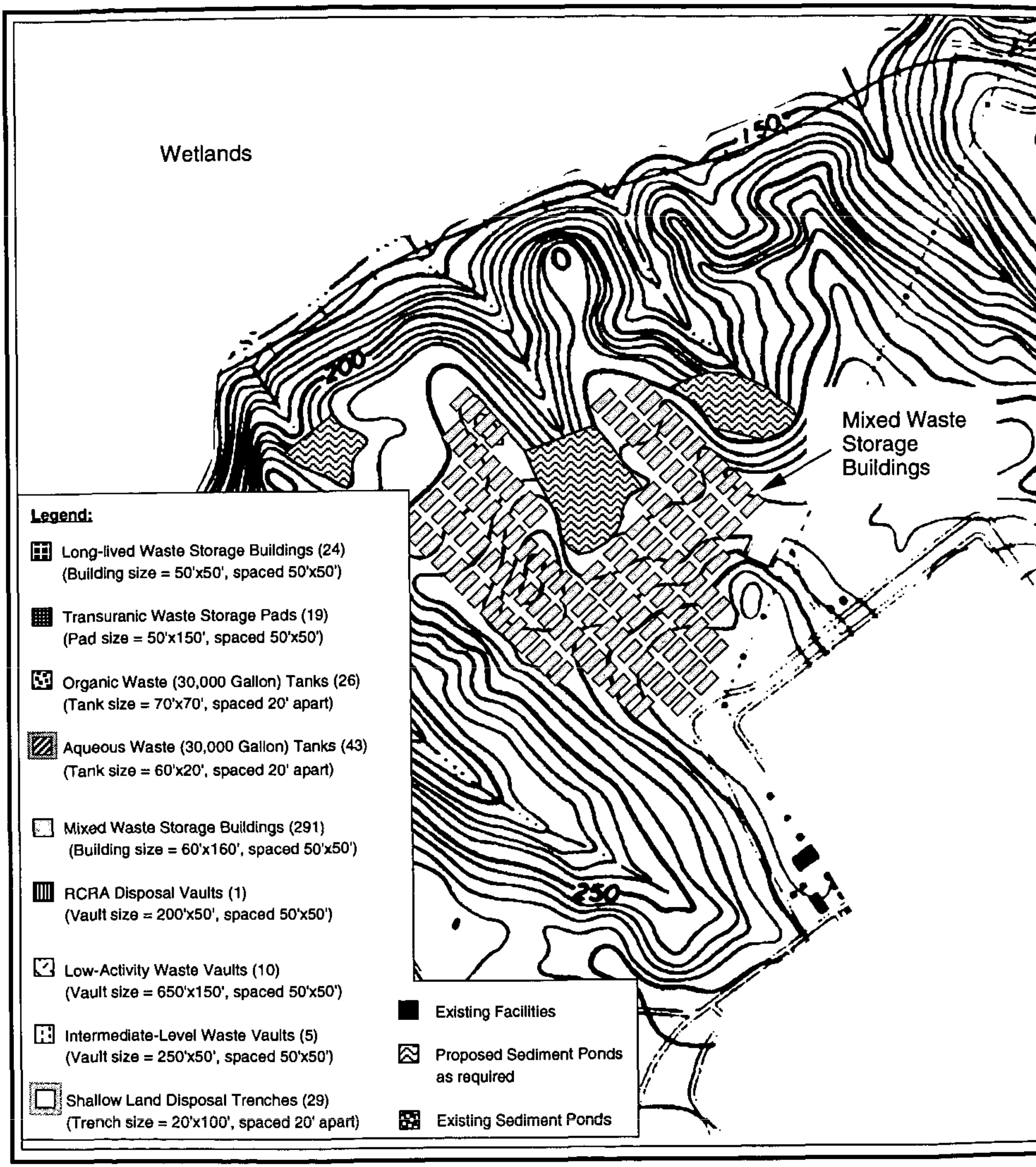


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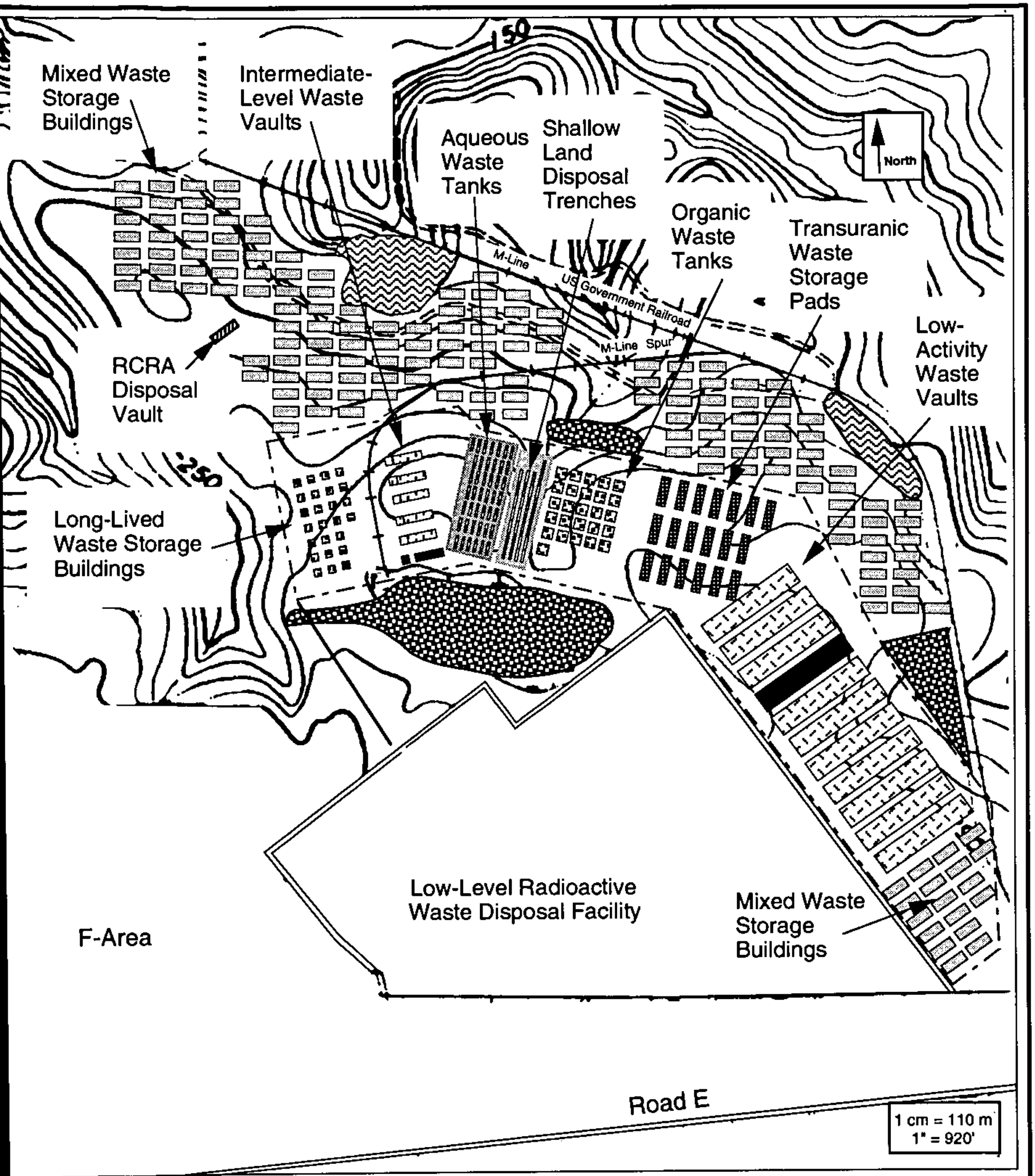
Figure 4-2. Configuration of treatment, storage, and disposal facilities in E-Area under the no-action alternative by 2024.


Mixed Waste Storage Buildings
Intermediate-Level Waste Vaults
Aqueous Waste Tanks
Shallow Land Disposal Trenches
North
Organic Waste Tanks
Transuranic Waste Storage Pads
M-Line
US Government Railroad
M-Line Spur
Low-Activity Waste Vaults
RCRA Disposal Vault
Long-Lived Waste Storage Buildings
Low-Level Radioactive Waste Disposal Facility
F-Area
Mixed Waste Storage Buildings
Road E
1 cm = 110 m
1" = 920'

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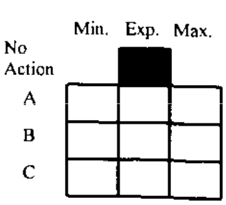
erosion hazard rating. The potential for erosion and sedimentation effects increases as the amount of land needed for construction increases, especially undeveloped land.

Potential adverse effects to geologic resources would be very small and could be mitigated by installing sediment and erosion control devices, properly grading slopes, and stabilizing the site. All new construction activities at SRS must comply with state regulations to prevent erosion. As a condition of the South Carolina Department of Health and Environmental Control (SCDHEC) National Pollutant Discharge Elimination System general permit for stormwater discharges from construction activities at SRS, a stormwater pollution prevention plan (WSRC 1993a) must be developed for each construction site covered by the permit, and each plan must provide for erosion and sediment controls. E-Area erosion and sediment control activities are addressed in the *Solid Waste Operations Erosion and Sedimentation Control Maintenance Program Plan - E-Area* (WSRC 1992a). For those areas already cleared and ready for construction of new facilities and those areas already operating, proper construction and maintenance of sediment ponds, stormwater basins, and other erosion and sediment control devices would mitigate adverse effects to soils during operation of waste management facilities.

Construction and operation activities might produce accidental occasional spills (e.g., oil, fuel, and process chemicals) on the soil. SRS has formal spill prevention, control, and countermeasures plans to
TE prevent, identify, and mitigate spills of petroleum products (WSRC 1991a, b). Both the *Savannah River Site Best Management Practices Plan* (WSRC 1991a) and the *Savannah River Site Spill Prevention, Control, and Countermeasures Plan* (WSRC 1991b) are updated as conditions warrant or at least every 3 years. In addition, SRS is obligated under the Federal Facility Agreement (EPA 1993) to identify, evaluate, and, if necessary, remediate spills of hazardous substances, including radionuclides (e.g., high-level liquid radioactive waste leaks). This remediation could include removing, storing, or disposing of contaminated soil. Because SRS has controls to prevent spills, large spills of waste requiring remediation of extensive areas of soil are not expected; therefore, impacts to soils would be very small.



4.1.3 GROUNDWATER RESOURCES

Facilities and activities that are part of the no-action alternative which could affect groundwater quantity or quality include the M-Area Air Stripper, additional mixed waste storage buildings, intermediate-level, low-activity, and RCRA-permitted waste disposal vaults, long-lived waste storage buildings, shallow land disposal units, transuranic and alpha waste storage pads, and the Defense Waste Processing Facility.

Since these facilities do not withdraw groundwater in quantities that would materially affect the availability of this resource, the focus of these assessments was on their potential to impact groundwater TE quality.

The M-Area Air Stripper (see Appendix B.14 for description) removes volatile organic compounds from TE contaminated groundwater beneath A- and M-Areas. Based on current data, DOE anticipates that it would need to operate the M-Area Air Stripper for the remainder of its 30-year post-closure period (1987 to 2017) to meet the groundwater protection standard (40 CFR 264.92) for the contaminants trichloroethylene and tetrachloroethylene. The air stripper would also treat investigation-derived TE hazardous wastes generated from groundwater monitoring wells. Effects of the continued operation of TC the M-Area Air Stripper on groundwater quality at SRS would be beneficial because of the continued removal of volatile organic compounds from groundwater beneath A- and M-Areas.

For the remaining storage and disposal facilities, the most important impact to the groundwater resources of SRS is the potential for the leaching of radioactive and hazardous constituents by rainfall infiltration. There is also a potential for groundwater contamination during construction as a consequence of leaks and spills of oil, fuel, or other chemicals from construction equipment. However, the potential impacts of such spills or leaks would be mitigated by using spill prevention plans and best management practices, TE as described in Section 4.1.2.

DOE would design and construct waste storage facilities and engineered disposal vaults to prevent TE releases, as described for the individual facility types in Appendix B, and would inspect and monitor them to ensure their continued integrity. Their operation, therefore, is very unlikely to adversely affect groundwater quality during the 30-year period considered in this EIS. Releases to groundwater could occur, however, whenever active maintenance is discontinued. For shallow land disposal facilities (i.e., slit trenches), releases could occur sooner. For purposes of assessment, it is assumed that TC institutional controls, including active maintenance, would be continued for 100 years. The potential TE impacts of releases from both disposal vaults and slit trenches were evaluated by calculating the effects of infiltration and the leaching of radionuclides from wastes on the concentration of radionuclides in groundwater beneath these facilities at a compliance point defined as a hypothetical well 100 meters (328 feet) away (Toblin 1995). The predicted groundwater concentrations were derived from information provided in the *Radiological Performance Assessment for the E-Area Vaults Disposal* TE *Facility* (Martin Marietta, EG&G, and WSRC 1994). The Radiological Performance Assessment evaluated disposal of unstabilized waste forms in the intermediate-level waste vaults, low-activity waste TC vaults, as well as suspect soil in slit trenches. This evaluation calculated the groundwater concentrations for each nuclide per curie of that nuclide in each of the waste disposal facilities (intermediate-level waste

TC

vaults, low-activity waste vaults, and slit trenches). The groundwater concentrations predicted in this environmental impact statement (EIS) were derived by applying these Radiological Performance Assessment-determined unit dilution factors to the anticipated inventories in each type of facility for each alternative and waste forecast.

TC

After the draft EIS was issued, DOE reevaluated the isotopic inventory of wastes and modified the inventories assumed in this EIS to better reflect waste composition. Because curium-247 and -248 are not present at detectable concentrations in the current wastes and are not expected to occur at detectable concentrations in any future waste, these isotopes were removed from the inventories considered in analysis. Therefore, the curium-247 and -248 exceedances discussed in the draft EIS do not occur under any alternative.

TE

Thus, the groundwater concentrations were predicted for the alternatives in this EIS by scaling from the Radiological Performance Assessment based on the number and type of facilities required, the radionuclide inventories, and the characteristics of the unstabilized waste forms. Factors such as retardation of radionuclide movement in groundwater by sorption processes, which differ between nuclides, were considered, as were the characteristics of the shallow aquifer (through which migration to surface water would occur). These concentrations were not added to existing groundwater contamination levels since, as noted below, they would not occur until a century or more in the future, after current groundwater concentrations would have been reduced by natural means (decay) or remediation activities. Potential contamination of the deep Middendorf aquifer (formerly known as the Tuscaloosa) was determined in an earlier EIS (DOE 1987) not to be a concern because of the isolation of that aquifer from the shallow aquifer affected by these facilities.

TC

The disposal of stabilized waste forms (ashcrete, glass) in slit trenches was not evaluated in the Radiological Performance Assessment and is subject to completion of performance assessments and demonstration of compliance with performance objectives required by DOE Order 5820.2A ("Radioactive Waste Management"). Therefore, DOE was unable to base an analysis of stabilized waste in slit trenches on the Radiological Performance Assessment. The analysis presented in the draft EIS did not account for the reduced mobility of stabilized waste forms in slit trenches. The final EIS assumes that releases from these wastes in slit trenches would not exceed the performance objectives specified by DOE Order 5820.2A. As a result of the modified assessment approach, exceedances for uranium and plutonium isotopes identified in the draft EIS under some alternatives and waste forecasts are no longer predicted to occur.

TE

DOE would re-evaluate the performance assessment and, if necessary, adjust either the waste acceptance criteria or the inventory limit for the storage or disposal units to ensure compliance with these criteria, or standards which may become applicable in the future. The results of applying this assessment methodology to the different storage and disposal facilities are presented below. TE

The performance objectives required by DOE Order 5820.2A include ensuring that groundwater resources are protected as required by federal, state, and local requirements. Additionally, public drinking water standards promulgated in 40 CFR 141 which limit dose to 4 millirem per year were adopted by DOE in Order 5400.5 ("Radiation Protection of the Public and the Environment"). TC

Compliance with the performance objectives required by DOE is determined by comparing the annual dose resulting from drinking 2 liters per day of the contaminated groundwater. This annual dose was compared with the 4 millirem per year effective dose equivalent criterion specified in DOE Order 5400.5. The factors used to convert from groundwater concentrations to dose are specified in DOE Order 5400.5. Assessment of compliance with this dose criterion was based on the potential additive effects of new units contaminating the same groundwater. The concentration values do not, however, include the groundwater contamination from prior waste disposal activities at SRS, as presented in Chapter 3. Groundwater contamination resulting from the waste disposal under this EIS would be in addition to existing contamination from past waste disposal. By the time that concentrations resulting from waste disposal activities evaluated in this EIS reached their peak (at least 97 to 130 years in the future), the concentrations of contaminants introduced by past disposal will have been substantially reduced below present concentrations as a result of natural decay processes and any environmental restoration programs. TE TC

Three types of vaults – RCRA-permitted disposal vaults, intermediate-level waste vaults, and low-activity waste vaults – would be used in E-Area. The existing vaults are subsurface structures designed to comply with the performance objectives of DOE Order 5820.2A. The performance assessment described above considered intact vaults operating as designed and a worst-case scenario of a fractured protective cap and fractured vaults (Martin Marietta, EG&G, and WSRC 1994). The groundwater analysis (Toblin 1995) determined that during the 30-year period of this EIS (1995 through 2024), releases of radionuclides from intermediate-level waste vaults or low-activity waste vaults are not expected to reach the 100-meter (328-foot) compliance point, even conservatively assuming an infiltration rate of 40 centimeters per year. The analysis also assumes that failure and collapse of either type of vault would be expected to occur as a result of normal deterioration within a period ranging from 570 years for the development of cracks in a vault's roof to over 1,000 years for a roof's collapse. TE TC

Under normal conditions vaults are slightly permeable, so some easily-leachable constituents will move through them and into the groundwater. The modeling results from this groundwater analysis indicate TC

TC that tritium would be the first radionuclide detected at the compliance point. Assuming infiltration at a rate of 40 centimeters per year, the peak concentration of tritium in groundwater at the compliance point would occur after 130 years for the intermediate-level waste vaults and after 97 years for the low-activity waste vaults. Peak concentrations of tritium in groundwater from these facilities would be 7.3×10^{-4} and 1.0×10^{-6} picocuries per liter, respectively, which are very small fractions of the 20,000 picocuries per liter limit specified in the EPA drinking water standard for this nuclide, and are not measurable by current instrumentation. In addition, during the 100-year institutional control period, periodic site inspections would discover any visible degradation of the cover and drainage system constructed over the vaults after the vaults are closed, and corrective actions would be taken.

TC The modeling results of the groundwater analysis for both types of low-level waste vaults beyond the institutional control period predicts that no dose of any constituent placed in these vaults under the no-action alternative would exceed the 4 millirem per year drinking water dose criterion at any time after disposal. The disposal of wastes in the RCRA-permitted vaults was not evaluated quantitatively. It would be subject to completion of performance assessments and demonstration of compliance with the performance objectives required by DOE Order 5820.2A. Therefore, DOE has conservatively assumed that groundwater concentrations as a result of radioactive releases from the RCRA-permitted vaults and all other low-level waste disposal facilities (vaults and slit trenches) would remain within the DOE performance objective of 4 millirem per year adopted by DOE in Order 5400.5.

TE

Releases of nonradioactive constituents from the RCRA-permitted vaults were not evaluated in this EIS. Hazardous constituent releases to groundwater could occur as a result of vault failure after loss of institutional control. The hazardous constituents in these vaults would consist primarily of metals, such as mercury and lead. These do not decay over time as do radioactive constituents such as tritium. Potential groundwater concentrations of hazardous constituents have not been evaluated, but some hazardous metals might enter groundwater following degradation of the vaults and waste forms.

Under the no-action alternative, shallow land disposal of radioactive waste would also continue. DOE Order 5820.2A as now implemented requires that performance assessments for radioactive waste management at DOE facilities be conducted prior to disposal of wastes. Recently issued guidance for

TE management of low-level waste at SRS (WSRC 1994a) prohibited shallow land disposal of wastes without a radiological performance assessment after March 31, 1995 (see Appendix B.27). The performance assessment referred to above (Martin Marietta, EG&G, and WSRC 1994) evaluated the impact of shallow land disposal of suspect soils on groundwater quality near the center of SRS (west of the E-Area vaults). Modeling results for suspect soils under the no-action alternative (Toblin 1995)

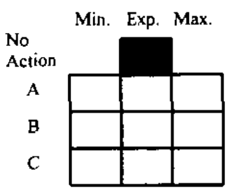
TC indicate that none of the radionuclides analyzed would exceed the 4 millirem per year drinking water dose criterion at any time. The projected impacts on groundwater resources at SRS from E-Area disposal facilities do not consider existing groundwater contamination beneath the Burial Ground Complex, because of the time displacements of the impacts, as discussed earlier. TC

Under the no-action alternative, DOE would store packaged mixed wastes on concrete pads within each of the mixed waste storage buildings; each pad would include a concrete sump to collect and contain leaks per RCRA requirements (see Appendix B.18). Therefore, it is not anticipated that operation of these mixed waste storage buildings through the year 2024 would affect the quality of groundwater in the area. Shallow groundwater in this area flows to Upper Three Runs and Crouch Branch to the north and northeast and to Fourmile Branch to the south. Mixed waste storage buildings would be located a short distance from two of these streams (see Figures 4-1 and 4-2). However, these buildings would be above-grade, zero-release facilities and, as discussed above, releases would not be expected to soils, streams, or groundwater. If, however, releases did occur, groundwater monitoring around such facilities would detect contaminants in groundwater and mitigation by containment, removal, and proper disposal of contaminated media would be implemented.

The no-action alternative also calls for construction of 24 long-lived radioactive waste storage buildings, TC
19 transuranic and alpha waste storage pads, 26 114-cubic-meter (30,000-gallon) organic waste storage TE
tanks, and 43 114-cubic-meter (30,000-gallon) aqueous waste tanks in E-Area (see Figure 4-2). These storage facilities would be designed and constructed to meet regulatory requirements to protect human health and the environment, including maintenance of zero releases as noted above. The long-lived waste storage buildings and the transuranic and alpha waste storage pads would include sumps to collect and contain leaks. Below-grade organic waste tanks would be constructed with secondary containment and leak detection and leachate collection systems, as required by the Resource Conservation and Recovery Act (RCRA). Neither the low-level waste and transuranic and alpha waste storage facilities nor the above- and below-grade mixed waste tanks are expected to adversely affect the quality of groundwater at SRS under normal circumstances.

Because DOE would not intend to release the areas containing these storage facilities to unrestricted access, the facilities would not be designed to function for extended time intervals without institutional control and maintenance. Accordingly, no assessment of potential releases from long-term unattended operation of these facilities and their contents has been performed.

The Defense Waste Processing Facility and the Z-Area Saltstone Facility would operate under the no-action alternative for this EIS. High-level waste stored in the F- and H-Area tank farms would be gradually removed for vitrification, storage and permanent disposal. As the high-level waste is removed from the tanks and vitrified, the potential for inadvertent releases to groundwater would decrease. Possible effects on groundwater would be minimized with the treatment and ultimate disposal of the high-level waste. In case of accidental spills of salt solution (e.g., from transfer pipes in the tank farms) during Defense Waste Processing Facility operations, the soil would be expected to slow the migration of contaminants in the subsurface, and remedial actions would be undertaken to recover as much of the spilled material as is feasible and to minimize the dispersal of the residual material. The effects on groundwater of the operation of the Defense Waste Processing Facility and the Saltstone Facility were TE presented in the *Final Supplemental Environmental Impact Statement Defense Waste Processing Facility*.



4.1.4 SURFACE WATER RESOURCES

This section examines the no-action alternative activities (described in Section 2.2) that would produce wastewater discharges to surface waters and presents the potential effects on the environment from both radiological and nonradiological constituents contained in treated wastewater. The evaluation of these consequences is based on Section 4.1.3. Evaluation of these consequences assumed that existing regulatory limits would continue to apply for the various nonradiological constituents. The radiological TE criterion used as the basis for this evaluation comply with DOE Order 5400.5 and 40 CFR 141, the U.S. Environmental Protection Agency (EPA) national primary drinking water regulations.

Spills or leaks could occur from various tanks and equipment. Sumps and secondary containment around tanks and vulnerable equipment would capture and collect spills or leaks if they were to occur. Material that accumulates in sumps and secondary containment would be sampled to determine if contaminants were present. If contaminated, the wastewater would be treated in the appropriate treatment facility, such as the F/H-Area Effluent Treatment Facility or the M-Area Dilute Effluent Treatment Facility. Uncontaminated wastewater would be discharged via a permitted outfall to surface waters. SRS has and would maintain a best management practices plan, a spill prevention control and countermeasures plan, and administrative procedures for monitoring and cleaning up spills to prevent them from reaching a surface stream.

In construction of the various storage facilities needed under the no-action alternative in E-Area, DOE would prepare sedimentation and erosion control plans in compliance with state regulations on stormwater discharges, which became effective in 1992 as part of the Clean Water Act. SRS was issued a permit by SCDHEC (Permit SCR100000) that applies to stormwater runoff during construction activities. If a project requires disturbing more than 0.02 square kilometer (5 acres) of land, SCDHEC must approve the sediment and erosion control plan. Facilities or measures taken to control erosion during the construction phase would be regularly inspected by SCDHEC; the Management and Operating Contractor's Environmental Protection Department; the U.S. Natural Resources Conservation Service (formerly the Soil Conservation Service); and the U.S. Forest Service to monitor the effectiveness of the erosion control measures (particularly following a storm). Corrective measures, if needed, would be taken by DOE. After facilities begin operating, they would be included in the *SRS Stormwater Pollution Prevention Plan*, which details the required stormwater control measures and is one of the criteria of the stormwater general permit issued to SRS by SCDHEC (Permit SCR000000) for operating facilities. Also, as required by the National Pollutant Discharge Elimination System permit, the facilities would be included in the *SRS Best Management Practices Plan.* TE

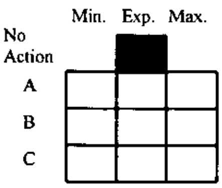
Studies have been performed to determine the effect of stormwater that might infiltrate waste in the disposal facilities in E-Area and then enter the groundwater. As noted in Section 4.1.3, the incremental increase in groundwater concentrations of the radionuclides present in the waste would be small. Most of the radionuclides would not reach peak concentrations in the river until at least 10,000 years beyond the present. The tritium would peak in 70 to 237 years at a concentration below 10^{-5} picocuries per liter, which is one billion times below the regulatory limits; iodine-129, selenium-79 and technetium-99 would peak in 150 to 9,700 years at concentrations below 10^{-6}, 10^{-6}, and 10^{-4} picocuries per liter, respectively, which are also well below regulatory limits (Toblin 1995). Thus, the impact on the Savannah River from groundwater which reaches the surface and eventually enters the river would be very small. TC TC TE

The M-Area Vendor Treatment Facility (see Appendix B.15) would not discharge wastewater directly to a surface stream. However, the wastewater discharged from the scrubber system [an average flow of approximately 0.5 liter (0.13 gallon) per minute] would be directed to the M-Area Dilute Effluent Treatment Facility (DOE 1993a), which can adjust the wastewater pH, add alum as a coagulant, settle the resulting suspended solids, and dewater the solids. Since the wastewater from the scrubber system would be similar in composition to the wastewater already being treated, the surface water would receive little, if any, impact from the discharge of this additional treated water. The water resources section in Appendix E lists the minimum and maximum chemical concentrations found in the effluent from the M-Area Liquid Effluent Treatment Facility, which includes the Dilute Effluent Treatment Facility (outfall M-004). The treatment facility has been meeting the discharge criteria. The M-Area Liquid Effluent Treatment Facility has been processing approximately 53 liters (14 gallons) per minute for the last several years (Arnett 1994), but it is designed to treat 100 liters (26 gallons) per minute. Thus, the additional flow of 0.5 liter (0.13 gallon) per minute from the M-Area Vendor Treatment Facility would TE TE have a very small effect on the flow rate of the water being treated and the effectiveness of the treatment facility. The treated water would be discharged to Tims Branch via National Pollutant Discharge Elimination System permitted outfall M-004. A DOE environmental assessment (DOE 1993a) concluded that water quality and indigenous biota within the receiving stream (Tims Branch) would not be adversely impacted by this discharge of treated water.

Additional wastewater streams would be treated in existing SRS wastewater treatment facilities. The M-Area Air Stripper removes volatile organic compounds from the groundwater beneath A- and M-Areas. The air stripper is permitted by SCDHEC to treat 2,270 liters (600 gallons) per minute of contaminated groundwater and operates at approximately 1,900 liters (500 gallons) per minute. Purge water containing volatile organic compounds from the monitoring wells would be treated by the air stripper. An additional 2 liters (0.53 gallon) per minute average flow of purge water would be treated by the air stripper. The operation of the air stripper would not be compromised, and the quality of the effluent would not change.

Additional wastewater would be sent to the F/H-Area Effluent Treatment Facility, either directly or after being treated in one of the high-level waste evaporator systems. The F/H-Area Effluent Treatment Facility has a design flow rate of 1,135 liters (300 gallons) per minute. The projected additional wastewater stream for the no-action alternative (based on the expected waste forecast) is estimated to be 1.8 liters (0.48 gallon) per minute. There would also be 26 liters (6.9 gallons) per minute of recycle water from the Defense Waste Processing Facility being sent to the F/H-Area Effluent Treatment Facility. Thus, the additional flow of wastewater to be treated would be 27.8 liters (7.3 gallons) per
TE minute. Since the facility processes approximately 114 liters (30 gallons) per minute, this additional flow would be within its design capability. The *Final Supplemental Environmental Impact Statement Defense Waste Processing Facility* discusses the effects of this wastewater on the treatment processes. This release, on an annual basis, represents approximately 15 percent of the total dose to the offsite maximally exposed individual from liquid releases from SRS in 1993. The water resources section in Appendix E lists the minimum and maximum chemical concentrations which were reported for the F/H-Area Effluent Treatment Facility outfall (outfall H-016) for 1993. The effluent concentrations have been in compliance with the permit limits. Since the additional wastewater is of similar composition to the wastewater already being treated by this system, the quality of the effluent from the F/H-Area Effluent Treatment Facility is not likely to change. The calculated dose of the various radionuclides is included in
TC the tables in Appendix E. Two radionuclides account for more than 99 percent of the calculated dose: tritium and cesium-137 together account for 0.0206 millirem of the total dose of 0.0208 millirem to the offsite maximally exposed individual over the 30-year period (1995 through 2024)., The impact on Upper Three Runs from radionuclides would be very small.

The Replacement High-Level Waste Evaporator would eventually replace existing evaporators and would produce distillate of the same quality as produced by the present evaporators and which would be treated in the F/H-Area Effluent Treatment Facility. Concentrated waste from the evaporator would be sent to the Defense Waste Processing Facility (WSRC 1994b). Operation of the replacement evaporator TE would not change the quality of the wastewater discharges. The wastewater flow would be approximately the same because the older evaporators would be retired.



4.1.5 AIR RESOURCES

The no-action alternative would result in additional nonradiological and radiological emissions from SRS. In both cases, the resulting incremental increase in air concentrations at and beyond the SRS boundary would be very small compared to existing concentrations at and beyond the SRS boundary. TE Operations under the no-action alternative would not exceed state or Federal air quality standards.

4.1.5.1 Construction

Potential impacts to air quality from construction activities under the no-action alternative would include fugitive dust and emissions from construction equipment. Fugitive dust results from soil transportation activities, moving and maintenance of soil piles, and clearing and excavation of soil. Approximately 182,500 cubic meters (239,000 cubic yards) of soil would be displaced in E-Area for the construction of the treatment, storage, and disposal facilities listed in Section 2.2.7.

The amount of fugitive dust produced was assumed to be proportional to the land area disturbed. Amounts of fugitive dust for the no-action alternative were calculated from the estimated annual average amount of soil excavated during construction activities over the 30-year analysis period. Fugitive soil emissions are based on U.S. Environmental Protection Agency (EPA) AP-42 emission factors and the number of cubic meters of soil excavated (EPA 1985; Hess 1994a). Maximum downwind concentrations at the SRS boundary for total suspended particulates and particulate matter less than 10 microns in diameter were calculated using EPA's TSCREEN model (EPA 1988).

Exhaust emissions from construction equipment were calculated from estimates of the types and number of earth-moving equipment required and from EPA AP-42 emission factors. Maximum downwind concentrations for criteria pollutants at the SRS boundary were calculated using EPA's TSCREEN model (EPA 1988).

The 30-year average annual concentrations due to construction activities are shown in Table 4-1. The increases in SRS-boundary concentrations due to construction activities would be less than state and Federal ambient air quality standards for all air contaminants.

TE

Table 4-1. Average increase over baseline[a] of criteria pollutants at the SRS boundary from construction-related activities under the no-action alternative.

Pollutant	Averaging time	No-action alternative: Baseline (mg/m^3)[b,c]	No-action alternative: Increase[d] (mg/m^3)	SCDHEC standard[e] (mg/m^3)	Existing + increase as percent of standard (%)[f]
Nitrogen oxides	1 year	14	0.01	100	14
Sulfur dioxide	3 hours	857	65.65	1,300	71
	24 hours	213	1.27	365	59
	1 year	17	<0.01[g]	80	21
Carbon monoxide	1 hour	171	1,919	40,000	5
	8 hours	22	302	10,000	3
Total suspended particulates	1 year	43	0.01	75	57
Particulate matter less than 10 microns in diameter	24 hours	85	5.24	150	60
	1 year	25	0.01	50	50

TC

TE

a. Baseline includes background concentrations and the contributions from existing sources.
b. Micrograms per cubic meter.
c. Source: Stewart (1994).
d. Source: Hess (1994a).
e. Source SCDHEC (1976).
f. Percent of standard = 100 × (existing sources + baseline + increase) divided by regulatory standard.
g. < is read as "less than."

4.1.5.2 Operations

The following facilities were included in the no-action alternative air dispersion modeling analysis: the Defense Waste Processing Facility, including In-Tank Precipitation; additional organic waste storage tanks; the M-Area Vendor Treatment Facility; additional mixed waste storage tanks (E-Area); and hazardous and mixed waste storage facilities.

Air emissions from disposal vaults in E-Area are very small because solvents and solvent-contaminated rags are not disposed of in the vaults. Solvents and solvent-contaminated rags are stored in drums, with pressure relief valves that release with pressures greater than 280 grams per square centimeter (4 pounds per square inch), located in the hazardous waste and mixed waste storage buildings. Emissions are very small under routine operating conditions because pressure changes greater than 280 grams per square centimeter (4 pounds per square inch) would occur only during emergency conditions, such as a fire. TE

To determine which facility source terms should be revised to accurately reflect the structure of operations of the no-action alternative, a thorough review of facilities was performed. The following summarizes facility source terms that were not changed and the rationale for not modifying them.

Changes in impacts to maximum boundary-line concentrations would not be expected to result from the continued operation of the F- and H-Area evaporators, the F/H-Area Effluent Treatment Facility, the lead melter, solvent reclamation units, the silver recovery unit, the Organic Waste Storage Tank, Savannah River Technology Center ion exchange process, the low-level waste compactors, or the M-Area Air Stripper, because these facilities are currently operating. Additional organic emissions from the M-Area Air Stripper due to the treatment of investigation-derived waste from groundwater monitoring well operations would be less than 13 kilograms (29 pounds) per year; the incremental contribution to maximum boundary-line concentrations would be very small [less than 0.005 micrograms per cubic meter, based on TSCREEN modeling and Hess (1995a)]. Additional organic emissions from the F/H-Area Effluent Treatment Facility would be 2.7 kilograms (6 pounds) per year; the incremental impact would be very small (Hess 1994b). TC

4.1.5.2.1 Nonradiological Air Emissions Impacts

Table 4-2 shows maximum ground-level concentrations at the SRS boundary for nonradiological air pollutants emitted under the no-action alternative. Air dispersion modeling was performed with calculated emission rates for facilities not yet operating and actual 1990 emission levels for facilities currently operating (Stewart 1994). For proposed facilities for which permit limits have not yet been established, emissions were estimated based on operational processes (see Appendix B) and data obtained from similar activities at SRS and other waste management facilities. The dispersion calculations for criteria pollutants were performed with 1991 meteorological data from H-Area. DOE used periods ranging from 1 hour to 1 year to model criteria pollutant concentrations, which correspond to the averaging periods found in South Carolina's "Ambient Air Quality Standards" (SCDHEC 1976). TC

Table 4-2. Changes in maximum ground-level concentrations of criteria pollutants at the SRS boundary from operation activities under the no-action alternative.

TE

Pollutant	Averaging time	Existing sources (μ/m^3)[a,b]	Regulatory standards (μ/m^3)[c]	Background concentration (μ/m^3)[d]	Increase in concentration (μ/m^3)	Existing + background + increase as percent of standard (%)[e]
Nitrogen oxides	1 year	6	100	8	0.11	14[f]
Sulfur dioxide	3 hour	823	1300	34	15.36	67
	24 hour	196	365	17	2.8	59
	1 year	14	80	3	0.08	21
Carbon monoxide	1 hour	171	40,000	NA[g]	24.2	0.5
	8 hour	22	10,000	NA	4.03	0.3
Total suspended particulates	1 year	13	75	30	2.02	60
Particulate matter < 10 microns in diameter	24 hour	51	150	34	5.20	60
	1 year	3	50	22	0.13	50
Lead	3 months	4×10^{-4}	1.5	0.011	0	0.8
Gaseous fluorides (as hydrogen fluoride)	12 hour	2	3.7	NA	0.0019	54
	24 hour	1	2.9	NA	9×10^{-4}	35
	1 week	0.4	1.6	NA	3.5×10^{-4}	25
	1 month	0.1	0.8	NA	9×10^{-5}	13

TC

a. Micrograms per cubic meter.
b. Source: Stewart (1994).
c. Source: SCDHEC (1976).
d. Source: SCDHEC (1992).
TE e. Percent of standard = 100 × (existing sources + background + increase in concentration) divided by regulatory standard.
f. For example, 6 + 8 + 0.11 divided by 100 would equal 14.11 percent, rounded to the nearest whole number, 14 percent.
g. NA = not applicable.

Maximum ground-level concentrations for nonradiological air pollutants were determined from the Industrial Source Complex Version 2 Dispersion Model using maximum potential emissions from all the facilities proposed in the no-action alternative (Stewart 1994). The calculations for the dispersion of carcinogenic toxic substances were performed with 1991 meteorological data from H-Area. Modeled air toxic concentrations for carcinogens were based on an annual averaging period and are presented in Section 4.1.12.2.2. To get a 30-year exposure period, annual averages were calculated by adding all emissions occurring in an annual period, and then proportioning the emissions on a unit-time basis (e.g., grams per second). Under the no-action alternative, emissions of noncarcinogenic air toxics are very small. Maximum boundary-line concentrations for all SCDHEC air toxics are very small and are below SCDHEC regulatory standards. They are presented in the *SCDHEC Regulation No. 62.5 Standard*

No. 2 and Standard No. 8 Compliance Modeling Report Input/Output Data (WSRC 1993b) and in Section 3.5 of this EIS.

4.1.5.2.2 Radiological Air Emissions Impacts

Offsite maximally exposed individual and population doses are presented for atmospheric releases resulting from routine operations under the no-action alternative. The largest sources of radionuclides would be from activities at the transuranic and alpha waste storage pads, the F- and H-Area tank farms, M-Area Vendor Treatment Facility, and the F/H-Area Effluent Treatment Facility. L004-13

SRS-specific computer models MAXIGASP and POPGASP (Hamby 1992) were used to determine the maximum individual dose at the SRS boundary and the 80-kilometer (50-mile) population dose, respectively, resulting from routine atmospheric releases. See Appendix E for detailed facility-specific isotopic and dose data. L004-13

Table 4-3 shows the doses to the offsite maximally exposed individual and the population as a consequence of the normal radiological emissions from the no-action alternative activities. The calculated incremental committed effective annual dose equivalent to the hypothetical offsite maximally exposed individual would be 1.2×10^{-4} millirem [doses were calculated using dose factors provided by Simpkins (1994a)], which is well within the annual dose limit of 10 millirem for SRS atmospheric releases. In comparison, an individual living near SRS receives a dose of 0.25 millirem from all current releases of radioactivity at SRS (Arnett 1994). TC

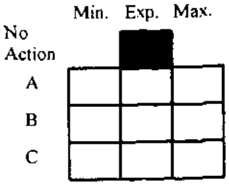
Table 4-3. Annual radiological doses to individuals and the population within 80 kilometers (50 miles) of SRS from atmospheric releases under the no-action alternative.[a] TE

	Offsite maximally exposed individual	Population
Release Pathway	Dose (millirem)	Dose (person-rem)
Atmospheric	1.2×10^{-4}	2.9×10^{-4}

TC

a. Source: Simpkins (1994a). TE

The annual incremental dose to the population within 80 kilometers (50 miles) of SRS from the no-action alternative would be 2.9×10^{-4} person-rem. In comparison, the collective dose received from natural sources of radiation is approximately 1.95×10^{5} person-rem (Arnett, Karapatakis, Mamatey 1994). Sections 4.1.12.1 and 4.1.12.2 describe the potential health effects of these releases on the workers and public, respectively.



4.1.6 ECOLOGICAL RESOURCES

Under the no-action alternative, disturbed areas would be cleared and graded to build new waste storage and disposal facilities. (Areas are given in acres; to convert to square kilometers, multiply by 0.004047.) Approximately 160 acres of the following types of woodlands would be cleared and graded by 2024:

- 7 acres of slash pine planted in 1959
- 42 acres of loblolly pine planted in 1987
- 26 acres of white oak, red oak, and hickory regenerated in 1922
- 44 acres of longleaf pine planted in 1922, 1931, or 1936
- 3 acres of loblolly pine planted in 1946
- 20 acres of longleaf pine planted in 1988
- 18 acres from which mixed pine/hardwood was recently harvested

Larger, more mobile animal species inhabiting the undeveloped portions of the site, such as fox, raccoon, bobcat, gray squirrel, and white-tailed deer would be able to avoid the clearing and grading equipment and escape; smaller, less mobile species such as reptiles, amphibians, and small mammals could be killed or displaced by the logging and earth-moving equipment. Although the animals displaced by construction will likely survive for some time in newly established home ranges, these individuals or those whose home ranges they infringe on may die or experience decreased reproduction. The net result of the construction would be less habitat and therefore fewer individuals. If the clearing were done in the spring and summer, birds' nests, including nestlings and eggs, would be destroyed. Hardwood-dominated sites on steep slopes and in wetlands would be avoided whenever possible. Approximately 15 percent of the total acreage of mature hardwoods in or near E-Area would be cleared (Figure 3-9). The clearing of hardwoods would be restricted to some upland areas required for sediment ponds (Figures 3-9 and 4-2).

Construction and operation of storage and disposal facilities within the previously cleared and graded portions of E-Area would have little effect on terrestrial wildlife. Wildlife habitat in these areas is poor and characterized by mowed grassy areas with few animals. Birds and mammals that use these areas, mostly for feeding, would be displaced by construction activities, but it is unlikely that they would be physically harmed or killed.

The undeveloped land between the M-Line railroad and the E-Area expansion and extending northwest of F-Area is described in Section 3.6. Animal species common to these areas are typical of the mixed pine/hardwood forests of South Carolina and are described in Section 3.6.1. TE

Wetlands would not be affected by construction on the developed or undeveloped lands (Ebasco 1992). Potential adverse effects to the downstream wetlands, aquatic macroinvertebrate, and fish species of Crouch Branch and five small unnamed tributaries to Upper Three Runs would be minimized during construction by installing sediment and erosion control devices before clearing begins, maintaining the sediment and erosion control devices, properly grading the slopes, and stabilizing the site. By state law, construction activities on SRS must have an approved sediment and erosion control plan (see Section 4.1.2). Proper construction and maintenance of sediment ponds and stormwater basins would mitigate adverse effects to the wetlands during operation of waste storage and disposal facilities. Additional sediments are not likely to reach the wetlands adjacent to Upper Three Runs.

The effect of additional wastewater discharges to surface waters for the no-action alternative are presented in Section 4.1.4. Small changes would occur to discharge rates, but the wastewater discharges would remain within permit limits. The aquatic biota in the receiving streams would not be affected because the water quality would not change.

Suitable habitat for the red-cockaded woodpecker exists in the area adjacent to E-Area. Red-cockaded woodpeckers prefer to nest in living pine trees over 70 years of age and forage in pine stands over 30 years of age (Wike et al. 1994). Trees suitable for nesting and foraging are found throughout SRS. In 1986, DOE and the U.S. Fish and Wildlife Service agreed on a red-cockaded woodpecker management plan at SRS, which is based on dividing SRS into two management areas (Henry 1986) (Figure 4-3). TE

One management area (112,000 acres; Management Area Two) forms a natural buffer just within the SRS boundary. This management area contains most of the suitable red-cockaded woodpecker habitat on SRS and all the active colonies. Timber in this area is managed to produce a viable population of red-cockaded woodpeckers. The red-cockaded woodpecker population has increased from 5 in 1985 to 77 in 1994 (LeMaster 1994a). TC

The other management area (69,000 acres; Management Area One; Figure 4-3) includes developed areas of SRS and adjacent woodland. E-Area and the area of proposed expansion are located within this management area. While potential red-cockaded woodpecker habitat occurs within this area, no active colonies or birds have been identified. By agreement between DOE and the U.S. Fish and Wildlife Service, Management Area Two, the outer ring of the SRS, has been dedicated to enhancement of

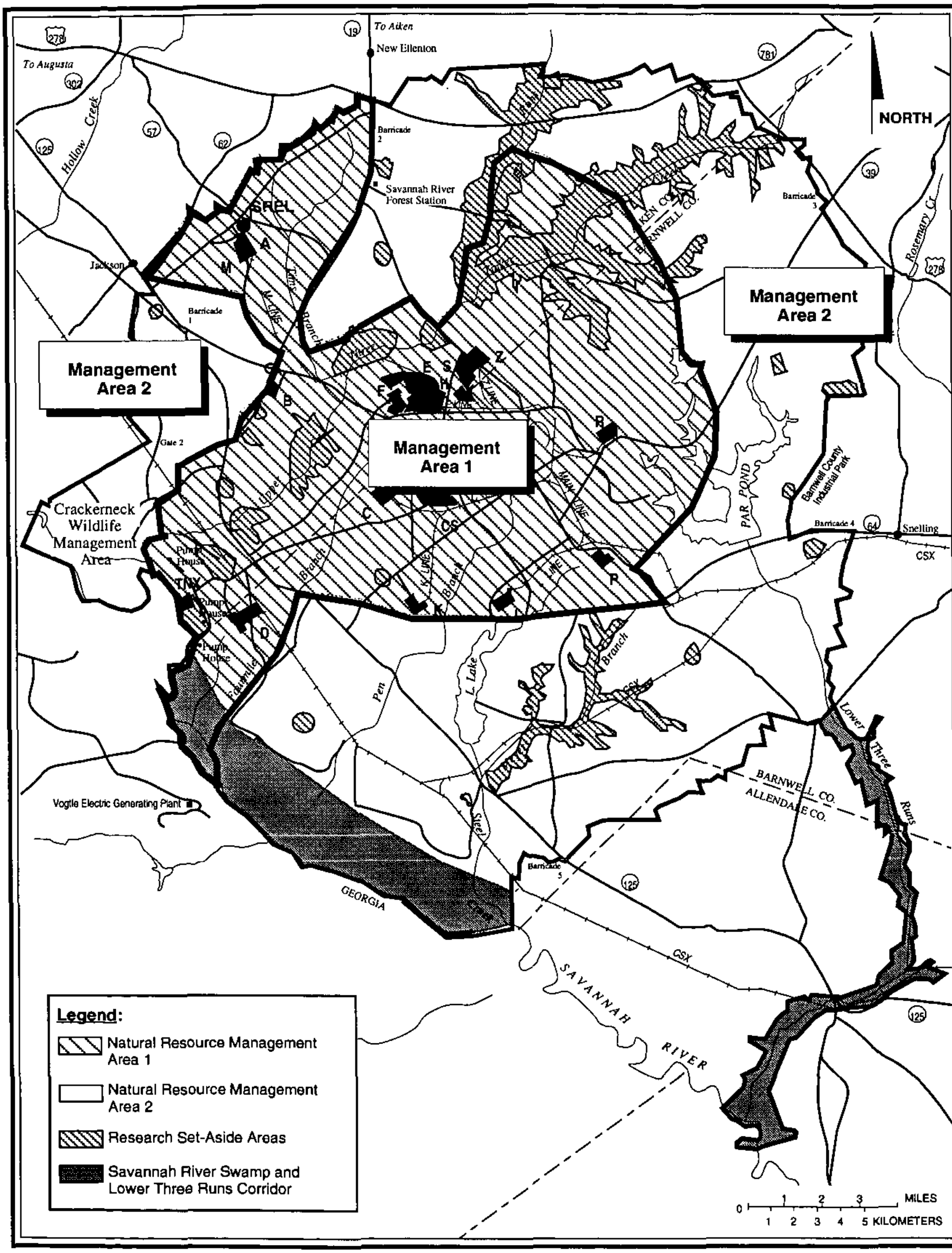


Figure 4-3. SRS natural resource management areas, Savannah River Swamp, Lower Three Runs corridor, and research set-aside areas.

red-cockaded woodpecker populations and habitat, and reserved for timber management activities compatible with this goal. In the same agreement, Management Area One, the central core of SRS that includes E-Area, has been dedicated to DOE mission requirements and intensive timber management. The area northwest of F-Area contains suitable nesting and foraging habitat. This area was surveyed for red-cockaded woodpeckers in 1993 and no colonies or foraging birds were located (LeMaster 1994a). Because of the intensive red-cockaded woodpecker management conducted on most of SRS, clearing of this land would not affect red-cockaded woodpeckers.

The smooth coneflower is another Federally protected species on SRS. It grows in open woods, in cedar barrens, along roadsides, in clearcuts, and in powerline rights-of-way – habitat which is available in the area. However, the species was not found in or near E-Area during 1992 or 1994 botanical surveys (LeMaster 1994b).

One Federally listed Category 2 species, the American sandburrowing mayfly, is known to occur in Upper Three Runs. Several Federally listed Category 2 animal species could occur on the site proposed for new construction. These species include the southern hognose snake, northern pine snake, loggerhead shrike, and Bachman's sparrow.

Botanical surveys performed during 1992 and 1994 by the Savannah River Forest Station located four populations of rare plants in or adjacent to E-Area (see Figure 4-4). One population of *Nestronia umbellula* (a shrub) and three populations of Oconee azalea (*Rhododendron flammeum*) were located on the steep slopes adjacent to the Upper Three Runs floodplain (LeMaster 1994b). The Oconee azalea is a South Carolina-listed rare species. *Nestronia umbellula* was a Federally listed Category 2 species that was found to be more abundant than previously believed; consequently, it is no longer listed (USFWS 1993). These species would not be adversely impacted by the no-action alternative. TE

DOE prepared a Protected Species Survey (April 1995) based on information presented in the draft EIS and submitted it to the U.S. Fish and Wildlife Service and the National Marine Fisheries Service as part of the formal consultation process in compliance with the Endangered Species Act of 1973. The survey is included as Appendix J of this EIS. Both the U.S. Fish and Wildlife Service and the National Marine Fisheries Service concur with DOE's determination of no jeopardy (i.e., no impact to endangered species) for the proposed project in the no-jeopardy opinions contained in Appendix J. However, both agencies stated that additional consultation would be necessary as siting for new facilities proceeds. DOE has committed to conduct additional protected species surveys as needed, and to consult with these agencies should changes occur in the proposed project and as new waste management facilities are planned. TC L003-02

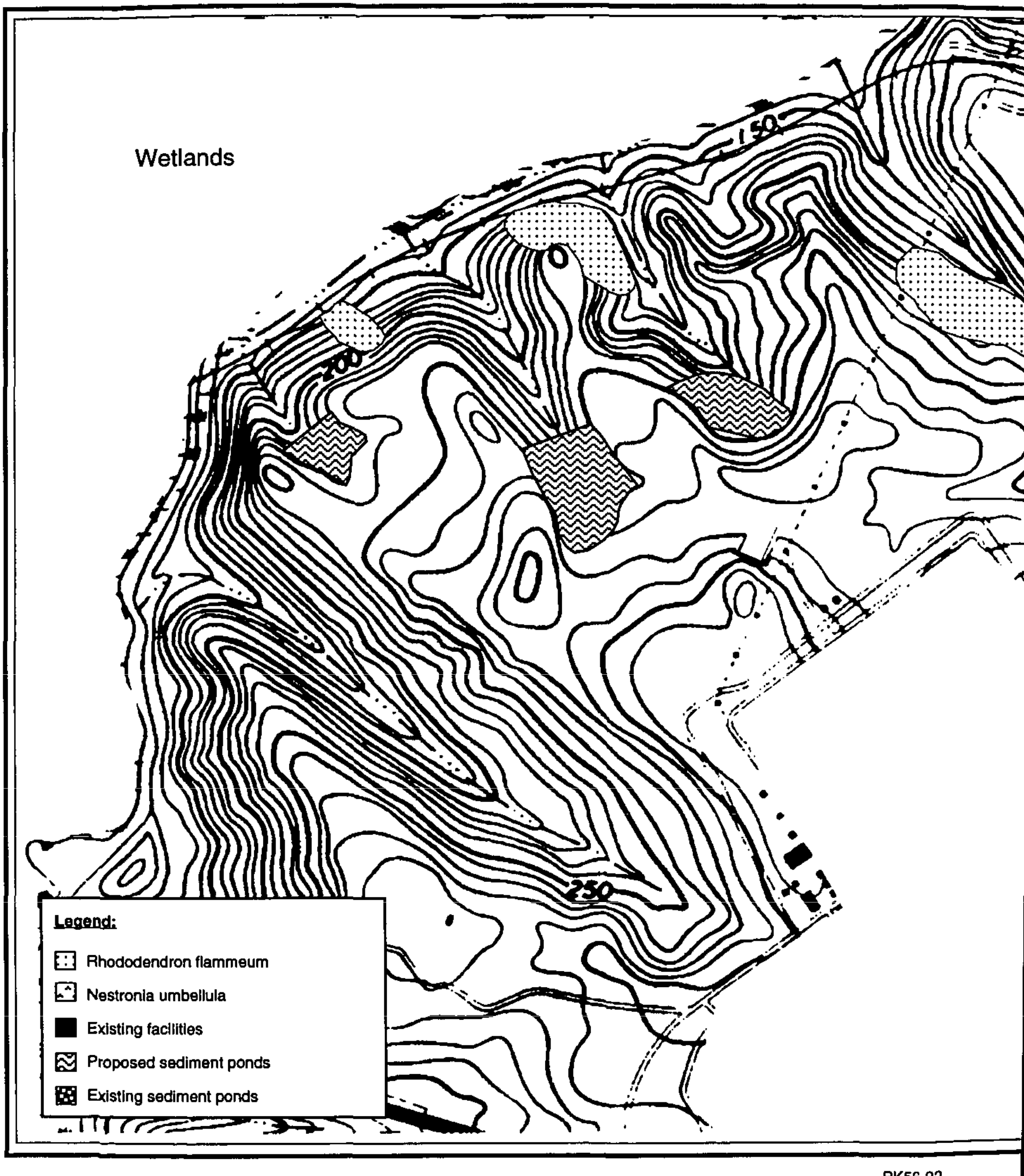
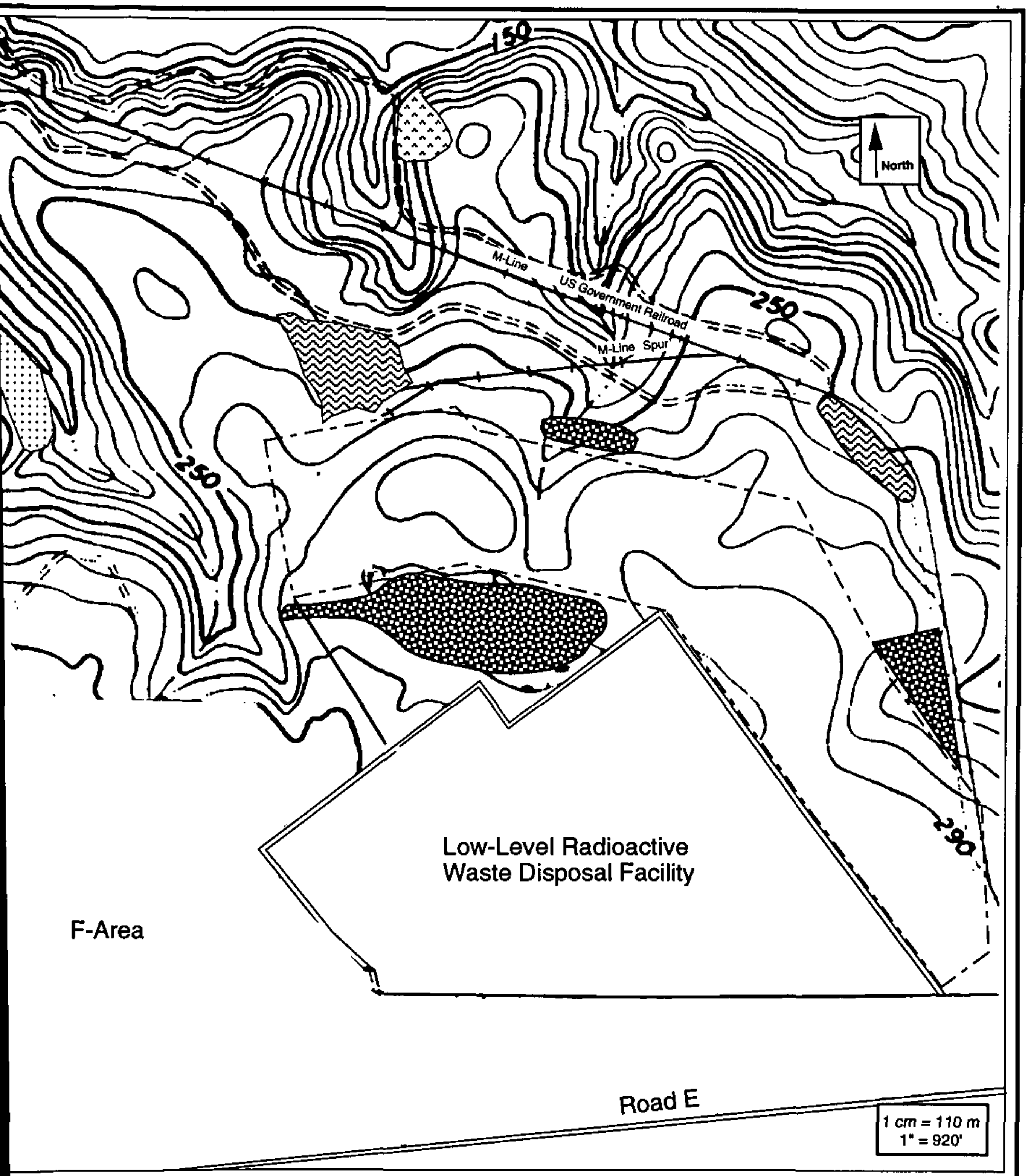
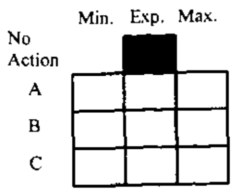


Figure 4-4. Rare plants located near E-Area during Savannah River Forest Station 1992 and 1994 botanical surveys.


150
North
M-Line
US Government Railroad
250
M-Line Spur
250
290
Low-Level Radioactive
Waste Disposal Facility
F-Area
Road E
1 cm = 110 m
1" = 920'

PK56-22

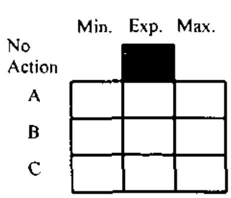


4.1.7 LAND USE

Land use impacts were evaluated on the basis of the amount of land that would be cleared to build facilities that otherwise would be available for non-industrial uses such as natural resource conservation or research, or future, but unidentified, land options.

TC DOE would use approximately 0.98 square kilometer (160 acres of undeveloped; 81 acres of developed) of land in E-Area for activities associated with the no-action alternative. SRS has about 181,000 acres of undeveloped land, which includes wetlands and other areas that cannot be developed, and 17,000 acres of developed land.

Activities associated with the no-action alternative would not affect current SRS land-use plans; E-Area was designed as an area for nuclear facilities in the *Draft 1994 Land-Use Baseline Report* (WSRC
TE 1994c). Furthermore, no part of E-Area has been identified as a potential site for future new missions. According to the *FY 1994 Draft Site Development Plan* (DOE 1994a), proposed future land management plans specify that E-Area be characterized and remediated for environmental contamination in its entirety, if necessary. Decisions on future SRS land uses will be made by DOE through the site development, land-use, and future-use planning processes, including public input through avenues such as the Citizens Advisory Board as required by DOE Order 4320.1B.



4.1.8 SOCIOECONOMICS

This section describes the potential effects of the no-action alternative on the socioeconomic resources in the region of influence. This assessment is based on the estimated construction and operations personnel required to implement this alternative (Table 4-4). Impacts to socioeconomic resources can be evaluated by examining the potential effects from both the construction and operation of each waste management alternative on factors such as employment, income, population, and community resources in the region of influence.

Table 4-4. Estimated construction and operations employment under the no-action alternative.[a]

Year	Construction employment	Operations employment
1995	30	1,880
1996	50	1,880
1997	50	2,000
1998	40	2,210
1999	40	2,310
2000	40	2,420
2001	40	2,420
2002	40	2,420
2003	40	2,450
2004	40	2,450
2005	40	2,450
2006	40	2,450
2007	40	2,450
2008	40	2,450
2009	40	2,450
2010	40	2,450
2011	40	2,450
2012	40	2,450
2013	40	2,450
2014	40	2,450
2015	40	2,450
2016	40	2,450
2017	40	2,450
2018	40	2,450
2019	40	2,450
2020	40	2,450
2021	40	2,450
2022	40	2,450
2023	40	2,450
2024	40	2,450

a. Source: Hess (1995a, b).

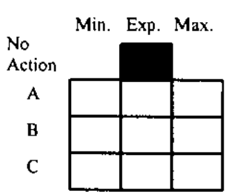
TC

4.1.8.1 Construction

TC Construction employment associated with the no-action alternative is expected to peak in 1996 and 1997 with approximately 50 jobs (Table 4-4). Given the normal fluctuation of employment in the construction industry, DOE does not expect a net change in regional construction employment from implementation of the no-action alternative. Therefore, DOE does not expect socioeconomic resources in the region to be affected.

4.1.8.2 Operations

TC Operations employment associated with implementation of the no-action alternative would peak during 2003 through 2024 with an estimated 2,450 jobs (Table 4-4), which represents approximately 12 percent of the 1992 SRS employment. DOE expects that these jobs would be filled through the reassignment of existing workers. Thus, DOE anticipates that socioeconomic resources would not be affected by changes in operations employment.



4.1.9 CULTURAL RESOURCES

Potential impacts on cultural resources can be evaluated by identifying the known or expected important resources in the areas of potential impact and activities that could directly or indirectly affect those significant resources. Potential impacts would vary by alternative relative to the amount of land disturbed for construction, modification, and/or operation of waste management facilities. No areas of religious importance to Native American tribes have been identified within areas to be disturbed by construction and operation of facilities associated with the no-action alternative. While several tribes have indicated general concerns about SRS (see Section 3.9.2), no tribe has specifically identified SRS or specific portions of SRS as possessing religious importance.

A Programmatic Memorandum of Agreement between the DOE Savannah River Operations Office, the South Carolina State Historic Preservation Office, and the Advisory Council on Historic Preservation (SRARP 1989), which was ratified on August 24, 1990, is the instrument for the management of cultural resources at SRS. DOE uses this memorandum to identify cultural resources, assess them in terms of eligibility for the National Register of Historic Places, and develop mitigation plans for affected resources in consultation with the State Historic Preservation Officer. DOE will comply with the terms of the memorandum for activities required to support waste management activities.

Construction within the developed and fenced portion of E-Area would not affect archaeological resources because this area has been disturbed. Most of the construction activities that would take place to the north of the currently developed portion of E-Area would be within an area that was surveyed in 1986 as a potential site for waste disposal facilities (Figure 4-5) (Brooks, Hanson, and Brooks 1986). No important cultural resources were discovered during that survey, and further archaeological work would not be required prior to construction in this area. TE

As shown in Figure 4-5, there are two small areas of unsurveyed land to the east and northeast of the currently developed portion of E-Area that would be used to support the no-action alternative. In compliance with the Programmatic Memorandum of Agreement (SRARP 1989), DOE would survey these areas before beginning construction. If important resources were discovered, DOE would avoid them or remove them.

The Savannah River Archaeological Research Program has recently completed an archaeological survey of a 4-square-kilometer (1,000-acre) parcel of undeveloped land within E-Area to the north and northwest of F-Area (Figure 4-5). During this survey, 33 archaeological sites were identified, 12 of which may be eligible for listing on the National Register of Historic Places. However, recommendations on eligibility made by the Savannah River Archaeological Research Program are not binding until the South Carolina State Historic Preservation Officer concurs with the recommendations. DOE expects to receive concurrence in 1995. One of the 12 sites that may be eligible for listing on the National Register of Historic Places would be disturbed by construction of a sediment pond. Some potential exists that other important archaeological sites in the vicinity of new waste management facilities could be indirectly affected if the introduction of contamination were to make the area unsuitable for additional research activities or if operation of the new facilities were to bring a larger permanent workforce closer to the sites. Before beginning construction in this area, the Savannah River Archaeological Research Program and DOE would complete the consultation process with the State Historic Preservation Officer and develop mitigation action plans to ensure that important archaeological resources would be protected and preserved (Sassaman 1994). TE

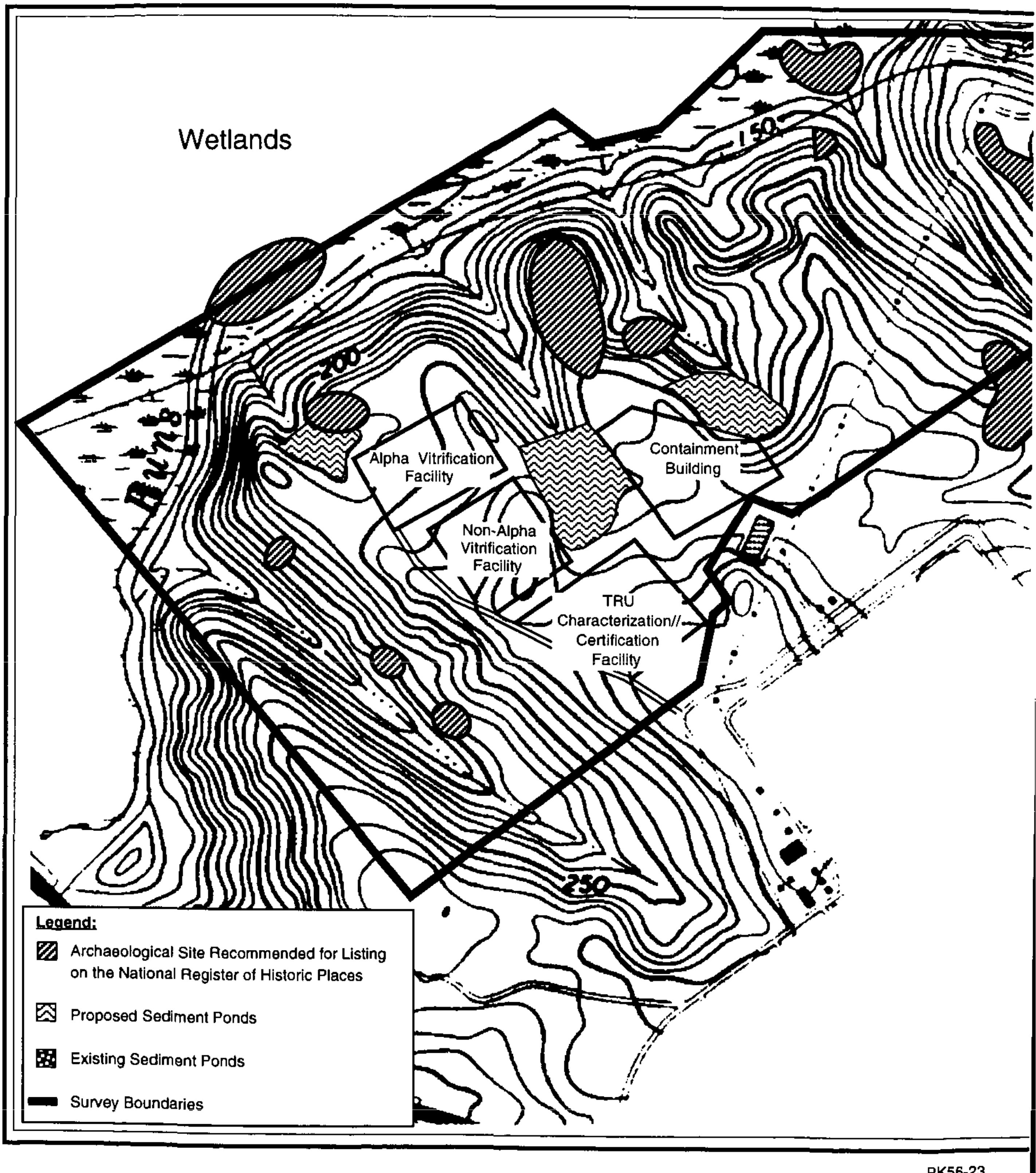
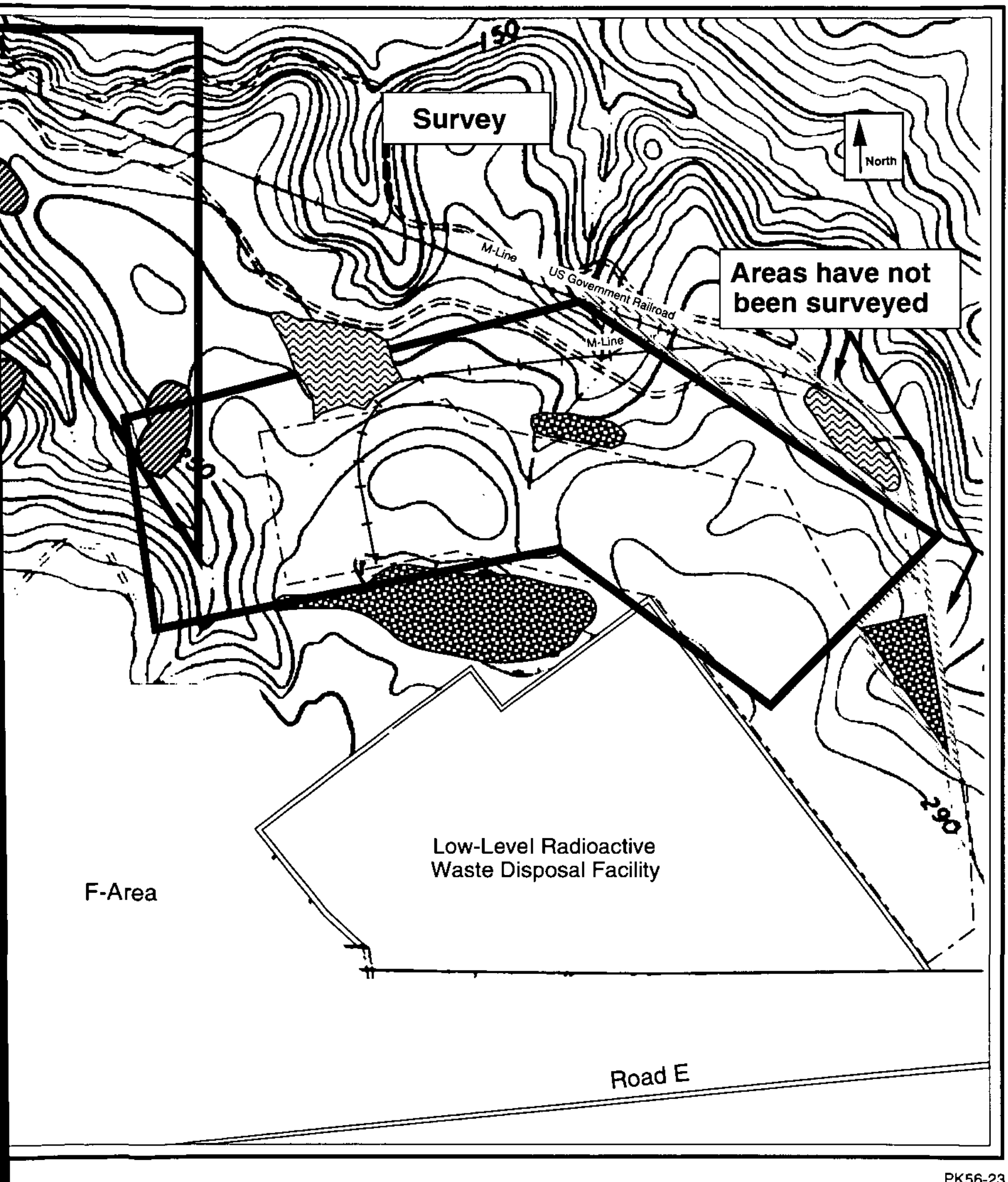
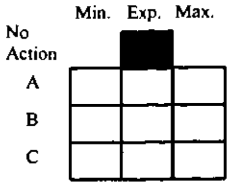


Figure 4-5. Location of previous archaeological survey areas and significant archaeological sites in E-Area.

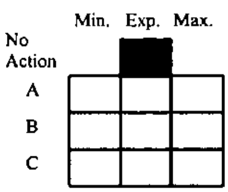

Survey
North
Areas have not been surveyed
M-Line
US Government Railroad
M-Line
Low-Level Radioactive Waste Disposal Facility
F-Area
Road E
290

PK56-23



4.1.10 AESTHETICS AND SCENIC RESOURCES

Impacts were evaluated on the basis of visibility of new facilities from offsite. Under the no-action alternative, the facilities DOE plans to construct in E-Area would not adversely affect scenic resources or aesthetics. E-Area is already dedicated to industrial use. New construction would not be visible off SRS or from public access roads on SRS. The new facilities would not produce emissions to the atmosphere that would be visible or that would indirectly reduce visibility.



4.1.11 TRAFFIC AND TRANSPORTATION

DOE analyzed impacts under each alternative that would result from changes in daily commuter and truck traffic. Traffic impacts are expressed as increases in vehicles per hour and in the number of hazardous and radioactive waste shipments by truck. As a road's carrying capacity is approached, the likelihood of traffic accidents increases. Similarly, the more truck shipments on a given road, the greater the probability of a traffic accident involving a truck. Increases in either condition could cause an increase in traffic fatalities.

TE

DOE also evaluated the impacts that transportation of low-level, mixed, transuranic, and hazardous wastes would have on individuals located onsite and offsite. These impacts were determined by the calculation of dose and expressed as health effects (i.e., the number of excess fatal cancers resulting from exposure to radioactive waste shipments). High-level waste was excluded from the analyses because it is not transported by vehicle.

Impacts from incident-free (normal) transport and postulated transportation accidents involving onsite shipment of radioactive waste over 30 years were calculated for the no-action alternative. Offsite transportation impacts were also calculated. The only traffic increases considered were from construction workers traveling to and from the site.

4.1.11.1 Traffic

Vehicle counts were estimated from current and projected levels of SRS employment (Turner 1994) and waste shipments. The baseline number of vehicles per hour was estimated from values in Smith (1989) and Swygert (1994). Table 4-5 shows estimated peak vehicles per hour for representative onsite and offsite roads. The table also shows the design carrying capacity for the roads (vehicles per hour) and the percentage of this design carrying capacity that the expected traffic represents. Vehicles per hour on offsite roads represent daily maximum values, while vehicles per hour onsite represent peak morning traffic. For the no-action alternative, the year when the most people would be employed was used to determine the change from the baseline. These traffic analyses conservatively assume that each worker drives a vehicle and arrives at E-Area during the peak commuter traffic hour.

Table 4-5. Number of vehicles per hour during peak hours under the no-action alternative.

Road	Design capacity (vehicles per hour)	1994 baseline traffic[a] (percentage of design capacity)[b]	No-action alternative change (percentage of design capacity)[c]	
		Offsite		
SC 19	3,000[d]	2,800[d](93)	21(94)	TC
SC 125	3,200[d]	2,700[d](84)	20(85)	
SC 57	2,100[d]	700[e](33)	6(34)	
		Onsite		
Road E at E-Area	2,300[e]	741[f,g](32)	47[h](34)	TC TE

a. Vehicles per hour baseline traffic for 1994 was estimated from actual counts measured in 1989 (offsite) and 1992/1993 (onsite) (Smith 1989) by adjusting vehicle counts by the change in SRS employment between measured years and 1994.
b. Numbers in parentheses indicate percentage of carrying capacity.
c. Percentage of design capacity changed between the draft and final EIS because the manpower numbers are based on construction costs which were modified after the draft was issued to better reflect actual costs.
d. Adapted from Smith (1989).
e. Adapted from TRB (1985).
f. Source: Swygert (1994).
g. Morning traffic traveling to E-Area.
h. Maximum number of construction workers (Hess 1995a, b). TE

For the no-action alternative, the roads' carrying capacities would not be exceeded by the workforce increase of 47 vehicles per hour. DOE would not expect adverse impacts from traffic associated with the no-action alternative. TC

Impacts of daily truck traffic associated with onsite shipments of hazardous and radioactive waste were analyzed for the no-action alternative. These shipments, presented in Table 4-6, are assumed to occur during normal working hours (versus commuter hours), and therefore, would have very little effect on the roadway carrying capacity. Hazardous waste shipments include shipments from accumulation areas to the RCRA-permitted storage buildings and from the storage buildings to offsite treatment and disposal facilities. Shipments of radioactive waste include those from the generators to the treatment, storage, or disposal facilities.

Table 4-6. Projected SRS hazardous and radioactive waste shipments by truck.[a]

Waste Type	Destination	Total Shipments	No-action alternative (1994 baseline traffic)[b]
Hazardous	Onsite/offsite	101,437	14
Low-level	Onsite	1,559	7
Mixed	Onsite/offsite	58,349	8
Transuranic[c]	Onsite	3,790	1
		Total Shipments per day	30

a. To arrive at shipments per day, the total number of waste shipments estimated for the 30 years considered in this EIS was divided by 30 to determine estimated shipments per year. These numbers were divided by 250, which represents working days in a calendar year, to determine shipments per day.
b. Shipments per day. 1994 baseline traffic is assumed to equal the no-action alternative using expected waste volumes.
c. Includes mixed and nonmixed transuranic waste shipments.

Under the no-action alternative, daily truck shipments would be the same as for the baseline. This assumption was based on transportation data (Hess 1994c) developed from historical shipping configurations for each waste. Baseline waste volumes were estimated from the 30-year expected waste forecast. DOE expects that impacts from waste shipments under the no-action alternative would be the same as for baseline waste management activities. Numbers of shipments assumed under the no-action alternative are given in Tables E.3-1 through E.3-3.

In 1992, South Carolina had a highway fatality rate of 2.3 per 100 million miles driven (SCDOT 1992). At this rate, an estimated 5.5 fatalities would be expected to occur annually within the commuter population for the baseline case based on a 40-mile round-trip commute 250 times a year (see Section 3.11.2.1). For the no-action alternative, an additional 47 workers would be expected to drive an additional one-half million miles per year, which is predicted to result in less than one additional traffic fatality.

The occurrence of highway injuries and prompt fatalities for truck accidents can be estimated from data reported by the National Highway Safety Council (DOT 1982). Injuries occur in 24 percent of all single truck accidents. The estimated injury- and fatality-causing accident rates are 3.2×10^{-7} and 1.2×10^{-7} per mile traveled, respectively.

Trucks carrying hazardous waste have an accident rate of 1.4×10^{-6} accidents per mile traveled for all road types. An estimated 20 percent of these truck accidents will result in a release of hazardous materials (EPA 1984).

Based on these statistics, an analysis (Rollins 1995) was performed to determine impacts from shipments of hazardous and radioactive materials for the 30-year period of interest for this EIS. For the no-action alternative, 7,200 annual (onsite and offsite) hazardous and radioactive waste shipments would travel TC approximately 600,000 miles and would result in slightly less than 1 accident with 0.074 prompt fatality. TE Accidents involving the release of hazardous material would be expected to occur, on average, once in 6 years.

The analysis determined that the largest impacts would occur for alternative B – maximum waste TC TE forecast. For this case, 22,000 annual (onsite and offsite) hazardous and radioactive waste shipments would travel approximately 1.9 million miles, leading to an expectation of less than 3 accidents with 0.23 prompt fatality. Accidents involving the release of hazardous material would be expected to occur, on TE average, once in 4 years. Impacts for all other alternatives and waste forecasts would be lower. These impacts are considered very small and are not discussed further in this EIS.

4.1.11.2 Transportation

DOE used the RADTRAN (Neuhauser and Kanipe 1992) computer codes to model the transportation of radioactive materials. These computer codes were configured with applicable SRS demographics and transportation accident rates (HNUS 1995a). The parameters for the RADTRAN analysis include the package dose rate, the number of packages per shipment, the number of shipments, the distance traveled, the fraction of travel in rural, suburban, and (for offsite transportation) urban population zones, traffic counts, travel speed, and type of highway traveled. Transport of radioactive material within a particular TE facility was excluded from this assessment because it involves operational transfers that are not defined as transportation and that would be included in facility accidents (e.g., Section 4.1.13). A more detailed breakdown of the transportation analysis by waste type is provided in Appendix E. Other model assumptions and input parameters are described in HNUS (1995a).

DOE analyzed the impacts that transportation of low-level, mixed, transuranic, and hazardous wastes would have on individuals located onsite and offsite. Doses from incident-free (normal) transport of waste over 30 years and from postulated transportation accidents involving radioactive waste were calculated for each alternative. Finally, health effects, expressed as the number of excess latent cancer fatalities associated with the estimated doses, were calculated by multiplying the resultant occupational and general public doses by the risk factors of 0.0004 (for occupational health) and 0.0005 (for the general public) excess latent cancer fatalities per person-rem (ICRP 1991). For individuals, the
TE calculated value represents the additional probability of developing a latent fatal cancer.

The AXAIR89Q (Hess 1995c) computer code uses SRS-specific meteorological data to model releases offsite from postulated onsite accidents. AXAIR89Q conservatively calculates the offsite individual and population doses because it uses very conservative air quality parameters (99.5 percent of the time the actual meteorology at SRS is less severe than that used by the model). For the transportation analyses, seven hypothetical human receptor groups were identified:

- Uninvolved worker: The SRS employee who is not assigned to the transportation activity but is
TE located along the normal transportation route at an assumed distance of 30 meters (98 feet) and would be exposed to radiation from the normal transport shipment. Doses are reported in units of rem.

- Uninvolved workers: The collective SRS employee population not assigned to the transportation activity that would receive external or internal radiation exposure from normal onsite shipments and accidents. About 7,000 SRS employees would be exposed to routine shipments and as many as 6,000 could be exposed to radiation in the event of an accident. Doses are reported in units of person-rem.

- Involved workers: The collective SRS employee population assigned to the transportation activity (i.e., two transport crew and six package handlers per shipment) that would receive external radiation exposure from normal transport of shipments. These workers are allowed to receive a greater radiation dose than the general public. Doses are reported in units of person-rem.

- Offsite maximally exposed individual: The member of the public located at the point along the SRS boundary that receives the highest ground-level radioactive material concentration and who would receive external or internal radiation exposure from an onsite transportation accident. Doses are reported in units of rem.

- Offsite population: The members of the public in the compass sector most likely to experience the maximum collective dose due to radioactive material released from an onsite transportation accident. Approximately 182,000 people are considered part of the offsite population. Doses are reported in units of person-rem.

- Remote maximally exposed individual: The member of the public located along the offsite transportation route who would receive radiation exposure from normal transport. Doses are reported in units of rem.

- Remote population: Members of the public (as many as 1,837 people per square kilometer) along the offsite transportation route who would receive external or internal radiation exposure from normal shipments and accidents. Members of the remote population who would be exposed to incident-free shipments by rail number about 200,000, and about 130,000 for truck shipments. As many as 3 million people have the potential to be exposed to offsite accidents involving the transport of radioactive wastes. TC

4.1.11.2.1 Incident-Free Radiological Impacts

The magnitude of incident-free impacts depends on the dose rate at the surface of the transport vehicle, the exposure time, and the number of people exposed. Radiological consequences of incident-free transport would result from external exposure to radiation by the vehicle crew and package handlers and by the uninvolved workers along the transportation route (including those in vehicles sharing the route at the time of transport). For each waste and package type, external dose rates at 1 meter (3.3 feet) from the transport vehicle were calculated and used to calculate incident-free consequences to onsite receptors (HNUS 1995a). Duration of exposure depends on the speed of the transport vehicle and the distance it travels. Additionally, occupational exposure time depends on the number of shipments and how long it takes to load each transport vehicle. TE

Annual incident-free doses for the no-action alternative are shown in Table 4-7. The uninvolved worker dose represents the maximum annual exposure from each waste type (shown in Appendix E). Using conservative assumptions, involved workers would experience the highest doses because they would be closest to the waste. Of the waste types handled by these workers, low-level waste would deliver the highest dose due to the types of radionuclides present. TE

Table 4-7. Annual dose and associated excess latent cancer fatalities from incident-free onsite transport of radioactive material under the no-action alternative.

Waste[a]	Uninvolved worker[b] (rem)	Uninvolved workers (person-rem)	Involved workers (person-rem)
Low-level	0.011	2.0	150
Mixed	5.5×10^{-5}	0.12	4.3
Transuranic	1.3×10^{-4}	0.0095	0.15
Total[c]	0.011[d]	2.1[e]	150[e]
Excess latent cancer fatalities	4.5×10^{-6}[f]	8.4×10^{-4}[g]	0.060[g]

a. See Appendix E for a list of waste streams which make up each waste type. Dose is based on exposure to all waste streams of a particular waste type.
b. See Section 4.1.11.2 for descriptions of the receptors.
c. Totals are rounded to two significant figures.
d. Assumes the same individual has maximum exposure to each waste stream (Appendix E) for a single year.
e. Dose from 1 year of exposure to incident-free transportation of all waste streams (see Appendix E).
f. Represents additional probability of an excess latent cancer fatality.
g. Values equal the total dose × the risk factor (0.0004 excess latent fatal cancers per person-rem).

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The concepts of fractions of fatalities may be applied to estimate the effects of exposing a population to radiation. For example, in a population of 100,000 people exposed only to background radiation (0.3 rem per year), 15 latent cancer fatalities per year would be inferred to be caused by the radiation (100,000 persons × 0.3 rem per year × 0.0005 latent cancer fatalities per person-rem = 15 latent cancer fatalities per year).

Sometimes calculations of the number of latent cancer fatalities associated with radiation exposure do not yield whole numbers, and, especially in environmental applications, may yield numbers less than 1.0. For example, if a population of 100,000 were exposed as above, but to a total dose of only 0.001 rem, the collective dose would be 100 person-rem, and the corresponding estimated number of latent cancer fatalities would be 0.05 (100,000 persons × 0.001 rem × 0.0005 latent cancer fatalities per person-rem = 0.05 latent fatal cancers).

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In this instance, 0.05 is the average number of deaths that would result if the same exposure situation were applied to many different groups of 100,000 people. In most groups, no one (0 people) would incur a latent cancer fatality from the 0.001 rem dose each member would have received. In a small fraction of the groups, 1 latent fatal cancer would result; in exceptionally few groups, 2 or more latent fatal cancers would occur. The average number of deaths over all of the groups would be 0.05 latent fatal cancers (just as the average of 0, 0, 0, and 1 is 1/4, or 0.25). The most likely outcome is 0 latent cancer fatalities.

4.1.11.2.2 Radiological Transportation Accident Impacts

How great the consequences of an accident are depends on the amount of radioactive contamination to which the individual(s) are exposed, how long they are exposed, and the number of people exposed. DOE considered both the consequence and probability of vehicle accidents in the transportation impacts model. The joint probability of a given severity of accident occurring for each type of waste shipped was calculated based on the probability of a range of impact forces that a package could receive in a hypothetical accident (NRC 1977), vehicle accident rates, and number of miles traveled. The severity of an accident is determined by the amount of damage to the package and subsequent release of material. Joint probabilities of a given accident severity greater than approximately 1×10^{-7} were selected for further analysis to determine the magnitude of accident consequences. Dispersion of radioactive material from the damaged package, combined with assumed release fractions, the fraction of released material that becomes airborne, and the fraction of airborne material that is of a size capable of being breathed in, is modeled to calculate the amount of radioactive contamination to which the individuals(s) are exposed. Generally, the requirements for package integrity and transport vehicles for onsite waste shipments are not as stringent as for transportation on public highways where package and vehicle requirements are regulated by the Department of Transportation and the Nuclear Regulatory Commission. Consequently, impacts from onsite accidents would be much greater than those for offsite accidents, because it is assumed that larger fractions of material would be released in an onsite accident. TE

Accident probabilities are best understood by assuming that many trips occur for a given type of transportation event (i.e., shipping low-level waste to an offsite facility). The number of trips when an accident occurs for a given number of trips is the accident probability. For example, if on a single trip, there was an accident, the probability of having an accident would be 1. If there was a second trip without an accident, the number of trips with accidents which occurred overall (1 out of 2 possible) would be one-half (0.5). However, since the number of accidents can only be whole numbers (i.e., it is impossible to have half an accident), the probability of having an accident is now 1 out of 2 trips, or 0.5, or 50 percent probability. Note that the probability is a unitless number. TE

Over the 30-year analysis period, for all accidents resulting in any consequence, the total probability of an accident involving low-level waste would be 0.49; from mixed waste, it would be 0.52; and from transuranic waste, it would be 0.038. The most probable accidents would not result in a dose because radioactive material would not be released. Table 4-8 presents the consequences to both onsite and offsite receptors from high consequence (low probability) postulated accidents. The results indicate that the highest consequences would result from accidents involving the release of transuranic waste and occur through inhalation of high-energy alpha particles associated with transuranic nuclides. TC

Table 4-8. Annual accident probabilities, doses associated with those accidents, and associated excess latent cancer fatalities from high consequence (low probability) accidents involving the transport of radioactive materials under the no-action alternative.

		Dose					
		Uninvolved workers[a]		Offsite population		Offsite MEI[b]	
Waste type	Annual accident probability	Dose (person-rem)	Excess latent cancer fatalities[c]	Dose (person-rem)	Excess latent cancer fatalities[c]	Dose (rem)	Excess latent cancer probability[d]
Low-level	5.6×10^{-7}	720	0.29	65	0.032	0.0092	4.6×10^{-6}
Mixed	7.1×10^{-5}	140	0.058	14	0.0071	0.0020	1.0×10^{-6}
Transuranic	4.8×10^{-8}	3.1×10^{5}	120	2.7×10^{4}	14	3.9	0.0019

a. See Section 4.1.11.2 for descriptions of the receptors.
b. MEI = maximally exposed individual.
c. Excess latent cancer fatalities = risk factor (0.0004 excess latent fatal cancers per person-rem for uninvolved workers and 0.0005 per person-rem for the offsite population) × total dose.
d. Additional probability of an excess fatal cancer.

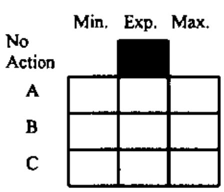
The greatest consequence from postulated transportation accidents involving radioactive materials would be to the uninvolved workers (with an estimated 120 latent cancer fatalities; Table 4-8) as the result of an accident in which it is assumed that all of the conservatively estimated transuranic nuclides in a transuranic waste container would be released over an area of about 3 square kilometers (1.1 square miles) in a single transportation accident. The number of cancers would be highest for the uninvolved workers due to the larger number of people that would be exposed and the greater amount of radioactive material to which they would potentially be exposed. Over the 30-year analysis period, the probability that an accident of this consequence would occur is 1.44×10^{-6}.

4.1.11.2.3 Nonradiological Transportation Accident Impacts

Since the actions evaluated in this EIS do not introduce new dispersible, nonradioactive, hazardous materials to the SRS transportation system, DOE reviewed the results of prior transportation accident analyses (WSRC 1991c, 1992b) for applicability to the waste management alternatives. These analyses were based on the facilities, equipment, and operations representative of SRS conditions between 1982 and mid-1985, when SRS's chemical inventory and the movement of chemicals were at their peak. Because the actions evaluated in this EIS involve the shipment of hazardous waste (rather than hazardous materials whose concentrations are generally much larger) and current and future site chemical inventories would be less than those previously analyzed (WSRC 1992b), this prior conclusion that there would be very small onsite and offsite impacts from onsite shipments of hazardous waste remains valid. This conclusion is further supported by recent analysis (see Section 4.1.11.1) which determined that accidents resulting in the release of hazardous material would occur, on average, only once in 6 years for the no-action alternative. This analysis also predicted that for the scenario with the largest impacts (alternative B – maximum waste forecast), accidents resulting in the release of hazardous material would occur, on average, only once in 4 years. Based on the waste forecasts (Appendix A) over the next 30 years, most hazardous waste shipments (91 percent) are expected to be soil and debris. These wastes do not contain high concentrations of toxic materials, and accidental release of these solid materials would not lead to an explosion hazard or atmospheric release of dangerous chemicals. Accident consequences are therefore expected to be localized and result in minimal impacts to human health or the environment. These impacts are considered very small and are not discussed further in this document. TC

4.1.11.3 <u>Noise</u>

As discussed in Section 3.11.3, studies have concluded that, because of the remote locations of the SRS operational areas, no known conditions are associated with existing onsite noise sources that adversely affect offsite individuals (NUS 1991; DOE 1990, 1991, 1993b). Since the vast majority of waste management activities occur onsite, adverse impacts due to noise are not expected for any of the alternatives or waste forecasts. Thus, noise impacts are not discussed further in this EIS. TE



4.1.12 OCCUPATIONAL AND PUBLIC HEALTH

This section discusses the radiological and nonradiological exposures due to normal operations under the no-action alternative and subsequent impacts to the public and workers. This analysis, further discussed in Section 4.1.12.1.1, shows that the health effects (specifically latent cancer fatalities) associated with the no-action alternative are themselves small and are small relative to those normally expected in the worker and regional area population groups from other causes.

The principal potential human health effect from exposure to low levels of radiation is cancer. Human health effects from exposure to chemicals may be toxic effects (e.g., nervous system disorders) or cancer. For the purpose of this analysis, radiological carcinogenic effects are expressed as the number of fatal cancers for populations and the maximum probability of death of a maximally exposed individual. Nonradiological carcinogenic effects are expressed as the total number of fatal and non-fatal cancers.

In addition to latent cancer fatalities, other health effects could result from environmental and occupational exposures to radiation. These effects include nonfatal cancers among the exposed population and genetic effects in subsequent generations. To enable comparisons with fatal cancer risk, the International Commission of Radiological Protection (ICRP 1991) suggested use of detriment weighting factors which take into consideration the curability rate of non-fatal cancers and the reduced quality of life associated with non-fatal cancer and heredity effect. The commission recommended probability coefficients (risk factors) for the general public of 0.0001 per person-rem for non-fatal cancers and 0.00013 per person-rem for hereditary effects. Both of these values are approximately a factor of four lower than the risk factors for fatal cancer. Therefore, this EIS presents estimated effects of radiation only in terms of latent cancer fatalities, because that is the major health effect from exposure to radiation.

TC

For nonradiological health effects, risks are estimated as the incremental probability of an individual developing cancer (either fatal or nonfatal) over a lifetime as a result of exposure to the potential carcinogen. The overall potential for cancer posed by exposure to multiple chemicals is calculated by summing the chemical-specific cancer risks to give a total individual lifetime cancer risk.

For radiological emissions from facilities considered under the no-action alternative, the largest occupational and public health effects were projected from the following facilities: (1) for involved workers, the transuranic and alpha waste storage pads and the F- and H-Area (high-level waste) tank farms; (2) for the public and uninvolved workers, the M-Area Vendor Treatment Facility; and (3) for the public only, the F/H-Area Effluent Treatment Facility. To simplify the calculation, 30-year process volumes were used to estimate occupational and public health effects.

Nonradiological air emissions are expected to produce very small health impacts for involved and uninvolved workers. Although overall public health impacts would be very small, the greatest contribution to these impacts would occur due to emissions from benzene waste generated from the Defense Waste Processing Facility, including In-Tank Precipitation.

4.1.12.1 <u>Occupational Health and Safety</u>

4.1.12.1.1 Radiological Impacts

Doses to involved workers were estimated based on a review of exposures resulting from waste management activities for the no-action alternative. Direct radiation and inhalation would be the largest exposure pathways. Doses to uninvolved workers were calculated using the MAXIGASP computer code (see Section 4.1.12.2). An uninvolved worker was conservatively assumed to be located 100 meters (328 feet) from the release point (of the affected facility) for 80 hours per week; another was conservatively assumed to be located 640 meters (2,100 feet) from the release point for 80 hours per week. The weekly exposure period was conservatively estimated to ensure that doses to overtime workers were not underestimated. Doses were estimated for the inhalation, ground contamination, and plume immersion exposure pathways. Data required to calculate doses to the uninvolved worker population are not currently available; however, dose to an individual uninvolved worker at 100 meters (328 feet) and 640 meters (2,100 feet) would bound the impact to the individual members of the population. TE

The incremental worker doses (the increase in dose due to activities under the no-action alternative) are given in Table 4-9. DOE regulations (10 CFR 835) require that annual doses to individual workers not exceed 5 rem per year. DOE assumes that exposure to the maximally exposed involved worker at SRS would not exceed 0.8 rem per year due to administrative controls (WSRC 1994d). TC

From these radiological doses, estimates of latent cancer fatalities were calculated using the conversion factor for workers of 0.0004 latent cancer fatality per rem (ICRP 1991). Based on this factor, the probability that the average involved worker would develop a fatal cancer sometime during his lifetime as the result of a single year's exposure to waste management-generated radiation would be 1.0×10^{-5}, or approximately 1 in 100,000. For the worker exposed to the administrative limit (0.8 rem), the probability of developing a fatal cancer sometime in his lifetime as a result of a single year's exposure would be TE 3.2×10^{-4}, or approximately 3 in 10,000. For the total involved workforce, the collective radiation dose could produce up to 0.022 additional fatal cancer as the result of a single year's exposure; over the 30-year period the involved workers could have 0.65 additional fatal cancer as a result of exposure. TC The probability of any individual uninvolved worker developing a fatal cancer as a result of the estimated exposure would be very small (Table 4-9). TC

The calculated numbers of fatal cancers due to worker exposure to radiation can be compared with the number of fatal cancers that would normally be expected among the workers during their lifetimes. Population statistics indicate that, of the U.S. population which died in 1990, 23.5 percent died of cancer (CDC 1993). If this percentage of deaths from cancer remains constant, 23.5 percent of the U.S. population will develop a fatal cancer during their lifetime. Therefore, in the group of 2,088 involved workers, about 491 would normally be expected to die of cancer.

The probability of developing a radiation-induced fatal cancer associated with the no-action alternative is much less than the probability of developing a fatal cancer from other causes.

Table 4-9. Worker radiological doses[a] and resulting health effects associated with the no-action alternative.

	Individual		All workers	
Receptor(s)	Dose (rem)	Probability of a fatal cancer	Dose (person-rem)	Number of fatal cancers
Average involved worker				
• Annual[b]	0.025	1.0×10^{-5}	NA[c]	NA
• 30-year	0.75	3.1×10^{-4}	NA	NA
All involved workers[d]				
• Annual[b]	NA	NA	52[e]	0.021
• 30-year	NA	NA	1,600	0.62
Uninvolved worker at 100 meters[f,g,h]				
• Annual[b]	1.0×10^{-5}	4.1×10^{-9}	NC[i]	NC
• 30-year	3.0×10^{-4}	1.2×10^{-7}	NC	NC
Uninvolved worker at 640 meters[f,g]				
• Annual[b]	2.9×10^{-7}	1.1×10^{-10}	NC	NC
• 30-year	8.6×10^{-6}	3.4×10^{-9}	NC	NC

a. Supplemental facility information is provided in Appendix E.
b. Annual individual worker doses can be compared with the regulatory dose limit of 5 rem (10 CFR 835) and with the SRS administrative exposure guideline of 0.8 rem. Operational procedures ensure that the dose to the maximally exposed worker will remain as far below the regulatory dose limit as is reasonably achievable. The 1993 average dose for all site workers who received a measurable dose was 0.051 rem (see Table 3-18).
c. NA = not applicable.
d. The number of involved workers is estimated to be 2,088.
e. Total for involved workers; 1993 SRS total for all workers was 263 person-rem (see Table 3-18).
f. M-Area Vendor Treatment Facility.
g. Doses conservatively assume 80 hours per week of exposure.
h. To convert to feet, multiply by 3.28.
i. NC = not calculated. Uninvolved worker population doses were not calculated because not all facilities have not been sited.

4.1.12.1.2 Nonradiological Impacts

Potential nonradiological impacts to SRS workers were considered for air emissions emanating from the following facilities: Defense Waste Processing Facility, including In-Tank Precipitation; M-Area Vendor Treatment Facility; M-Area Air Stripper; hazardous and mixed waste storage buildings; and the E-Area organic waste storage tanks. Occupational health impacts to employees in the Defense Waste Processing Facility and In-Tank Precipitation are presented in the *Final Supplemental Environmental Impact Statement Defense Waste Processing Facility*. TC TC

Table 4-10 presents a comparison between Occupational Safety and Health Administration-permissible exposure limit values and potential exposures to employees at both 100 meters (328 feet) and 640 meters (2,100 feet) from each facility considered. Downwind concentrations were calculated using EPA's TSCREEN model. In all cases, employee exposure would be below Occupational Safety and Health Administration-permissible exposure limits, and health impacts would be expected to be very small.

4.1.12.1.3 Noise

Occupational exposures to noise are controlled through the contractor hearing conservation program activities in Industrial Hygiene Manual 4Q, Procedure 501. This program implements the contractor requirements for identifying, evaluating, and controlling noise exposures to meet the requirements of 29 CFR 1910.95, Occupational Noise Exposure. All personnel with 8-hour time weighted average exposures greater than 85 dBA are enrolled in the program. Significant aspects of the hearing conservation program include: routine noise exposure monitoring, audiometric testing, hearing protection, employee information and training, and recordkeeping. TC

4.1.12.2 Public Health and Safety

4.1.12.2.1 Radiological Impacts

To estimate the health effects associated with the no-action alternative on the public, it was necessary to calculate radiological doses to individuals and population groups. Estimates of latent cancer fatalities were then calculated using the conversion factor of 0.0005 latent cancer fatality per rem for the general population (ICRP 1991). This factor is slightly higher than that for workers (Section 4.1.12.1), because infants and children are part of the general population. L004-06

Table 4-10. Calculated maximum 8-hour average pollutant concentrations (micrograms per cubic meter of air).

Facility	Pollutant	OSHA PEL[a,b]	Receptor locations	
			100 meters[c]	640 meters[c]
M-Area Air Stripper	Trichloroethylene	2.7×10^5	0.0046	0.0092
	Tetrachloroethylene	1.7×10^5	0.0023	0.0047
	Methyl chloroform	1.9×10^6	0.0008	0.0016
M-Area Vendor Treatment Facility	Nitrogen dioxide	9,000	37.4	43.6
	Sulfur dioxide	1.3×10^4	1.6	1.9
	PM-10[d]	5,000	2.0	2.3
	Carbon monoxide	4×10^4	6.0	7.0
Hazardous waste storage building (645-N)	Total suspended solids	1.5×10^4	25.13	10.56
	PM-10[d]	5,000	8.79	3.70
TC Mixed waste storage building (645-2N)	Total suspended particulates	1.5×10^4	7.0	2.9
	PM-10[d]	5,000	2.5	1.1
E-Area facilities	Vinyl chloride	2,600	0.26	0.11
	1,1 Dichloroethene	NA[e]	0.020	0.0083
	Methyl ethyl ketone	5.9×10^5	1.13	0.48
	Chloroform	9,780	0.12	0.051
	Carbon tetrachloride	1.26×10^4	0.0098	0.004
	Benzene	3,250	0.16	0.067
	1,2 Dichloroethane	NA[e]	0.0065	0.0027
	Trichloroethene	2.7×10^5	0.0062	0.0026
	Tetrachloroethylene	1.7×10^5	0.0014	5.8×10^{-4}
	Chlorobenzene	3.5×10^5	8.6×10^{-4}	3.6×10^{-4}

a. Source: NIOSH (1990).
b. OSHA PEL is Occupational Safety and Health Administration Permissible Exposure Limit.
c. To convert to feet multiply by 3.281.
d. Particulate matter less than 10 microns in diameter.
e. NA = not applicable.

Effects are estimated for two separate population groups: (1) the 620,100 people living within 80 kilometers (50 miles) of SRS and the 871,000 people living within 80 kilometers (50 miles) of the offsite facility who would be exposed to atmospheric releases; and (2) the 65,000 people using the Savannah River who would be exposed to releases to the river (Arnett, Karapatakis, and Mamatey 1994). Impacts are estimated for the maximally exposed individual in each of these population groups.

To facilitate the prediction of the radiological doses associated with the no-action alternative, current and future waste management practices at SRS were assessed. Wastes were aggregated into treatability groups to estimate the radionuclide releases to air and water.

Airborne radiological releases were converted to doses using the MAXIGASP and POPGASP computer codes (Hamby 1992). Doses were calculated using dose factors provided in Simpkins (1994a). These codes calculate the dose to a hypothetical maximally exposed individual at the SRS boundary and the collective dose to the population within an 80-kilometer (50-mile) radius, respectively. The inhalation, food ingestion, ground contamination, and plume exposure pathways were evaluated. Both codes utilize the GASPAR (Eckerman et al. 1980) and XOQDOQ (Sagendorf, Croll, and Sandusky 1982) modules. GASPAR and XOQDOQ have been adapted for use at SRS (Hamby 1992 and Bauer 1991, respectively).

For the assessments, DOE assumed that the population would remain constant over the 30-year period of analysis. This assumption is justified because (1) current estimates indicate that the population will increase by less than 15 percent during this period (HNUS 1995b), (2) there are uncertainties in the determination of year-to-year population distributions, and (3) although the absolute impacts would increase proportionately with population growth, the relative impact comparison between alternatives would not be affected. TE

Calculated atmospheric doses are given in Table 4-11 (releases from operation of the Defense Waste Processing Facility are not included). The annual doses (0.00012 millirem to the offsite maximally exposed individual and 0.00029 person-rem to the offsite population) would be small fractions of the dose from total SRS airborne releases in 1993 [0.11 millirem to the offsite maximally exposed individual and 7.6 person-rem to the population within 80 kilometers (50 miles) of SRS (Arnett, Karapatakis, and Mamatey 1994)]. Doses from 1993 operations were well within the EPA requirements given in 40 CFR 161 and adopted by DOE in Order 5400.5, which allow an annual dose limit to the offsite maximally exposed individual of 10 millirem from all airborne releases. TC TC

Waterborne releases were converted to doses using the LADTAP XL computer code (Hamby 1991). This code calculates the dose to a hypothetical maximally exposed individual along the Savannah River just downstream of SRS, and to the population using the Savannah River from SRS to the Atlantic Ocean. Fish ingestion, water ingestion, and recreational exposure pathways were evaluated. The aqueous dose-producing-releases were discharges from the F/H-Area Effluent Treatment Facility; seeps from groundwater discharges were too small to affect the totals. TE

TE | **Table 4-11.** Radiological doses[a] associated with the no-action alternative and resulting health effects to the public.

Receptor(s)[c]	Individual: Dose (millirem) Atmospheric releases	Individual: Dose (millirem) Aqueous releases	Individual: Dose (millirem) Total	Individual: Probability of a fatal cancer	Population: Dose (person-rem)[b] Atmospheric releases	Population: Dose (person-rem)[b] Aqueous releases	Population: Dose (person-rem)[b] Total	Population: Number of fatal cancers
Offsite maximally exposed individual								
TC • Annual	1.2×10^{-4}	6.9×10^{-4}	8.1×10^{-4}	4.1×10^{-10}	NA[d]	NA	NA	NA
• 30-year	0.0037	0.021	0.025	1.2×10^{-8}	NA	NA	NA	NA
Population								
• Annual	NA	NA	NA	NA	2.9×10^{-4}	0.0068	0.0071	3.5×10^{-6}
TC • 30-year	NA	NA	NA	NA	0.0086	0.20	0.21	1.1×10^{-4}

a. Supplemental information is provided in Appendix E.

b. For atmospheric releases, the dose is to the population within 80 kilometers (50 miles) of SRS. For aqueous releases, the dose is to the people using the Savannah River from SRS to the Atlantic Ocean.

c The doses to the public from total SRS operations in 1993 were 0.25 millirem to the offsite maximally exposed individual (0.11 millirem from airborne releases and 0.14 millirem from aqueous releases) and 9.1 person-rem to the regional population (7.6 person-rem from airborne releases and 1.5 person-rem from aqueous releases). Source: Arnett, Karapatakis, and Mamatey (1994).

d. NA = not applicable.

As was done for the atmospheric assessments, the population was assumed to remain constant over the 30-year period of analysis. TE

Calculated doses from releases to water are given in Table 4-11. The annual doses (0.00069 millirem to the offsite maximally exposed individual and 0.0068 person-rem to the offsite population) would be small fractions of the doses from total SRS releases to water in 1993 [0.14 millirem to the maximally exposed member of the public and 1.5 person-rem to the population using the Savannah River from SRS to the Atlantic Ocean (Arnett, Karapatakis, and Mamatey 1994)]. Doses from 1993 operations were well within the regulatory requirements specified in DOE Order 5400.5 and by EPA in 40 CFR 141, which TC allow an annual dose limit to the offsite maximally exposed individual of 4 millirem from drinking water.

Using the fatal-cancer-per-rem dose factor given above, the probability of the maximally exposed TE individual developing a fatal cancer and the numbers of fatal cancers that could occur in the regional population under the no-action alternative were calculated (Table 4-11). The probability of the maximally exposed individual dying of cancer as a result of 30 years of exposure to radiation from activities under the no-action alternative is slightly more than 1 in 100 million; the number of additional fatal cancers that might occur in the regional population for this same exposure period would be 1.1×10^{-4}. TC

About 23.5 percent of the U.S. population die from cancer from all causes (Section 4.1.12.1); accordingly, the probability of an individual dying of cancer is 0.235, or approximately 1 in 4. In a population of 620,100 people (the number of people living within 80 kilometers [50 miles] of SRS), the L004-08 number of people expected to die of cancer is 145,700. In a population of 65,000 (the number of people using the Savannah River as a source of drinking water), the number of people expected to die of cancer is 15,275. Thus, the incidence of radiation-induced fatal cancers associated with the no-action alternative (see Table 4-11) would be much smaller than the incidence of cancers from all causes.

4.1.12.2.2 Nonradiological Impacts

Potential nonradiological impacts to individuals residing offsite were considered for both criteria and carcinogenic pollutants. Maximum SRS boundary-line concentrations for criteria pollutants are discussed in Section 4.1.5.

For routine releases from operating facilities under the no-action alternative, criteria pollutant concentrations would be within both state and federal ambient air quality standards and are discussed in

Section 4.1.5. During periods of construction under normal operating conditions, the criteria pollutant concentrations at the SRS boundary would not exceed air quality standards, and very small health impacts would be expected from criteria pollutant emissions.

Offsite risks due to carcinogens were calculated using the Industrial Source Complex 2 model for the same facilities discussed in Section 4.1.12.1.2. The assumptions in the model are conservative. Emissions of carcinogenic compounds were estimated using permitted values for facilities not currently operating (e.g., the Defense Waste Processing Facility) and emission factors for facilities currently operating (e.g., aqueous and organic waste storage tanks) (EPA 1985). Table 4-12 shows estimated latent cancers based on EPA's Integrated Risk Information System database (EPA 1994).

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Table 4-12. Estimated probability of excess latent cancers in the SRS offsite population.

Pollutant	Unit risk factor (latent cancers per $\mu g/m^3$)[a]	Concentration[b] ($\mu g/m^3$)	Latent cancers[c]
Chloroform	2.3×10^{-5}	0.0029	2.9×10^{-8}
Carbon tetrachloride	1.5×10^{-5}	2.0×10^{-7}	1.3×10^{-12}
Benzene	8.3×10^{-6}	0.048	1.7×10^{-7}
1,1 Dichloroethene	5.0×10^{-5}	4.0×10^{-7}	8.6×10^{-12}
Total			2.0×10^{-7}

TC

a. Micrograms per cubic meter of air.
b. Source: Stewart (1994).
c. Latent cancer probability equals unit risk factor times concentration times 30 years divided by 70 years.

The unit risk (cancer risk per unit of air concentration) for a chemical is the highest lifetime risk (over 70 years) of developing cancer (either fatal or nonfatal) when continuously exposed to the chemical at an air concentration of 1 microgram per cubic meter. As shown in Table 4-12, the estimated lifetime risk associated with routine emissions from facilities included in the no-action alternative is approximately 2 in 1.0×10^{7}. Health impacts to the public would be very small.

4.1.12.2.3 Environmental Justice Assessment

Environmental justice has assumed an increasingly prominent role in the environmental movement over the past decade. In general, the term "environmental justice" refers to fair treatment of all races, cultures, and income levels with respect to laws, policies, and government actions. In February 1994, Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," was released. This order directs federal agencies to identify and address, as appropriate, disproportionately high and adverse effects of its programs, policies, and activities on

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minority and low-income populations. Executive Order 12898 also directs the Administrator of EPA to convene an interagency federal working group on environmental justice (referred to below as the Working Group). The Working Group will provide guidance to federal agencies for identifying disproportionately high and adverse human health or environmental effects on minority and low-income populations. The Working Group has not yet issued this guidance. It has developed working draft definitions. Although the definitions are in draft form, DOE used them in the analysis for this EIS. In coordination with the Working Group, DOE is developing internal guidance on implementation of the executive order. DOE's internal guidance was used in preparing this EIS. TE TC

This EIS addresses environmental justice concerns in three areas: (1) potential air emissions, (2) potential impacts from transportation of wastes offsite, and (3) potential impacts from consuming fish and game. Based on these analyses, DOE concluded that none of the alternatives would have disproportionate adverse effects on minority populations or low-income communities. TE

Although adverse health effects are not expected under the no-action alternative, in the spirit of Executive Order 12898 an analysis was performed to determine whether any impacts would have been disproportionately distributed. Figures 3-12 and 3-13 identify census tracts with significant proportions of people of color or low income. This section presents the predicted average radiation doses that would be received under the no-action alternative by individuals in these census tracts and compares them to the predicted per capita doses received in the remaining tracts within the 80-kilometer (50-mile) radius of SRS. This section also discusses impacts of doses received in the downstream communities from liquid effluents from all alternatives and cases. TE

Figure 4-6 shows a wheel with 22.5-degree sectors and concentric rings from 16 to 80 kilometers (10 to 50 miles) radiating at 16-kilometer (10-mile) intervals from the center of SRS. A fraction of the total dose (see Appendix E) was calculated for each sector based on meteorological data (Simpkins 1994b), the sector wheel was laid over the census tract map, and each tract was assigned to a sector. For purposes of this analysis, if a tract fell in more than one sector, the tract was assigned to the sector with the highest dose.

DOE analyzed the effects by comparing the per capita dose received by each type of community to the other types of communities within a defined region. To eliminate the possibility that effects to a small community close to SRS would be diluted and masked by including it with a larger community located farther from SRS, comparisons were made within increasingly larger concentric circles, the radii of which increase in 16-kilometer (10-mile) increments.

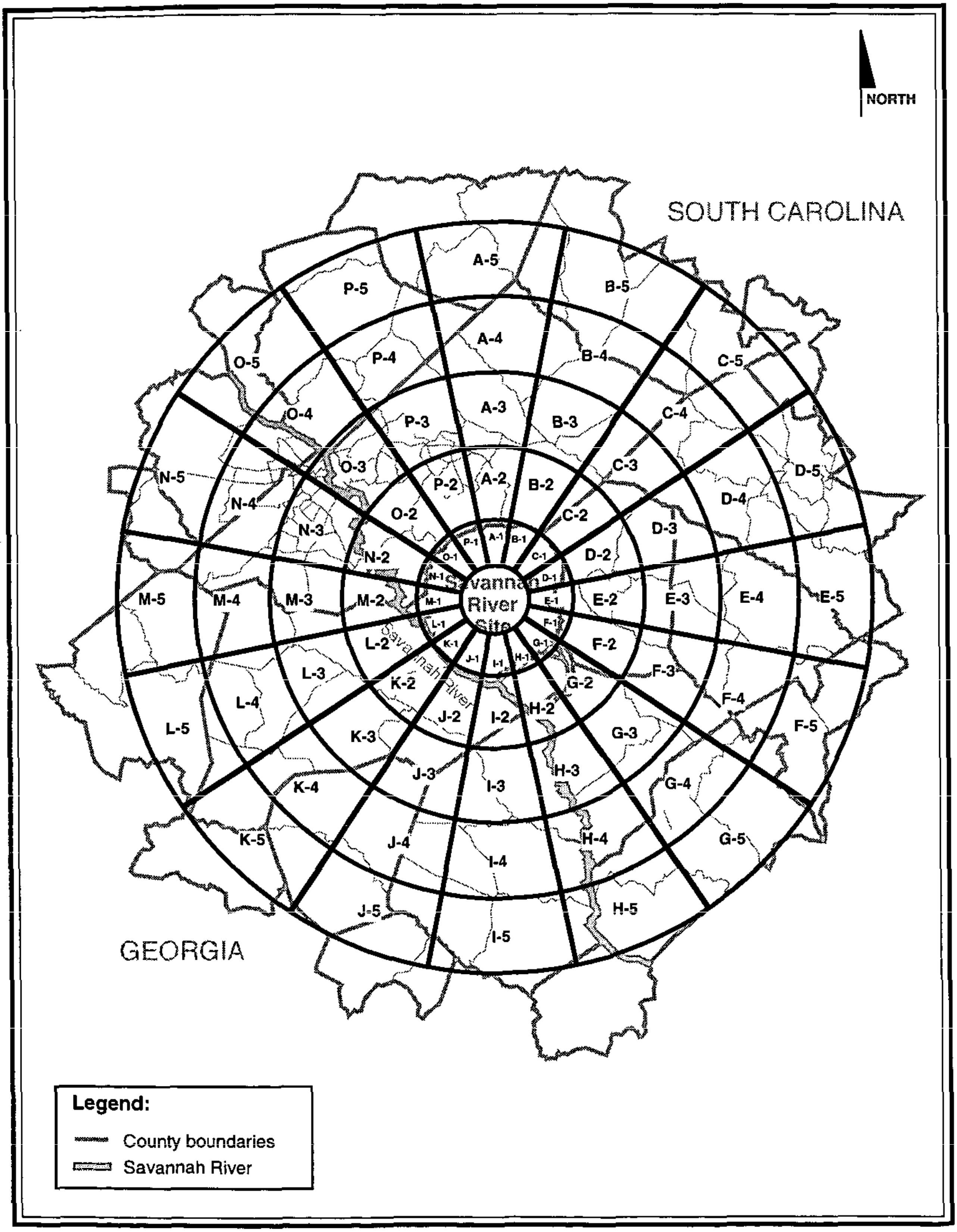

Figure 4-6. Identification of annular sectors around SRS. (See Appendix E for dose fractions by sector.)

To determine the per capita radiation dose in each census tract for the no-action alternative, the number of people in each tract was multiplied by that tract's dose value to obtain a total population dose for each tract. These population doses were summed over each concentric circle and divided by the total community population to obtain a mean per capita dose for each circular area. The dose determined for each tract was compared to this mean dose. Figure 4-7 illustrates these results for the no-action alternative. Appendix E provides the supporting data.

As shown, the per capita dose is extremely small for each community type. This analysis indicates that
communities of people of color (in which the minority population is equal to or greater than 35 percent | TE
of the total population) or low income (in which the number of low income persons is equal to or greater than 25 percent of the total population) would not be disproportionately affected by atmospheric releases.

Table 4-11 lists predicted doses to the offsite maximally exposed individual and to the downstream population from exposure to water resources. The doses reflect people using the Savannah River for
drinking water, sports, and food (fish). Because the communities of people of color or low income living | TE
in the areas downstream from SRS are well distributed and because persons in the downstream region would not be affected (the 30-year dose to the offsite maximally exposed individual for all alternatives
and forecasts would be 0.021 millirem), there are no disparate adverse impacts on low-income or | TC TE
minority communities in the downstream areas for any of the alternatives.

The distribution of carcinogen and criteria pollutant emissions due to routine operations, and of criteria pollutants from construction activities, would be essentially identical to those presented for airborne radiological emissions, so people of color and the poor would not be disproportionately affected by non-
radiological emissions under any of the alternatives. Because non-radiological pollutant emissions have | TE
only very small impacts in any of the alternatives, and are not disproportionately distributed among types of communities, there are no environmental justice concerns related to these pollutants for any of the alternatives.

Environmental justice concerns were also considered for the impacts associated with the offsite
transportation of hazardous and radioactive waste that would occur under the alternatives. A recent | TE
impact analysis (see Section 4.1.11.1) determined that for the no-action alternative, accidents resulting in
the release of hazardous material would be expected to occur, on average, only once in 6 years (i.e., five | TE
accidents resulting in hazardous material release over the 30-year period of this EIS). The impact
analysis determined that for the scenario with largest impacts (alternative B – maximum waste forecast), | TC
accidents involving the release of hazardous material would be expected to occur, on average, only once in 4 years. In addition to the expected frequency of such accidents, their impacts can be mitigated by

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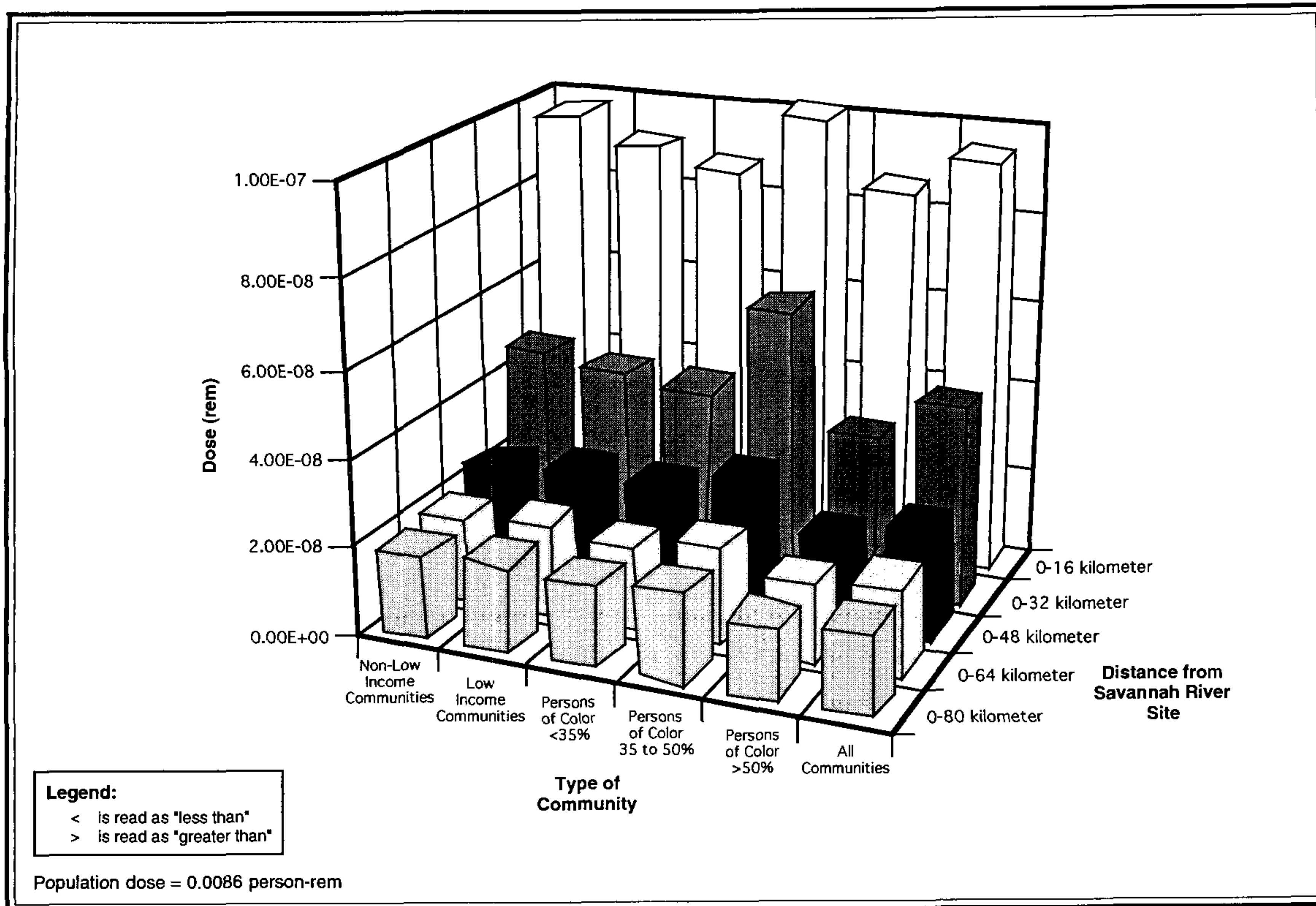

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Figure 4-7. Dose to individuals in communities within 80 kilometers (50 miles) of SRS under the no-action alternative.

existing training and technology for controlling spills from vehicles. Because these rare events are expected to occur randomly in time with equal distribution throughout various types of communities, there are no disproportionate adverse impacts on poor or minority communities from transportation of hazardous and radioactive waste for any of the alternatives evaluated in this EIS.

DOE also considered impacts associated with consumption of wildlife from SRS and fish from the Savannah River from the perspective of environmental justice. Doses to the maximally exposed hunter and fisherman (see Section 3.12.1.2) have been determined to be 57 and 1.3 millirem, respectively. These analyses assumed that the hunter consumed 153 kilograms (337 pounds) of meat from deer and hogs taken from SRS and 19 kilograms (42 pounds) of fish from the Savannah River at the mouth of Steel Creek each year. If the rate of fish consumption, for conservatism, was doubled to 39 kilograms (84 pounds) per year, the total annual dose to an individual consuming both game and fish would be 59.6 millirem or 59.6 percent of the DOE annual limit (DOE 1993c). A dose of this magnitude would result in an annual probability of contracting a latent fatal cancer of 3.0×10^{-5} (approximately 3 in 100,000). It is highly unlikely that communities of people of color or low income consume game and fish at a rate greater than that calculated for the maximally exposed individual who both hunts and fishes, as that person is assumed to eat 421 pounds of fish and game each year. Because the doses received by this maximally exposed individual from fish and game are not significant, there would be no disproportionate adverse impacts from consumption of wildlife by people of color or low income.

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4.1.13 FACILITY ACCIDENTS

This section summarizes the risks to workers and members of the public from potential accidents at facilities associated with the various waste types under the no-action alternative. An accident is a series of unexpected or undesirable events leading to a release of radioactive or hazardous material within a facility or to the environment. Appendix F provides further detail and discussion regarding the accident analysis.

4.1.13.1 Methodology

Accident assessment is based on potential accidents identified and described in safety documentation for SRS facilities and on material inventories at SRS facilities that support the no-action alternative. Accidents include events resulting from external initiators (e.g., vehicle crashes, nearby explosions), internal initiators (e.g., equipment failures, human error), and natural phenomena initiators (e.g., earthquakes, tornadoes). Radioactive and hazardous material releases resulting from accidents are considered in this analysis.

The accident scenarios selected for this evaluation were chosen to represent the full spectrum of events which could occur (i.e., both high- and low-frequency events and large- and small-consequence events). The frequency ranges, as presented in Table 4-13, are as follows: anticipated accidents, unlikely accidents, extremely unlikely accidents, and beyond-extremely-unlikely accidents. A more complete discussion on accident frequencies is given in Section F.2 of Appendix F. However, it should be noted that all frequency ranges may not have representative accident scenarios identified for them. Accident scenarios in the beyond-extremely-unlikely frequency range are so unlikely that they often are not analyzed in safety documentation.

Table 4-13. Accident frequency categories.[a]

Frequency category	Frequency range (accidents per year)[b]
Anticipated accidents	$10^{-1} \geq p \geq 10^{-2}$
Unlikely accidents	$10^{-2} \geq p \geq 10^{-4}$
Extremely unlikely accidents	$10^{-4} \geq p \geq 10^{-6}$
Beyond-extremely-unlikely accidents	$10^{-6} \geq p$

a. The frequencies for accidents are from DOE Standard 3009-94 (DOE 1994b).
b. $x \geq y$. The number "x" is greater than or equal to the number "y." Conversely, the number "y" is less than or equal to the number "x" (e.g., $5 \geq 4 \geq 3$).

Radiological consequences are defined in terms of (1) the dose to an individual and collective dose to a population; and (2) latent fatal cancers from a postulated accident. The human health effect of concern is the development of latent fatal cancers. The International Commission on Radiological Protection (ICRP) has made specific recommendations for quantifying these health effects (ICRP 1991). The results of these health effects are presented in terms of increased latent fatal cancers (i.e., number of additional fatal cancers expected in the population) calculated using ICRP-60 conversion factors of 0.0005 for the public and 0.0004 for onsite workers if the effective dose equivalent is less than 20 rem. For individual doses of 20 rem or more, the ICRP-60 conversion factors are doubled. For hazardous materials, consequences are defined in terms of airborne chemical concentrations.

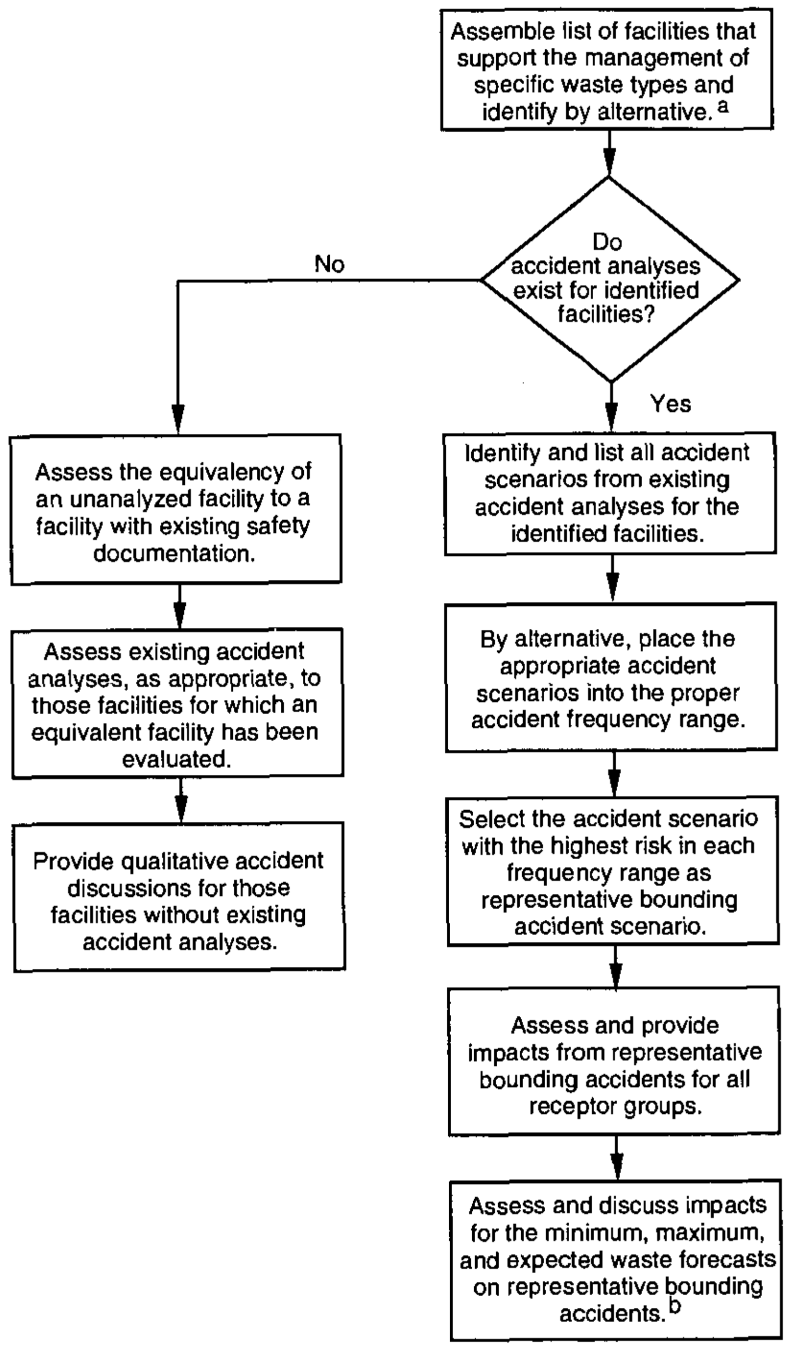
Radiological doses for the postulated accident scenarios were extracted from information provided in the following technical reports: *Bounding Accident Determination for the Accident Input Analysis of the*
TE *SRS Waste Management Environmental Impact Statement* (WSRC 1994e), *Solid Waste Accident Analysis in Support of the Savannah River Waste Management Environmental Impact Statement* (WSRC 1994f), and the *Liquid Waste Accident Analysis in Support of the Savannah River Waste Management*
TE *Environmental Impact Statement* (WSRC 1994g). These technical reports compiled pre-existing safety

documentation addressing the risks of operating waste management facilities. Figure 4-8 is a flowchart for the preparation of radiological accident analysis information. No new analyses were performed because existing documentation adequately supported a quantitative or qualitative estimation of potential impacts, as required by the National Environmental Policy Act (NEPA). As indicated by the last step of the flowchart (Figure 4-8), impacts resulting from the expected, minimum, and maximum forecast are evaluated and discussed for the representative bounding accidents. However, the no-action alternative only considers the expected waste forecast. TE TE

The figures presented in Section 4.1.13.2 reflect the increase in cancers estimated using the above conversion factors. The AXAIR89Q computer code (WSRC 1994h) predicted impacts in terms of dose for onsite and offsite receptor groups. The code then calculated the collective dose to the affected population living within 80 kilometers (50 miles) of SRS. This population exposure is given as person-rem dose equivalent, as if the accident occurred. Increases in latent fatal cancers as the result of an accident would be in addition to the number of cancers expected from all other causes.

The point estimate of increased risk is provided to allow consideration of accidents that may not have the highest consequence, but due to a higher estimated frequency, may pose a greater risk. An example of this concept for the no-action alternative can be seen in the representative bounding accidents selected for liquid high-level radioactive waste. An accidental release of radioactive material due to a pressurization and breach at the Replacement High-Level Waste Evaporator would result in the greatest consequence, which would be 6.8×10^{-1} latent fatal cancer per occurrence for the offsite population within 80 kilometers (50 miles). Because this accident is estimated to occur once every 20,000 years, a time-weighted average of these consequences over the accident frequency time span (i.e., consequences times frequency) results in an annualized point estimate of increased risk of 3.4×10^{-5} latent fatal cancer per year. A release due to a feed line break at the Replacement High-Level Waste Evaporator produces lower consequences than the pressurization and breach scenario: 9.1×10^{-3} latent fatal cancer per occurrence. However, this accident is estimated to occur every 14 years, resulting in a point estimate of increased risk of 6.3×10^{-4} latent fatal cancer per year. Thus, by factoring in the accident probability, a more accurate comparison of the resulting risks can be made.

To fully understand the hazards associated with SRS facilities under the alternatives considered in this EIS, it is necessary to evaluate potential accidents involving both hazardous and radiological materials. For chemically toxic materials, several government agencies recommend quantifying chemical concentrations that cause short-term effects as threshold values of concentrations in air.



NOTES: [a]Specific waste types are identified in Section F.1 of Appendix F.

[b]The no-action alternative does not consider a minimum or maximum waste forecast.

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Figure 4-8. Radiological accident analysis process flowchart.

Because the long-term health consequences of human exposure to hazardous materials are not as well understood as those related to radiation exposure, a determination of potential health effects from exposures to hazardous materials is more subjective than a determination of health effects from exposure to radiation. Therefore, the consequences from accidents involving hazardous materials are in terms of airborne concentrations at various distances from the accident location. Emergency Response Planning Guidelines (ERPG) values are the only well-documented parameters developed specifically for use in evaluating the health consequences of exposure of the general public to accidental releases of hazardous materials (WSRC 1992c). ERPG-3 values represent the threshold concentration for lethal effects, while ERPG-2 values represent the threshold concentration for severe or irreversible health effects in exposed populations (see Appendix F, Table F-3). The quantities and airborne concentrations of toxic chemicals at the various receptor locations were extracted from information provided in the technical reports (WSRC 1994g, h) supporting this EIS. The analysis presented in Appendix F presents facility-specific chemical hazards. TE

4.1.13.2 Summary of Accident Impacts

Figures 4-9 through 4-12 summarize the projected impacts of radiological accidents to the population, the offsite maximally exposed individual, and uninvolved workers at 100 and 640 meters (328 and 2,100 feet), respectively. Data required to calculate uninvolved worker population doses are not currently available; however, doses to uninvolved workers at 100 and 640 meters (328 and 2,100 feet) would bound impacts to the individual member of the population. For example, Figure 4-9 shows the estimated increase in latent fatal cancers resulting from the estimated population dose for the representative bounding accidents selected for each waste type. Representative bounding accidents are identified by each frequency range for each applicable waste type. An anticipated accident (i.e., one occurring between once every 10 years and once every 100 years) involving low-level and mixed waste is the accident scenario under the no-action alternative that would present the greatest risk to the population within 80 kilometers (50 miles) of SRS (see Figure 4-9). This accident scenario would increase the risk to the population within 80 kilometers (50 miles) by 1.7×10^{-2} latent fatal cancer per year. TE

Figures 4-10, 4-11, and 4-12 present similar information for the offsite maximally exposed individual, uninvolved workers at 640 meters (2,100 feet), and uninvolved workers at 100 meters (328 feet), respectively. An anticipated accident involving either mixed waste or low-level waste would pose the greatest risk to the offsite maximally exposed individual (Figure 4-10) and the uninvolved worker at 640 meters (2,100 feet) (Figure 4-11). The anticipated accident increases the risk to the offsite

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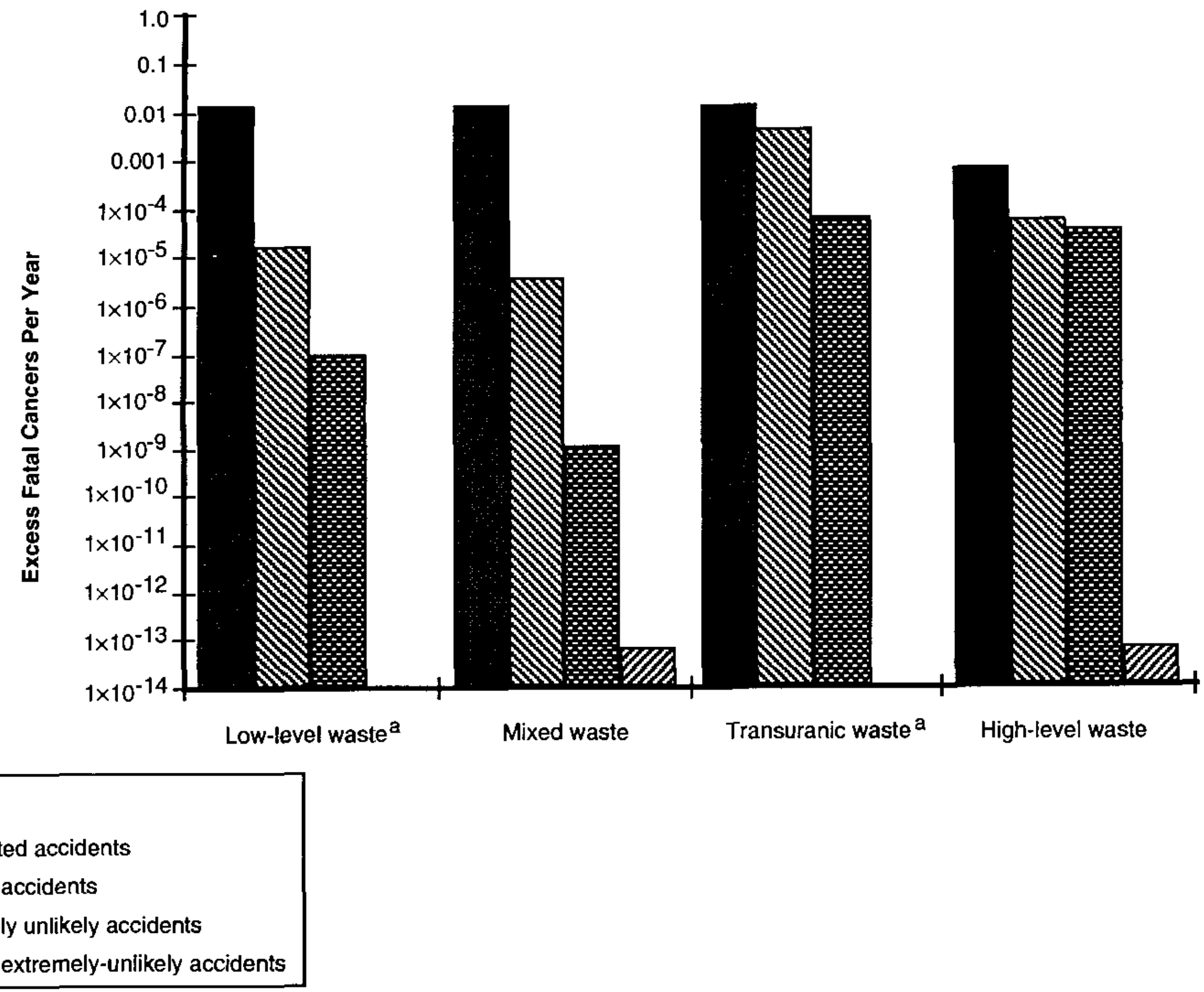
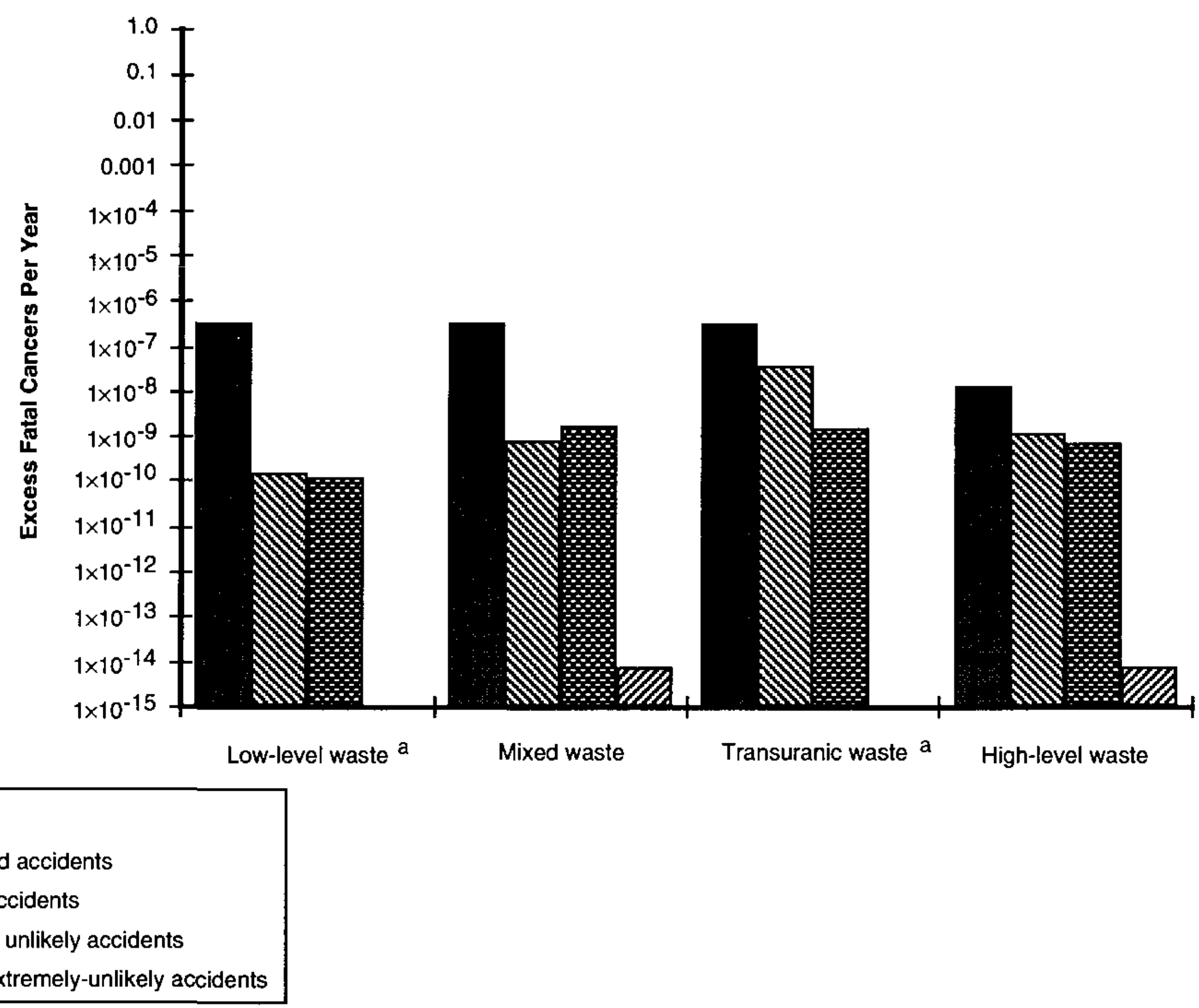


Notes:

a. No beyond-extremely-unlikely accidents were identified for low-level or transuranic wastes.

PK56-31

TE **Figure 4-9.** Summary of radiological impacts to the population within 80 kilometers (50 miles) of SRS under the no-action alternative.



Notes:

a. No beyond-extremely-unlikely accidents were identified for low-level or transuranic wastes.

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Figure 4-10. Summary of radiological accident impacts to the offsite maximally exposed individual under the no-action alternative.

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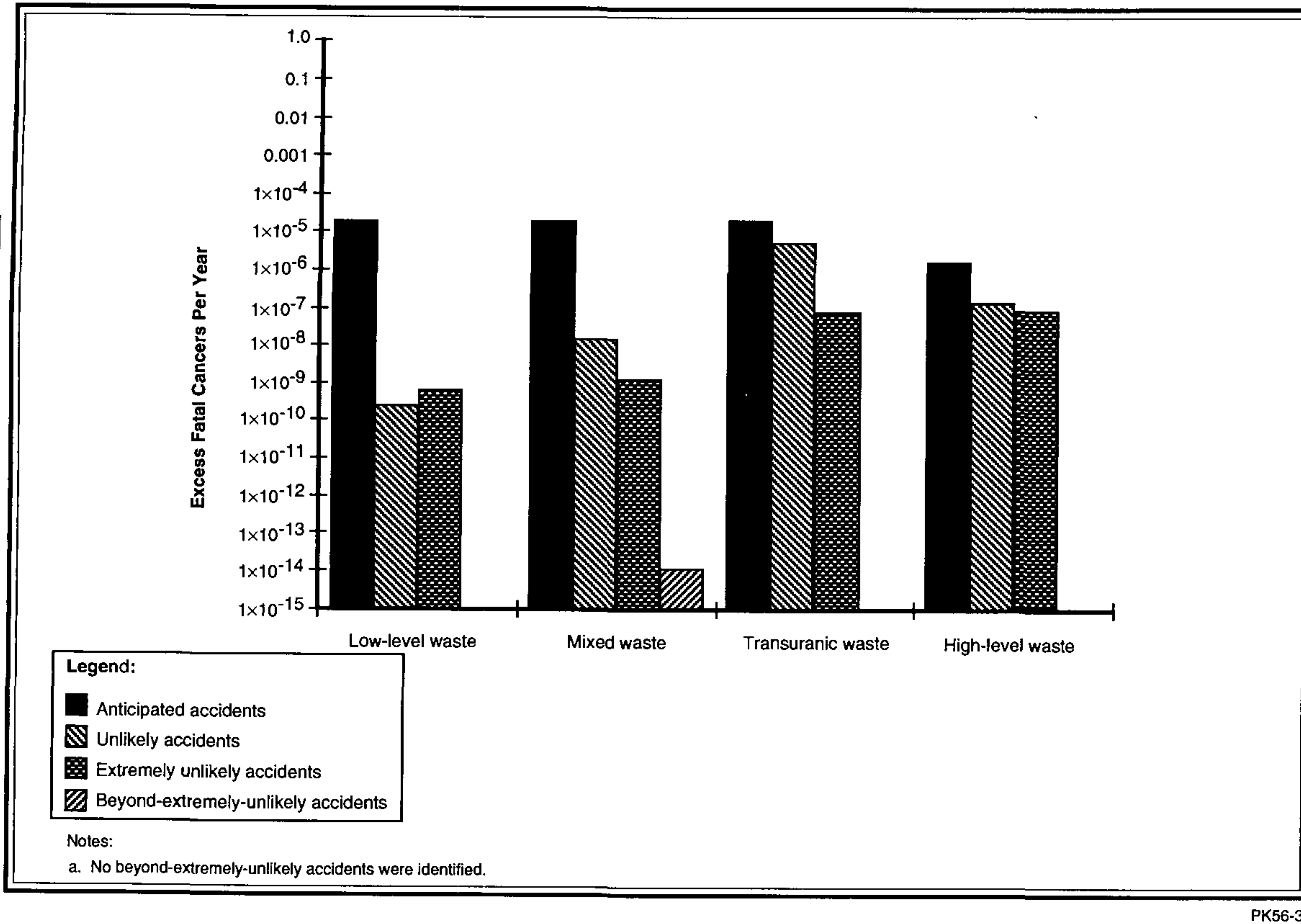
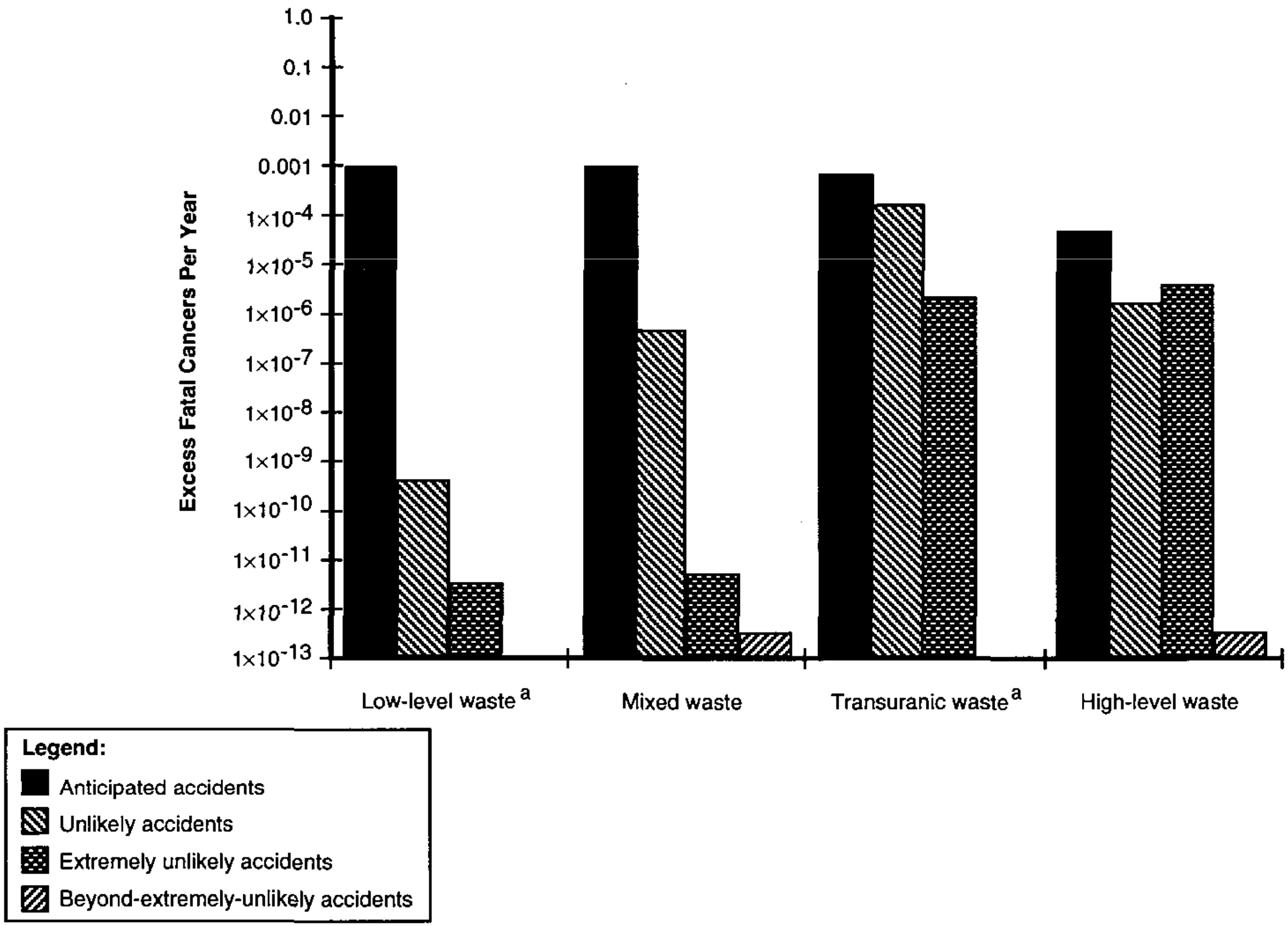


TE **Figure 4-11.** Summary of radiological accident impacts to the uninvolved worker within 640 meters (2,100 feet) under the no-action alternative.



Notes:
a. No beyond-extremely-unlikely accidents were identified for low-level or transuranic wastes.

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Figure 4-12. Summary of radiological accident impacts to the uninvolved worker within 100 meters (328 feet) under the no-action alternative.

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maximally exposed individual by 3.3×10^{-7} latent fatal cancer per year and to the uninvolved worker at 640 meters (2,100 feet) by 1.8×10^{-5} latent fatal cancer per year.

An accident involving either mixed waste or low-level waste would also pose the greatest risk to the uninvolved worker at 100 meters (328 feet) (Figure 4-12). This accident scenario would increase the risk to the uninvolved worker at 100 meters (328 feet) by 1.0×10^{-3} latent fatal cancer per year.

Except for an accident in the transuranic waste characterization/certification facility (discussed under alternatives A, B, and C), radiological accidents considered in this EIS would not result in doses that would result in substantial acute or latent health effects.

A complete summary of all representative bounding accidents considered for the no-action alternative is presented in Table 4-14. This table provides accident descriptions, annual frequency of occurrence, accident scenario. Details regarding the individual postulated accident scenarios associated with the various waste types are provided in Appendix F.

For all the waste types considered, a summary of the chemical hazards associated with the no-action alternative estimated to exceed ERPG-2 values is presented in Table 4-15. For the uninvolved worker at 100 meters (328 feet), nine chemical-release scenarios are estimated to exceed ERPG-3 values. Moreover, another five chemical-release scenarios estimate airborne concentrations that exceed ERPG-2 values where equivalent ERPG-3 values were not identified. For the offsite maximally exposed individual, no chemical-release scenario identified airborne concentrations that exceeded ERPG-3 values. Only the lead-release scenario estimates airborne concentrations that exceed the ERPG-2 guidelines (Table F-25 in Appendix F).

Furthermore, the benzene-release scenarios (see Table F-19) result from an explosion and tornado at the Organic Waste Storage Tank, respectively. Under the no-action alternative, the Consolidated Incineration Facility is unavailable as a benzene treatment option. As a result, an additional four organic waste storage tanks would be required for the management of benzene mixed waste. Therefore, DOE assumes an increase in the likelihood that a catastrophic benzene release could occur (i.e., more organic waste storage tanks that could explode or be hit by a tornado).

In addition to the risk to human health, secondary impacts from postulated accidents on plant and animal resources, water resources, the economy, national defense, environmental contamination, threatened and endangered species, land use, and Native American treaty rights are considered. DOE believes secondary impacts from postulated accidents as assessed in Appendix F, Section F.7 to be minor.

Table 4-14. Summary of representative bounding accidents under the no-action alternative.[a]

Accident Description	Affected waste types[c]	Frequency (per year)	Increased risk of latent fatal cancers per year[b]: Uninvolved worker at 100 meters	Uninvolved worker at 640 meters	Maximally exposed offsite individual	Population within 80 kilometers
RHLWE[d] release due to a feed line break	High-level	0.07[e]	1.79×10^{-5}	6.38×10^{-8}	1.32×10^{-8}	6.34×10^{-4}
RHLWE release due to a design basis earthquake	High-level	2.00×10^{-4}[f]	1.54×10^{-6}	5.46×10^{-8}	1.12×10^{-9}	5.43×10^{-5}
RHLWE release due to evaporator pressurization and breech	High-level	5.09×10^{-5}[g]	1.95×10^{-6}	3.46×10^{-8}	7.13×10^{-10}	3.44×10^{-5}
Design basis ETF[h] airborne release due to tornado	High-level Mixed	3.69×10^{-7}[i]	3.20×10^{-13}	1.02×10^{-14}	7.20×10^{-15}	6.35×10^{-14}
Container breach at the ILNTV[j]	Low-level Mixed	0.02[e]	0.00104	1.84×10^{-5}	3.31×10^{-7}	0.0168
High wind at the ILNTV	Low-level	0.001[f]	4.04×10^{-10}	2.43×10^{-10}	1.52×10^{-10}	1.06×10^{-5}
Tornado at the ILNTV	Low-level	2.00×10^{-5}[g]	3.26×10^{-12}	6.18×10^{-10}	1.18×10^{-10}	1.18×10^{-7}
Earthquake at the SRTC[k] storage tanks	Mixed	2.00×10^{-4}[f]	4.80×10^{-7}	1.54×10^{-8}	8.06×10^{-10}	3.60×10^{-6}
F3 tornado[l] at Building 316-M	Mixed	2.80×10^{-5}[g]	5.35×10^{-12}	1.29×10^{-9}	1.65×10^{-9}	1.12×10^{-9}
Deflagration in culvert during TRU[m] drum retrieval activities	Transuranic	1.00×10^{-2}	8.96×10^{-4}	1.59×10^{-5}	2.86×10^{-7}	1.45×10^{-2}
Fire in culvert at the TRU waste storage pads (one drum in culvert)	Transuranic	8.10×10^{-4}[f]	3.07×10^{-4}	5.48×10^{-6}	9.84×10^{-8}	0.0498
Vehicle crash with resulting fire at the TRU waste storage pads	Transuranic	6.50×10^{-5}[g]	4.47×10^{-6}	7.96×10^{-8}	1.43×10^{-9}	7.25×10^{-5}

TC

a. A complete description and analysis of the representative bounding accidents are presented in Appendix F.
b. Increased risk of fatal cancers per year is calculated by multiplying the [consequence (dose) × latent cancer conversion factor] × annual frequency. For dose consequences and latent cancer fatalities per dose, see tables in Appendix F.
c. The waste type for which the accident scenario is identified as a representative bounding accident. A representative bounding accident may be identified for more than one waste type. These waste types are high-level, low-level, mixed, and transuranic.
d. Replacement High-Level Waste Evaporator.
e. The frequency of this accident scenario is within the anticipated accident range.
f. The frequency of this accident scenario is within the unlikely accident range.
g. The frequency of this accident scenario is within the extremely unlikely accident range.
h. F/H-Area Effluent Treatment Facility.
i. The frequency of this accident scenario is within the beyond-extremely-unlikely accident range.
j. Intermediate-Level Nontritium Vault.
k. Savannah River Technology Center.
l. F3 tornadoes have rotational wind speeds of 254 to 331 kilometers (158 to 206 miles) per hour.
m. Transuranic.

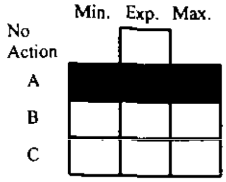
TE

Table 4-15. Summary of chemical hazards associated with the no-action alternative estimated to exceed ERPG-2[a] values.

TE

Chemical name	Appendix F table reference[b]	100-meter concentration (mg/m^3)[c]	640-meter concentration (mg/m^3)	Offsite concentration (mg/m^3)	Reference concentrations	
					ERPG-2 (mg/m^3)	ERPG-3 (mg/m^3)
Nitric acid	F-6	830[d]	100	2	39	77
Nitrogen dioxide	F-7	79.6[d]	0.339	0.159	1.88	56.4
Oxalic acid	F-7	276	1.18	0.552	5	500
Nitric acid	F-7	181[d]	0.771	0.361	38.7	77.3
Benzene	F-18	670	(e)	0.42	160	9,600
Cadmium	F-18	2.7	(e)	0.0017	0.25	500
Chromium	F-18	2.7	(e)	0.0017	2.5	(f)
Lead	F-18	160	(e)	0.10	0.25	700
Mercury	F-18	15	(e)	0.0094	0.20	28
Methyl ethyl ketone	F-18	1,800	(e)	1.1	845	1.01×10^4
Benzene[g]	F-19	1.40×10^4[d]	610	5.7	160	9,600
Benzene[g]	F-19	1.02×10^4[d]	1,210	15.4	160	9,600
Beryllium	F-25	16.7[d]	(e)	0.00823	0.01	10
Cadmium	F-25	333[d]	(e)	0.165	0.25	50
Chloroform	F-25	8,330[d]	(e)	4.11	488	4,880
Chromium	F-25	16.7	(e)	0.00823	2.5	(f)
Copper	F-25	66.7	(e)	0.0329	5	(f)
Lead	F-25	66.7	(e)	0.329	0.25	700
Lead nitrate	F-25	16.7	(e)	0.00823	0.25	700
Mercuric nitrate	F-25	16.7	(e)	0.00823	0.2	28
Mercury	F-25	16.7	(e)	0.00823	0.2	28
Nickel nitrate	F-25	16.7	(e)	0.00823	5	(f)
Silver nitrate	F-25	16.7	(e)	0.00823	0.5	(f)
Sodium chromate	F-25	16.7	(e)	0.00823	0.25	30
Toluene	F-25	8,330[d]	(e)	4.11	754	7,450
Uranyl nitrate	F-25	16.7	(e)	0.00823	0.25	30

a. Emergency Response Planning Guidelines. (See glossary.)
b. Analyses regarding specific chemical releases are provided in the referenced Appendix F tables.
c. Milligrams per cubic meter of air.
d. Concentration at 100 meters (328 feet) exceeds ERPG-3 values.
e. Airborne concentrations at 640 meters (2,100 feet) were not available from existing safety documentation.
f. No equivalent value found.
g. Benzene appears twice under the F-19 category due to different accident initiators: explosion or tornado.



4.2 Alternative A - Limited Treatment Configuration

This section describes the effects alternative A (described in Section 2.4) would have on the existing environment (described in Chapter 3).

4.2.1 INTRODUCTION

Alternative A (limited treatment practices for waste at SRS) includes the continuation of ongoing activities listed under the no-action alternative (Section 4.1.1). In addition DOE would:

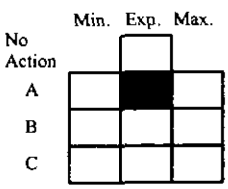
- Construct and operate a containment building to process mixed wastes. TE
- Operate a mobile soil sort facility. TE
- Treat small quantities of mixed and polychlorinated biphenyl (PCB) wastes offsite. TE
- Burn mixed and hazardous wastes in the Consolidated Incineration Facility.
- Construct and operate a transuranic waste characterization/certification facility.
- Store transuranic wastes until they can be sent to the Waste Isolation Pilot Plant. TE

Storage facilities would be constructed on previously cleared land in E-Area. The new waste treatment facilities for characterization/certification of transuranic and alpha wastes and for decontamination/macroencapsulation (containment) of mixed waste would be built on undeveloped land northwest of F-Area.

Construction related to this alternative would require 0.22 square kilometer (55 acres) of undeveloped land northwest of F-Area and 0.04 square kilometer (9 acres) of undeveloped land northeast of F-Area TC

TC by 2006 (Figure 4-13). An additional 0.13 square kilometer (32 acres) of undeveloped land would be required by 2024 for construction of disposal vaults northeast of F-Area (Figure 4-14). Other construction would be on previously cleared and developed land in the eastern portion of E-Area. The minimum waste forecast for this alternative would require 0.29 square kilometer (73 acres) of TC undeveloped land, and the maximum waste forecast would require 4.0 square kilometers (986 acres). Additional site-selection studies would be required to locate suitable land if the maximum waste forecast is realized.

4.2.2 GEOLOGIC RESOURCES

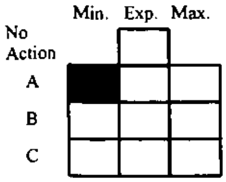


4.2.2.1 Geologic Resources – Expected Waste Forecast

Effects on geologic resources from alternative A – expected waste forecast would result primarily from the construction of new facilities. The effects discussed under the no-action alternative (Section 4.1.2) form the basis for comparison and are referenced in this section.

Although the number of facilities required for this case would be substantially fewer than for the no-action alternative because more waste would be treated and less would be stored, waste management activities associated with alternative A expected waste forecast would affect soils in E-Area. The fewer number of facilities and the corresponding decrease in the amount of land needed would result in smaller effects on soils under this alternative. Cleared and graded land required for this alternative totals approximately 0.26 square kilometer (65 acres) (by 2006). Approximately 0.26 square kilometer (65 acres) of undeveloped land in E-Area would be cleared and graded for the construction of new TC facilities through 2006. Later, an additional 0.13 square kilometer (32 acres) would be cleared for construction of additional RCRA-permitted disposal vaults. This total of 0.39 square kilometer (96 acres) is approximately 60 percent of the 0.65 square kilometer (160 acres) of undisturbed land that would be required for the no-action alternative.

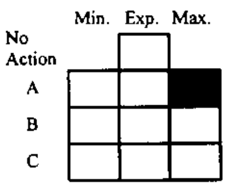
The potential for accidental oil, fuel, and chemical spills would be lower under this alternative than under the no-action alternative because of reduced construction and operation activities. Spill prevention, control, and countermeasures for this scenario would be the same as for the no-action alternative discussed in Section 4.1.2, and impacts to soils would be very small.



4.2.2.2 Geologic Resources – Minimum Waste Forecast

Effects from alternative A – minimum waste forecast would be slightly less than those for the expected waste forecast because less land would be disturbed during construction activities. Approximately 0.17 square kilometer (41 acres) of cleared land (by 2008) and 0.29 square kilometer (73 acres) of uncleared land (by 2024) would be used for construction of treatment, storage, and disposal facilities. TC

For operations activities, spill prevention, control, and countermeasures plans for this case would be the same as for the no-action alternative.



4.2.2.3 Geologic Resources – Maximum Waste Forecast

Effects from alternative A – maximum waste forecast would be greater than from the minimum or expected forecasts previously discussed, because more land would be disturbed during construction activities. Approximately 0.283 square kilometer (70 acres) of cleared land, 0.745 square kilometer (184 acres) of uncleared land in E-Area, and 3.25 square kilometers (802 acres) of land outside E-Area, TC approximately 7 times as much land as would be required for the expected waste forecast, would be used for construction of treatment, storage, and disposal facilities.

For operations activities, spill prevention, control, and countermeasures plans for this alternative would be the same as for the no-action alternative; the potential for spills would be greater because there would be more facilities, and larger amounts of wastes would be managed.

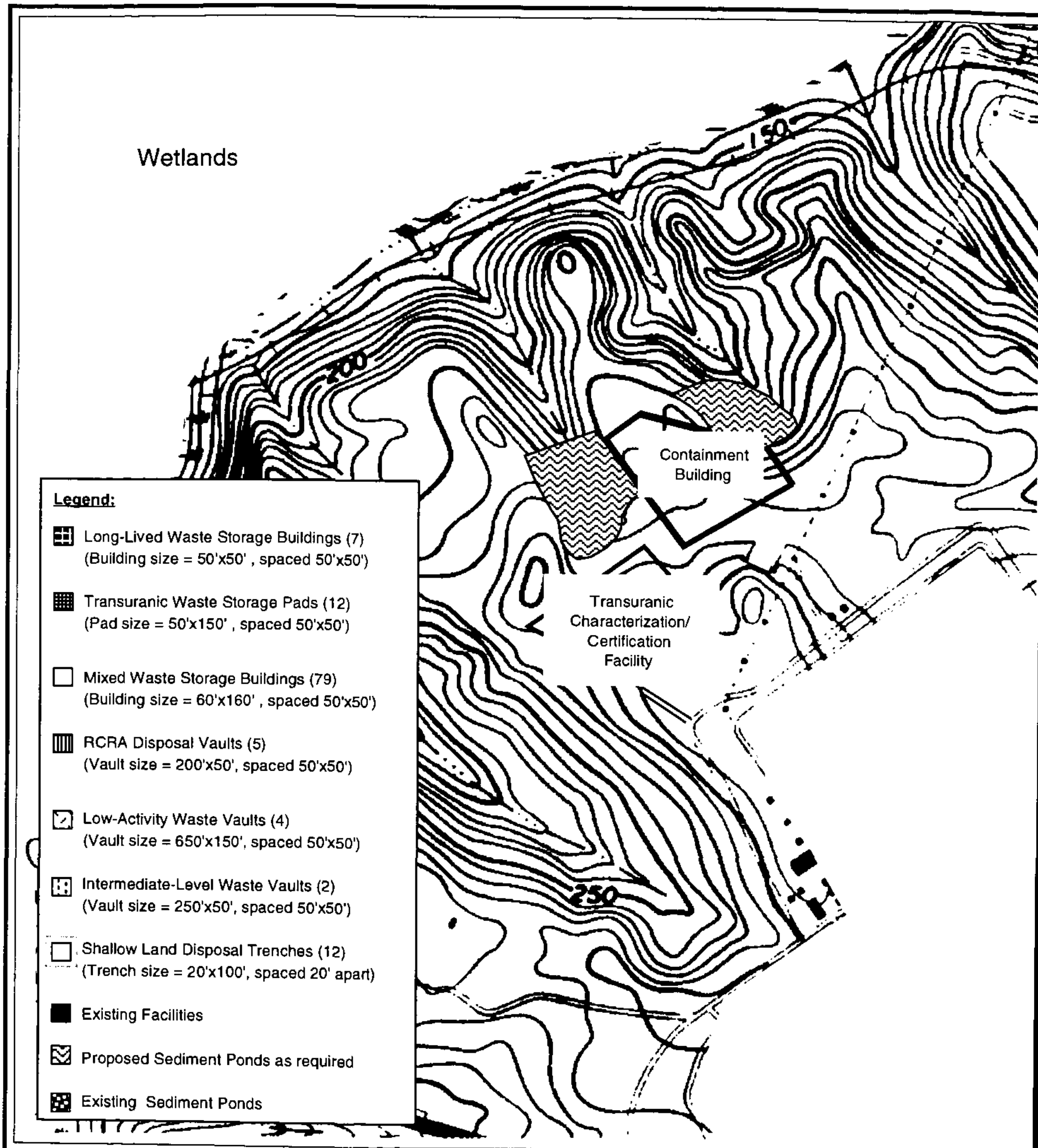
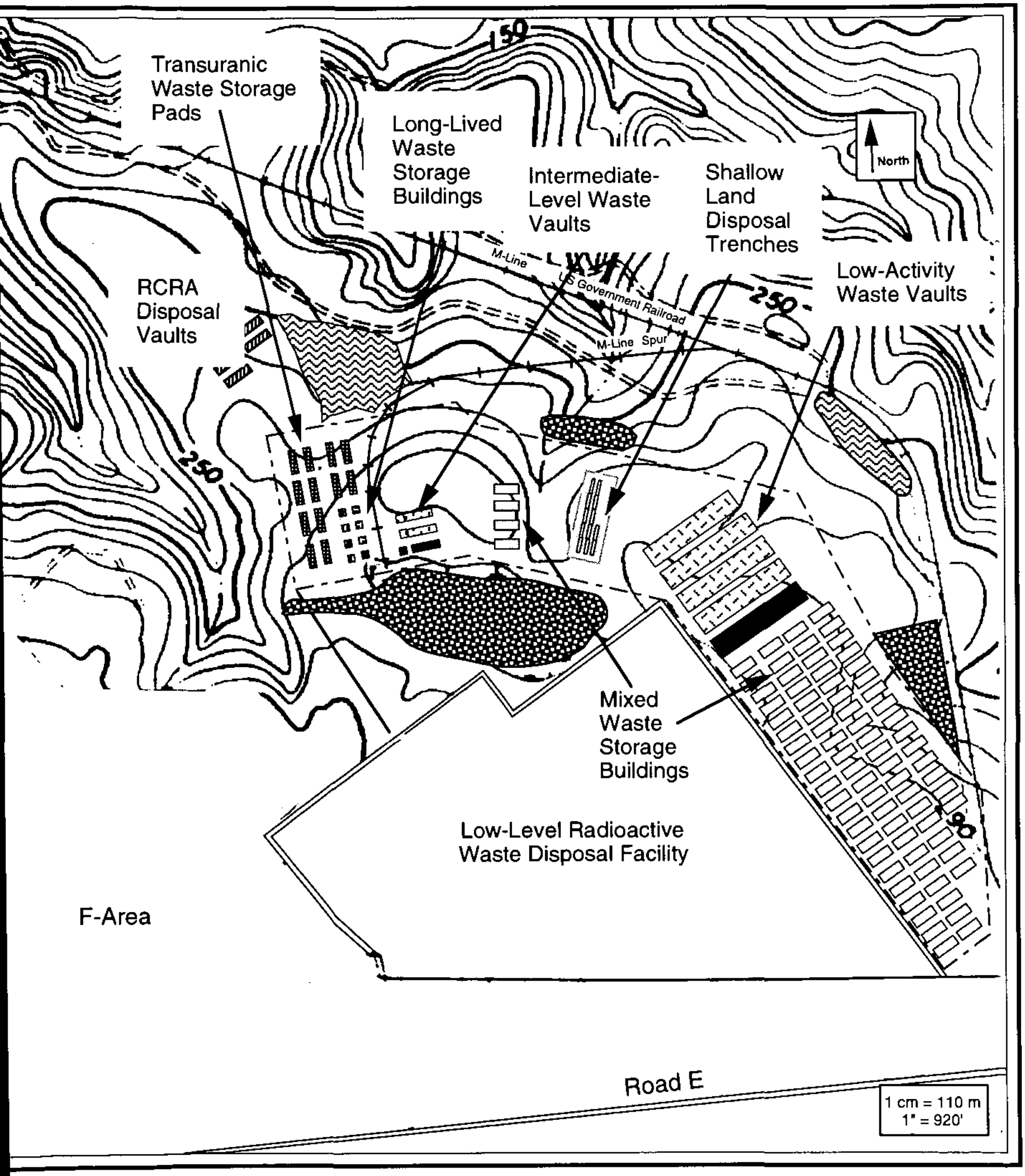
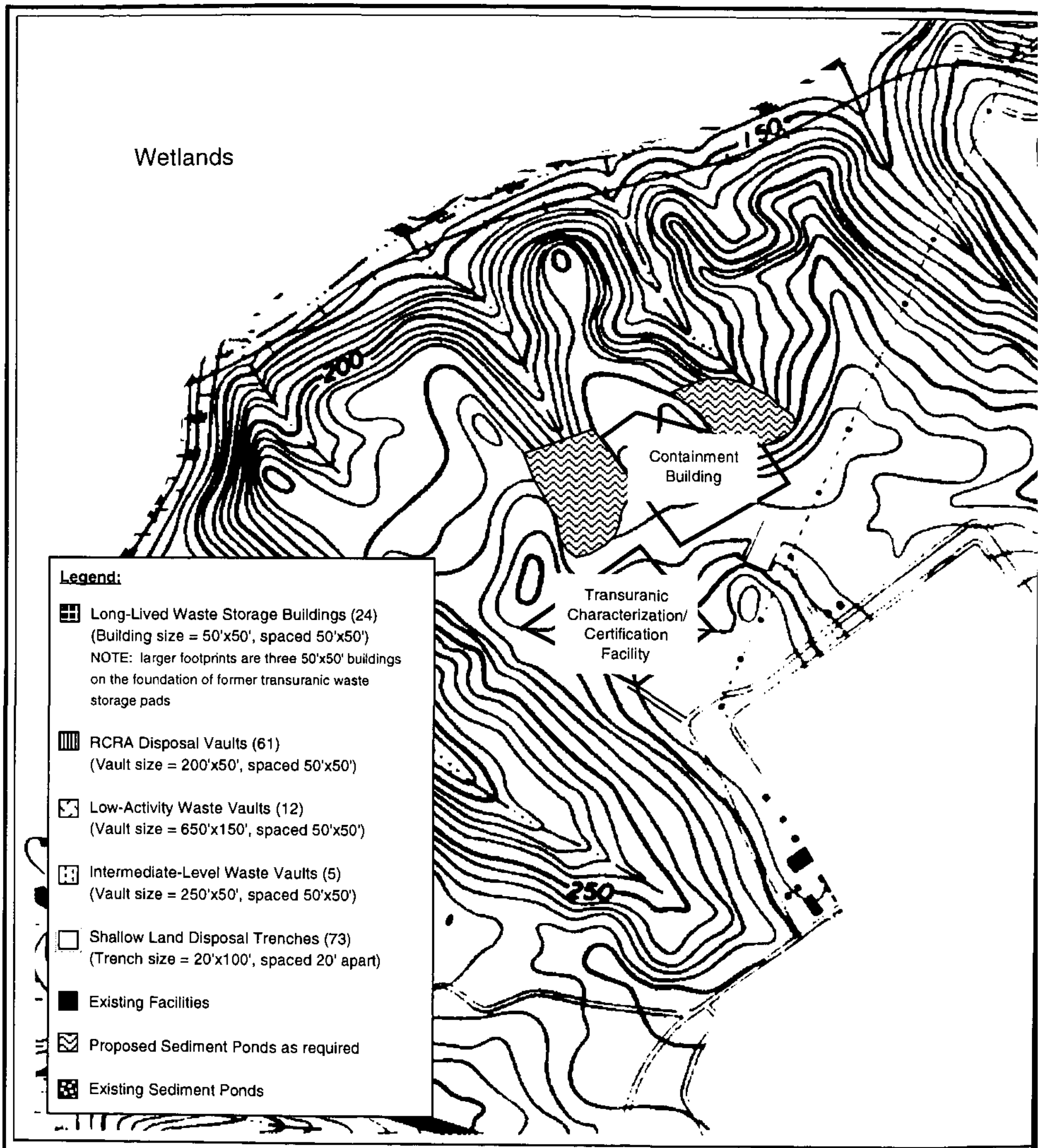


Figure 4-13. Configuration of treatment, storage, and disposal facilities in E-Area for alternative A – expected waste forecast by 2006.

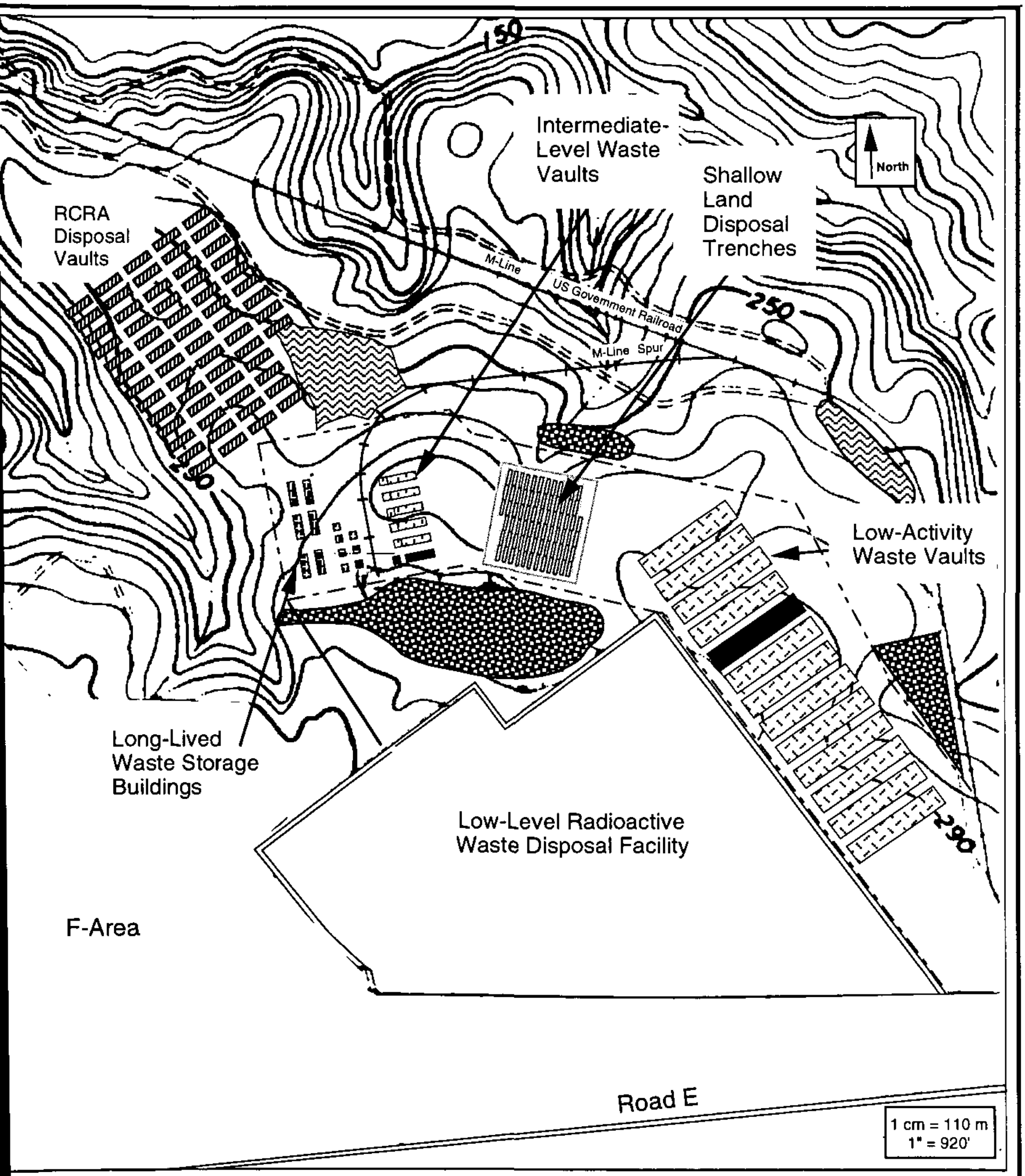

Transuranic Waste Storage Pads
Long-Lived Waste Storage Buildings
Intermediate-Level Waste Vaults
Shallow Land Disposal Trenches
North
Low-Activity Waste Vaults
RCRA Disposal Vaults
M-Line
US Government Railroad
M-Line Spur
150
250
250
250
80
Mixed Waste Storage Buildings
Low-Level Radioactive Waste Disposal Facility
F-Area
Road E
1 cm = 110 m
1" = 920'

PK56-22



TC TC TC TC

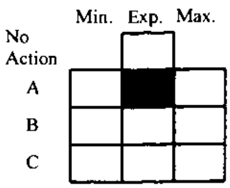
TC **Figure 4-14.** Configuration of treatment, storage, and disposal facilities in E-Area for alternative A – expected waste forecast by 2024.



150
Intermediate-Level Waste Vaults
Shallow Land Disposal Trenches
North
RCRA Disposal Vaults
M-Line
US Government Railroad
250
M-Line Spur
Low-Activity Waste Vaults
Long-Lived Waste Storage Buildings
Low-Level Radioactive Waste Disposal Facility
290
F-Area
Road E
1 cm = 110 m
1" = 920'

PK56-22

4.2.3 GROUNDWATER RESOURCES



4.2.3.1 Groundwater Resources – Expected Waste Forecast

This section discusses the effects of alternative A – expected waste forecast on groundwater resources at SRS. Effects can be evaluated by comparing the concentrations of contaminants predicted to enter the groundwater for each alternative and waste forecast. Effects on groundwater resources under the no-action alternative (Section 4.1.3) form the basis for comparison among the alternatives and are referenced in this section.

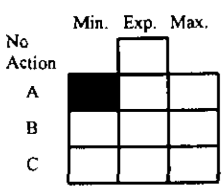
Operation and impacts of the M-Area Air Stripper and the F- and H-Area tank farms would be the same as under the no-action alternative.

For the expected forecast and as noted in Section 4.1.3, releases to groundwater from RCRA-permitted
TE disposal vaults would be improbable during active maintenance; however, releases could eventually
occur after loss of institutional control and degradation of the vaults. Impacts from the RCRA-permitted
disposal vaults would be similar to the effects under the no-action alternative (Section 4.1.3).

There would be two more additional low-activity and intermediate-level radioactive waste disposal
TC vaults (17) than under the no-action alternative (15). Modeling has shown that releases from these vaults
would not cause groundwater standards to be exceeded during the 30-year planning period or the
TC 100-year institutional control period. As in the no-action alternative, no radionuclide exceeded the
TE 4 millirem per year standard for a user of shallow groundwater from the hypothetical well 100 meters
TC (328 feet) from the waste disposal facility at any time after disposal (Toblin 1995). Also as in the
no-action alternative, the predicted concentrations of tritium would be a very small fraction of the
TE drinking water standard. The discussion in Section 4.1.3 on the basis for the 4 millirem standard also
applies to this case. Impacts under this forecast would be similar to the effects under the no-action
alternative.

Under this waste forecast, 73 additional slit trenches would be constructed. Twenty-seven (27) of these slit trenches would be used for disposal of suspect soil and have been evaluated using results from the previous Radiological Performance Assessment (Martin Marietta, EG&G, and WSRC 1994). Under this waste forecast, modeling results indicate that none of the radionuclides analyzed would at any time exceed DOE's performance objective of 4 millirem per year for drinking water (Toblin 1995). The remaining trenches would be filled with stabilized waste forms (e.g., ashcrete) subject to completion of performance assessments and demonstration of compliance with the performance objectives required by DOE Order 5820.2A. Therefore, DOE has conservatively assumed that groundwater concentrations as a result of radioactive releases from the RCRA-permitted vaults and all other low-level waste disposal facilities (vaults and slit trenches) would remain within the DOE performance objective of 4 millirem per year adopted by DOE in Order 5400.5. TC TE

In summary, effects on groundwater for alternative A – expected waste forecast would be very small and similar to the effects discussed under the no-action alternative. TC



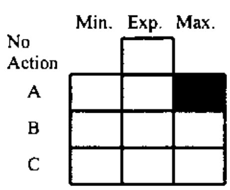
4.2.3.2 Groundwater Resources – Minimum Waste Forecast

For the minimum forecast, and as discussed in Section 4.1.3, releases to groundwater from the disposal vaults would be improbable during active maintenance; however, releases could eventually occur after the loss of institutional control and degradation of the vaults. Impacts from the disposal vaults would be similar to the effects under the no-action alternative (Section 4.1.3). TE

There would be four fewer additional low-activity and intermediate-level radioactive waste disposal vaults (11) than under the no-action alternative (15). Impacts of disposal in these vaults are similar to the impacts discussed in Section 4.1.3. Exceedance of the 4 millirem per year drinking water standard does not occur for any radionuclide in shallow groundwater at any time after disposal (Toblin 1995). TC

For this forecast there would be limited direct disposal of radioactive waste by shallow land disposal (25 additional slit trenches). Eleven (11) of these slit trenches would be used for disposal of suspect soil and have been evaluated using results from the previous Radiological Performance Assessment (Martin Marietta, EG&G, and WSRC 1994). Under this waste forecast, modeling results indicate that none of TC the radionuclides analyzed would at any time exceed DOE's performance objective of 4 millirem per year for drinking water. The remaining trenches would be filled with stabilized waste forms (e.g., ashcrete) subject to completion of performance assessments and demonstration of compliance with the performance objectives required by DOE Order 5820.2A. Therefore, DOE has conservatively assumed that groundwater concentrations as a result of radioactive releases from the RCRA-permitted vaults and all other low-level waste disposal facilities (vaults and slit trenches) would remain within the DOE performance objective of 4 millirem per year adopted by DOE in Order 5400.5.

In summary, effects on groundwater for alternative A – minimum waste forecast would be similar to the effects under the no-action alternative (Section 4.1.3) and the effects for alternative A – expected waste forecast.



4.2.3.3 Groundwater Resources – Maximum Waste Forecast

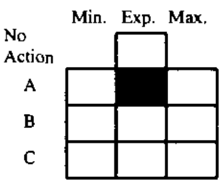
For the maximum forecast under alternative A, a total of 347 disposal vaults would have been constructed by 2024. However, these vaults would have double liners and leak-detection and leachate-collection systems, as required by RCRA (see Section 4.1.3). Therefore, despite the large number of vaults required, releases to groundwater would be improbable during active maintenance; however, releases could eventually occur after loss of institutional control and degradation of the vaults. Impacts from the RCRA-permitted disposal vaults would be similar to the effects under the no-action alternative (Section 4.1.3). Potential effects on groundwater resources due to the construction of RCRA-permitted disposal vaults would be similar to the potential effects due to the construction of mixed-waste storage buildings under the no-action alternative discussed in Section 4.1.3.

There would be more than four times the number of low-activity and intermediate-level radioactive waste disposal vaults (62) than under the no-action alternative (15). Predicted effects on groundwater resources from low-activity and intermediate-level radioactive waste disposal vaults would be similar to those effects under the no-action alternative (Section 4.1.3); no radionuclide would exceed the 4 millirem drinking water standard at any time after disposal (Toblin 1995).

For the maximum forecast, 644 additional slit trenches would be needed to support shallow land disposal. Four hundred twenty six (426) of these slit would be used for disposal of suspect soil and have been evaluated using results from the previous Radiological Performance Assessment (Martin Marietta, EG&G, and WSRC 1994). Under this waste forecast, modeling results indicate that none of the radionuclides analyzed would at any time exceed DOE's performance objective of 4 millirem per year from drinking water (Toblin 1995). The remaining trenches would be filled with stabilized waste forms (e.g., ashcrete) subject to completion of performance assessments and demonstration of compliance with the performance objectives required by DOE Order 5820.2A. Therefore, DOE has conservatively assumed that groundwater concentrations as a result of radioactive releases from the RCRA-permitted vaults and all other low-level waste disposal facilities (vaults and slit trenches) would remain with the DOE performance objective of 4 millirem per year adopted by DOE in Order 5400.5. TC TE

In summary, predicted impacts to groundwater for alternative A – maximum waste forecast would be similar to those under the no-action alternative (Section 4.1.3) and alternative A – expected waste forecast (Section 4.2.3.1). TC

4.2.4 SURFACE WATER RESOURCES



4.2.4.1 Surface Water Resources – Expected Waste Forecast

The impacts of the alternatives can be compared by examining the pollutants that would be introduced to the surface waters. The effect of alternative A – expected waste forecast on SRS streams would not differ from present effects, except that flow rates of the discharged treated wastewater would increase slightly. TE

As discussed in Section 4.1.4, construction of facilities would require sedimentation and erosion control plans to prevent adverse effects to streams by silt, oil/grease, or other pollutants that could occur in runoff. Regular inspection of the implementation of these plans would be performed as outlined in Section 4.1.4. After facilities were operating, they would be included in the *SRS Stormwater Pollution Prevention Plan*, and erosion and pollution control measures would be implemented as indicated in this plan.

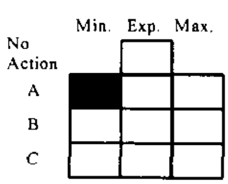
For alternative A – expected waste forecast, the M-Area Air Stripper, the M-Area Dilute Effluent Treatment Facility, and the F/H-Area Effluent Treatment Facility would receive the same additional wastewater flows for treatment as those received in the no-action alternative. Each of these facilities has the design capacity to treat the additional flows and maintain discharge levels in compliance with TC

established permit conditions. The treated effluent from these facilities would, as explained in Section 4.1.4, continue to have little, if any, impact to receiving streams. Radionuclide concentrations would be the same as those reported for the no-action alternative. Drinking water doses due to stormwater infiltrating the vaults and trenches and draining to surface water would be many times lower
TC than regulatory standards (Toblin 1995).

The Replacement High-Level Waste Evaporator (as noted under the no-action alternative) would evaporate the liquid waste from the high-level waste tanks in the F- and H-Area tank farms. It would be used in the same manner as the present F- and H-Area evaporators, with the distillate being sent to the F/H-Area Effluent Treatment Facility for treatment prior to being discharged to Upper Three Runs. The concentrate from the evaporator would be sent to the Defense Waste Processing Facility for vitrification. Since the Replacement High Level Waste Evaporator would be used in the same manner as the existing evaporators and would produce a distillate similar in composition to the present distillate, the effect of the F/H-Area Effluent Treatment Facility effluent on Upper Three Runs would be the same as it is now.

Wastewater from the containment building would be transferred to the Consolidated Incineration Facility for treatment. The containment building would not discharge to a stream.

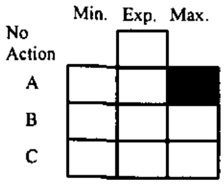
Wastewater discharges would not occur from the mobile soil sort facility under this alternative.



4.2.4.2 <u>Surface Water Resources – Minimum Waste Forecast</u>

The M-Area Dilute Effluent Treatment Facility would receive the same additional wastewater flow for treatment as under the no-action alternative. The M-Area Air Stripper and the F/H-Area Effluent Treatment Facility would each receive approximately 0.4 gallon (1.5 liters) per minute less than that sent to each facility under the no-action alternative. As explained in Section 4.1.4, the treated effluent from these facilities would continue to have little, if any, impact on receiving streams. Each facility has the necessary capacity to treat the additional wastewater and maintain discharges in compliance with established permit conditions. Also, because of less waste disposal, groundwater discharging to surface water would have a very small impact (Toblin 1995). Drinking water doses due to stormwater
TC infiltrating waste disposal vaults and trenches and draining to surface waters would be many times lower than regulatory standards.

As discussed in Section 4.1.4, erosion and sedimentation control plans would be prepared and implemented for the construction projects, and the operators of the facilities would be required to abide by the *SRS Pollution Prevention Plan*.



4.2.4.3 <u>Surface Water Resources – Maximum Waste Forecast</u>

Storage and disposal facilities would be as described in Section 4.2.4.1. Surface waters would not be affected by operation of these facilities.

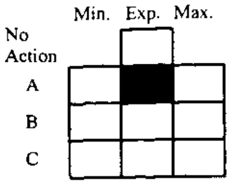
For the maximum waste forecast, wastewater from the containment building would not be transferred to the Consolidated Incineration Facility because that facility could not handle the increased volume. A new wastewater treatment facility would be installed to treat this wastewater to meet outfall discharge limits established by SCDHEC. The average flow rate for this discharge would be approximately 11 liters (2.9 gallons) per minute. The dose to the offsite maximally exposed individual would be 2.1×10^{-5} millirem (Appendix E). The flow of properly treated water would not affect the water quality of the receiving stream.

The M-Area Air Stripper and the M-Area Dilute Effluent Treatment Facility would receive approximately the same additional wastewater flows as under the no-action alternative. The F/H-Area Effluent Treatment Facility would receive additional wastewater flow of 0.28 gallon (1.1 liter) per minute above that for the no-action alternative. The facilities have the capacity to treat the additional flow.

Stormwater infiltrating the disposal vaults and trenches would drain to surface water at concentrations many times less than regulatory standards (Toblin 1995). TC

Erosion and sediment control during construction projects and pollution prevention plans after operations begin would be required, as discussed in Section 4.1.4.

4.2.5 AIR RESOURCES



4.2.5.1 Air Resources – Expected Waste Forecast

Impacts to air can be compared among the alternatives by evaluating the pollutants introduced to the air. Under alternative A expected waste forecast, DOE would continue ongoing and planned waste treatment activities and construct and operate the additional facilities identified in Section 4.2.1. Additional nonradiological and radiological emissions would come from these facilities. The resulting increases of
TE pollutant concentrations at and beyond the SRS boundary would be very small compared to existing concentrations. Operations for alternative A – expected waste forecast would not exceed state or Federal air quality standards.

4.2.5.1.1 Construction

Potential impacts to air quality from construction activities would include fugitive dust (particulate matter) and exhaust from earth-moving equipment. For this case, approximately 5.73×10^5 cubic meters (7.50×10^5 cubic yards) of soil in E-Area would be moved. Fugitive dust emissions for alternative A –
TE expected waste forecast were estimated using the calculations described in Section 4.1.5.1.

Maximum SRS boundary-line concentrations of air pollutants from a year of average construction activity are shown in Table 4-16. The sum of the incremental increases of pollutant concentrations due to construction and the existing baseline concentrations would be within both state and Federal air quality standards.

4.2.5.1.2 Operations

In addition to the current emissions from SRS, nonradiological and radiological emissions would occur due to the operation of new facilities such as the Defense Waste Processing Facility, including In-Tank Precipitation; the M-Area Vendor Treatment Facility; the Consolidated Incineration Facility; the mixed waste containment building; mixed waste soil sort facility; and the transuranic waste characterization/ certification facility. Air emissions from facilities such as disposal vaults and mixed waste storage buildings would be very small.

Table 4-16. Maximum SRS boundary-line concentrations resulting from a year of construction activities under alternative A (in micrograms per cubic meter of air).

Pollutant	Averaging time	Baseline[a] ($\mu g/m^3$)	Average increase[b] ($\mu g/m^3$) Expected	Average increase[b] ($\mu g/m^3$) Minimum	Average increase[b] ($\mu g/m^3$) Maximum	SCDHEC[c] standard ($\mu g/m^3$)	Baseline + increase as percent of standard Expected	Baseline + increase as percent of standard Minimum	Baseline + increase as percent of standard Maximum
Nitrogen oxides	1 year	14	0.01	<0.01[d]	0.02	100	14	14	14
Sulfur dioxide	3 hours	857	37.06	17.61	414	1,300	69	67	98
	24 hours	213	0.70	0.34	7.82	365	59	58	60
	1 year	17	<0.01	<0.01	<0.01	80	21	21	21
Carbon monoxide	1 hour	171	769	394	7,751	4.0×10^4	2	1	20
	8 hours	22	54	62	1,177	1.0×10^4	1	1	12
Total suspended particulates	1 year	43	0.01	0.01	0.06	75	57	57	57
Particulate matter less than 10 microns in diameter	24 hours	85	2.71	1.30	28.00	150	59	58	75
	1 year	25	0.02	0.01	0.09	50	50	50	50

TC

a. Source: Stewart (1994).
b. Source: Hess (1994a).
c. Source: SCDHEC (1976).
d. < is read as "less than."

According to the rationale provided about similar facilities contained in Section 4.1.5.2, increases in maximum boundary-line concentrations of pollutants would not result from the continued operation of the F- and H-Area tank farm evaporators, the F/H-Area Effluent Treatment Facility, the scrap-lead melter, solvent distillation units, the silver recovery unit, the Organic Waste Storage Tank, Savannah River Technology Center ion exchange process, low-level waste compactors, or the M-Area Air Stripper. Additional emissions from the M-Area Air Stripper and the F/H-Area Effluent Treatment Facility would be very small, as addressed in Section 4.1.5.2.

Nonradiological Air Emissions Impacts

Maximum ground-level concentrations for nonradiological air pollutants were determined from the Industrial Source Complex Version 2 Dispersion Model using maximum potential emissions from all the facilities included in alternative A (Stewart 1994). The bases for calculating the dispersion of toxic substances that are carcinogenic are presented in Section 4.1.5.2. Modeled air toxic concentrations for carcinogens are based on an annual averaging period and are presented in Section 4.2.12.2.2. The methodology for calculating an annual averaging period is presented in Section 4.1.5.2.1. Air dispersion modeling was performed using calculated emission rates for facilities not yet operating and actual 1990 emission levels for facilities currently operating (Stewart 1994).

The following facilities were incorporated in the modeling analysis for alternative A air dispersion: the Consolidated Incineration Facility, including the ashcrete storage silo, the ashcrete hopper duct, and the TC ashcrete mixer; four new solvent tanks at the Consolidated Incineration Facility; the Defense Waste Processing Facility, including In-Tank Precipitation; the M-Area Vendor Treatment Facility; the mixed waste containment building; the transuranic waste characterization/certification facility; hazardous waste storage facilities; and mixed waste storage facilities.

Emissions of air toxics would be very small. Maximum boundary-line concentrations for air toxics emanating from SRS sources, including the Consolidated Incineration Facility and the Defense Waste Processing Facility, would be well below regulatory standards and are presented in the *SCDHEC Regulation No. 62.5 Standard No. 2 and Standard No. 8 Compliance Modeling Input/Output Data.*

The Savannah River Technology Center laboratory's liquid waste and the E-Area vaults would have very small air emissions, as described in Section 4.1.5.2.

Table 4-17 shows the increase in maximum ground-level concentrations at the SRS boundary for nonradiological air pollutants due to treating the expected, minimum, and maximum waste forecasts under alternative A.

Concentrations at the SRS boundary would be within both state and Federal ambient air quality regulations. Minimal health effects would occur to the public due to routine emissions.

Offsite lead decontamination operations (described in Appendix B.21) would result in a maximum ground-level 3-month concentration of 0.008 micrograms per cubic meter for all alternatives and forecasts, less than the 0.011 micrograms per cubic meter background concentrations of lead in the SRS area (EPA 1990). Both the concentrations at the offsite facility and at SRS are less than 1 percent of the SCDHEC regulatory standard (SCDHEC 1976). Impacts would be very small. TC

Radiological Air Emissions Impacts TE

Offsite maximally exposed individual and population doses were determined for atmospheric releases resulting from routine operations under alternative A. The major sources of radionuclides would be the Consolidated Incineration Facility (mixed waste only), the transuranic waste characterization/certification facility, and the F/H-Area Effluent Treatment Facility. Other facilities with radiological releases would be the M-Area Vendor Treatment Facility, the mixed waste containment building, and the soil sort facility.

SRS-specific computer codes MAXIGASP and POPGASP were used to determine the maximum individual dose and the dose to the population within an 80-kilometer (50-mile) radius of SRS respectively, from routine atmospheric releases. See Appendix E for detailed facility-specific isotopic and dose data. TE L004-01

Table 4-18 shows the dose to the offsite maximally exposed individual and the population from atmospheric pathways. The calculated maximum committed effective annual dose equivalent (see glossary for definitions of dose, dose equivalent, effective dose, and committed effective dose equivalent) to a hypothetical individual would be 0.011 millirem (Chesney 1995), which is 1,000 times less than the annual dose limit of 10 millirem from SRS atmospheric releases. In comparison, an individual living near SRS receives a dose of 0.25 millirem from all current SRS releases of radioactivity (Arnett 1994). The 0.011 millirem annual dose is greater than the 1.3×10^{-4} millirem dose shown for the no-action alternative. TE TC TC

Table 4-17. Changes in maximum ground-level concentrations of air pollutants at the SRS boundary for alternative A – expected, minimum, and maximum waste forecasts (micrograms per cubic meter of air).

Pollutant	Averaging time	Existing sources ($\mu g/m^3$)[a,b]	Regulatory standards ($\mu g/m^3$)[c]	Background concentration ($\mu g/m^3$)[d]	Increase in concentration ($\mu g/m^3$) Expected[b]	Minimum	Maximum	Percent of standard[e] Expected	Minimum	Maximum
Nitrogen oxides	1 year	6	100	8	0.46	0.46	0.47	14	14	14
Sulfur dioxides	3 hours	823	1,300	34	3.78	3.78	3.79	66	66	66
	24 hours	196	365	17	0.69	0.69	0.69	59	59	59
	1 year	14	80	3	0.23	0.23	0.23	22	22	22
Carbon monoxide	1 hour	171	40,000	NA[f]	22.93	22.93	22.93	0.5	0.5	0.5
	8 hours	22	10,000	NA	5.37	5.37	5.37	0.3	0.3	0.3
Total suspended particulates	1 year	13	75	30	2.01	2.01	2.01	60	60	60
Particulate matter less than 10 microns in diameter	24 hours	51	150	34	4.61	4.61	4.61	60	60	60
	1 year	3	50	22	0.10	0.10	0.10	50	50	50
Lead	3 months	4.0×10^{-4}	1.50	0.01	8.0×10^{-6}	4.9×10^{-6}	6.2×10^{-6}	0.8	0.8	0.8
Gaseous fluorides (as hydrogen fluoride)	12 hours	2	3.70	NA	0.00187	0.00187	0.00187	54	54	54
	24 hours	1	2.90	NA	9.3×10^{-4}	9.3×10^{-4}	9.3×10^{-4}	35	35	35
	1 week	0.4	1.60	NA	3.5×10^{-4}	3.5×10^{-4}	3.5×10^{-4}	25	25	25
	1 month	0.1	0.80	NA	9.0×10^{-5}	9.0×10^{-5}	9.0×10^{-5}	13	13	13

TC

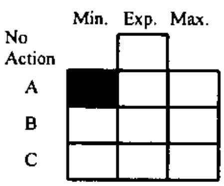
a. Micrograms per cubic meter of air.
b. Source: Stewart (1994).
c. Source: SCDHEC (1976).
d. Source: SCDHEC (1992).
TE e. Percent of standard = 100 × (existing + background + increase) divided by the regulatory standard.
f. NA = not applicable.

The annual dose to the population within 80 kilometers (50 miles) of SRS from treatment of the expected amount of waste would be 0.56 person-rem. This dose is greater than the population dose of 2.9×10^{-4} TC
for the no-action alternative. In comparison, the collective dose received by the same population from natural sources of radiation is approximately 195,000 person-rem (Arnett, Karapatakis, and Mamatey 1994). Section 4.2.12.1.2 describes the potential health effects of these releases.

Table 4-18. Annual radiological doses to individuals and the population within 80 kilometers (50 miles) of SRS from atmospheric pathways under alternative A.[a]

Waste forecast	Offsite maximally exposed individual dose (millirem)	Population[b] dose (person-rem)	
Expected waste forecast	0.011	0.56	TC
Minimum waste forecast	0.0057	0.27	
Maximum waste forecast	0.080	3.4	

a. Source: Chesney (1995). TC
b. For atmospheric releases, the dose is to the population within 80 kilometers (50 miles) of SRS.



4.2.5.2 Air Resources – Minimum Waste Forecast

4.2.5.2.1 Construction

Impacts were evaluated for the construction of storage, treatment, and disposal facilities listed in Section 2.4.7. Maximum concentrations at the SRS boundary resulting from a year of average construction activity are shown in Table 4-16 for alternative A – minimum waste forecast. Construction-related emissions would yield SRS boundary-line concentrations less than both state and Federal air quality standards.

4.2.5.2.2 Operations

Both radiological and nonradiological emission changes were determined for the same facilities listed in Section 4.2.5.1.2. Air emissions would be less than those for the expected waste forecast.

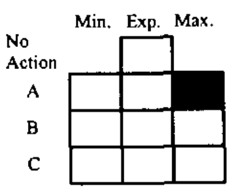
Nonradiological Air Emission Impacts

Nonradiological air emissions would be only slightly less than those for the expected waste forecast. Maximum SRS boundary-line concentrations are presented in Table 4-17. Modeled concentrations are similar to those shown for the expected waste forecast and under the no-action alternative (Table 4-17). Total concentrations would be less than applicable state and Federal ambient air quality standards.

Radiological Air Emission Impacts

Table 4-18 presents the dose to the offsite maximally exposed individual and the population due to atmospheric releases. The calculated maximum committed annual dose equivalent to a hypothetical TC individual is 0.0057 millirem (Chesney 1995), which is less than the dose for the expected waste forecast and well below the annual dose limit of 10 millirem from SRS atmospheric releases.

The annual dose to the population within 80 kilometers (50 miles) of SRS would be 0.27 person-rem, which is less than the population dose calculated for the expected waste forecast.



4.2.5.3 Air Resources – Maximum Waste Forecast

Alternative A – maximum waste forecast would have greater air quality impacts than the expected waste forecast.

4.2.5.3.1 Construction

Impacts were evaluated for the construction of storage, treatment, and disposal facilities listed in Section 2.4.7. Maximum concentrations at the SRS boundary resulting from a year of average construction activity are presented in Table 4-16 for the maximum waste forecast. Construction-related concentrations would yield SRS boundary concentrations less than both state and Federal air quality standards.

4.2.5.3.2 Operations

Both radiological and nonradiological emissions increases were determined for the same facilities listed in Section 4.2.5.1.2. Air emissions would be greater than in the expected waste forecast; therefore, TC impacts to air quality would be greater. However, they would remain within state and Federal ambient air quality standards.

Nonradiological Air Emissions Impacts TE

Nonradiological air emissions would be slightly higher than those associated with the expected waste forecast. Maximum concentrations at the SRS boundary are presented in Table 4-17. Modeled concentrations are similar to those for the expected waste forecast. Cumulative concentrations would be below applicable state and Federal ambient air quality standards.

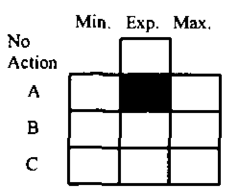
Radiological Air Emissions Impacts TE

Offsite maximally exposed individual and population doses were determined for atmospheric releases resulting from routine operations at the facilities identified in Section 4.2.5.1.2.

Table 4-18 shows the dose to the offsite maximally exposed individual and to the population due to atmospheric releases. The calculated maximum committed annual dose equivalent to a hypothetical individual is 0.080 millirem (Chesney 1995), which would be greater than the dose from the expected waste forecast but well below the annual dose limit of 10 millirem from SRS atmospheric releases. TC

The annual dose to the population within 80 kilometers (50 miles) of SRS would be 3.4 person-rem, which would be greater than the population dose calculated for the expected waste forecast. Section 4.2.12.1.2 describes the potential health effects of these releases.

4.2.6 ECOLOGICAL RESOURCES



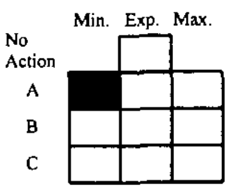
4.2.6.1 Ecological Resources – Expected Waste Forecast

Construction of new waste treatment, storage, and disposal facilities for alternative A – expected waste forecast would result in the clearing and grading of undisturbed areas. (These areas are given in acres; to convert to square kilometers, multiply by 0.004047.) Sixty-four acres of woodland would be cleared and graded by 2006 and an additional 32 acres would be needed by 2024, as follows: TC

- 27 acres of loblolly pine planted in 1987 TC
- 15 acres of white oak, red oak, and hickory regenerated in 1922
- 18 acres of longleaf pine regenerated in 1922, 1931, or 1936

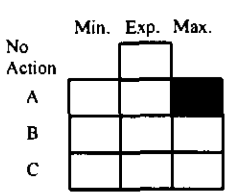
- 4 acres from which mixed pine/hardwood was recently harvested
- 20 acres of loblolly pine planted in 1987 would be cleared between 2007 and 2024
- TC 3 acres of loblolly pine planted in 1946 would be cleared between 2007 and 2024
- 9 acres of longleaf pine planted in 1988 would be cleared between 2007 and 2024

Effects on the ecological resources are described in Section 4.1.6; however, because less land would be TC required for this case (96 acres versus 160 under the no-action alternative), the overall impact due to loss of habitat would be less. For example, fewer animals would be displaced or destroyed.



4.2.6.2 Ecological Resources – Minimum Waste Forecast

TC Approximately 73 acres of undeveloped land located between the M-Line railroad and the E-Area expansion and extending northwest of F-Area would be required. Because less undeveloped land would be required under this waste forecast, impacts to the ecological resources of the area would be slightly less than for the expected waste forecast.

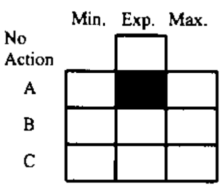


4.2.6.3 Ecological Resources – Maximum Waste Forecast

Approximately 184 acres of undeveloped land located between the M-Line railroad and the developed portion of E-Area and extending northwest of F-Area would be required for the maximum waste TC forecast. By 2006, an additional 802 acres of undeveloped land in an undetermined location would also be required. Impacts to the ecological resources of SRS under this forecast would be approximately 7 times greater than the impacts described in Section 4.1.6 due to the greater acreage required. For example, many more animals would be destroyed or displaced during clearing of this much land. Loss of cover from several hundred acres in a watershed can alter the water chemistry of the creeks in the drainage, which in turn could influence the kinds of organisms that live in the streams.

TE TC Wetlands constitute nearly 21 percent of SRS (DOE 1991). Should the maximum amount of waste be treated, and 802 acres of additional land be required, it is probable that some sites needed for the expansion could contain wetlands. Additionally, a large portion of SRS soils are on steep slopes and highly erodible, with conditions so difficult to overcome that special facility designs, substantial increases in construction costs, and increased maintenance costs would be required (WSRC 1994c). Soils on the steep slopes adjacent to E-Area would be avoided under all alternatives due to these construction and maintenance problems. It is likely that a portion of a site selected for additional waste management construction would contain some unsuitable soils. Threatened and endangered species and significant historic and pre-historic cultural resources are also found throughout SRS and could occur on portions of any site selected for additional waste management facilities. Because of these considerations, it is likely that a tract of land substantially larger than 802 acres would be needed to provide the required acreage. Threatened and endangered species surveys and floodplains and wetland assessments would be required before final site selection. TC

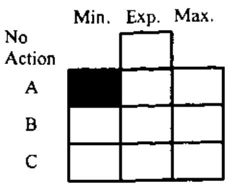
4.2.7 LAND USE



4.2.7.1 <u>Land Use – Expected Waste Forecast</u>

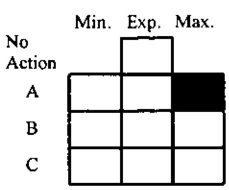
DOE would use approximately 0.52 square kilometer (64 acres of undeveloped; 65 acres of developed) land in E-Area through 2006 for activities associated with alternative A – expected waste forecast. By 2024, 0.61 square kilometer (152 acres) would be required, about 89 acres less than under the no-action alternative. SRS has about 181,000 acres of undeveloped land, which includes wetlands and other areas that cannot be developed, and 17,000 acres of developed land. TC

Activities associated with alternative A would not affect current SRS land-use plans; E-Area was designated as an area for nuclear facilities in the draft *1994 Land-Use Baseline Report*. Furthermore, no part of E-Area has been identified as a potential site for future new missions. According to the *FY 1994 Draft Site Development Plan*, proposed future land management plans specify that E-Area should be characterized and remediated for environmental contamination in its entirety, if necessary. Decisions on future SRS land uses will be made by DOE through the site development, land-use, and future-use planning processes, including public input through avenues such as the Citizens Advisory Board.



4.2.7.2 Land Use – Minimum Waste Forecast

Activities associated with alternative A – minimum waste forecast would not affect current SRS land uses. By 2024, approximately 0.44 square kilometer (108 acres; slightly less acreage than would be required in the expected waste forecast) in E-Area would be used for the facilities described in Section 4.2.1.

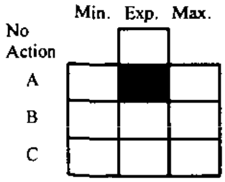


4.2.7.3 Land Use – Maximum Waste Forecast

Activities associated with alternative A – maximum waste forecast would not affect current SRS land uses. By 2006, DOE would need a total of 1.03 square kilometers (254 acres) in E-Area and 3.24 square kilometers (802 acres) elsewhere for the facilities described in Section 4.2.1. This acreage is nearly 10 times the land that would be required for the expected or minimum waste forecast, but less than 1 percent of the total undeveloped land on SRS (DOE 1993d). However, considerably more acreage than this may be affected (see Section 4.2.6.3). Current land uses in E-Area would not be impacted. The location of the 3.24 square kilometers (802 acres) outside of E-Area has not been identified and the site selection would involve further impact analyses. However, DOE would minimize the impact of clearing 3.24 square kilometers (802 acres) by locating these facilities within the central industrialized portion of SRS, as described in Section 2.1.2 and shown in Figure 2-1.

4.2.8 SOCIOECONOMICS

This section describes the potential effects of implementing alternative A on the socioeconomic resources in the region of influence discussed in Section 3.8. This assessment is based on the estimated construction and operations employment required to implement this alternative.



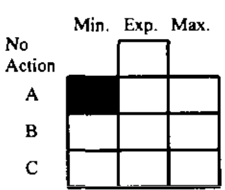
4.2.8.1 Socioeconomics – Expected Waste Forecast

4.2.8.1.1 Construction

Table 4-19 shows the estimated construction employment associated with the expected waste forecast for this alternative. DOE anticipates that construction employment would peak during 2003 through 2005 with approximately 80 jobs, 30 more jobs than during peak employment under the no-action alternative. TC This employment demand represents much less than 1 percent of the forecast employment in 2005. Given the normal fluctuation of employment in the construction industry, DOE does not expect a net change in regional construction employment from implementation of this forecast. Given no net change in employment, neither the population nor personal income in the region would change. As a result, socioeconomic resources would not be affected.

4.2.8.1.2 Operations

Operations employment associated with implementation of the expected waste forecast under this alternative is expected to peak from 2008 through 2018 with an estimated 2,560 jobs, 110 more jobs than during peak employment under the no-action alternative. This employment demand represents less than TC 1 percent of the forecast employment in 2015 (see Chapter 3) and approximately 12 percent of 1995 SRS employment. DOE believes these jobs would be filled from the existing SRS workforce. Thus, DOE anticipates that socioeconomic resources would not be affected by changes in operations employment.



4.2.8.2 Socioeconomics – Minimum Waste Forecast

4.2.8.2.1 Construction

Construction employment associated with the minimum waste forecast under this alternative would be slightly less than that for the expected waste forecast and would peak during 2003 through 2005 with approximately 70 jobs, which represents much less than 1 percent of the forecast employment in 2005. TC Socioeconomic resources in the region would not be affected.

Table 4-19. Estimated construction and operations employment for alternative A – expected, minimum, and maximum waste forecasts.[a]

	Waste Forecast				
	Minimum		Expected		Maximum[b]
Year	Construction	Operations	Construction	Operations	Construction
1995	20	920	50	1,650	290
1996	20	1,150	30	1,920	80
1997	20	1,150	30	1,920	80
1998	20	1,150	40	2,060	190
1999	20	1,150	40	2,170	190
2000	20	1,230	40	2,280	190
2001	20	1,230	40	2,280	190
2002	30	1,310	60	2,330	230
2003	70	1,350	80	2,330	260
2004	70	1,350	80	2,330	260
2005	70	1,350	80	2,330	260
2006	40	1,430	60	2,270	210
2007	20	1,390	40	2,190	80
2008	20	1,680	40	2,560	160
2009	20	1,610	40	2,560	160
2010	20	1,610	40	2,560	160
2011	20	1,610	40	2,560	160
2012	20	1,610	40	2,560	160
2013	20	1,610	40	2,560	160
2014	20	1,610	40	2,560	160
2015	20	1,610	40	2,560	160
2016	20	1,610	40	2,560	160
2017	20	1,610	40	2,560	160
2018	20	1,610	40	2,560	160
2019	20	1,310	40	2,190	80
2020	20	1,310	40	2,190	80
2021	20	1,310	40	2,190	80
2022	20	1,310	40	2,190	80
2023	20	1,310	40	2,190	80
2024	20	1,310	40	2,190	80

TC

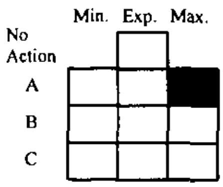
TE

a. Source: Hess (1995a, b).
b. Operations employment for the maximum waste forecast is provided in Table 4-20.

4.2.8.2.2 Operations

TC

Operations employment associated with implementation of the minimum waste forecast is expected to peak in the year 2008 with an estimated 1,680 jobs, 880 fewer jobs than for the expected waste forecast. This employment demand represents less than 1 percent of the forecast employment in 2008 and approximately 8 percent of 1995 SRS employment. DOE believes these jobs would be filled from the existing SRS workforce and anticipates that socioeconomic resources from changes in operations employment would not be affected.



4.2.8.3 Socioeconomics – Maximum Waste Forecast

4.2.8.3.1 Construction

Construction employment associated with alternative A – maximum waste forecast would be greater than that for the expected waste forecast and would peak during 2003 through 2005 with approximately 260 jobs, which represents much less than 1 percent of the forecast employment in 2005. DOE does not expect a net change in regional construction employment from implementation of this case. As a result, socioeconomic resources in the region would not be affected. TC

4.2.8.3.2 Operations

Operations employment associated with implementation of alternative A – maximum waste forecast is expected to peak during 2002 through 2005 with an estimated 11,200 jobs (Table 4-20), which represents 4 percent of the forecast employment in 2005 and approximately 56 percent of 1995 SRS employment. DOE assumes that approximately 50 percent of the total SRS workforce would be available to support the implementation of this case. If DOE transfers 50 percent of the SRS workforce, an additional 3,300 new employees would still be required during the peak years. Based on the number of new jobs predicted, DOE calculated changes in regional employment, population, and personal income using the Economic-Demographic Forecasting and Simulation Model developed for the six-county region of influence (Treyz, Rickman, and Shao 1992). TC

Results of the modeling indicate that the peak regional employment change would occur in 2002 with a total of approximately 7,540 new jobs (Table 4-21) (HNUS 1995b). This would represent a 3 percent increase in baseline regional employment and would have a substantial positive impact on the regional economy. TC

Potential changes in regional population would lag behind the peak change in employment because of migration lags and also because in-migrants may have children after they move into the area. As a result, the maximum change in population would occur in 2005 with an estimated 12,900 additional people in TC

TC the six-county region (HNUS 1995b). This increase is approximately 2.7 percent above the baseline regional population forecast (Table 4-21) and could affect the demand for community resources and services such as housing, schools, police, health care, and fire protection.

Table 4-20. Estimated new operations jobs required to support the alternative A – maximum waste forecast.[a]

Year	Projected total SRS employment	SRS employment available for waste management activities[b]	Total operations employment for the alternative A– maximum waste forecast	New hires[c]
1995	20,000	10,000	2,620	0
1996	15,800	7,900	4,420	0
1997	15,800	7,900	4,730	0
1998	15,800	7,900	10,200	2,300
1999	15,800	7,900	10,490	2,590
2000	15,800	7,900	10,510	2,610
2001	15,800	7,900	10,510	2,610
2002	15,800	7,900	11,200	3,300
2003	15,800	7,900	11,200	3,300
2004	15,800	7,900	11,200	3,300
2005	15,800	7,900	11,200	3,300
2006	15,800	7,900	10,040	2,140
2007	15,800	7,900	4,600	0
2008	15,800	7,900	9,060	1,160
2009	15,800	7,900	9,060	1,160
TC 2010	15,800	7,900	9,060	1,160
2011	15,800	7,900	9,060	1,160
2012	15,800	7,900	9,060	1,160
2013	15,800	7,900	9,060	1,160
2014	15,800	7,900	9,060	1,160
2015	15,800	7,900	9,060	1,160
2016	15,800	7,900	9,060	1,160
2017	15,800	7,900	9,060	1,160
2018	15,800	7,900	9,060	1,160
2019	15,800	7,900	4,600	0
2020	15,800	7,900	4,600	0
2021	15,800	7,900	4,600	0
2022	15,800	7,900	4,600	0
2023	15,800	7,900	4,600	0
2024	15,800	7,900	4,600	0

a. Source: Hess (1995a, b).

b. DOE assumed that approximately 50 percent of the total SRS workforce would be available to support waste management activities.

c. New hires are calculated by comparing the required employment (column 4) to available employment (column 3); new hires would be needed only in those years when required employment exceeds available employees.

Table 4-21. Changes in employment, population, and personal income for alternative A – maximum waste forecast.[a]

Year	New hires[b]	Change in indirect regional employment[c]	Net change in total regional employment	Percent change in regional employment	Change in regional population	Percent change in regional population	Change in regional personal income (millions)	Percent change in regional personal income
1998	2,300	3,300	5,600	2.26	1,960	0.42	270	2.60
1999	2,590	3,640	6,230	2.49	4,600	0.97	340	3.09
2000	2,610	3,490	6,100	2.41	6,380	1.34	370	3.18
2001	2,610	3,330	5,940	2.32	7,770	1.63	390	3.16
2002	3,300	4,240	7,540	2.92	9,460	1.98	520	3.98
2003	3,300	4,100	7,400	2.83	11,020	2.30	550	3.96
2004	3,300	3,990	7,290	2.76	12,080	2.52	580	3.94
2005	3,300	3,920	7,220	2.70	12,900	2.69	610	3.91
2006	2,140	2,170	4,310	1.60	12,490	2.60	430	2.59
2007	0	3,060	3,060	1.13	11,270	2.34	340	1.92
2008	1,160	760	1,920	0.71	9,880	2.04	240	1.27
2009	1,160	910	2,070	0.76	8,690	1.79	240	1.20
2010	1,160	1,070	2,230	0.82	7,850	1.61	250	1.17
2011	1,160	1,220	2,380	0.87	7,170	1.47	260	1.15
2012	1,160	1,340	2,500	0.91	6,630	1.35	280	1.17
2013	1,160	1,450	2,610	0.95	6,200	1.26	310	1.22
2014	1,160	1,530	2,690	0.98	5,850	1.18	330	1.22
2015	1,160	1,600	2,760	1.01	5,560	1.12	360	1.25
2016	1,160	1,650	2,810	1.03	5,310	1.06	380	1.25
2017	1,160	1,680	2,840	1.04	5,100	1.02	410	1.27
2018	1,160	1,710	2,870	1.05	4,920	0.98	440	1.29

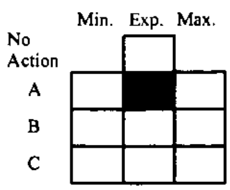
TC

a. Source: Hess (1995a, b); HNUS (1995b).
b. From Table 4-20.
c. Change in employment related to changes in population.

Potential changes in total personal income would peak in 2005 with a $610 million increase over forecast
TC income levels for that year (HNUS 1995b). This would be a 4 percent increase over baseline income levels (Table 4-21) and would have a substantial, positive effect on the regional economy.

4.2.9 CULTURAL RESOURCES

This section discusses the effect of alternative A on cultural resources.



4.2.9.1 <u>Cultural Resources – Expected Waste Forecast</u>

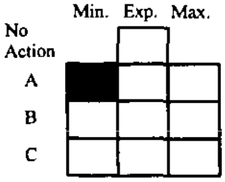
Waste treatment, storage, and disposal facilities would be constructed within the currently developed portion of E-Area, to the north and northwest of this area, and to the northwest of F-Area (see Figures 4-13 and 4-14).

Construction within the developed and fenced portion of E-Area would not affect cultural or archaeological resources because this area has been previously disturbed.

Two small areas of unsurveyed land to the east and northeast of the currently developed portion of E-Area that would be used for the construction of sediment ponds (see Figure 4-5) would be surveyed before beginning construction. If important resources were discovered, DOE would avoid them or remove them.

Construction of the RCRA-permitted disposal vaults to the northwest of the currently developed portion of E-Area (see Figure 4-13) would not affect archaeological resources because when this area was surveyed important sites were not discovered.

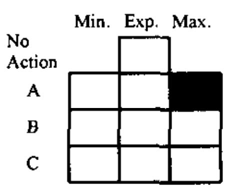
Archaeological sites in the area of expansion could be impacted as described in Section 4.1.9. If this occurred, DOE would protect these resources as described in Section 4.1.9.



4.2.9.2 Cultural Resources – Minimum Waste Forecast

Construction of new waste management storage facilities for this forecast would require approximately 0.18 fewer square kilometer (44 fewer acres) than that for the expected waste forecast. Although the precise configuration of facilities is currently undetermined, construction would take place within previously disturbed parts of E-Area. TC

As discussed in Section 4.2.9.1, construction within the developed and fenced portion of E-Area or to the northwest of this area would not have an effect on archaeological resources. Before construction would begin in the undeveloped area northwest of F-Area, the Savannah River Archaeology Research Program and DOE would complete the consultation process with the State Historic Preservation Officer and develop mitigation action plans to ensure that important archaeological resources would be protected and preserved (Sassaman 1994).



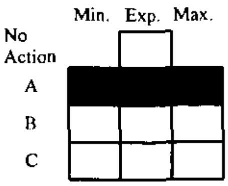
4.2.9.3 Cultural Resources – Maximum Waste Forecast

Construction of new waste management storage, treatment, and disposal facilities for this forecast would require approximately 4.27 square kilometers (1,056 acres), 3.66 kilometers (904 acres) more than for the expected waste forecast. Some of the new facilities would be sited within E-Area; however, DOE would need an estimated additional 3.24 square kilometers (802 acres) outside of E-Area. TC TC

Construction within the developed and fenced portion of E-Area or to the northwest of this area would be preceded by consultation with the State Historic Preservation Officer and the development of a mitigation plan to ensure that archaeological resources would be protected.

Until DOE determines the precise location of the additional 3.24 square kilometers (802 acres) that would be used outside of E-Area, effects on cultural resources cannot be predicted. The potential disturbance of important cultural resources would be proportional to the amount of land disturbed. However, in compliance with the Programmatic Memorandum of Agreement, DOE would survey areas TC proposed for new facilities prior to disturbance. If important resources were discovered, DOE would avoid or remove them.

TE

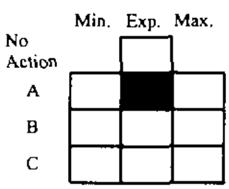


4.2.10 AESTHETICS AND SCENIC RESOURCES – EXPECTED, MINIMUM, AND MAXIMUM WASTE FORECASTS

TE Activities associated with alternative A – expected, minimum, and maximum waste forecasts would not adversely affect scenic resources or aesthetics. E-Area is already dedicated to industrial use. In all cases, new construction would not be visible from off SRS or from public access roads on SRS. The new facilities would not produce emissions that would be visible or that would indirectly reduce visibility.

4.2.11 TRAFFIC AND TRANSPORTATION

4.2.11.1 Traffic



4.2.11.1.1 Traffic – Expected Waste Forecast

The additional traffic under alternative A – expected waste forecast (Table 4-22) would result from construction activities. The increase would be greatest in 2003, when the greatest number of people would be employed. In the table, the additional traffic is distributed among offsite roads based on the percentage of baseline traffic each road carries. Traffic on all roads would remain within design capacity, and the effects of increased traffic would be very small.

Additional truck traffic due to increased construction activities was estimated to be fewer than 10 trucks per day for all alternatives (Hess 1994d). DOE would not expect this increase in construction-related truck traffic during normal working hours to adversely affect traffic; therefore, it will not be discussed in subsequent sections.

TC For the expected waste forecast, there would be two additional waste shipments per day over the no-action estimates (Table 4-23). This would be due to shipments of stabilized ash and blowdown from the Consolidated Incineration Facility to disposal facilities. DOE would not expect the additional truck traffic during normal working hours to adversely affect traffic. Numbers of shipments assumed under each alternative are given in Tables E.3-1 through E.3-3. TE

Table 4-22. Number of vehicles per hour during peak hours under alternative A.

Road	Design capacity (vehicles per hour)	No-action alternative (Percentage of design capacity)	Waste Forecast Minimum	Waste Forecast Expected	Waste Forecast Maximum
Offsite			(percentage of design capacity)		
SC 19	3,000[b]	2,821(94)	2,831(94)	2,837(95)	2,917(97)
SC 125	3,200[b]	2,720(85)	2,730(85)	2,736(85)	2,812(88)
SC 57	2,100[b]	706(33)	707(34)	709(34)	729(35)
Onsite					
Road E at E-Area	2,300[c]	788[d](34)	809[e](35)	824[e](36)	999[e](43)

TC

a. Number in parentheses represents percentage of design capacity.
b. Adapted from Smith (1989).
c. Adapted from TRB (1985).
d. Includes baseline plus the maximum number (47) of construction workers (Hess 1995a, b).
e. Includes baseline plus the maximum number (68 for the minimum, 83 for the expected, and 258 for the maximum waste forecast) of construction workers (Hess 1995a, b).

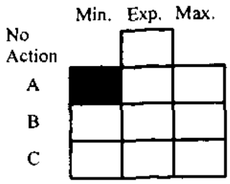
TC

Table 4-23. SRS daily hazardous and radioactive waste shipments by truck under alternative A.[a]

Waste type	1994 no-action traffic[a]	Change from no-action Minimum	Change from no-action Expected	Change from no-action Maximum
Hazardous	14	-6	<1[b]	6
Low-level	7	-3	0	12
Mixed	8	-4	2	25
Transuranic[c]	1	<1	<1	15
Total change	NA[d]	-13	2	58
Total shipments per day	30	17	32	88

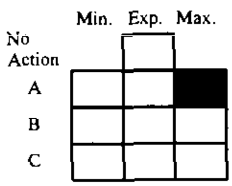
TC

a. Shipments per day: To arrive at shipments per day, the total number of waste shipments estimated for the 30 years considered in this EIS was divided by 30 to determine estimated shipments per year. These numbers were divided by 250, which represents working days in a calendar year, to determine shipments per day. Supplemental data are provided in the traffic and transportation section of Appendix E.
b. Values less than 1 are treated as zero for purposes of comparison.
c. Includes mixed and nonmixed transuranic waste shipments.
d. NA = not applicable.



4.2.11.1.2 Traffic – Minimum Waste Forecast

TC For the minimum waste forecast, there would be 21 more vehicles than in the no-action alternative during peak commuter hours (Table 4-22). Traffic on all roads would remain within design capacity. The effects of traffic under this case would be very small. There would be 13 fewer waste shipments per day compared to no-action estimates (Table 4-23). This decrease is due to smaller volumes of all types of waste. The lower volume of truck traffic would result in a slightly positive effect on traffic.



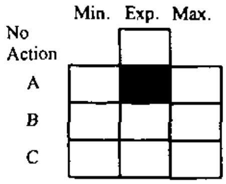
4.2.11.1.3 Traffic – Maximum Waste Forecast

As discussed in Section 4.1.11.1, the 1992 highway fatality rate of 2.3 per 100 million miles driven in South Carolina provides a baseline estimate of 5.5 traffic fatalities annually. Under alternative A, the largest increase in construction workers would occur for the maximum waste forecast (211 more workers
TC than under the no-action alternative). These workers would be expected to drive 2.6 million miles annually (2.1 million miles more than under the no-action alternative), which would result in less than one additional traffic fatality per year.

TC Even with the addition of 211 vehicles above the estimates under the no-action alternative, traffic on all
TE roads would remain within design carrying capacity; therefore, effects on traffic would be very small. Depending on the areas to which these employees were assigned and the shifts they worked, DOE would need to examine the design capacity of the affected roads.

Daily waste shipments would increase by 58 (Table 4-23), primarily due to overall increases in waste volumes and shipment of stabilized ash and blowdown to disposal facilities. The shipments would originate at various SRS locations (primarily F- and H-Areas) and terminate at the E-Area treatment and disposal facilities. Shipments from the transuranic waste characterization/certification facility and containment building would not affect traffic because these shipments would occur on a dedicated road that would be upgraded to accommodate expected traffic flows. The addition of 58 trucks during normal working hours is expected to have very small adverse effects on traffic.

4.2.11.2 Transportation



4.2.11.2.1 Transportation – Expected Waste Forecast

Consequences from incident-free onsite transportation over 30 years under alternative A were based on those under the no-action alternative, adjusted by the changes in the number of waste shipments (as a result of changes in volumes of waste shipped). The percent change in dose from the no-action alternative and corresponding health effects are shown in Table 4-24 for incident-free transportation. Consequences of onsite transportation accidents for any given shipment are independent of the number of shipments and are, therefore, the same as for the no-action alternative (Table 4-8).

Table 4-24. Annual dose (percent change from the no-action alternative) and associated excess latent cancer fatalities from incident-free onsite transport of radioactive material for alternative A – expected waste forecast.

Waste[a]	Uninvolved worker[b] (rem)		Uninvolved workers (person-rem)		Involved workers (person-rem)	
Low-level	0.011	(0%)	2.0	(2%)	280	(94%)
Mixed	8.4×10^{-5}	(52%)	0.17	(36%)	5.3	(23%)
Transuranic	1.3×10^{-4}	(0%)	9.5×10^{-3}	(0%)	0.15	(0%)
Totals[c]	0.011[d]		2.2[e]		290[e]	
Excess latent cancer fatalities	4.6×10^{-6}[f]		8.8×10^{-4}[g]		0.1[g]	

TC

a. See Appendix E for a list of waste streams which make up each waste type. Dose is based on exposure to all waste streams of a particular waste type. TC
b. See Section 4.1.11.2 for descriptions of the receptors.
c. Totals were rounded to two significant figures.
d. Assumes the same individual has maximal exposure to each waste type (Appendix E) for a single year.
e. Dose from 1 year of exposure to incident-free transportation of treatability groups (see Appendix E).
f. Additional probability of an excess latent cancer fatality.
g. Value equals the total dose × the risk factor (0.0004 excess latent fatal cancers per person-rem).

Doses from incident-free offsite shipments of mixed wastes were calculated as in Section 4.1.11.2 using calculated external dose rates 1 meter (3.3 feet) from the transport vehicle for each waste and package type (HNUS 1995a). Additionally, occupational exposure time depends on the number of shipments and how long it takes to load each transport vehicle. The results are shown in Table 4-25. TE

Table 4-25. Annual dose and excess latent cancer fatalities from incident-free offsite transport of mixed waste under alternative A – expected waste forecast.

Waste	Involved workers[a] (person-rem)	Remote MEI[b] (rem)	Remote population (person-rem)
Mixed	0.012[c]	3.2×10^{-8}[c]	2.5×10^{-3}[c]
Excess latent cancer fatalities	4.8×10^{-6}	1.6×10^{-11}[d]	1.3×10^{-6}

a. See Section 4.1.11.2 for descriptions of the receptors.
b. MEI = maximally exposed individual.
TC c. Dose for the remote MEI assumes exposure to each waste in a single year; for the population, dose is the result of exposure to 1 year of incident-free transportation of each waste (see Appendix E).
d. Additional probability of an excess latent fatal cancer.

Incident-Free Radiological Impacts

For the expected waste forecast, there would be increases in dose to all onsite receptors and in the associated number of excess fatal cancers compared to the no-action alternative (Table 4-24) due to the increased volume of mixed waste. Additionally, involved workers' exposures would increase due to their exposure to the increased volume of low-level equipment shipped.

Transportation Accident Impacts

Refer to Sections 4.1.11.2.2 and 4.1.11.2.3 for radiological and nonradiological accident impacts, respectively. The probability of an onsite accident involving low-level or mixed wastes would increase or decrease compared to the no-action alternative depending on the volumes of wastes being shipped; however, the consequences due to a particular accident would be the same as described in Section 4.1.11.2.2. Accident probabilities for onsite shipments remain the same under all alternatives and are summarized in Table 4-26. Impacts of accidents involving offsite shipments were calculated as described in Section 4.1.11.2.2. The results are summarized in Table 4-27.

Table 4-26. Annual accident probabilities for onsite shipments for all alternatives and waste forecasts.[a]

Waste type	Waste forecast		
	Expected	Minimum	Maximum
Low-level	5.62×10^{-7}	2.19×10^{-7}	7.70×10^{-7}
Mixed	7.08×10^{-5}	1.78×10^{-5}	3.53×10^{-4}
Transuranic	2.57×10^{-6}	1.79×10^{-6}	4.24×10^{-5}

a. The accident probabilities under the no-action alternative are the same as for the expected waste forecast. See Appendix E for numbers of shipments.

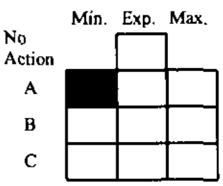
Table 4-27. Annual accident probability, doses associated with an accident, and excess latent cancer fatalities from an accident during offsite transport of mixed waste under alternative A.

Waste	Accident probabilities: Minimum forecast	Expected forecast	Maximum forecast	Remote population dose[a] (person-rem)	Number of latent cancer fatalities
Mixed	4.6×10^{-4}	1.1×10^{-3}	2.7×10^{-3}	0.0047	2.4×10^{-6}

a. See Section 4.1.11.2 for description of receptor.

TC

The consequences and associated excess latent cancer fatalities from offsite shipments of mixed waste under this alternative (Table 4-27) would be similar to the consequences to uninvolved workers under the no-action alternative (Table 4-8). However, because of the small volume of waste shipped offsite, a high consequence offsite accident would have less severe impacts than an onsite shipment.



4.2.11.2.2 Transportation – Minimum Waste Forecast

Incident-Free Radiological Impacts

For the minimum waste forecast, there would be decreases in dose (Table 4-28) to all onsite receptors compared to those from the expected waste forecast due to the smaller volumes of all wastes shipped onsite.

Table 4-28. Annual dose (percent change from the expected waste forecast) and associated excess latent cancer fatalities from incident-free onsite transport of radioactive material for alternative A –minimum waste forecast.

Waste[a]	Uninvolved worker[b] (rem)		Uninvolved workers (person-rem)		Involved workers (person-rem)	
Low-level	0.0057	(49%)	0.98	(52%)	140	(51%)
Mixed	3.2×10^{-5}	(62%)	0.067	(62%)	2.0	(62%)
Transuranic	9.0×10^{-5}	(30%)	6.6×10^{-3}	(30%)	0.10	(30%)
Totals[c]	5.8×10^{-3}[d]		1.0[e]		140[e]	
Excess latent cancer fatalities	2.3×10^{-6}[f]		4.2×10^{-4}[g]		0.057[g]	

a. See Appendix E for a list of waste streams which make up each waste type. Dose is based on exposure to all waste streams of a particular waste type.
b. See Section 4.1.11.2 for descriptions of receptors.
c. Totals rounded to two significant figures.
d. Assumes the same individual has maximal exposure to each waste type (Appendix E) for a single year..
e. Dose from 1 year of exposure to incident-free transportation of treatability groups (see Appendix E).
f. Additional probability of an excess fatal cancer.
g. Value equals the total dose × the risk factor (0.0004 excess latent fatal cancers per person-rem).

TC
TE
TE

For the minimum waste forecast, impacts from incident-free offsite transportation of radioactive materials (Table 4-29) would be very small.

Table 4-29. Annual dose and excess latent cancer fatalities from incident-free offsite transport of mixed waste for alternative A – minimum waste forecast.

TC

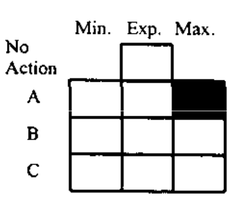
Waste	Involved workers[a] (person-rem)	Remote MEI[b] (rem)	Remote population (person-rem)
Mixed	5.2×10^{-3c}	1.4×10^{-8c}	1.1×10^{-3c}
Excess latent cancer fatalities	2.1×10^{-6}	7.0×10^{-12d}	5.5×10^{-7}

a. See Section 4.1.11.2 for descriptions of receptors.
b. MEI = maximally exposed individual.
TE c. Dose for the remote MEI assumes exposure to each waste in a year; for the population, dose is the result of exposure to 1 year of incident-free transportation of treatability groups (see Appendix E).
d. Additional probability of an excess latent fatal cancer.

Transportation Accident Impacts

The probability of an onsite accident involving radioactive wastes would decrease slightly for the minimum waste forecast (Table 4-26) because less waste would be shipped compared to the expected waste forecast; however, the consequences due to an accident would be the same as described in Section 4.1.11.2.2.

Effects of offsite accidents would be the same as for the expected waste forecast; however, the probability of an offsite accident would decrease by about one-third compared to the expected waste forecast because of the smaller volumes of wastes shipped (Table 4-27).



4.2.11.2.3 Transportation – Maximum Waste Forecast

Incident-Free Radiological Impacts

For the maximum waste forecast, there would be large increases in dose to all receptors (Table 4-30) due to the increases in volumes of all wastes shipped. Impacts from incident-free offsite transportation of mixed waste (Table 4-31) would be very small.

Table 4-30. Annual dose (percent change from the expected waste forecast) and associated excess latent cancer fatalities from incident-free onsite transport of radioactive material for alternative A – maximum waste forecast.

Waste[a]	Uninvolved worker[b] (rem)		Uninvolved workers (person-rem)		Involved workers (person-rem)	
Low-level	0.014	(27%)	2.8	(32%)	7.3×10-	(155%)
Mixed	3.3×10^{-4}	(291%)	0.70	(300%)	24	(342%)
Transuranic	0.0021	(1,550%)	0.16	(1,550%)	2.4	(1,550%)
Total[c]	0.017[d]		3.7[e]		750[e]	
Excess latent cancer	6.7×10^{-6}[f]		1.4×10^{-3}[g]		0.30[g]	

TC

a. See Appendix E for a list of waste streams which make up each waste type. Dose is based on exposure to all waste streams of a particular waste type.
b. See Section 4.1.11.2 for descriptions of receptors.
c. Totals rounded to two significant figures.
d. Assumes the same individual has maximum exposure to each waste type (Appendix E) for a single year.
e. Dose from 1 year of exposure to incident-free transportation of waste (see Appendix E).
f. Additional probability of an excess fatal cancer.
g. Value equals the total dose × the risk factor (0.0004 excess latent fatal cancers per person-rem).

TE

Table 4-31. Annual dose and excess latent cancer fatalities from incident-free offsite transport of mixed waste for alternative A – maximum waste forecast.

Waste	Involved workers[a] (person-rem)	Remote MEI[b] (rem)	Remote population (person-rem)
Mixed	0.031[c]	8.2×10^{-8}[c]	6.3×10^{-3}[c]
Excess latent cancer fatalities	1.2×10^{-5}	4.1×10^{-11}[d]	3.2×10^{-6}

L004-10

a. See Section 4.1.11.2 for descriptions of receptors.
b. MEI = maximally exposed individual.
c. Dose for the remote MEI assumes exposure to each waste in a year; for the population, dose is the result of exposure to 1 year of incident-free transportation of waste (see Appendix E). TE
d. Additional probability of an excess latent fatal cancer.

Transportation Accident Impacts

The probability of an onsite accident involving radioactive wastes would increase for the maximum waste forecast (Table 4-26) because more waste would be shipped compared to the expected waste forecast; however, the consequences due to an accident would be the same as described in Section 4.1.11.2.2. Effects of offsite accidents would be the same as for the expected waste; however, the probability of an offsite accident would be three times greater than that in the expected waste forecast because of the larger volumes of wastes shipped (Table 4-27).

4.2.12 OCCUPATIONAL AND PUBLIC HEALTH

Radiological and nonradiological impacts to workers and the public are presented in this section for the three waste forecasts. As expected, the impacts are smallest for the minimum waste forecast and largest for the maximum waste forecast.

Under this alternative, the Consolidated Incineration Facility, the transuranic waste characterization/certification facility, the mixed waste containment building, compaction facilities, and the mobile soil sort facility would operate. These facilities and changes in waste management would result in an increase in adverse health effects over the no-action alternative for the three waste forecasts. However, the effects would be small overall, except to involved workers under the maximum waste forecast.

The waste management operations that produce most of the occupational and public health effects are as follows:

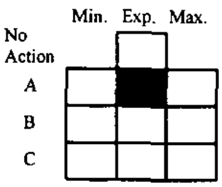
- For the involved workers, the sources of largest exposure would be the transuranic waste storage pads, the H-Area high-level waste tank farm, and the transuranic waste characterization/certification facility.

- For the public and uninvolved workers, the sources of largest exposure would be the Consolidated Incineration Facility and the transuranic waste characterization/certification facility. (Doses and health effects for the Consolidated Incineration Facility are presented in Appendix B.5.)

- For the public only, the F/H-Area Effluent Treatment Facility would be the source of greatest exposure.

For radiological assessments, the same general methodology was used as under the no-action alternative (see Section 4.1.12). The same risk estimators were used to convert doses to fatal cancers, and wastes were classified into treatability groups to facilitate the evaluations. However, the development of radiological source terms and worker exposures was much more involved. The releases of radioactivity to the environment and the radiation exposures of workers were determined for each waste forecast. The expected performance of new facilities was based on actual design information, augmented as necessary by operating experience with similar facilities.

Radiological impacts of facility operations were estimated for the 30-year period of analysis based on total material throughput. Annual impacts to workers and the offsite population were estimated by dividing the total 30-year impact by 30. TE



4.2.12.1 <u>Occupational and Public Health – Expected Waste Forecast</u>

For alternative A – expected waste forecast, the volumes of wastes to be treated would be the same as under the no-action alternative.

4.2.12.1.1 Occupational Health and Safety

Radiological Impacts

Table 4-32 presents the worker doses and resulting health effects associated with the expected waste forecast. Doses would remain well within the SRS administrative guideline of 0.8 rem per year. The probabilities and projected numbers of fatal cancers from 30 years of waste management operations under this alternative would be much lower than those expected from all causes during the workers' lifetimes. It is expected that there could be 0.86 additional fatal cancer in the workforce of 2,123. In comparison, the lifetime fatal cancer risk from all causes is 23.5 percent (refer to Section 4.1.12.1), which translates to a 1 in 4 chance of any individual (including a worker) contracting a fatal cancer, or TC
499 fatal cancers in the workforce of 2,123.

Nonradiological Impacts

DOE considered potential nonradiological impacts to SRS workers from air emissions from the following facilities: the Defense Waste Processing Facility, including In-Tank Precipitation; the M-Area Vendor Treatment Facility; the Consolidated Incineration Facility; Building 645-N, hazardous waste storage; Building 645-2N, mixed waste storage; the mobile soil sort facility; four new solvent tanks; the transuranic waste characterization/certification facility; and the mixed waste containment building. Occupational health impacts to employees at the Defense Waste Processing Facility and In-Tank Precipitation were discussed in the *Final Supplemental Environmental Impact Statement Defense Waste Processing Facility*. Occupational health impacts to employees associated with the Consolidated

Table 4-32. Worker radiological doses and resulting health effects associated with implementation of alternative A.[a]

Receptor(s)	No-action alternative	Waste forecast: Expected	Waste forecast: Minimum	Waste forecast: Maximum
Individual involved worker				
• Average annual dose (rem)[b]	0.025	0.033	0.032	0.047
• Associated probability of a fatal cancer	1.0×10^{-5}	1.3×10^{-5}	1.3×10^{-5}	1.9×10^{-5}
• 30-year dose to average worker (rem)	0.75	0.99	0.96	1.4
• Associated probability of a fatal cancer	3.0×10^{-4}	4.0×10^{-4}	3.9×10^{-4}	5.7×10^{-4}
All involved workers[c]				
• Annual dose[b] (person-rem)	52	70	67	113
• Associated number of fatal cancers	0.021	0.028	0.027	0.045
• 30-year dose (person-rem)	1,600	2,100	2,000	3,400
• Associated number of fatal cancers	0.62	0.84	0.81	1.4
Individual uninvolved worker[b,d]				
• Annual dose at 100 meter[e] (rem) (associated probability of a fatal cancer)	1.0×10^{-5} (4.1×10^{-9})	0.0054 (2.1×10^{-6})	3.7×10^{-3} (1.5×10^{-6})	0.088 (3.5×10^{-5})
• Annual dose at 640 meters (rem) (associated probability of a fatal cancer)	2.9×10^{-7} (1.1×10^{-10})	1.6×10^{-4} (6.2×10^{-8})	1.1×10^{-4} (4.3×10^{-8})	0.0026 (1.0×10^{-6})
• 30-year dose at 100 meters (rem) (associated probability of a fatal cancer)	3.0×10^{-4} (1.2×10^{-7})	0.16 (6.4×10^{-5})	0.11 (4.5×10^{-5})	2.7 0.0011
• 30-year dose at 640 meters (rem) (associated probability of a fatal cancer)	8.6×10^{-6} (3.4×10^{-9})	0.0047 (1.9×10^{-6})	0.0033 (1.3×10^{-6})	0.077 (3.1×10^{-5})

a. Supplemental facility information is provided in Appendix E.

b. Annual individual worker doses can be compared with the regulatory dose limit of 5 rem (10 CFR 835) and with the SRS administrative exposure guideline of 0.8 rem. Operational procedures ensure that the dose to the maximally exposed worker remains as far below the regulatory dose limit as is reasonably achievable.

c. The number of involved workers is estimated to be 2,123 for the expected waste forecast; 2,104 for the minimum waste forecast; and 2,379 for the maximum waste forecast.

d. Dose is due to emissions from the transuranic waste characterization/certification facility except for the no-action alternative. Doses conservatively assume 80 hours per week of exposure. Exposures for a typical 40-hour work week would be approximately 50 percent of doses given in the table.

e. To convert to feet, multiply by 3.28.

Incineration Facility were discussed in the *Environmental Assessment, Consolidated Incineration Facility* (DOE 1992).

Table E.2-2 in Appendix E presents a comparison between Occupational Safety and Health Administration permissible exposure limit values and potential exposures to uninvolved workers at both 100 meters (328 feet) and 640 meters (2,100 feet) from each facility for the expected, minimum, and maximum waste forecasts. Downwind concentrations were calculated using EPA's TSCREEN model TE (EPA 1988). For each facility's emissions, based on the expected waste forecast, uninvolved workers occupational exposure would be less than Occupational Safety and Health Administration permissible exposure limits. In most instances, downwind concentrations would be less than 1 microgram per cubic TE meter, whereas the Occupational Safety and Health Administration limits are greater than 2,000 micrograms per cubic meter.

4.2.12.1.2 Public Health and Safety

Radiological Impacts

Table 4-33 presents the radiological doses to the public and the resulting health effects associated with the expected waste forecast. The annual doses to the offsite maximally exposed individual (0.012 millirem) and to the regional population (0.57 person-rem) surrounding SRS are small fractions of the doses that resulted from SRS operations in 1993, which were well within regulatory limits (Arnett, Karapatakis, and Mamatey 1994). For the offsite facility (assumed to be located in Oak Ridge, Tennessee, for the purposes of this assessment) under this forecast, the annual doses to the offsite maximally exposed individual (5.1×10^{-7} millirem) and to the regional population (2.3×10^{-7} person-rem) TC surrounding Oak Ridge, Tennessee, represent a very small fraction (less than 0.01 percent) of the comparable doses to the SRS regional population. These doses remain less than 0.01 percent of the comparable SRS doses for all waste forecasts under this alternative (see Appendix E for facility-specific data). For this waste forecast, radiologically induced health effects to the public would be very small (Table 4-33).

Nonradiological Impacts

Potential nonradiological impacts to individuals residing offsite were considered for both criteria and carcinogenic pollutants. Maximum SRS boundary-line concentrations for criteria pollutants are discussed in Section 4.2.5.1.2.

Table 4-33. Radiological doses associated with implementation of alternative A and resulting health effects to the public.[a]

	No-action alternative				Alternative A			
	Dose[b]				Dose			
Waste forecast/receptor(s)[c]	Atmospheric releases	Aqueous releases	Total	Probability[d] or number of fatal cancers	Atmospheric releases [g]	Aqueous releases	Total	Probability[d] or number of fatal cancers
Expected waste forecast								
Offsite MEI[e]								
• Annual, millirem	1.2×10^{-4}	6.9×10^{-4}	8.1×10^{-4}	4.1×10^{-10}	0.011	6.9×10^{-4}	0.012	5.8×10^{-9}
• 30 years, millirem	0.0037	0.021	0.025	1.2×10^{-8}	0.33	0.021	0.35	1.7×10^{-7}
Population								
• Annual, person-rem	2.9×10^{-4}	0.0068	0.0071	3.5×10^{-6}	0.56	0.0068	0.57	2.8×10^{-4}
• 30 years, person-rem	0.0086	0.20	0.21	1.1×10^{-4}	17	0.20	17	0.0085
Minimum waste forecast								
Offsite MEI								
• Annual, millirem	NA[f]	NA	NA	NA	0.0057	6.9×10^{-4}	0.0064	3.2×10^{-9}
• 30 years, millirem	NA	NA	NA	NA	0.17	0.021	0.19	9.6×10^{-8}
Population								
• Annual, person-rem	NA	NA	NA	NA	0.27	0.0068	0.28	1.4×10^{-4}
• 30 years, person-rem	NA	NA	NA	NA	8.2	0.20	8.4	0.0042
Maximum waste forecast								
Offsite MEI								
• Annual, millirem	NA	NA	NA	NA	0.08	6.9×10^{-4}	0.081	4.1×10^{-8}
• 30 years, millirem	NA	NA	NA	NA	2.4	0.021	2.4	1.2×10^{-6}
Population								
• Annual, person-rem	NA	NA	NA	NA	3.4	0.0068	3.4	0.0017
• 30 years, person-rem	NA	NA	NA	NA	100	0.20	100	0.052

a. Supplemental facility information is provided in Appendix E.
b. For atmospheric releases, the dose is to the population within 80 kilometers (50 miles) of SRS. For aqueous releases, the dose is to the people using the Savannah River from SRS to the Atlantic Ocean.
c. The doses to the public from total SRS operations in 1993 were 0.25 millirem to the offsite maximally exposed individual and 9.1 person-rem to the regional population. These doses, when added to the incremental doses associated with the waste management alternative given in this table, are assumed to equal total SRS doses. Source: Arnett, Karapatakis, and Mamatey (1994).
d. For the offsite maximally exposed individual, probability of a latent fatal cancer; for the population, number of fatal cancers.
e. MEI = maximally exposed individual.
g. Atmospheric releases for MEI and population include contribution from off-site facilities, which contribute less than 0.01% to the atmospheric releases reported here.

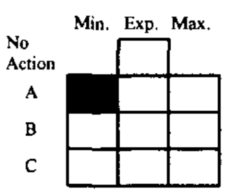
For routine releases from operating facilities under the expected waste forecast, criteria pollutant concentrations would be within state and federal ambient air quality standards, as discussed in Section 4.2.5.1.2, and health impacts to the public would be very small.

Offsite risks due to carcinogens were calculated using the Industrial Source Complex 2 model (Stewart 1994) for the same facilities listed in Section 4.2.12.1.1. Emissions of carcinogenic compounds were based on the types and quantities of waste being processed at each facility. Table 4-34 shows the excess individual lifetime cancer risks calculated from unit risk factors (see Section 4.1.12.2.2) derived from EPA's Integrated Risk Information System database (EPA 1994). As shown in Table 4-34, the estimated incremental lifetime cancer risk associated with routine emissions under the expected waste forecast is 2 in ten million. This is the same as that for the no-action alternative and represents a small overall increase in risk.

4.2.12.1.3 Environmental Justice Assessment

Section 4.1.12.2.3 described DOE's methodology for analyzing radiological dose to determine if there might be adverse and disproportionate impacts on people of color low income. Figure 4-15 illustrates the results of the analysis for alternative A – expected waste forecast for the 80-kilometer (50-mile) region of interest in this EIS. Supporting data for the analysis can be found in Appendix E. TE

The predicted per capita dose differs very little between types of communities at a given distance from SRS, and the per capita dose is extremely small in each type of community. This analysis indicates that people of color or with low incomes in the 80-kilometer (50-mile) region would be neither disproportionately nor adversely affected. TC



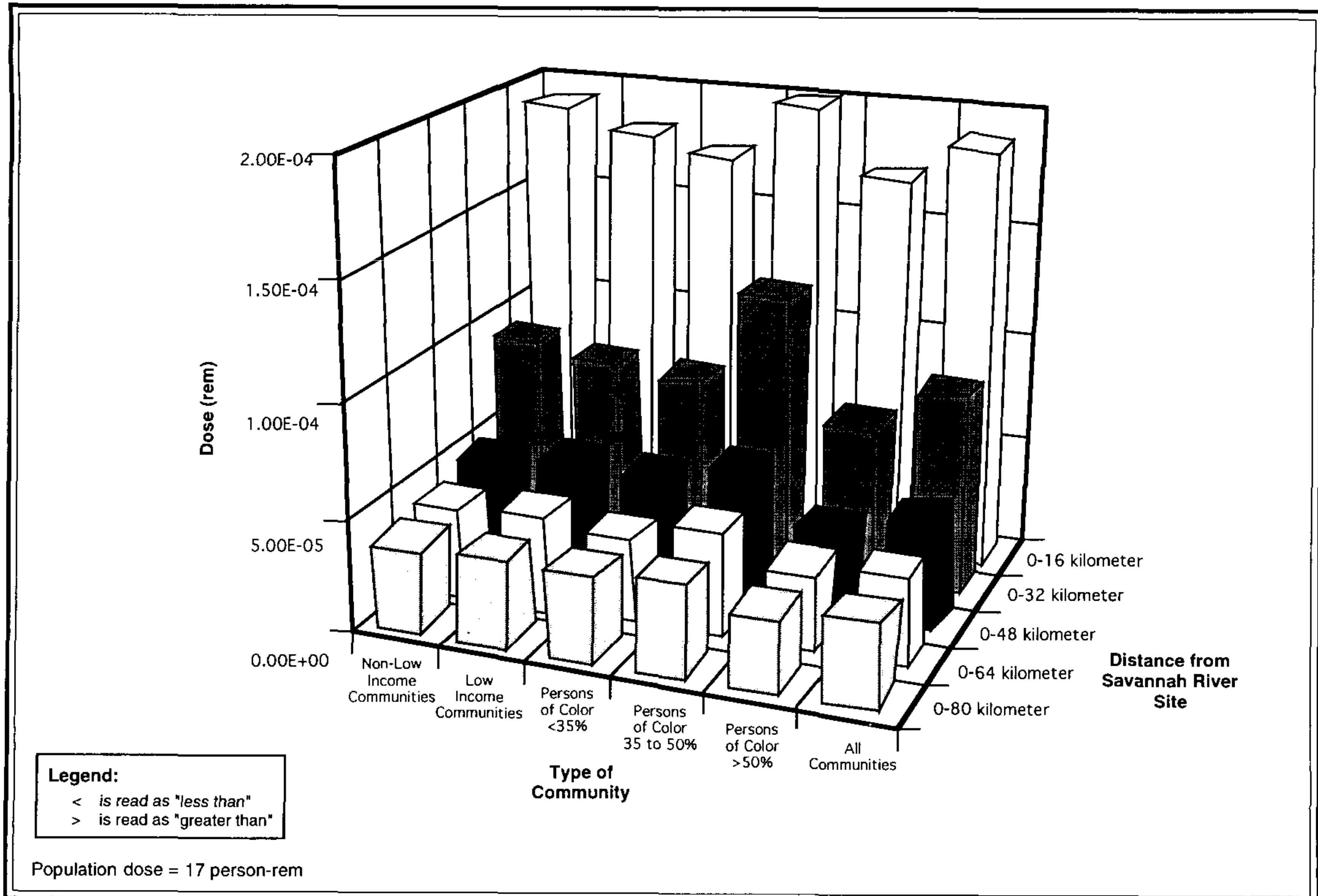
4.2.12.2 Occupational and Public Health – Minimum Waste Forecast

Because the waste amounts for alternative A – minimum waste forecast would be smaller than for the expected waste forecast and the treatment operations would be the same, the impacts to workers and the public would be smaller than described for the expected waste forecast.

Table 4-34. Estimated number of excess latent cancers in the offsite population from nonradiological carcinogens emitted under alternative A.

Pollutant	Unit risk factor[a] (latent cancers/ ($\mu g/m^3$)[e]	Concentration[b,c] Expected waste forecast ($\mu g/m^3$)	Minimum waste forecast ($\mu g/m^3$)	Maximum waste forecast ($\mu g/m^3$)	Latent cancers[d] Expected waste forecast[f]	Minimum waste forecast	Maximum waste forecast
Acetaldehyde	2.2×10^{-6}	1.5×10^{-7}	2.7×10^{-8}	9.1×10^{-8}	1.4×10^{-13}	2.5×10^{-14}	8.6×10^{-14}
Acrylamide	0.001	1.5×10^{-7}	2.7×10^{-8}	9.1×10^{-8}	8.2×10^{-11}	1.5×10^{-11}	5.1×10^{-11}
Acrylonitrile	6.8×10^{-5}	1.5×10^{-7}	2.7×10^{-8}	9.1×10^{-8}	4.3×10^{-12}	7.9×10^{-13}	2.7×10^{-12}
Arsenic Pentoxide	0.004	8.1×10^{-7}	5.0×10^{-7}	6.3×10^{-7}	1.5×10^{-9}	9.1×10^{-10}	1.2×10^{-9}
Asbestos	0.23	3.5×10^{-9}	4.1×10^{-10}	2.2×10^{-8}	3.5×10^{-10}	4.0×10^{-11}	2.2×10^{-9}
Benzene	8.3×10^{-6}	0.044	0.044	0.044	1.6×10^{-7}	1.6×10^{-7}	1.6×10^{-7}
Benzidine	0.067	1.5×10^{-7}	2.7×10^{-8}	9.1×10^{-8}	4.2×10^{-9}	7.8×10^{-10}	2.6×10^{-9}
Bis(chloromethyl)ether	0.062	1.5×10^{-7}	2.7×10^{-8}	9.1×10^{-8}	3.9×10^{-9}	7.2×10^{-9}	2.4×10^{-9}
Bromoform	1.1×10^{-6}	1.5×10^{-7}	2.7×10^{-8}	9.1×10^{-8}	7.0×10^{-14}	1.3×10^{-14}	4.3×10^{-14}
Carbon Tetrachloride	1.5×10^{-5}	1.5×10^{-7}	2.7×10^{-8}	9.1×10^{-8}	9.5×10^{-13}	1.7×10^{-13}	5.9×10^{-13}
Chlordane	3.7×10^{-4}	1.5×10^{-7}	2.7×10^{-8}	9.1×10^{-8}	2.3×10^{-11}	4.3×10^{-12}	1.4×10^{-11}
Chloroform	2.3×10^{-5}	0.003	0.003	0.003	3.0×10^{-8}	3.0×10^{-8}	3.0×10^{-8}
Cr(+6) Compounds	0.012	4.2×10^{-9}	4.5×10^{-11}	2.3×10^{-9}	2.2×10^{-11}	4.9×10^{-13}	1.2×10^{-11}
Formaldehyde	1.3×10^{-5}	1.5×10^{-7}	2.7×10^{-8}	9.1×10^{-8}	8.2×10^{-13}	1.5×10^{-13}	5.1×10^{-13}
Heptachlor	0.0013	9.7×10^{-7}	6.7×10^{-7}	8.3×10^{-7}	5.4×10^{-10}	3.7×10^{-10}	4.6×10^{-10}
Hexachlorobenzene	4.6×10^{-4}	1.5×10^{-7}	2.7×10^{-8}	9.1×10^{-8}	2.9×10^{-11}	5.3×10^{-12}	1.8×10^{-11}
Hexachlorobutadiene	2.2×10^{-5}	1.5×10^{-7}	2.7×10^{-8}	9.1×10^{-8}	1.4×10^{-12}	2.5×10^{-13}	8.6×10^{-13}
Hydrazine	0.0049	1.5×10^{-7}	2.7×10^{-8}	9.1×10^{-8}	3.1×10^{-10}	5.7×10^{-11}	1.9×10^{-10}
1,1,2,2-Tetrachloroethane	5.8×10^{-5}	2.9×10^{-6}	4.9×10^{-7}	1.8×10^{-6}	7.2×10^{-11}	1.2×10^{-11}	4.4×10^{-11}
1,1,2-Trichloroethane	1.6×10^{-5}	1.5×10^{-7}	2.7×10^{-8}	9.1×10^{-8}	1.0×10^{-12}	1.9×10^{-13}	6.2×10^{-13}
Toxaphene	3.2×10^{-4}	9.7×10^{-7}	6.7×10^{-7}	8.3×10^{-7}	1.3×10^{-10}	9.2×10^{-11}	1.1×10^{-10}
1,1-Dichloroethene	5.0×10^{-5}	2.9×10^{-5}	4.8×10^{-5}	5.6×10^{-5}	6.3×10^{-10}	1.0×10^{-9}	1.2×10^{-9}
Methylene Chloride	4.7×10^{-7}	1.5×10^{-7}	2.7×10^{-8}	9.1×10^{-8}	3.0×10^{-14}	5.4×10^{-15}	1.8×10^{-14}
				TOTAL	2.0×10^{-7}	1.9×10^{-7}	2.0×10^{-7}

TE | a. Source: EPA (1994).
b. Maximum annual boundary-line concentration.
c. Source: Stewart (1994).
d. Latent cancer probability equals unit risk factor times concentration times 30 years divided by 70 years.
e. Micrograms per cubic meter of air.
TC | f. Under the maximum waste forecast, wastewater would be treated in the containment building, which would lower the amount of wastewater going to the Consolidated Incineration Facility. Therefore, slightly higher impacts may occur in the expected waste forecast than in the maximum waste forecast.



PK56-4

TC

Figure 4-15. Dose to individuals in communities within 80 kilometers (50 miles) of SRS for alternative A – expected waste forecast.

TE

4.2.12.2.1 Occupational Health and Safety

Radiological Impacts

Table 4-32 includes the worker doses and resulting health effects associated with the minimum waste forecast. Doses and health effects associated with this case would be smaller than those associated with the expected waste forecast.

Nonradiological Impacts

Table E.2-2 in Appendix E presents a comparison of the nonradiological air concentrations to SRS workers for the minimum waste forecast to permissible exposure limits under the Occupational Safety and Health Administration. Exposures to SRS workers are either equal to or less than those that would occur in the expected waste forecast. For each facility, employee occupational exposure would be less than Occupational Safety and Health Administration permissible exposure limits.

4.2.12.2.2 Public Health and Safety

Radiological Impacts

Table 4-33 includes the doses to the public and the resulting health effects associated with the minimum waste forecast. Doses and health effects associated with this case would be smaller than those associated with the expected waste forecast.

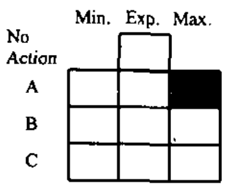
Nonradiological Impacts

Potential nonradiological impacts to individuals residing offsite are considered for both criteria and carcinogenic pollutants under the minimum waste forecast. For routine releases from operating facilities, criteria pollutant concentrations would be within state and Federal ambient air quality standards, as discussed in Section 4.2.5.2.

Offsite risks due to carcinogens are presented in Table 4-34. The overall incremental lifetime cancer risk
TC is approximately 1.9 in ten million. This latent cancer risk is slightly less than that expected from the no-action alternative. DOE expects very small health impacts to the public from emissions from facilities under alternative A minimum waste forecast.

4.2.12.2.3 Environmental Justice Assessment

Figure 4-16 illustrates the results of the analysis for alternative A – minimum waste forecast for the 80-kilometer (50-mile) region of interest in this EIS. Supporting data for the analysis can be found in the environmental justice section of Appendix E. No community within 80 kilometers (50 miles) would be disproportionately affected by emissions under this case.



4.2.12.3 Occupational and Public Health – Maximum Waste Forecast

The volumes of wastes to be treated for alternative A – maximum waste forecast would be larger than for the minimum and expected waste forecasts, but the treatment operations would be the same. Therefore, the maximum waste forecast would result in the greatest health impacts to workers and the public for this alternative.

4.2.12.3.1 Occupational Health and Safety

Radiological Impacts

Table 4-32 includes the worker doses and resulting health effects associated with the maximum waste forecast. The doses would remain well within the SRS administrative guideline of 0.8 rem per year. However, it is projected that less than 2 people in the involved workforce of 2,379 could develop a fatal cancer sometime during their lifetimes as the result of exposure to radiation during the 30-year period of analysis. TC

Nonradiological Impacts

DOE assessed concentrations for exposure to SRS workers. Table E.2-2 in Appendix E presents a comparison between the nonradiological air concentrations SRS workers would be exposed to for the maximum waste forecast with Occupational Safety and Health Administration permissible exposure limits values. Exposures to SRS workers are either equal to or greater than those occurring in the expected waste forecast. However, for all facilities, employee occupational exposure would be less than Occupational Safety and Health Administration permissible exposure limits.

TC

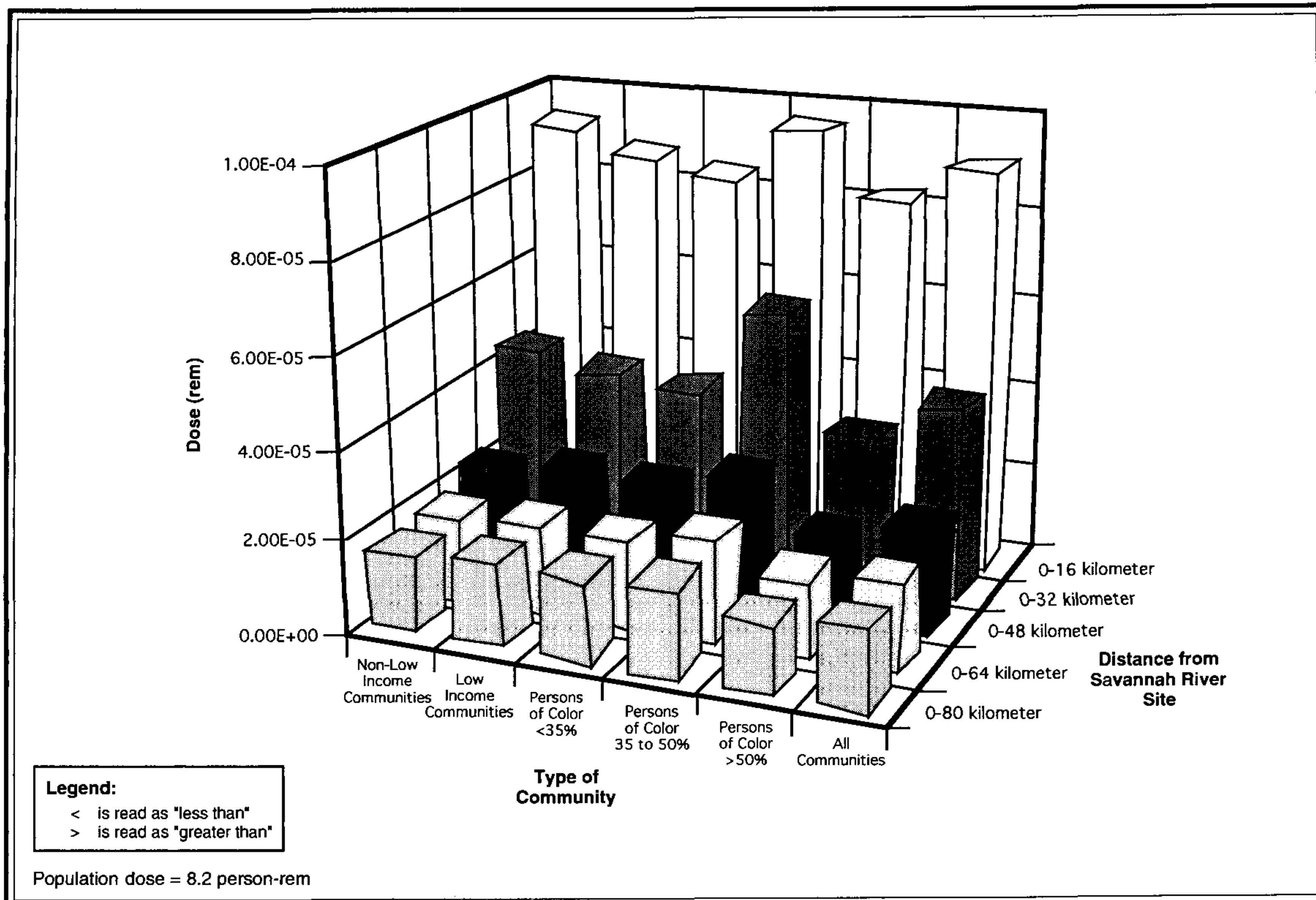


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Figure 4-16. Dose to individuals in communities within 80 kilometers (50 miles) of SRS for alternative A – minimum waste forecast.

4.2.12.3.2 Public Health and Safety

Radiological Impacts

Table 4-33 includes the doses and resulting health effects to the public associated with the maximum waste forecast. The annual doses to the offsite maximally exposed individual (0.08 millirem) and to the SRS regional population (3.4 person-rem) would be about one-third of the doses that resulted from SRS operations in 1993, which were well within regulatory limits (Arnett, Karapatakis, and Mamatey 1994). For alternative A – maximum waste forecast, radiologically induced health effects to the public would be very small.

Nonradiological Impacts

Potential nonradiological impacts to individuals residing offsite are considered for both criteria and carcinogenic pollutants under the maximum waste forecast. For routine releases from operating facilities, criteria pollutant concentrations would be within state and Federal ambient air quality standards, as discussed in Section 4.2.5.3. During periods of construction, the criteria pollutant concentrations at the SRS boundary would not exceed air quality standards under normal operating conditions. With good construction management practices, such as wetting dirt roads twice a day, particulate concentrations would be approximately 50 percent of those shown in Section 4.2.5.3.

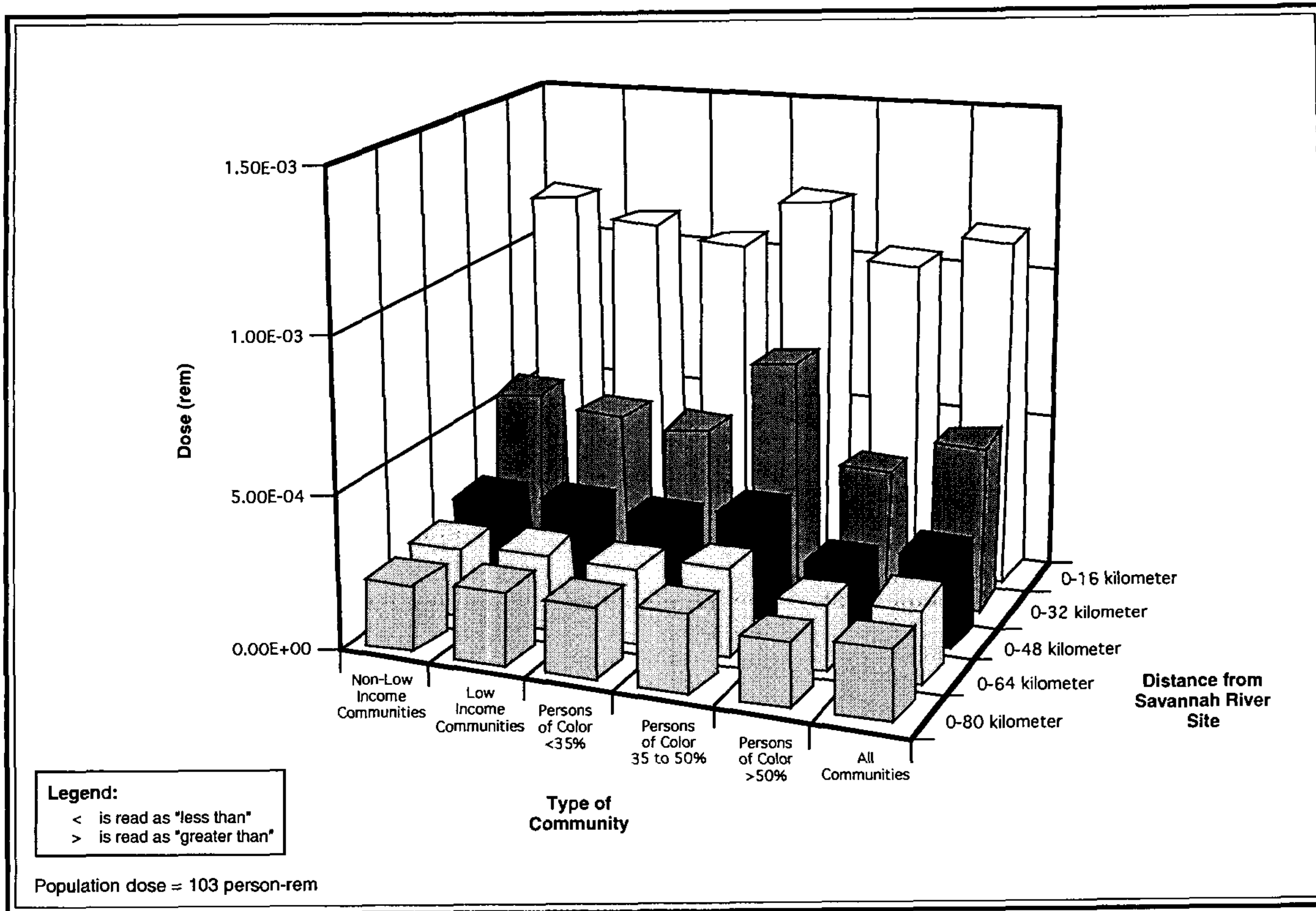
Table 4-34 presents offsite risks from carcinogens. The overall incremental lifetime cancer risk is approximately 2 in 10 million. This latent cancer risk is the same as expected under the no-action alternative. DOE expects very small health impacts to the public from emissions from facilities in the maximum waste forecast.

4.2.12.3.3 Environmental Justice Assessment

No community within 80 kilometers (50 miles) would be disproportionately affected by emissions under this scenario (Figure 4-17).

4.2.13 FACILITY ACCIDENTS

This section summarizes the risks to workers and members of the public from potential facility accidents associated with the various amounts of wastes that might be managed under alternative A. The



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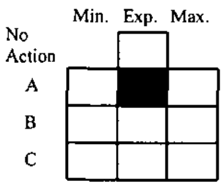
TC

Figure 4-17. Dose to individuals in communities within 80 kilometers (50 miles) of SRS for alternative A – maximum forecast. TE methodologies used to develop the radiological and hazardous material accident scenarios are the same as those discussed in Section 4.1.13.1 under the no-action alternative.



4.2.13.1 Facility Accidents – Expected Waste Forecast

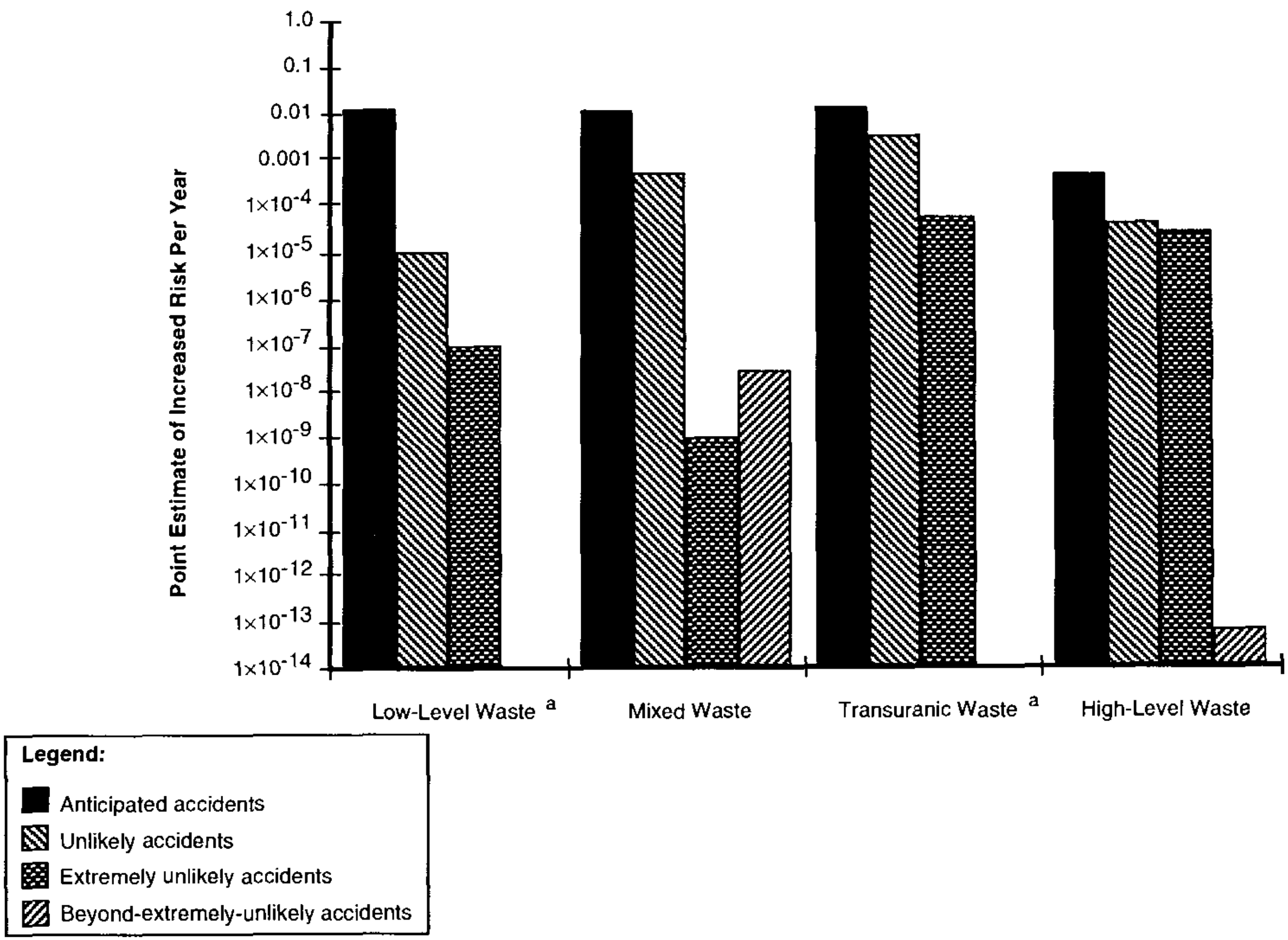
Figures 4-18 through 4-21 summarize the estimated increases in latent fatal cancers from radiological accidents involving the various waste types on the population, offsite maximally exposed individual, and uninvolved workers at 640 meters (2,100 feet) and 100 meters (328 feet) for alternative A expected waste forecast. Analyses are based on dose from the estimated bounding accident. The accident presenting the greatest overall risk to the population within 80 kilometers (50 miles) of SRS under this case is an anticipated accident (i.e., one occurring between once every 10 years and once every 100 years) involving either mixed waste or low-level waste, which would increase the risk to the population within 80 kilometers (50 miles) by 1.7×10^{-2} latent fatal cancer per year (Figure 4-18).

An anticipated accident involving either mixed waste or low-level waste would pose the greatest risk to the offsite maximally exposed individual (Figure 4-19) and the uninvolved worker at 640 meters (2,100 feet) (Figure 4-20). The anticipated accident scenario would increase the risk to the offsite maximally exposed individual by 3.3×10^{-7} latent fatal cancer per year and to the uninvolved worker at 640 meters (2,100 feet) by 1.8×10^{-5} latent fatal cancer per year.

An anticipated accident involving either mixed wastes or low-level wastes would also pose the greatest risk to the uninvolved worker at 100 meters (328 feet) (Figure 4-21). The anticipated accident scenario would increase the risk to the uninvolved worker at 100 meters (328 feet) by 1.0×10^{-3} latent fatal cancer per year.

For each receptor group, regardless of waste type, the greatest estimated risks associated with alternative A are identical to the no-action alternative. However, there could be differences in the overall risk to each receptor group for specific waste types. For example, the overall risks for transuranic waste increase approximately 100 times between the no-action alternative and alternative A. Table 4-35 provides a comparison of overall risk for specific waste types between the no-action alternative and alternative A. A multiplicative change factor is used to illustrate differences between no-action and alternative A risks. If the risks presented are identical, the multiplication factor is one. However, if the

TC

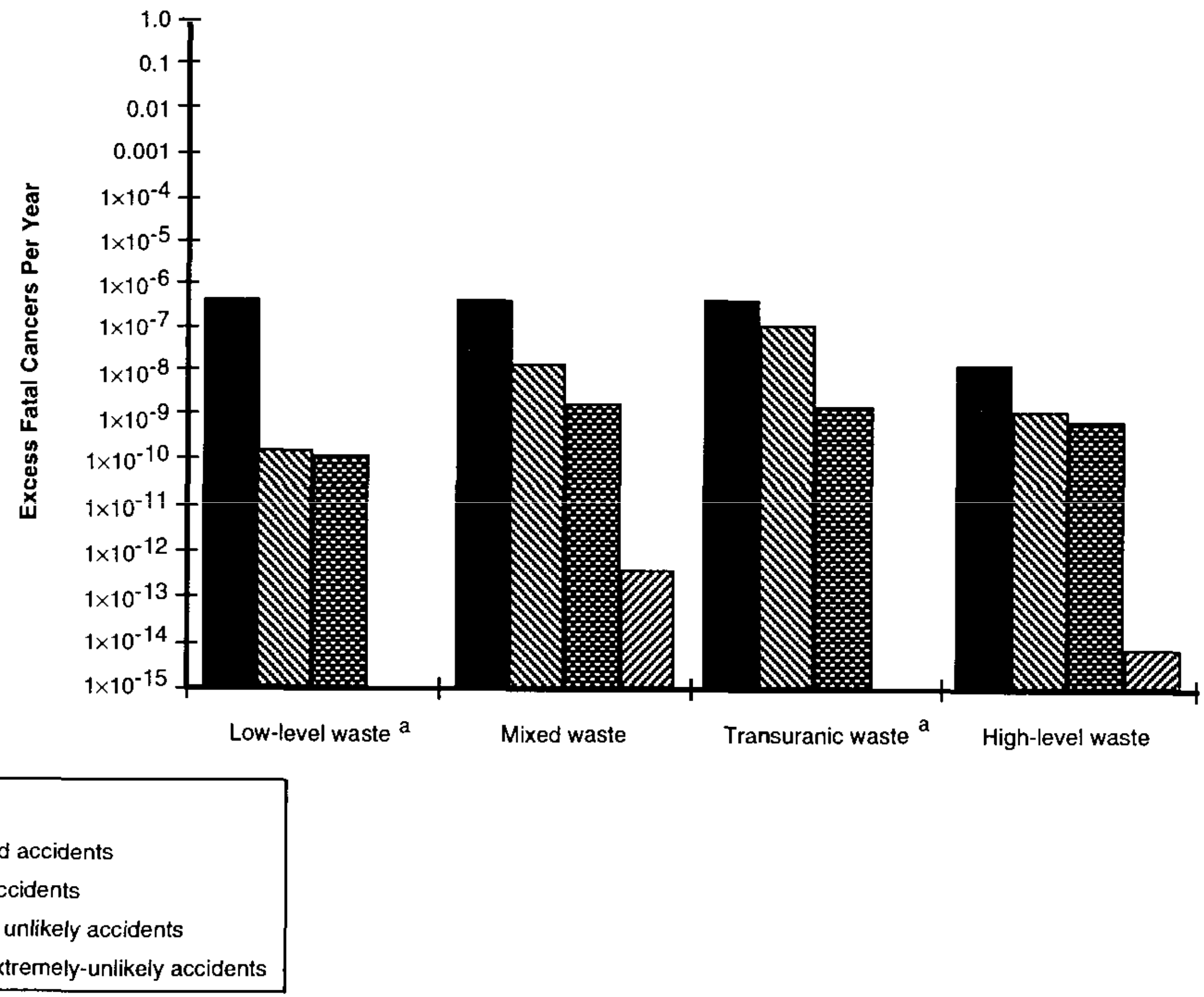


Notes:

a. No beyond-extremely-unlikely accidents were identified for low-level or transuranic wastes.

PK56-31

TE **Figure 4-18.** Summary of radiological accident impacts to population within 80 kilometers (50 miles) for alternative A – expected waste forecast.



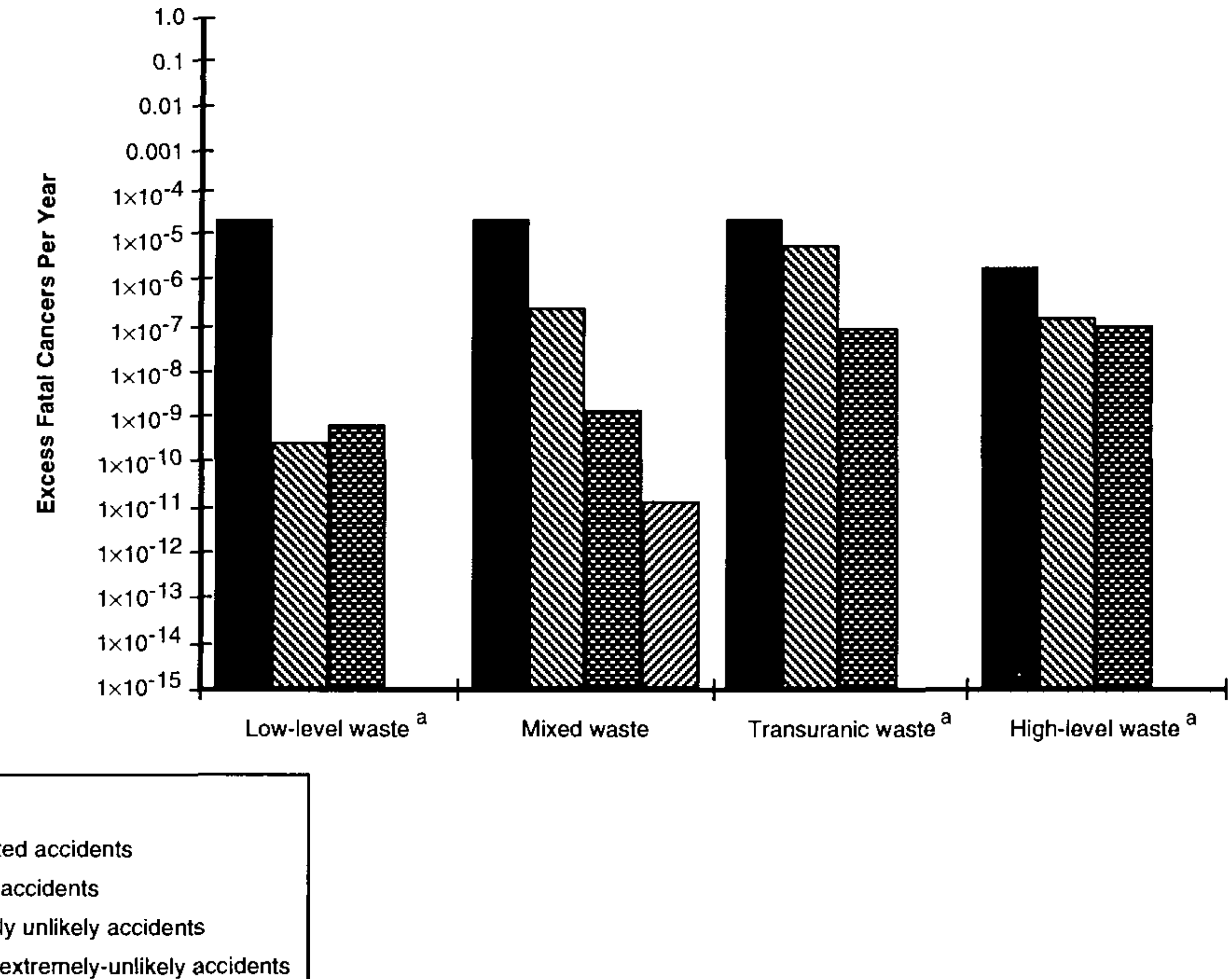
Notes:

a. No beyond-extremely-unlikely accidents were identified for low-level or transuranic wastes.

PK56-31

Figure 4-19. Summary of radiological accident impacts to the offsite maximally exposed individual for alternative A – expected waste forecast. | TE

TC



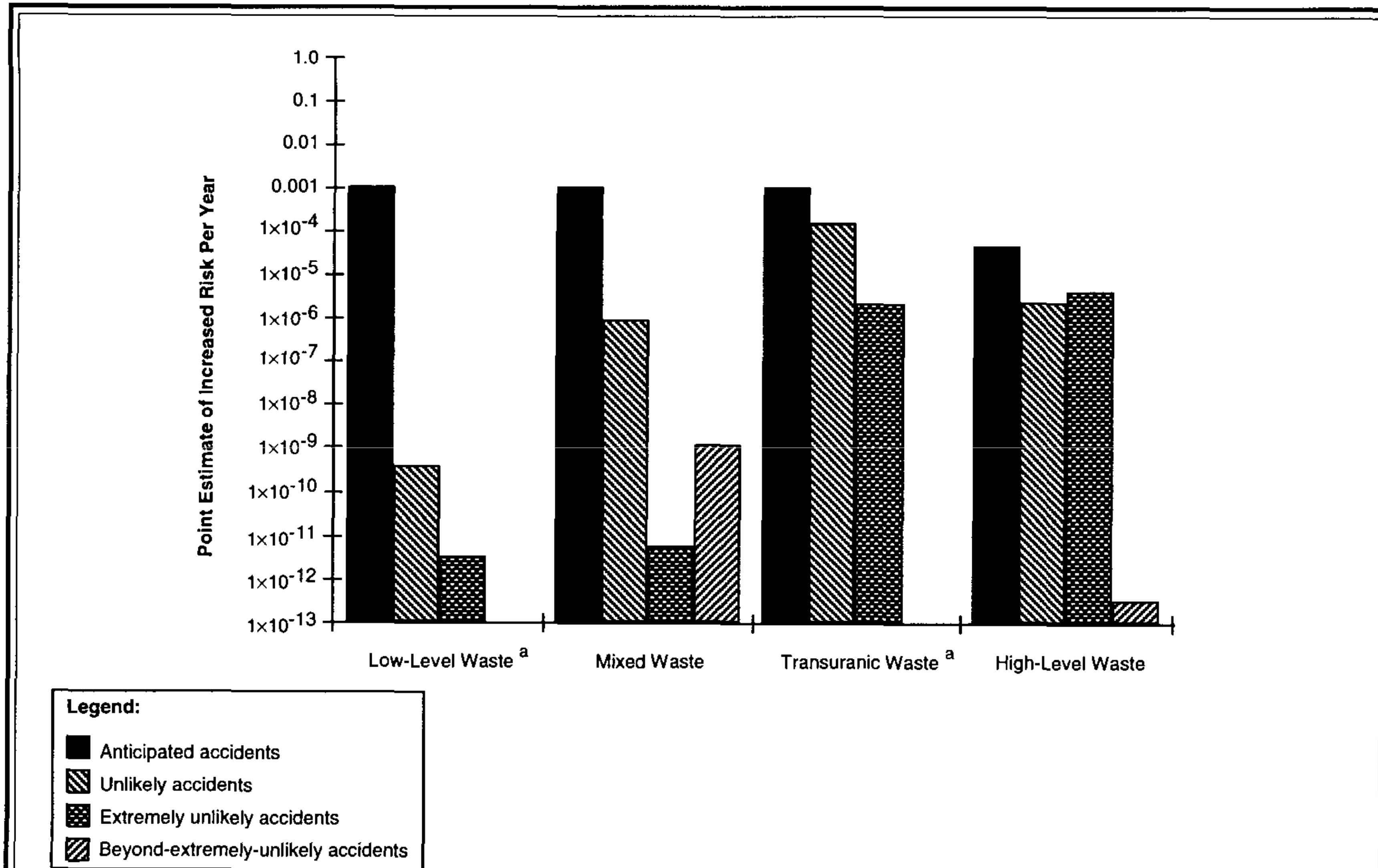
Notes:

a. No beyond-extremely-unlikely accidents were identified for low-level, transuranic, or high-level wastes.

PK56-31

TC

TE **Figure 4-20.** Summary of radiological accident impacts to the uninvolved worker within 640 meters (2,100 feet) for alternative A – expected waste forecast.



Notes:

a. No beyond-extremely-unlikely accidents were identified for low-level or transuranic wastes.

PK56-31

Figure 4-21. *Summary of radiological accident impacts to the uninvolved worker within 100 meters (328 feet) for alternative A – expected waste forecast.* TE risks presented are different, the multiplication factor is the ratio of the two values (i.e., higher estimated TC risk divided by smaller estimated risk). Arrows indicate the alternative A risks that are larger than the no-action risks.

TE **Table 4-35.** Comparison of risks from accidents under the no-action alternative and alternative A.

Receptor	Waste type[b]	Estimated risk[a] No-action alternative	Estimated risk[a] Alternative A	Change factor[c]
Population within 80 kilometers	Low-level waste	0.017	0.017	1.0
	Mixed waste	0.017	0.017	1.0
	Transuranic waste	0.005	0.015	↑3.0
	High-level waste	6.3×10^{-4}	6.3×10^{-4}	1.0
Offsite maximally exposed individual	Low-level waste	3.3×10^{-7}	3.3×10^{-7}	1.0
	Mixed waste	3.3×10^{-7}	3.3×10^{-7}	1.0
	Transuranic waste	9.8×10^{-8}	2.9×10^{-7}	↑3.0
	High-level waste	1.3×10^{-8}	1.3×10^{-8}	1.0
Uninvolved worker to 640 meters	Low-level waste	1.8×10^{-5}	1.8×10^{-5}	1.0
	Mixed waste	1.8×10^{-5}	1.8×10^{-5}	1.0
	Transuranic waste	5.5×10^{-6}	1.6×10^{-5}	↑2.9
	High-level waste	6.4×10^{-7}	6.4×10^{-7}	1.0
Uninvolved worker to 100 meters	Low-level waste	0.001	0.001	1.0
	Mixed waste	1.0×10^{-7}	0.001	1.0
	Transuranic waste	3.1×10^{-4}	9.0×10^{-4}	↑2.9
	High-level waste	1.8×10^{-5}	1.8×10^{-5}	1.0

a. Increased risk of latent fatal cancers per year.
b. Waste types are described in Appendix F.
c. Change factors represent the multiplication factor required to equate no-action alternative risks to alternative A risks (e.g., no-action risk times change factor equals alternative A risk). The up arrow (↑) indicates that the alternative A risk is greater.

A complete summary of all representative bounding accidents considered for alternative A is presented in Table 4-36. This table provides accident descriptions, annual frequency of occurrence, increased risk of latent fatal cancers for all receptor groups, and the waste type associated with the accident scenario. Details regarding the individual postulated accident scenarios associated with the various waste types are provided in Appendix F.

Table 4-37 presents for each waste considered a summary of the chemical hazards estimated to exceed ERPG-2 values for the uninvolved worker at 100 meters (328 feet). For this worker, seven chemical release scenarios would exceed ERPG-3 values. Moreover, another five chemical release scenarios would have estimated airborne concentrations that exceed ERPG-2 values where equivalent ERPG-3 values were not identified. For the offsite maximally exposed individual, no chemical release scenario

Table 4-36. Summary of representative bounding accidents under alternative A.[a]

Accident Description	Affected waste types[c]	Frequency (per year)	Increased risk of latent fatal cancers per year[b]: Uninvolved worker at 100 meters	Uninvolved worker at 640 meters	Maximally exposed offsite individual	Population within 80 kilometers
RHLWE[d] release due to a feed line break	High-level	0.07[e]	1.79×10^{-5}	6.38×10^{-7}	1.32×10^{-7}	6.34×10^{-4}
RHLWE release due to a design basis earthquake	High-level	2.00×10^{-4}[f]	1.54×10^{-6}	5.46×10^{-8}	1.12×10^{-9}	5.43×10^{-5}
RHLWE release due to evaporator pressurization and breech	High-level	5.09×10^{-5}[g]	1.95×10^{-6}	3.46×10^{-8}	7.13×10^{-10}	3.44×10^{-5}
Design basis ETF[h] airborne release due to tornado	High-level	3.69×10^{-7}[i]	3.20×10^{-13}	1.02×10^{-14}	7.20×10^{-15}	6.35×10^{-14}
Container breach at the ILNTV[j]	Low-level Mixed	0.02[e]	0.00104	1.84×10^{-5}	3.31×10^{-7}	0.0168
High wind at the ILNTV	Low-level	0.001[f]	4.04×10^{-10}	2.43×10^{-10}	1.52×10^{-10}	1.06×10^{-5}
Tornado at the ILNTV	Low-level	2.00×10^{-5}[g]	3.26×10^{-12}	6.18×10^{-10}	1.18×10^{-10}	1.18×10^{-7}
Release due to multiple open containers at the containment building	Mixed	0.003[f]	4.69×10^{-7}	6.91×10^{-7}	1.22×10^{-8}	5.70×10^{-4}
F3 tornado[k] at Building 316-M	Mixed	2.80×10^{-5}[g]	5.35×10^{-12}	1.29×10^{-9}	1.65×10^{-9}	1.12×10^{-9}
Aircraft crash at the containment building	Mixed	1.60×10^{-7}[i]	9.73×10^{-10}	3.46×10^{-11}	6.66×10^{-13}	3.19×10^{-8}
Deflagration in culvert during TRU[l] retrieval activities	Transuranic	0.01[e]	8.96×10^{-4}	1.59×10^{-5}	2.86×10^{-7}	1.45×10^{-2}
Fire in culvert at the TRU[l]waste storage pads (one drum in culvert)	Transuranic	8.10×10^{-4}[f]	3.07×10^{-4}	5.48×10^{-6}	9.84×10^{-8}	0.00498
Vehicle crash with resulting fire at the TRU[l]waste storage pads	Transuranic	6.50×10^{-5}[g]	4.47×10^{-6}	7.96×10^{-8}	1.43×10^{-9}	7.25×10^{-5}

a. A complete description and analysis of the representative bounding accidents are presented in Appendix F.
b. Increased risk of fatal cancers per year is calculated by multiplying the [consequence (dose) × latent cancer conversion factor] × annual frequency. For dose consequences and latent cancer fatalities per dose, see tables in Appendix F.
c. The waste type for which the accident scenario is identified as a representative bounding accident. A representative bounding accident may be identified for more than one waste type. These waste types are high-level, low-level, mixed, and transuranic.
d. Replacement High-Level Waste Evaporator.
e. The frequency of this accident scenario is within the anticipated accident range.
f. The frequency of this accident scenario is within the unlikely accident range.
g. The frequency of this accident scenario is within the extremely unlikely accident range.
h. F/H-Area Effluent Treatment Facility.
i. The frequency of this accident scenario is within beyond extremely unlikely accident range.
j. Intermediate-Level Nontritium Vault.
k. F3 tornadoes have rotational wind speeds of 254 to 331 kilometers (158 to 206 miles) per hour.
l. Transuranic.

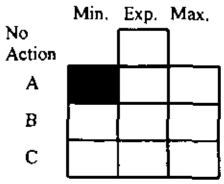
Table 4-37. Summary of chemical hazards associated with alternative A estimated to exceed ERPG-2 values.

Chemical name	Appendix F table reference[a]	100-meter concentration (mg/m^3)[b]	640-meter concentration (mg/m^3)	Offsite concentration (mg/m^3)	ERPG-2[c] (mg/m^3)	ERPG-3 (mg/m^3)
Nitric acid	F-6	830[d]	100[e]	2	39	77
Nitrogen dioxide	F-7	79.6[f]	0.339	0.159	1.88	54.6
Oxalic acid	F-7	276	1.18	0.552	5.00	500
Nitric acid	F-7	181[d]	0.771	0.361	38.7	77.3
Benzene	F-17	670	(f)	0.42	160	9,600
Cadmium	F-17	2.7	(f)	0.0017	0.25	500
Chromium	F-17	2.7	(f)	0.0017	2.5	(g)
Lead	F-17	160	(f)	0.10	0.25	700
Mercury	F-17	15	(f)	0.0094	0.20	28
Methyl ethyl ketone	F-17	1,800[d]	(f)	1.1	845	1.01×10^4
Beryllium	F-25	16.7[d]	(f)	0.00823	0.01	10
Cadmium	F-25	333[d]	(f)	0.165	0.25	50
Chloroform	F-25	8,330[d]	(f)	4.11	488	4,880
Chromium	F-25	16.7	(f)	0.00823	2.5	(g)
Copper	F-25	66.7	(f)	0.0329	5.0	(g)
Lead	F-25	667	(f)	0.329	0.25	700
Lead nitrate	F-25	16.7	(f)	0.00823	0.25	700
Mercuric nitrate	F-25	16.7	(f)	0.00823	0.2	28
Mercury	F-25	16.7	(f)	0.00823	0.2	28
Nickel nitrate	F-25	16.7	(f)	0.00823	5	(g)
Silver nitrate	F-25	16.7	(f)	0.00823	0.5	(g)
Sodium chromate	F-25	16.7	(f)	0.00823	0.25	30
Toluene	F-25	8,330[d]	(f)	4.11	754	7,450
Uranyl nitrate	F-25	16.7	(f)	0.00823	0.25	30

a. Analyses regarding specific chemical releases are provided in the referenced Appendix F tables.
b. Milligrams per cubic meter of air.
c. Emergency Response Planning Guidelines.
d. Concentration at 100 meters exceeds ERPG-3 concentration.
e. Concentration at 640 meters exceeds ERPG-3 concentration.
f. Airborne concentrations at 640 meters (2,100 feet) were not available from existing safety documentation.
g. No equivalent value found.

would have airborne concentrations that exceed ERPG-3 values. In fact, in only one instance would a chemical release scenario have an airborne concentration that exceeds an ERPG-2 value for the offsite TE maximally exposed individual (release of lead; see Table F-25 in Appendix F). Appendix F provides further detail and discussion regarding chemical hazards associated with each waste type.

In addition to the risk to human health from accidents, secondary impacts from postulated accidents on TE plant and animal resources, water resources, the economy, national defense, contamination, threatened and endangered species, land use, and Native American treaty rights are considered. This qualitative assessment (see Appendix F) determined that no substantial impacts would result from accidents for alternative A – expected waste forecast.

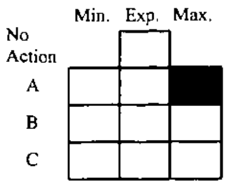


4.2.13.2 Facility Accidents – Minimum Waste Forecast

DOE assumes that conclusions regarding representative bounding accident scenarios could change with the amount of waste generated. Since accident analyses in this EIS are based on a conservative assumption of peak utilization of facilities, the various waste forecasts would only affect how long a facility (e.g., the Consolidated Incineration Facility) would operate. Therefore, while consequence or frequency for the postulated accidents would not change, the time the risk from a facility-specific accident would exist could be the same, more, or less, depending on the waste forecast. Alternative A – minimum waste forecast would not be expected to increase or decrease the duration of risk associated with the representative bounding accidents (see Appendix F).

The size and number of new facilities needed to meet waste management requirements would be affected by the amount of waste generated. Thus, the consequences or frequencies for specific accident scenarios | TE could increase or decrease with the addition or subtraction of facilities, depending on the waste forecast. DOE expects that a slight decrease in risk would occur for alternative A – minimum waste forecast. A comparison of the number and type of facilities needed for the minimum and expected waste forecasts is provided in Section 2.4.7.

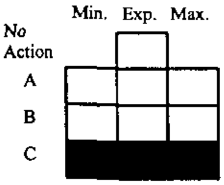
Transuranic waste provides the most dramatic example of why the risk would increase or decrease. It should be noted that the risk remains constant for an alternative and waste forecast, regardless of the waste type evaluated. For example, while alternative A – expected waste forecast calls for 12 transuranic | TE waste storage pads, the minimum waste forecast estimates only 3 additional transuranic waste storage pads. Since the number of drums would be reduced, a resultant decrease in the overall risk is assumed | TC between the two waste forecasts.



4.2.13.3 Facility Accidents – Maximum Waste Forecast

The maximum waste forecast would not be expected to increase or decrease the duration of risk for the facilities associated with the representative bounding accidents identified under alternative A (see Appendix F).

TC While the expected waste forecast calls for 12 transuranic waste storage pads, the maximum waste forecast estimates that 1,168 additional transuranic waste storage pads would be needed to store the maximum amount of waste SRS could receive. Since the number of drums would increase, an increase in risk over the expected waste forecast would occur.



4.3 Alternative C – Extensive Treatment Configuration

This section describes the effects of implementing alternative C (described in Section 2.5) on the existing environment (described in Chapter 3).

4.3.1 INTRODUCTION

Alternative C would use an extensive treatment configuration, which would minimize the long-term impacts of waste storage and disposal at SRS. This alternative includes continuing ongoing activities TE listed for the no-action alternative (Section 4.1.1). In addition, DOE would:

- Construct and operate a containment building to treat mixed and hazardous wastes.

- Roast and retort contaminated process equipment to remove mercury and treat mercury by amalgamation at the containment building.

- Oxidize a small quantity of reactive metal at the containment building.

- Construct and operate a non-alpha vitrification facility for hazardous, mixed, and low-level wastes to replace the Consolidated Incineration Facility in 2006. The facility would include low-level and mixed waste soil sort capability to separate soil with nondetectable amounts of contamination from contaminated soil.

TE

- Decontaminate and recycle low-activity equipment waste (metals) offsite. Treatment residues would be returned to SRS for shallow land disposal.

- Treat small quantities of radioactive PCB wastes offsite; residuals would be returned to SRS for shallow land disposal.

- Operate the Consolidated Incineration Facility for mixed, hazardous, low-level, and alpha wastes until the vitrification facilities become operational.

- Construct and operate a transuranic waste characterization/certification facility.

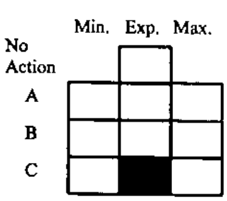
- Dispose of transuranic waste at the Waste Isolation Pilot Plant.

- Construct an alpha vitrification facility.

Alternative C would also require additional disposal areas for low-level radioactive wastes and mixed wastes. Four of six new waste treatment facilities [for characterization/certification of transuranic and alpha waste; for vitrification of transuranic and alpha wastes; for vitrification of mixed, hazardous, and low-level wastes; and for decontamination/macroencapsulation (containment) of mixed and hazardous waste] would be built in E-Area on undeveloped land northwest of F-Area.

Construction related to this alternative would require 0.40 square kilometer (99 acres) of undeveloped land northwest of F-Area and 0.036 square kilometer (9 acres) of undeveloped land northeast of F-Area by 2006 (Figure 4-22). An additional 0.081 square kilometer (20 acres) of undeveloped land would be required by 2024 for construction of RCRA-permitted disposal vaults northeast of F-Area (Figure 4-23). Other construction would be on previously cleared and developed land in the eastern portion of E-Area. The amount of undeveloped land required for the minimum waste forecast would be 0.45 square kilometer (111 acres), and the maximum waste forecast would require 3.9 square kilometers (959 acres). If alternative C were implemented, additional site-selection studies would be required to locate suitable land.

4.3.2 GEOLOGIC RESOURCES



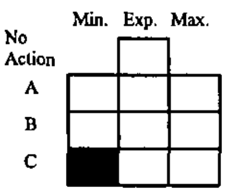
4.3.2.1 Geologic Resources – Expected Waste Forecast

Effects from alternative C – expected waste forecast would be mainly from the construction of new facilities. The effects discussed under the no-action alternative (Section 4.1.2) form the basis for comparison and are referenced in this section.

Although the number of facilities needed would be fewer for this forecast than under the no-action alternative, waste management activities associated with this case would affect soils in E-Area. Land that has been cleared and graded that would be required for this case totals approximately 0.239 square kilometer (59 acres). Approximately 0.44 square kilometer (108 acres) in E-Area would be cleared and graded for the construction of new facilities through 2006. Later, an additional 0.081 square kilometer

(20 acres) would be cleared for construction of RCRA-permitted disposal vaults. The total of 0.518 square kilometer (128 acres) is approximately 80 percent of the 0.65 square kilometer (160 acres) of undisturbed land that would be cleared and graded for the no-action alternative. Fewer facilities and the corresponding decrease in the amount of land needed would reduce the soils that would be affected under this case by about 15 percent. TC

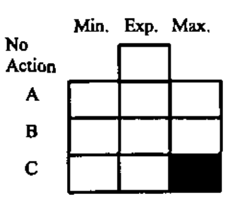
The potential for accidental oil, fuel, and chemical spills would be less for alternative C – expected waste forecast than under the no-action alternative because of reduced construction and operation activities. Spill prevention, control, and countermeasures for this alternative would be the same as for the no-action alternative discussed in Section 4.1.2; therefore, impacts to soils would be minimal.



4.3.2.2 Geologic Resources – Minimum Waste Forecast

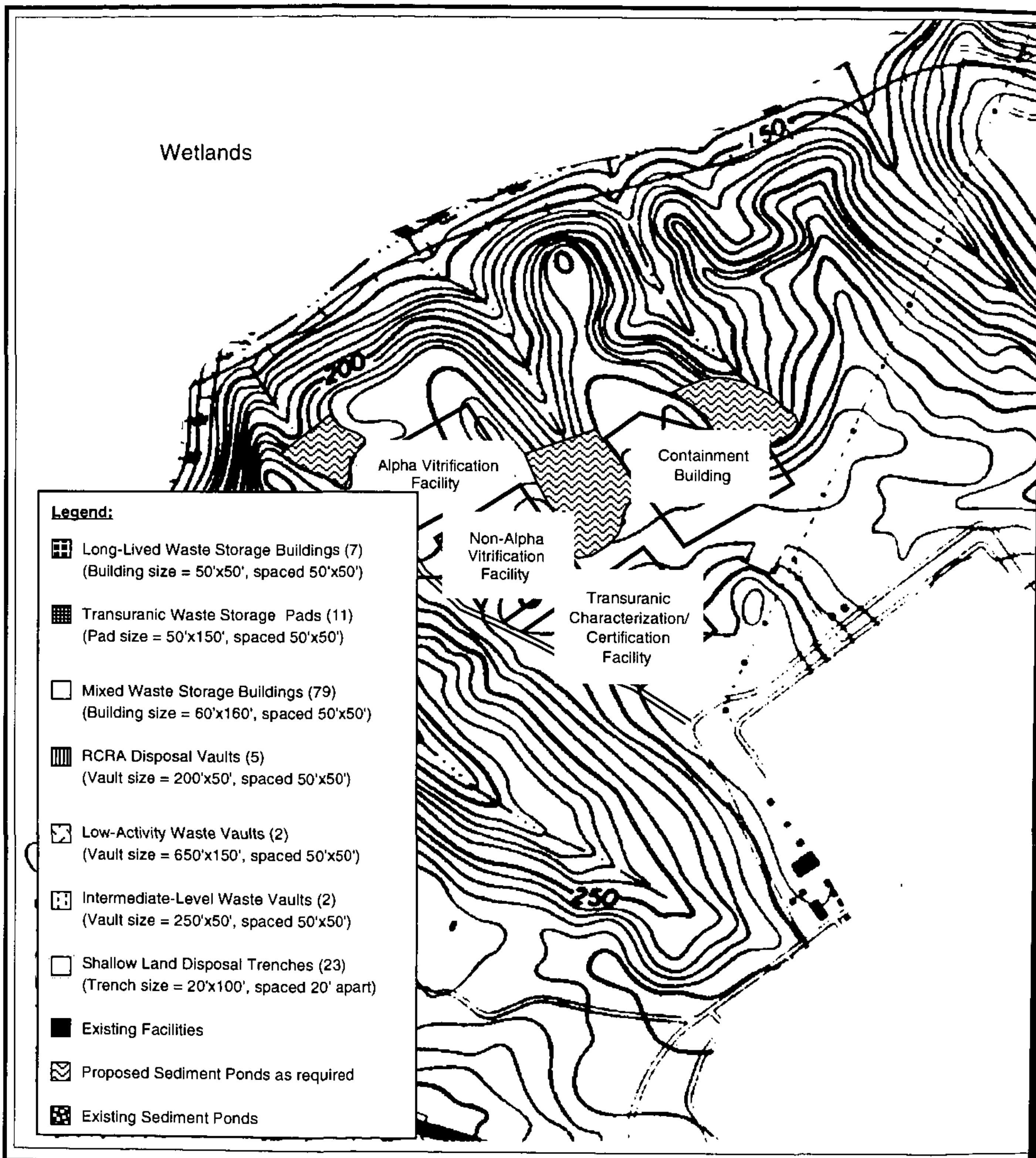
Effects from alternative C – minimum waste forecast would be slightly less than those from the expected waste forecast because less land would be disturbed during construction. Approximately 0.129 square kilometer (32 acres) of cleared land (by 2008) and 0.45 square kilometer (111 acres) (by 2024) of uncleared land would be used for new facilities. TC

For operations activities, spill prevention, control, and countermeasures for this scenario would be the same as for the no-action alternative.

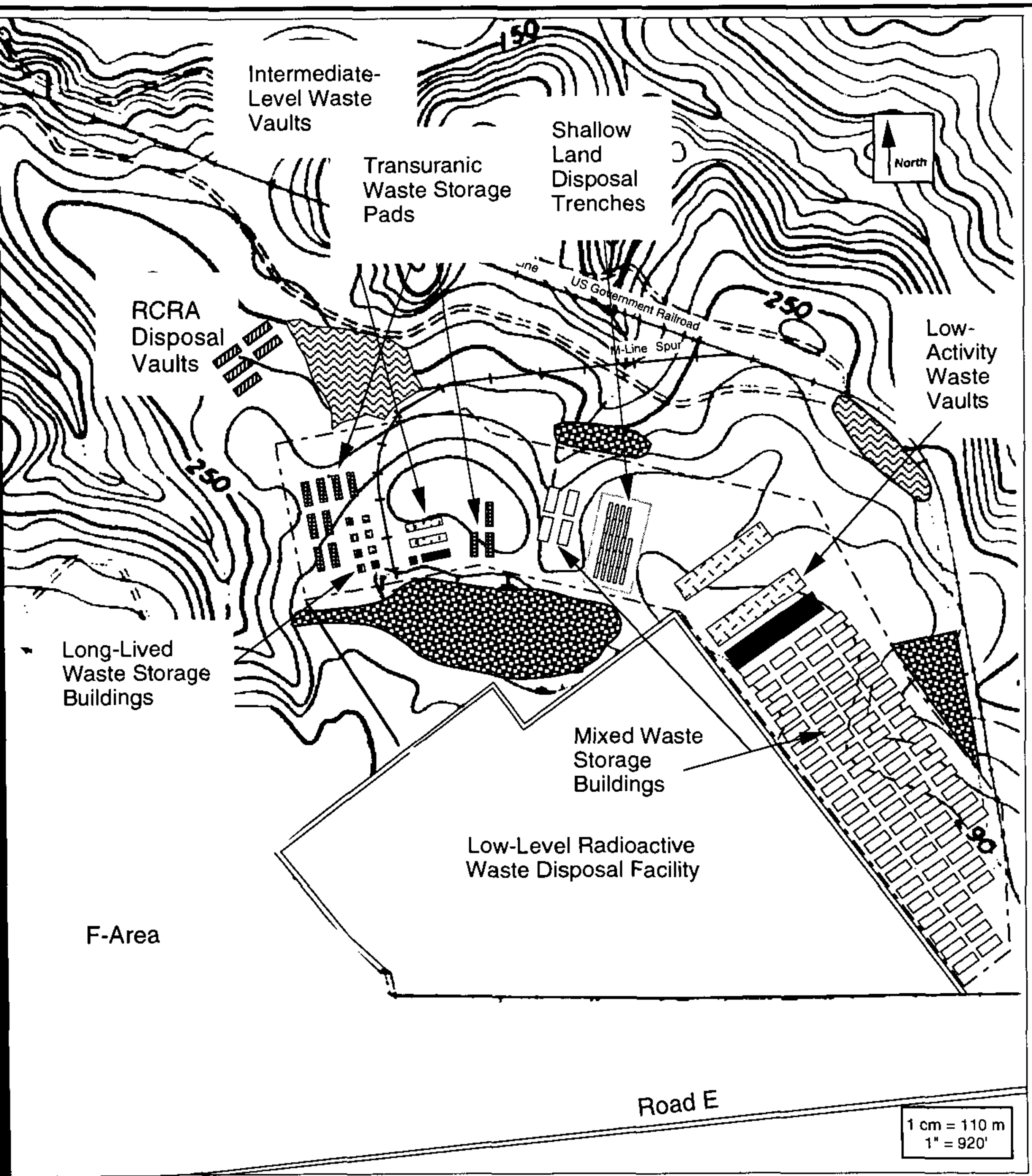


4.3.2.3 Geologic Resources – Maximum Waste Forecast

Effects from alternative C – maximum waste forecast would be greater than those from the minimum or expected waste forecasts because more land would be disturbed during construction. Approximately 0.283 square kilometer (70 acres) of cleared land and 0.745 square kilometer (184 acres) of uncleared land in E-Area, and 3.14 square kilometers (775 acres) of land outside E-Area would be used for new facilities. TC



TC | **Figure 4-22.** Configuration of treatment, storage, and disposal facilities in E-Area for alternative C – expected forecast by 2006.



Intermediate-Level Waste Vaults
Transuranic Waste Storage Pads
Shallow Land Disposal Trenches
North
150
US Government Railroad
M-Line Spur
250
RCRA Disposal Vaults
Low-Activity Waste Vaults
250
Long-Lived Waste Storage Buildings
Mixed Waste Storage Buildings
90
Low-Level Radioactive Waste Disposal Facility
F-Area
Road E
1 cm = 110 m
1" = 920'

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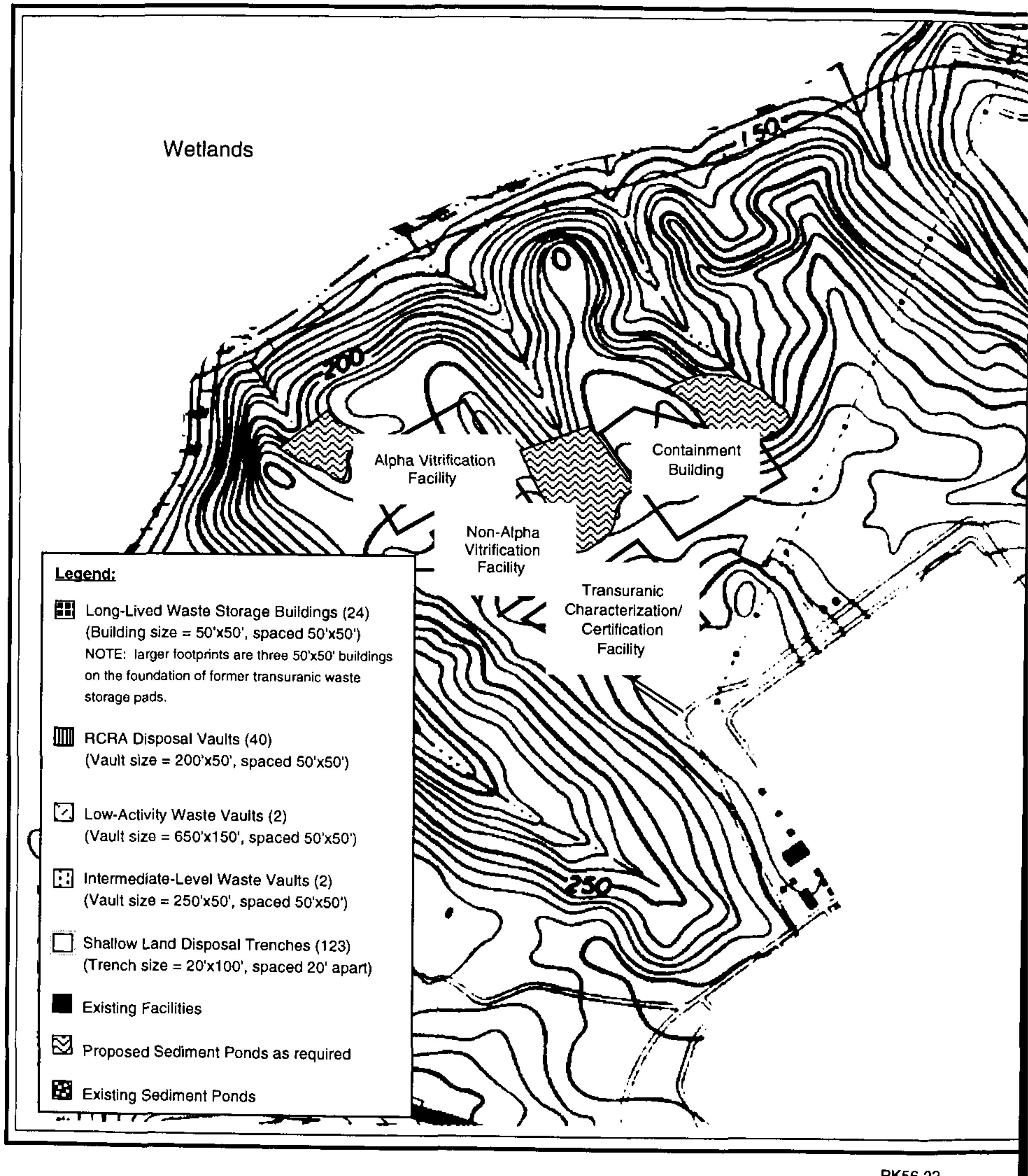
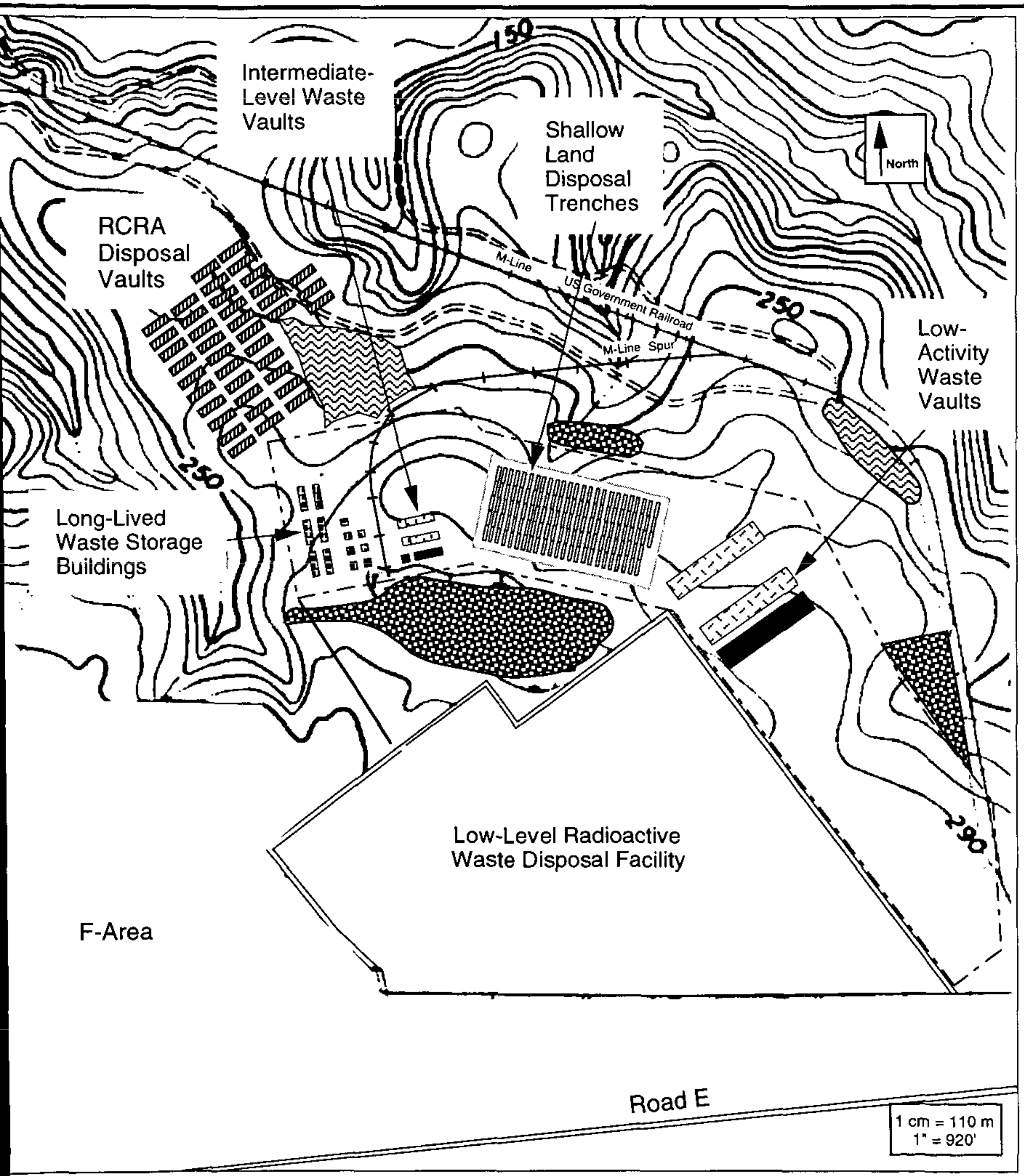


TC **Figure 4-23.** Configuration of treatment, storage, and disposal facilities in E-Area for alternative C – expected forecast by 2024.



Intermediate-Level Waste Vaults
Shallow Land Disposal Trenches
RCRA Disposal Vaults
North
150
250
M-Line
US Government Railroad
M-Line Spur
Low-Activity Waste Vaults
Long-Lived Waste Storage Buildings
Low-Level Radioactive Waste Disposal Facility
F-Area
290
Road E
1 cm = 110 m
1" = 920'

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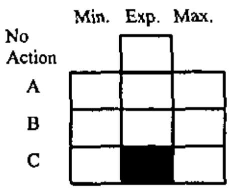
For operations activities, spill prevention, control, and countermeasures for this forecast would be the same as for the no-action alternative and the potential for spills would be greater than for the expected waste forecast because more facilities would be operated and larger volumes of wastes would be managed.

4.3.3 GROUNDWATER RESOURCES



4.3.3.1 Groundwater Resources – Expected Waste Forecast

This section discusses the effects of alternative C – expected waste forecast on groundwater resources at SRS. Effects can be evaluated by comparing the doses from contaminants predicted to enter the groundwater from each alternative and waste forecast. Effects on groundwater resources under the no-action alternative (Section 4.1.3) form the basis for comparison among the alternatives and are referenced in this section.

Operation and impacts of the M-Area Air Stripper and the F- and H-Area tank farms would be the same as for the no-action alternative.

TE

For this forecast, and as noted in Section 4.1.3, releases to the groundwater from RCRA-permitted disposal vaults would be improbable during active maintenance; however, releases could eventually occur after loss of institutional control and degradation of the vaults. Impacts from the RCRA-permitted disposal vaults would be similar to the effects under the no-action alternative (Section 4.1.3).

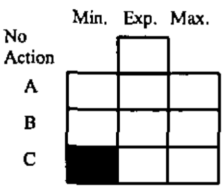
TC

TC
TE

There would be 11 fewer additional low-activity and intermediate-level radioactive waste disposal vaults (4) than under the no-action alternative (15). Modeling has shown that any releases from these vaults would not cause groundwater standards to be exceeded during the 30-year planning period or the 100-year institutional control period or at any time after disposal (Toblin 1995). As in the no-action alternative, the predicted concentrations of tritium would be a very small fraction of the drinking water standard. The discussion in Section 4.1.3 on the basis of the 4 millirem standard is applicable to this case. For this waste forecast, impacts to groundwater resources from disposal vaults would be similar to the impacts under the no-action alternative.

For this waste forecast, 123 additional slit trenches would be constructed. Under this alternative, waste disposed in slit trenches would be stabilized (ashcrete, glass, smelter ingots). These disposal activities would be subject to completion of performance assessments and demonstration of compliance with the performance objectives required by DOE Order 5820.2A. Therefore, DOE has conservatively assumed that groundwater concentrations as a result of radioactive releases from the RCRA-permitted vaults and all other low-level waste disposal facilities (vaults and slit trenches) would remain within the DOE performance objective of 4 millirem per year adopted by DOE in Order 5400.5. TC

In summary, impacts to groundwater from alternative C – expected waste forecast would be similar to the impacts under the no-action alternative. TC TE



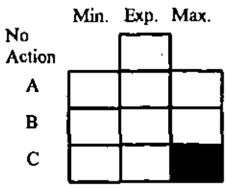
4.3.3.2 Groundwater Resources – Minimum Waste Forecast

For alternative C – minimum waste forecast, and as noted in Section 4.1.3, releases to the groundwater from RCRA-permitted disposal vaults would be improbable during active maintenance; however, releases could eventually occur after loss of institutional control and degradation of the vaults. Impacts from the RCRA-permitted disposal vaults would be similar to the effects under the no-action alternative (Section 4.1.3). TE

There would be 12 fewer additional low-activity and intermediate-level radioactive waste disposal vaults (3) than under the no-action alternative (15). Modeling has shown that the 4 millirem per year drinking water standard would not be exceeded by any radionuclide (Toblin 1995). TC Impacts to groundwater resources from disposal vaults, including minimal doses from tritium would be similar to those under the no-action alternative. TC

There would be less disposal of radioactive waste by shallow land disposal (45 additional slit trenches compared to 123 for the expected waste forecast). Under this alternative, waste disposed in slit trenches would be stabilized (ashcrete, glass, smelter ingots). These disposal activities would be subject to completion of performance assessments and demonstration of compliance with the performance objectives required by DOE Order 5820.2A. Therefore, DOE has conservatively assumed that groundwater concentrations as a result of radioactive releases from the RCRA-permitted vaults and all other low-level waste disposal facilities (vaults and slit trenches) would remain within the DOE performance objective of 4 millirem per year adopted by DOE in Order 5400.5. TC

TC In summary, impacts to groundwater from alternative C – minimum waste forecast would be similar to
TE the impacts discussed under the no-action alternative (Section 4.1.3).



4.3.3.3 Groundwater Resources – Maximum Waste Forecast

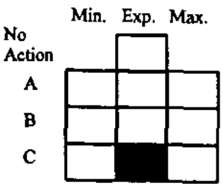
For this forecast, and as noted in Section 4.1.3, releases to the groundwater from RCRA-permitted disposal vaults would be improbable during active maintenance; however, releases could eventually
TE occur after loss of institutional control and degradation of the vaults. Impacts from the RCRA-permitted disposal vaults would be similar to the effects under the no-action alternative (Section 4.1.3).

There would be seven fewer additional low-activity and intermediate-level radioactive waste disposal
TC vaults (8) than under the no-action alternative (15). Modeling has predicted that the 4 millirem per year drinking water standard would not be exceeded for any radionuclide at any time after disposal (Toblin 1995). The impacts of the vaults in this case would be similar to those impacts in the no-action alternative (Section 4.1.3).

For alternative C – maximum waste forecast, there would be 576 additional slit trenches. Under this alternative, waste disposed in slit trenches would be stabilized (ashcrete, glass, smelter ingots). These disposal activities would be subject to completion of performance assessments and demonstration of
TC compliance with the performance objectives required by DOE Order 5820.2A. Therefore, DOE has conservatively assumed that groundwater concentrations as a result of radioactive releases from the RCRA-permitted vaults and all other low-level waste disposal facilities (vaults and slit trenches) would remain within the DOE performance objective of 4 millirem per year adopted by DOE in Order 5400.5.

In summary, impacts to groundwater from alternative C – maximum waste forecast would be similar to
TC the impacts under the no-action alternative (Section 4.1.3) and those for the expected waste forecast of this alternative (Section 4.3.3.1).

4.3.4 SURFACE WATER RESOURCES



4.3.4.1 Surface Water – Expected Waste Forecast

The extensive treatment configuration would use the treatment facilities presently available or being installed at SRS and several new facilities. Of the three alternatives, alternative C would treat waste most extensively prior to disposal. Impacts can be compared between the alternatives by evaluating the pollutants that would be introduced to the surface waters. The 4-millirem-per-year drinking water standard would not be exceeded for any radionuclide (Toblin 1995). TC

Under this alternative, the Consolidated Incineration Facility would operate until the non-alpha vitrification facility began operating. The incinerator would not discharge wastewater (blowdown) because it would be treated in the ashcrete process, and the stabilized ash and blowdown would be disposed of in RCRA-permitted disposal vaults or sent to shallow land disposal as discussed in Section 4.3.3.1. TE

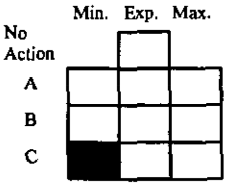
The Replacement High-Level Waste Evaporator would evaporate the liquid waste from the high-level waste tanks in the F- and H-Area tank farms (as noted in the no-action alternative). It would be used in TE the same manner as the present F- and H-Area evaporators, with the distillate being sent to the F/H-Area Effluent Treatment Facility for treatment prior to being discharged to Upper Three Runs. The concentrate from the evaporator would be sent to the Defense Waste Processing Facility for vitrification. Since the Replacement High-Level Waste Evaporator would be used in the same manner as the existing evaporators and would produce a distillate similar in composition to the present distillate, the effect of the effluent on Upper Three Runs would be the same as it is now.

DOE would also construct two vitrification facilities. The wastewater from both vitrification facilities would be treated at dedicated wastewater treatment facilities using an ion-exchange process, and the treated water would be recycled to each vitrification facility. Wastewater from the containment building would be transferred to the non-alpha vitrification facility for treatment and disposal. Wastewater would not be discharged to a surface stream.

Investigation-derived waste from groundwater wells that contained volatile organic compounds would be collected and treated by the M-Area Air Stripper. Since this water would be similar in composition to TE the groundwater presently being treated by the M-Area Air Stripper, surface waters would not be affected by the discharge of additional treated water.

As discussed in Section 4.2.4.1, additional wastewater would be treated in existing SRS facilities without exceeding the design capacity of any facility.

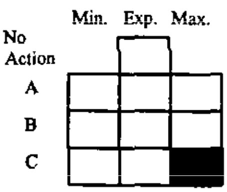
DOE would construct new facilities and additional storage buildings, pads, and vaults under this alternative. Erosion and sedimentation control plans would be developed and implemented for these projects, as noted in Section 4.1.4. After the facilities were operating, they would be included in the TE *Savannah River Site Stormwater Pollution Prevention Plan,* which details stormwater control measures.



4.3.4.2 Surface Water – Minimum Waste Forecast

TE As discussed in the other minimum waste forecasts (Sections 4.2.4.2 and 4.4.4.2), additional wastewater would be treated by the existing wastewater treatment facilities.

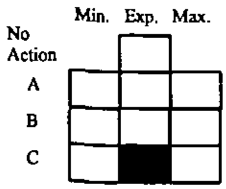
Erosion and sedimentation control plans for construction projects, and pollution prevention plans would be required as they are under the no-action alternative.



4.3.4.3 Surface Water – Maximum Waste Forecast

Facilities and discharges would be as described in Section 4.3.4.1. The previously described requirements for erosion and sedimentation control plans and pollution prevention plans would apply.

4.3.5 AIR RESOURCES



4.3.5.1 Air Resources – Expected Waste Forecast

Impacts to air resources can be evaluated by comparing pollutants introduced under the various alternatives. For alternative C – expected waste forecast, DOE would continue ongoing or planned waste treatment activities and construct and operate additional waste management facilities. Additional nonradiological and radiological emissions would occur. The resulting increases of pollutant concentrations at and beyond the SRS boundary would be minimal compared to existing concentrations. TE
Neither state nor Federal air quality standards would be exceeded by operations under alternative C.

4.3.5.1.1 Construction

Potential impacts to air quality from construction activities would include fugitive dust and earth-moving equipment exhaust. Approximately 6.19×10^5 cubic meters (8.10×10^5 cubic yards) of soil would be disturbed in E-Area for the construction of facilities for alternative C – expected waste forecast.

Maximum SRS boundary-line concentrations of air pollutants resulting from a year of average construction are shown in Table 4-38. These concentrations would be similar to those for the no-action alternative. During a year of average construction, the sum of the increase over baseline pollutant concentrations due to construction plus the existing baseline would be within both state and Federal air quality standards.

4.3.5.1.2 Operations

There would be additional radiological and nonradiological emissions at SRS due to the operation of new facilities such as the M-Area Vendor Treatment Facility, the mixed and hazardous waste containment building, the non-alpha waste vitrification facility, the transuranic waste characterization/certification facility, the alpha waste vitrification facility, and the Consolidated Incineration Facility (assuming it operates as scheduled until it is replaced by the vitrification facilities).

Table 4-38. Maximum SRS boundary-line concentrations resulting from a year of average construction activities under alternative C (in micrograms per cubic meter of air).

TC

Pollutant	Averaging time	Existing baseline[a] ($\mu g/m^3$)	Average change[b] ($\mu g/m^3$)			SCDHEC standard[c] ($\mu g/m^3$)	Existing baseline + change as percent of standard		
			Expected	Minimum	Maximum		Expected	Minimum	Maximum
Nitrogen oxides	1 year	14	<0.01[d]	<0.01	0.03	100	14	14	14
Sulfur dioxide	3 hours	857	38.71	15.94	362.25	1,300	69	67	94
	24 hours	213	0.72	0.30	6.83	365	59	58	60
	1 year	17	<0.01	<0.01	<0.01	80	21	21	21
Carbon monoxide	1 hour	171	737	330	6,793	40,000	2	1	17
	8 hours	22	115	52	1,030	10,000	1	1	11
Total suspended particulates	1 year	43	0.01	<0.01	0.03	75	57	57	57
Particulate matter less than 10 microns in diameter	24 hours	85	2.47	1.03	23.51	150	58	58	72
	1 year	25	0.01	<0.01	0.04	50	50	50	50

a. Source: Stewart (1994).
b. Source: Hess (1994a).
c. Source: SCDHEC (1976).
d. < is read as "less than."

Emissions from new or proposed facilities are estimated from processes occurring in the facilities or similar facilities, annual average waste flow volumes, and air permit applications. Air emissions from facilities such as disposal vaults and mixed waste storage buildings would be very small.

Per the rationale provided in Section 4.1.5.2 regarding similar facilities, no increase in maximum boundary-line concentrations of pollutants would result from the continued operation of currently operating facilities. Additional emissions from the M-Area Air Stripper and the F/H-Area Effluent Treatment Facility due to the expected waste forecast would be very small and are discussed in Section 4.1.5.2. TE

Nonradiological Air Emissions Impacts

Maximum ground-level concentrations for nonradiological air pollutants are estimated from the Industrial Source Complex Version 2 Dispersion Model using maximum potential emissions from all facilities included in alternative C (Stewart 1994). Calculations for the annual averaging period and for the dispersion of toxic substances that are carcinogenic are presented in Section 4.1.5.2. Modeled air toxic concentrations for carcinogens are based on an annual averaging period and are presented in Section 4.3.12.1.2. Air dispersion modeling was performed with calculated emission rates for facilities not yet operating and actual 1990 emission levels for facilities currently operating (Stewart 1994).

The following facilities were included in the modeling analysis for alternative C air dispersion: the Consolidated Incineration Facility, including the ashcrete storage silo, the ashcrete hopper duct, and the ashcrete mixer; four new solvent tanks; the M-Area Vendor Treatment Facility; the hazardous and mixed waste containment building; the transuranic waste characterization/certification facility; hazardous waste storage facilities; mixed waste storage facilities; the non-alpha waste vitrification facility; and the alpha waste vitrification facility. TC

Emissions of air toxics would be negligible. Maximum boundary-line concentrations for air toxics emanating from existing SRS sources, including the Consolidated Incineration Facility and the Defense Waste Processing Facility, would be well below regulatory standards and are presented in the *SCDHEC Regulation No. 62.5 Standard No. 2 and Standard No. 8 Compliance Modeling Input/Output Data.* TE

The Savannah River Technology Center laboratory's liquid waste and E-Area vaults would have very small air emissions, as discussed in Section 4.1.5.2.

Table 4-39 shows the increase in maximum ground-level concentrations at the SRS boundary for nonradiological air pollutants due to routine releases for alternative C – expected, minimum, and maximum waste forecasts. Concentrations due to routine emissions resulting from alternative C – expected waste forecast are similar to those under the no-action alternative. Refer to Section 4.2.5.1.2 for a discussion of the emissions from offsite lead decontamination.

TC

TE **Radiological Air Emissions Impacts**

Offsite maximally exposed individual and population doses were determined for atmospheric releases resulting from routine operations. The major sources of radionuclides would be the Consolidated Incineration Facility, the alpha and non-alpha vitrification facilities, and the transuranic waste characterization/certification facility. Other facilities with radiological releases include the M-Area Vendor Treatment Facility and the mixed and hazardous waste containment building.

L004-13

SRS-specific computer codes MAXIGASP and POPGASP were used to determine the maximum offsite individual dose and the 80-kilometer (50-mile) population dose, respectively, resulting from routine atmospheric releases. See Appendix E for detailed facility specific isotopic and dose data.

L004-13

Table 4-40 shows the dose to the offsite maximally exposed individual and the population. The calculated maximum committed effective annual dose equivalent to a hypothetical individual is 0.18 millirem (Chesney 1995), which is well within the annual dose limit of 10 millirem from SRS atmospheric releases. In comparison, an individual living near SRS receives a dose of 0.25 millirem from all current SRS routine releases (Arnett 1994).

TC

For alternative C – expected waste forecast, the annual dose to the population within 80 kilometers (50 miles) of SRS would be 10 person-rem. In comparison, the collective dose received from natural sources of radiation is approximately 195,000 person-rem (Arnett, Karapatakis, and Mamatey 1994) to the same population. Section 4.3.12.1.2 describes the potential health effects of these releases on individuals residing offsite.

TC

Table 4-39. Changes in maximum ground-level concentrations of air pollutants at the SRS boundary for alternative C – expected, minimum, and maximum waste forecasts. TE

Pollutant	Averaging time	Existing sources (μg/m³)[a,b]	Regulatory standards (μg/m³)[c]	Background concentration (μg/m³)[d]	Increase in concentration (μg/m³)			Percent of standard[e]		
					Expected[b]	Minimum	Maximum	Expected	Minimum	Maximum
Nitrogen oxides	1 year	6	100	8	0.28	0.28	0.32	14	14	14
Sulfur oxides	3 hours	823	1,300	34	2.70	2.69	2.74	66	66	66
	24 hours	196	365	17	0.39	0.39	0.40	58	58	58
	1 year	14	80	3	0.01	0.01	0.01	21	21	21
Carbon monoxide	1 hour	171	40,000	NA[f]	24.19	24.19	24.19	0.5	0.5	0.5
	8 hours	22	10,000	NA	4.02	4.02	4.02	0.3	0.3	0.3
Total suspended particulates	1 year	13	75	30	1.98	1.98	1.98	60	60	60
Particulate matter less than 10 microns in diameter	24 hours	51	150	34	3.20	3.18	3.52	59	59	59
	1 year	3	50	22	0.08	0.08	0.10	50	50	50
Lead	3 months	4.0×10^{-4}	1.5	0.011	2.50×10^{-5}	1.90×10^{-5}	6.60×10^{-5}	0.8	0.8	0.8
Gaseous fluorides (as hydrogen fluoride)	12 hours	2	3.7	NA	0.0012	0.0011	0.0012	54	54	54
	24 hours	1	2.9	NA	8.60×10^{-4}	8.60×10^{-4}	8.80×10^{-4}	35	35	35
	1 week	0.4	1.60	NA	3.40×10^{-4}	3.40×10^{-4}	3.50×10^{-4}	25	25	25
	1 month	0.01	0.80	NA	1.10×10^{-4}	1.10×10^{-4}	1.10×10^{-4}	13	13	13

TC

a. Micrograms per cubic meter of air.
b. Source: Stewart (1994).
c. Source: SCDHEC (1976).
d. Source: SCDHEC (1992).
e. Percent of standard = 100 × (actual + background + increment) divided by the regulatory standards.
f. NA = not applicable.

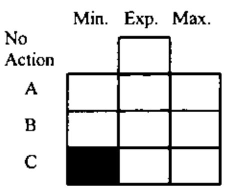
TE

Table 4-40. Annual radiological doses to individuals and the population within 80 kilometers (50 miles) of SRS under alternative C.[a]

TC

	Offsite maximally exposed individual	Population
Waste forecast	Dose (millirem)	Dose (person-rem)
Expected	0.18	10
Minimum	0.09	4.9
Maximum	4.0	229

a. Source: Chesney (1995).



4.3.5.2 Air Resources – Minimum Waste Forecast

The alternative C – minimum waste forecast would have a smaller impact to air resources than the expected waste forecast.

4.3.5.2.1 Construction

Impacts were evaluated for the construction of facilities listed in Section 2.5.7. Maximum concentrations at the SRS boundary resulting from average annual emissions during the 30-year construction period are presented in Table 4-38. As discussed in Section 4.3.5.1.1, SRS would still be in compliance with both state and Federal air quality standards.

4.3.5.2.2 Operations

Both radiological and nonradiological impacts were determined for the same facilities listed in Section 2.5.7. Air emissions would be less than for the expected waste forecast.

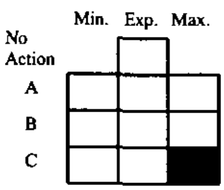
TE

Nonradiological Air Emissions Impacts

Nonradiological air emissions would be less than those estimated for the expected waste forecast. Maximum concentrations at the SRS boundary are presented in Table 4-39. Modeled concentrations are similar to the expected waste forecast. Total concentrations would be less than both state and Federal ambient air quality standards, and SRS would remain in compliance with both state and Federal standards.

Radiological Air Emissions Impacts TE

Table 4-40 shows the dose to the offsite maximally exposed individual and the population due to atmospheric releases. The calculated maximum committed annual dose equivalent to a hypothetical individual is 0.09 millirem (Chesney 1995), which is less than the dose from the expected waste forecast TC and below the annual dose limit of 10 millirem from SRS atmospheric releases. The annual dose to the population within 80 kilometers (50 miles) of SRS would be 4.9 person-rem, less than the population TC dose calculated for the expected waste forecast.



4.3.5.3 Air Resources – Maximum Waste Forecast

Alternative C – maximum waste forecast would have greater impacts than the expected waste forecast.

4.3.5.3.1 Construction

Maximum concentrations at the SRS boundary that would result from average annual emissions during the 30-year construction period are presented in Table 4-38.

During a year of average construction, the sum of concentrations of air pollutants resulting from construction activities plus the existing baseline would be below both state and Federal air quality standards. Good construction management procedures would require the wetting of roads to reduce particulate emissions.

4.3.5.3.2 Operations

Nonradiological Air Emissions Impacts TE

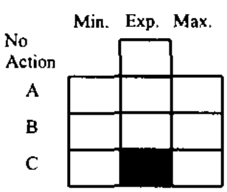
Nonradiological air emissions would be greater than those estimated for the expected waste forecast. Maximum concentrations at the SRS boundary are presented in Table 4-39. Cumulative concentrations would be within applicable state and federal ambient air quality standards.

Radiological Air Emissions Impacts

Table 4-40 shows the dose to the offsite maximally exposed individual and the population due to atmospheric releases from the facilities operating for the maximum waste forecast. The calculated maximum committed annual dose equivalent to a hypothetical individual is 4.0 millirem (Chesney 1995), which is greater than the dose calculated for the expected waste forecast but within the annual dose limit of 10 millirem from all SRS atmospheric releases.

The annual dose to the population within 80 kilometers (50 miles) of SRS would be 229 person-rem, which is greater than the population dose calculated for the expected waste forecast. The collective dose the same population receives from natural sources of radiation is approximately 195,000 person-rem (Arnett, Karapatakis, and Mamatey 1994). Section 4.3.12.1.2 describes the potential health effects of these releases.

4.3.6 ECOLOGICAL RESOURCES

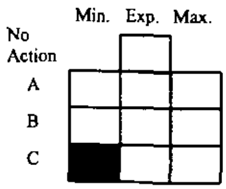


4.3.6.1 Ecological Resources – Expected Waste Forecast

Development of new facilities would result in the clearing and grading of undisturbed land. (These land areas are presented in acres; to convert from acres to square kilometers, multiply by 0.004047.) Clearing and grading would affect 108 acres of woodland by 2006 and an additional 20 acres by 2024, as follows:

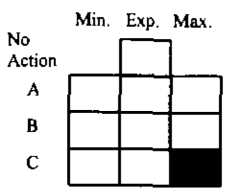
- 27 acres of loblolly pine planted in 1987
- 20 acres of white oak, red oak, and hickory regenerated in 1922
- 57 acres of longleaf pine regenerated in 1922, 1931, or 1936
- 4 acres from which mixed pine/hardwood was recently harvested
- 20 acres of loblolly pine planted in 1987 would be cleared between the years 2008 and 2024

Effects on the ecological resources would be the same as those described in Section 4.1.6 for the no-action alternative; however, because slightly less land (i.e., 128 acres versus 160 under the no-action alternative) would be required, the overall impact would be slightly less.



4.3.6.2 <u>Ecological Resources – Minimum Waste Forecast</u>

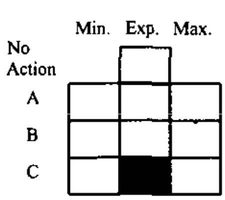
Approximately 111 acres of undeveloped land located between the M-Line railroad and the E-Area expansion and extending northwest of F-Area would be required. Impacts to the ecological resources of the area would be slightly less than under the expected waste forecast due to the reduced area. TC



4.3.6.3 <u>Ecological Resources – Maximum Waste Forecast</u>

Approximately 184 acres of undeveloped land located between M-Line railroad and the E-Area expansion and extending northwest of F-Area would be required. By 2006, an additional 775 acres of land in an undetermined location would also be required for alternative C – maximum waste forecast. Impacts to the ecological resources would be considerably greater than for the expected waste forecast due to the greater area, and similar to those described for alternative A – maximum forecast (see Section 4.2.6.3). Additional threatened and endangered species surveys and a floodplain/wetlands assessment would be required as part of the site-selection process. TC

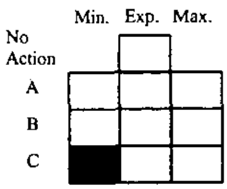
4.3.7 LAND USE



4.3.7.1 <u>Land Use – Expected Waste Forecast</u>

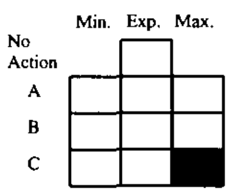
DOE would use approximately 167 acres (108 acres of undeveloped; 59 acres of developed) of land in E-Area through 2006 for activities associated with alternative C – expected waste forecast. By 2024, the total would have been reduced to about 155 acres because as wastes would be treated and disposed, the storage buildings would be taken out of service and decontaminated and decommissioned; some would be demolished and the land converted back to a natural area. SRS has about 181,000 acres of undeveloped land which includes wetlands and other areas that cannot be developed, and 17,000 acres of developed land. TC

Activities associated with alternative C would not affect current SRS land-use plans; E-Area was designated as an area for nuclear facilities in the *Draft 1994 Land-Use Baseline Report*. Furthermore, no part of E-Area has been identified as a potential site for future new missions. And according to the *FY 1994 Draft Site Development Plan*, proposed future land management plans specify that E-Area be characterized and remediated for environmental contamination in its entirety, if necessary. DOE will make decisions on future SRS land uses through the site development, land-use, and future-use planning processes, including public input through avenues such as the Citizens Advisory Board.



4.3.7.2 Land Use – Minimum Waste Forecast

Activities associated with alternative C – minimum waste forecast would not affect current SRS land
TC uses. Approximately 0.57 square kilometer (141 acres) (slightly less than for the expected waste
forecast) in E-Area would be utilized.

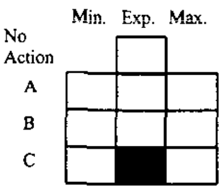


4.3.7.3 Land Use – Maximum Waste Forecast

Activities associated with alternative C – maximum waste forecast would not affect current SRS land
TC uses. By 2006, DOE would use a total of 1,029 acres (254 acres in E-Area and 775 acres elsewhere) for
the facilities listed in Section 4.3.1. This acreage is nearly 10 times the land that would be required
under the expected or minimum waste forecasts, but is less than 1 percent of the total undeveloped land
on SRS (DOE 1993d). However, considerably more acreage than this may be affected (see Section
TC 4.2.6.3). There would be no impact to current land uses in E-Area. The location of the 775 acres outside
of E-Area has not been identified and would be the subject of further impact analyses. However, DOE
TC would minimize the impact of clearing 775 acres by siting new facilities using the central industrialized
portion of SRS, as described in Section 2.1.2 and Figure 2-1.

4.3.8 SOCIOECONOMICS

This section describes the potential effects of alternative C on the socioeconomic resources in the region of influence discussed in Section 3.8. This assessment is based on the estimated construction and operations employment required to implement this alternative, as listed in Tables 4-41 and 4-42.



4.3.8.1 Socioeconomics – Expected Waste Forecast

4.3.8.1.1 Construction

DOE anticipates that for alternative C – expected waste forecast, construction employment would peak during 2004 through 2005 with approximately 160 jobs (Table 4-41), 110 more than during peak employment under the no-action alternative. This employment demand represents less than 1 percent of the forecast employment in 2005. Given the normal fluctuation of employment in the construction industry, DOE does not expect a net change in regional construction employment from implementation of this case. Given no net change in employment, neither population nor personal income in the region would change. As a result, socioeconomic resources would not be affected. TC TC

4.3.8.1.2 Operations

Operations employment associated with implementation of alternative C – expected waste forecast is expected to peak from 2002 through 2005 with an estimated 2,160 jobs, 290 fewer than during peak employment under the no-action alternative (Table 4-41). This employment demand represents less than 1 percent of the forecast employment in 2005 and approximately 10 percent of 1995 SRS employment. DOE believes these jobs would be filled from the existing SRS workforce. Thus, DOE does not anticipate impacts to socioeconomic resources from changes in operations employment. TC

Table 4-41. Estimated construction and operations employment for alternative C – minimum, expected, and maximum waste forecasts.[a]

TC

	Waste Forecast				
	Minimum		Expected		Maximum[b]
Year	Construction	Operations	Construction	Operations	Construction
1995	20	810	30	980	170
1996	20	970	20	1,250	40
1997	20	970	20	1,250	50
1998	20	970	20	1,360	140
1999	20	1,090	20	1,480	140
2000	20	1,100	20	1,610	140
2001	20	1,100	20	1,610	140
2002	60	1,230	90	2,160	270
2003	90	1,230	110	2,160	300
2004	130	1,470	160	2,160	350
2005	130	1,350	160	2,160	350
2006	90	1,300	100	1,940	230
2007	60	1,230	70	1,830	210
2008	20	1,330	30	1,910	80
2009	20	1,260	30	1,910	80
2010	20	1,260	30	1,910	80
2011	20	1,260	30	1,910	80
2012	20	1,260	30	1,910	80
2013	20	1,260	30	1,910	80
2014	20	1,260	30	1,910	80
2015	20	1,260	30	1,910	80
2016	20	1,260	30	1,910	80
2017	20	1,260	30	1,910	80
2018	20	1,260	30	1,910	80
2019	20	1,180	30	1,820	70
2020	20	1,180	30	1,820	70
2021	20	1,180	30	1,820	70
2022	20	1,180	30	1,820	70
2023	20	1,180	30	1,820	70
2024	20	1,180	30	1,820	70

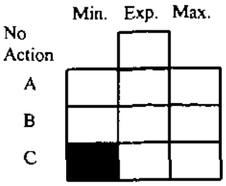
a. Source: Hess (1995a).
b. Operations employment for the maximum waste forecast is provided in Table 4-42.

Table 4-42. Estimated new operations jobs required to support alternative C – maximum waste forecast.[a]

Year	Projected total site employment	Site employment available for WM activities[b]	Total operations employment for alternative C – maximum case	New hires[c]
1995	20,000	10,000	1,260	0
1996	15,800	7,900	2,620	0
1997	15,800	7,900	2,800	0
1998	15,800	7,900	7,720	0
1999	15,800	7,900	7,720	0
2000	15,800	7,900	7,880	0
2001	15,800	7,900	7,880	0
2002	15,800	7,900	10,060	2,160
2003	15,800	7,900	10,060	2,160
2004	15,800	7,900	10,060	2,160
2005	15,800	7,900	10,060	2,160
2006	15,800	7,900	8,870	970
2007	15,800	7,900	8,910	1,010
2008	15,800	7,900	4,540	0
2009	15,800	7,900	4,540	0
2010	15,800	7,900	4,540	0
2011	15,800	7,900	4,540	0
2012	15,800	7,900	4,540	0
2013	15,800	7,900	4,540	0
2014	15,800	7,900	4,540	0
2015	15,800	7,900	4,540	0
2016	15,800	7,900	4,540	0
2017	15,800	7,900	4,540	0
2018	15,800	7,900	4,540	0
2019	15,800	7,900	4,020	0
2020	15,800	7,900	4,020	0
2021	15,800	7,900	4,020	0
2022	15,800	7,900	4,020	0
2023	15,800	7,900	4,020	0
2024	15,800	7,900	4,020	0

TC

a. Source: Hess (1995a).
b. DOE assumed that approximately 50 percent of the total site workforce would be available to work on waste management activities.
c. New hires are calculated by comparing the required employment (column 4) to available employment (column 3); new hires would result only in those years when required employment exceeds available employment.



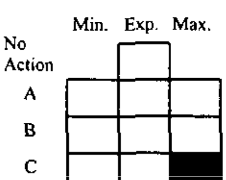
4.3.8.2 Socioeconomics – Minimum Waste Forecast

4.3.8.2.1 Construction

Construction employment associated with alternative C – minimum forecast would be slightly less than that for the expected waste forecast and would peak in 2004 and 2005 with approximately 130 jobs TC (Table 4-41), which represents much less than 1 percent of the forecast employment in 2005. DOE does not expect a net change in regional construction employment from implementation of this case. As a result, socioeconomic resources in the region would not be affected.

4.3.8.2.2 Operations

Operations employment associated with implementation of the minimum waste forecast is expected to peak in 2004 with an estimated 1,470 jobs, approximately 690 fewer jobs than under the expected waste TC forecast (Table 4-41). This employment demand represents less than 1 percent of the forecast employment in 2005 (see Chapter 3) and approximately 7 percent of 1995 SRS employment. DOE believes these jobs could be filled from the existing SRS workforce and, therefore, anticipates that socioeconomic resources would not be affected by changes in operations employment.



4.3.8.3 Socioeconomics – Maximum Waste Forecast

4.3.8.3.1 Construction

Construction employment associated with alternative C – maximum waste forecast would be greater than that for the expected waste forecast and would peak in 2004 and 2005 with approximately 350 jobs TE (Table 4-41), which represents less than 1 percent of forecast employment for 2005. DOE does not expect a net change in regional construction employment from implementation of this case. As a result, socioeconomic resources in the region would not be impacted.

4.3.8.3.2 Operations

Operations employment associated with the implementation of alternative C – maximum waste forecast is expected to peak during 2002 through 2005 with an estimated 10,060 jobs (Table 4-42), which represents 3.7 percent of the forecast regional employment in the year 2005 and approximately 50 percent of 1995 SRS employment. DOE assumes that approximately 50 percent of the total SRS workforce would be available to support implementation of this case. If DOE transfers 50 percent of the SRS workforce, an additional 2,160 new employees would still be required in the peak years. Based on the number of new jobs predicted, DOE calculated changes in regional employment, population, and personal income using the Economic-Demographic Forecasting and Simulation Model developed for the six-county region of influence (Treyz, Rickman, and Shao 1992). TC

Results of the modeling indicate that the peak regional employment change would occur in 2002 with a total of approximately 5,320 new jobs (Table 4-43) (HNUS 1995b). This would represent a 2 percent increase in baseline regional employment and would have a substantial positive impact on the regional economy.

Potential changes in regional population would lag behind the peak change in employment because of migration lags and because in-migrants may have children after they move into the area. As a result, the maximum change in population would occur in 2005 with an estimated 6,630 additional people in the six-county region (Table 4-43) (HNUS 1995b). This increase is approximately 1.4 percent above the baseline regional population forecast and could affect the demand for community resources and services such as housing, schools, police, health care, and fire protection. TC

Potential changes in total personal income would peak in 2005 with a $410 million increase over forecast regional income levels for that year (Table 4-43) (HNUS 1995b). This would be a 2.6 percent increase over baseline income levels and would have a substantial, positive effect on the regional economy.

4.3.9 CULTURAL RESOURCES

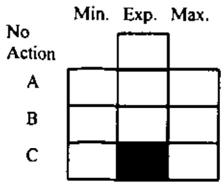
This section discusses the effect of alternative C on cultural resources.

Table 4-43. Changes in employment, population, and personal income for alternative C – maximum waste forecast.[a]

TC

Year	New hires[b]	Change in indirect regional employment[c]	Net change in total regional employment	Percent change in regional employment	Change in regional population	Percent change in regional population	Change in regional personal income (millions)	Percent change in regional personal income
2002	2,160	3,160	5,320	2.06	1,870	0.39	310	2.37
2003	2,160	3,110	5,270	2.02	4,130	0.86	350	2.52
2004	2,160	2,970	5,130	1.94	5,510	1.15	380	2.58
2005	2,160	2,860	5,020	1.88	6,630	1.38	410	2.63
2006	970	980	1,950	0.72	6,450	1.34	220	1.32
2007	1,010	980	1,990	0.74	5,900	1.23	220	1.32

a. Source: Hess (1995a); HNUS (1995b).
b. From Table 4-42.
c. Change in employment related to changes in population.

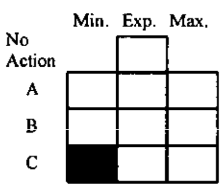


4.3.9.1 Cultural Resources – Expected Waste Forecast

Waste treatment, storage, and disposal facilities would be constructed within the currently developed portion of E-Area, to the north and northwest of this area, and to the northwest of F-Area (Figures 4-22 and 4-23).

Construction within the developed and fenced portion of E-Area would not affect cultural or archaeological resources because this area has been previously disturbed.

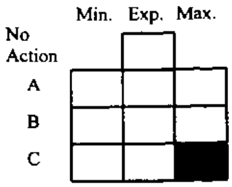
The two small areas of unsurveyed land (Figure 4-5) would be surveyed and any resources would be protected as described in Section 4.1.9. Archaeological sites in the proposed area of expansion could be impacted as described in Section 4.1.9. If this occurred, DOE would protect the cultural resources as described in Section 4.1.9.



4.3.9.2 Cultural Resources – Minimum Waste Forecast

Construction of new waste management facilities under this case would require approximately 0.11 fewer square kilometer (26 fewer acres) than for the expected waste forecast. Although the precise configuration of facilities is currently undetermined, construction would take place within the areas identified in Section 4.3.9.1. TC

As discussed in Section 4.3.9.1, construction within the developed and fenced portion of E-Area or to the northwest of this area would not affect archaeological resources. Before construction could begin in the undeveloped area northwest of F-Area, the Savannah River Archaeology Research Program and DOE would complete the consultation process with the State Historic Preservation Officer and develop mitigation action plans to ensure that important archaeological resources would be protected and preserved (Sassaman 1994).

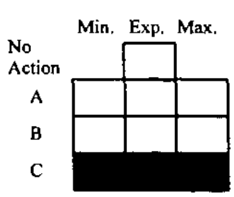


4.3.9.3 Cultural Resources – Maximum Waste Forecast

Construction of new waste management facilities for this forecast would require approximately TC 4.2 square kilometers (1,029 acres), 3.5 square kilometers (862 acres) more than for the expected waste forecast. Much of the proposed construction would take place within the areas identified in Section 4.3.9.1. However, these areas are not large enough to support all of the new facilities required TC under this case. DOE would need an estimated 3.1 square kilometers (775 acres) outside the areas identified in Section 4.3.9.1.

Construction within the developed and fenced portion of E-Area or to the northwest of this area would not affect archaeological resources. Before construction could begin in the undeveloped area northwest of F-Area, the Savannah River Archaeology Research Program and DOE would complete the consultation process with the State Historic Preservation Officer and develop mitigation action plans, as described in Section 4.3.9.2.

TC Until DOE determines the precise location of the additional 3.1 square kilometers (775 acres) that would be used outside of F- and E-Areas, effects on cultural resources cannot be predicted. The potential disturbance of important cultural resources would be proportional to the amount of land that would be disturbed. However, in compliance with the Programmatic Memorandum of Agreement, DOE would survey all areas proposed for construction activities prior to disturbance. If important resources are discovered, DOE would avoid or remove them.

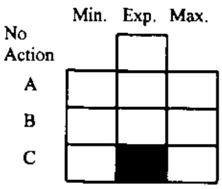


TE 4.3.10 AESTHETICS AND SCENIC RESOURCES – EXPECTED, MINIMUM, AND MAXIMUM WASTE FORECASTS

Activities associated with alternative C waste forecasts would not adversely affect scenic resources or aesthetics. E-Area is already dedicated to industrial use. In all cases, new construction would not be visible from off SRS or from public access roads on SRS. The new facilities would not produce emissions to the atmosphere that would be visible or that would indirectly reduce visibility.

4.3.11 TRAFFIC AND TRANSPORTATION

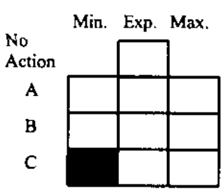
4.3.11.1 Traffic



4.3.11.1.1 Traffic – Expected Waste Forecast

The alternative C – expected waste forecast would require 108 more construction workers than the no-action alternative. As shown in Table 4-44, no roads would exceed carrying capacity. TC

Traffic effects would be minimal. There would be one less waste shipment per day compared to the estimate for the no-action alternative (Table 4-45) due to fewer hazardous waste shipments to and from the RCRA-permitted storage facility. The effect on traffic would be very small. TC



4.3.11.1.2 Traffic – Minimum Waste Forecast

For the minimum forecast, there would be 85 more construction workers than under the no-action alternative. Roads would remain within the design carrying capacity (Table 4-44). Effects on traffic would be minimal. TC

There would be 14 fewer daily waste shipments compared to no-action estimates (Table 4-45). This decrease would be due to smaller volumes of all types of waste. The lower number of hazardous waste shipments would also be due to a lower number of shipments to and from the storage facility. The lower volume of truck traffic would result in a slightly positive effect on traffic. TC

Table 4-44. Number of vehicles per hour during peak hours under alternative C.

Road	Design capacity, vehicles per hour	No-action alternative (percentage of design capacity)	Waste forecast Minimum	Expected	Maximum
Offsite			(percentage of design capacity)		
SC 19	3,000[a]	2,821(94)	2,860(95)	2,870(96)	2,957(99)
SC 125	3,200[a]	2,720(85)	2,757(86)	2,768(87)	2,853(89)
SC 57	2,100[a]	706(34)	714(34)	717(34)	738(35)
Onsite					
Road E at E-Area	2,300[b]	788[c](33)	873[d](38)	896[d](39)	1,089[d](47)

TE
TC

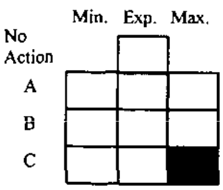
a. Adapted from Smith (1989).
b. Adapted from TRB (1985).
c. Includes baseline plus the maximum number (42) of construction workers (Hess 1995a).
d. Includes baseline plus the maximum number (132 for the minimum, 155 for expected, and 348 for the maximum waste forecast) of construction workers (Hess 1995a).

Table 4-45. SRS daily hazardous and radioactive waste shipments by truck under alternative C.[a]

Waste	1994 no-action traffic[a]	Change from no-action Minimum	Expected	Maximum
Hazardous	14	-6	-1	4
Low-level	7	-3	<1[b]	10
Mixed	8	-5	<1	14
Transuranic[c]	1	<1	<1	15
Total change	NA[d]	-14	-1	43
Total shipments per day	30	16	29	73

TC

a. Shipments per day: To arrive at shipments per day, the total number of waste shipments estimated for the 30 years considered in this EIS was divided by 30 to determine estimated shipments per year. These numbers were divided by 250, which represents working days in a calendar year, to determine shipments per day. Supplemental data are provided in the traffic and transportation section of Appendix E.
b. Values less than 1 are treated as 0 for purposes of comparison.
c. Includes mixed and nonmixed transuranic waste shipments.
d. NA = not applicable.



4.3.11.1.3 Traffic – Maximum Waste Forecast

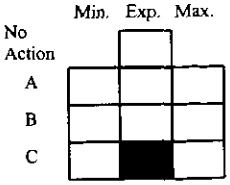
As discussed in Section 4.1.11.1, the 1992 South Carolina highway fatality rate of 2.3 per 100 million miles driven provides a baseline estimate of 5.5 traffic fatalities annually. Under alternative C, the largest increase in construction workers would occur for the maximum waste forecast (301 more workers than under the no-action alternative). These workers would be expected to drive 3.5 million miles annually (3.0 million miles more than under the no-action alternative), which is predicted to result in 1.5 additional traffic fatalities per year. Traffic on roads would remain within design carrying capacity (Table 4-44). Effects on traffic would be minimal. TC

There would be 43 additional daily waste shipments compared to no-action estimates (Table 4-45), TC primarily due to larger volumes of waste and shipments of ashcrete to E-Area. These shipments would originate at various SRS locations (primarily F- and H-Areas) and terminate at the E-Area treatment and disposal facilities. Shipments from the transuranic waste characterization/certification facility, alpha vitrification and non-alpha vitrification facilities, and containment building are not considered because these shipments would occur on a dedicated road that would be designed to accommodate expected traffic flows. The addition of 43 trucks during normal work hours would have minimal adverse effects TC on traffic.

4.3.11.2 Transportation

Consequences from incident-free onsite transportation under alternative C were based on those calculated under the no-action alternative adjusted for changes in number of shipments (as a result of changes in volumes of wastes shipped). Consequences and corresponding health effects from onsite transportation accidents for any given shipment are independent of the number of shipments and are, therefore, the same as the no-action alternative. These results are provided in Table 4-8. The probability of an accident occurring for each type of waste shipped is provided in Table 4-26. TE

For alternative C, DOE analyzed the impacts that would result from offsite shipments of mixed waste (lead) and low-level waste. Methodology and receptors are defined in Section 4.2.11. Incident-free doses from offsite shipments were calculated as in Section 4.1.11.2.1.



4.3.11.2.1 Transportation – Expected Waste Forecast

Incident-Free Radiological Impacts

The dose and number of excess fatal cancers from incident-free transportation for alternative C – expected waste forecast would not change from the no-action alternative in any receptor group except involved workers (Table 4-46) because of the minimal increases in volumes of waste shipped under this alternative. Involved workers' exposures would increase slightly due to the increased volume of low-level equipment shipped.

Table 4-46. Annual dose (percent change from the no-action alternative) and associated excess latent cancer fatalities from incident-free onsite transport of radioactive material for alternative C – expected waste forecast.

TC

Waste[a]	Uninvolved worker[b] (rem)		Uninvolved workers (person-rem)		Involved workers (person-rem)	
Low-level	0.011	(0%)	2.0	(2%)	190	(31%)
Mixed	5.8×10^{-5}	(5%)	0.12	(4%)	4.4	(2%)
Transuranic	1.3×10^{-4}	(0%)	0.0095	(0%)	0.15	(0%)
Total[c]	0.011[d]		2.1[e]		200[e]	
Excess latent cancer fatalities	4.5×10^{-6}[f]		8.6×10^{-4}[g]		0.079[g]	

a. See Appendix E for a list of waste streams which make up each waste type. Dose is based on exposure to all waste streams of a particular waste type.
b. See Section 4.1.11.2 for descriptions of receptors
c. Totals rounded to two significant figures.
TE d. Assumes the same individual has maximal exposure to each waste (Appendix E) for a single year.
e. Dose from 1 year of exposure to incident-free transportation of waste (see Appendix E).
f. Additional probability of an excess latent fatal cancer
g. Value equals the total dose × the risk factor (0.0004 excess latent fatal cancer per person-rem).

The probability of an uninvolved worker developing an excess fatal cancer would be about 1 in 220,000 from incident-free onsite transportation of radioactive material (Table 4-44). The number of additional fatal cancers in the involved and uninvolved workers workforce due to incident-free onsite transportation would be about two, while the uninvolved workers would be less than one.

The annual probability of a member of the public developing an excess fatal cancer would be about 1 in 58 million from incident-free offsite transportation of radioactive material (Table 4-47). The additional

Table 4-47. Annual dose and excess latent cancer fatalities from incident-free offsite transport of radioactive material for alternative C – expected waste forecast.

Waste	Involved workers[a] (person-rem)	Remote MEI[b] (rem)	Remote population (person-rem)
Low-level	0.36	3.3×10^{-5}	0.54
Mixed	0.012	3.2×10^{-8}	0.0025
Totals[c]	0.37	3.3×10^{-5}	0.54
Excess latent cancer fatalities	1.5×10^{-4}	1.7×10^{-8}[d]	2.7×10^{-4}

TC

a. See Section 4.1.11.2 for descriptions of receptors.
b MEI = maximally exposed individual.
c. Dose for the remote MEI assumes exposure to each waste (see Appendix E) in a year; for the populations, dose is the result of exposure to 1 year of incident-free transportation of waste (see Appendix E). TE
d. Additional probability of an excess latent fatal cancer.

fatal cancers that could develop in members of the public and involved workers from exposure to offsite waste shipments would be less than one.

Transportation Accident Impacts

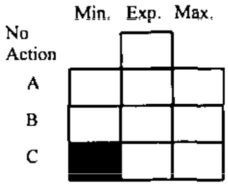
The probability of an onsite accident would be similar to that under the no-action alternative because similar waste volumes would be shipped; the consequences due to an accident would be the same as described in Section 4.1.11.2.2. Effects from accidents involving offsite shipments were calculated as in Section 4.1.11.2.2. The results are summarized in Table 4-48. Probabilities of an accident involving each waste type are presented in Table 4-26.

Table 4-48. Probability of an accident during 30 years of offsite transport of radioactive material for each waste forecast under alternative C, dose, and excess latent cancer fatalities from an accident.

	Probability of an accident				
Waste	Minimum forecast	Expected forecast	Maximum forecast	Dose (person-rem)	Number of excess latent fatal cancers
Low-level	7.2×10^{-7}	1.3×10^{-6}	3.4×10^{-6}	5.2×10^{-4}	2.6×10^{-7}
Mixed	4.6×10^{-4}	1.1×10^{-3}	2.7×10^{-3}	0.0047	2.4×10^{-6}

TC

The low consequences and associated excess latent cancer fatalities in the remote population from offsite shipments for alternative C – expected waste forecast (Table 4-48) would be comparable to consequences to the onsite population under the no-action alternative (Table 4-8) and alternative A (Table 4-25). An offsite accident would be less severe than one involving onsite shipments because of the small volume of waste shipped offsite. There would be less than one additional cancer to members of the general public from accidents during 30 years of waste shipments.



4.3.11.2.2 Transportation – Minimum Waste Forecast

Incident-Free Radiological Impacts

For alternative C – minimum waste forecast, there would be decreases in dose to all receptors from radioactive waste shipments (Table 4-49) compared to the expected waste forecast (Table 4-46) as a result of the decrease in volumes of all wastes. The annual probability of an uninvolved worker developing a fatal cancer from incident-free onsite transport would be about 1 in 430,000 (Table 4-49).

Table 4-49. Annual dose (percent change from the expected waste forecast) and associated excess latent cancer fatalities from incident-free onsite transport of radioactive material for alternative C – minimum waste forecast.

TC

Waste[a]	Uninvolved worker[b] (rem)		Uninvolved workers (person-rem)		Involved workers (person-rem)	
Low-level	0.0057	(-49%)	0.98	(-51%)	100	(-47%)
Mixed	2.3×10^{-5}	(-61%)	0.050	(-60%)	1.7	(-62%)
Transuranic	9.0×10^{-5}	(-30%)	0.0066	(-30%)	0.10	(-30%)
Total[c]	0.0058[d]		1.0[e]		100[e]	
Excess latent cancer fatalities	2.3×10^{-6}[f]		4.1×10^{-4}[g]		0.041[g]	

a. See Appendix E for a list of waste streams which make up each waste type. Dose is based on exposure to all waste streams of a particular waste type.
TE b. See Section 4.1.11.2 for descriptions of receptors.
c. Totals were rounded to two significant figures.
d. Assumes the same individual has maximal exposure to each waste (Appendix E) for a single year.
e. Dose from 1 year of exposure to incident-free transportation of waste (see Appendix E).
f. Additional probability of an excess latent fatal cancer.
g. Value equals the total dose × the risk factor (0.0004 excess latent fatal cancers per person-rem).

The involved worker population and the uninvolved workers could expect less than one additional fatal cancer per year from onsite transportation.

The probability per year that a member of the public would develop an excess fatal cancer from incident-
TC free offsite transportation of radioactive material would be 1 in 110 million (Table 4-50). The number of

Table 4-50. Annual dose and excess latent cancer fatalities from incident-free offsite transport of radioactive material for alternative C – minimum waste forecast.

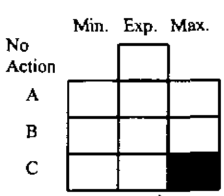
Waste	Involved workers (person-rem)	Remote MEI[a] (rem)	Remote population (person-rem)	
Low-level	0.20	1.8×10^{-5}	0.31	
Mixed	0.0052	1.4×10^{-8}	0.0011	
Totals[b]	0.21	1.8×10^{-5}	0.31	TC
Excess latent cancer fatalities	8.4×10^{-5}	9.0×10^{-9}[c]	1.6×10^{-4}	

a. MEI = maximally exposed individual.
b. Dose for the remote MEI assumes exposure to each waste (see Appendix E) in a year; for the populations, dose is the result of 1 year of incident-free transportation of waste (see Appendix E). TE
c. Additional probability of an excess latent fatal cancer.

additional fatal cancers in both the remote population and the involved worker population would be less than one.

Transportation Accident Impacts

The probability of an onsite accident involving radioactive wastes would decrease slightly (Table 4-26) for the minimum waste forecast because of the decreased volumes that would be shipped compared to the expected waste forecast; however, the consequences due to an accident would be the same as described in Section 4.1.11.3. Effects of offsite accidents would be the same for the expected case (Table 4-48); however, the probability of an offsite accident would decrease by about one-half compared to the expected waste forecast because of the decrease in volume of waste shipped.



4.3.11.2.3 Transportation – Maximum Waste Forecast

Incident-Free Radiological Impacts

For the maximum waste forecast, there would be large increases in dose to all receptors (Table 4-51) due to the increases in volumes of wastes shipped. These increases would be similar to those that would occur for alternative A – maximum waste forecast. The annual probability of an uninvolved worker developing an excess fatal cancer would be about 1 in 150,000 (Table 4-51). The involved workers

Table 4-51. Annual dose (percent change from the expected waste forecast) and excess latent cancer fatalities from incident-free onsite transport of radioactive material for alternative C – maximum waste forecast.

Waste[a]	Uninvolved worker[b] (rem)		Uninvolved workers (person-rem)		Involved workers (person-rem)	
Low-level	0.014	(27%)	2.6	(31%)	350	(83%)
Mixed	2.0×10^{-4}	(247%)	0.45	(263%)	19	(321%)
Transuranic	0.0021	(1,550%)	0.16	(1,550%)	2.4	(1,550%)
Total[c]	0.016[d]		3.2[e]		370[e]	
Excess latent cancer fatalities	6.6×10^{-6}[f]		0.0013[g]		0.15[g]	

a. See Appendix E for a list of waste streams which make up each waste type. Dose is based on exposure to all waste streams of a particular waste type.
TE | b. See Section 4.1.11.2 for descriptions of receptors.
c. Totals rounded to two significant figures.
d. Assumes the same individual has maximal exposure to each waste type (Appendix E) for a single year.
e. Dose from 1 year of exposure to incident-free transportation of waste (see Appendix E).
TC | f. Additional probability of an excess latent fatal cancer.
g. Value equals the total dose × the risk factor (0.0004 excess latent fatal cancers per person-rem).

population and the uninvolved workers could expect less than one additional fatal cancer per year from 30 years of incident-free transport.

Table 4-52 shows that the probability of a member of the public developing a fatal cancer is about 1 in 23 million per year from incident-free offsite transportation of radioactive material. The number of cancers that could develop in members of the public and involved workers would be less than one.

Table 4-52. Annual dose and excess latent cancer fatalities from incident-free offsite transport of radioactive material for alternative C – maximum waste forecast.

Waste	Involved workers (person-rem)	Remote MEI[a] (rem)	Remote population (person-rem)
Low-level	0.94	8.6×10^{-5}	1.4
Mixed	0.031	8.2×10^{-8}	0.0064
Totals[b]	0.97	8.6×10^{-5}	1.4
Excess latent cancer fatalities	3.84×10^{-4}	4.3×10^{-8}[c]	7.0×10^{-4}

a. MEI = maximally exposed individual.
TE | b. Dose for the remote MEI assumes exposure to each waste (see Appendix E) in a year; for the populations, dose is the result of exposure to 1 year of incident-free transportation of waste (see Appendix E).
c. Additional probability of an excess latent fatal cancer.

Transportation Accident Impacts

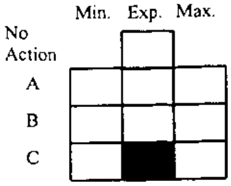
The probability of an onsite accident involving radioactive wastes would increase (Table 4-26) under the maximum waste forecast because more waste would be shipped compared to the expected waste forecast; however, the consequences due to a particular accident would be the same as described in Section 4.1.11.3. Effects of offsite shipments would be the same as for the expected case (Table 4-48); however, the probability of an offsite accident would be three times greater than that in the expected waste forecast because of the increase in volume of waste shipped. TE

4.3.12 OCCUPATIONAL AND PUBLIC HEALTH

Under alternative C, the non-alpha vitrification facility (including soil sorting), the transuranic waste characterization/certification facility, the Consolidated Incineration Facility, the alpha vitrification facility, compaction facilities, and the containment building would operate. Emissions from these facilities would increase adverse health effects over the no-action alternative for each of the three waste forecasts. However, effects would be small overall, except to involved workers under the maximum waste forecast.

For involved workers, the sources of most exposure would be the transuranic waste storage pads, the non-alpha vitrification facility, the Consolidated Incineration Facility, the H-Area high-level waste tank farm, and the transuranic waste characterization/certification facility; for the public and uninvolved workers the sources of most exposure would be the environmental releases from the alpha vitrification facility, the non-alpha vitrification facility, the Consolidated Incineration Facility, and the transuranic waste characterization/certification facility. (Consolidated Incineration Facility impacts are summarized in Appendix B.5.)

For radiological assessments, the same general methodology was used as under the no-action alternative (Section 4.1.12). The same risk estimators were used to convert doses to fatal cancers, and wastes were classified into treatability groups to facilitate the evaluations. However, the development of radiological source terms and worker exposures was much more involved. The expected performance of new facilities was based on actual design information, if available, augmented as necessary with operating experience with similar facilities.



4.3.12.1 <u>Occupational and Public Health – Expected Waste Forecast</u>

For alternative C – expected waste forecast, the amounts of wastes would be the same as under the no-action alternative. Refer to Section 4.1.12 for a discussion of the no-action alternative.

4.3.12.1.1 Occupational Health And Safety

Radiological Impacts

Table 4-53 presents the worker doses and resulting health effects associated with alternative C – expected waste forecast. The doses (0.04 rem per year) would remain well within the SRS administrative guideline of 0.8 rem per year. The probabilities and projected numbers of fatal cancers from 30 years of alternative C waste management operations under this forecast would be much lower than those expected from all causes during the workers' lifetimes. It is expected that there would be 1.1
TE additional fatal cancers in the projected workforce of 2,184 involved workers.

Nonradiological Impacts

DOE considered potential nonradiological impacts to SRS workers from air emissions from the following facilities: the Defense Waste Processing Facility, including In-Tank Precipitation; the M-Area Vendor Treatment Facility; the Consolidated Incineration Facility; Building 645-2N, mixed waste storage; four new solvent tanks; the transuranic waste characterization/certification facility (includingsoil sorting); the containment building; the non-alpha vitrification facility (including soil sorting); and the alpha vitrification facility. Occupational health impacts to employees in the Defense Waste Processing Facility, including In-Tank Precipitation, were discussed in the *Final Supplemental Environmental Impact Statement, Defense Waste Processing Facility*. Occupational health impacts to employees associated with the Consolidated Incineration Facility were discussed in the *Environmental Assessment, Consolidated Incineration Facility*.

Table E.2-3 in Appendix E presents a comparison between Occupational Safety and Health Administration permissible exposure limit values and potential exposures to uninvolved workers at both 100 meters (328 feet) and 640 meters (2,100 feet) from each facility for the expected, minimum, and
TE maximum waste forecasts. Downwind concentrations were calculated using EPA's TSCREEN model

Table 4-53. Worker radiological doses and resulting health effects associated with the implementation of alternative C.[a]

Receptor(s)	No-action alternative	Waste forecast: Expected	Waste forecast: Minimum	Waste forecast: Maximum
Individual involved worker[b]				
• Average annual dose (rem)	0.025	0.040	0.038	0.060
• Associated probability of a fatal cancer	1.0×10^{-5}	1.6×10^{-5}	1.5×10^{-5}	2.4×10^{-5}
• 30-year dose to average worker (rem)	0.75	1.2	1.2	1.8
• Associated probability of a fatal cancer	3.9×10^{-4}	4.8×10^{-4}	4.6×10^{-4}	7.2×10^{-4}
All involved workers[c,b]				
• Annual dose (person-rem)	52	86	83	150
• Associated number of fatal cancers	0.021	0.035	0.033	0.060
• 30-year dose (person-rem)	1,600	2,600	2,500	4.5×10^{4}
• Associated number of a fatal cancer	0.62	1.0	1.0	1.8
Individual uninvolved worker[b,d]				
• Annual dose at 100 meters (rem)[a] (associated probability of a fatal cancer)	1.0×10^{-5} (4.1×10^{-9})	0.0094 3.8×10^{-6}	0.0045 1.8×10^{-6}	0.22 (8.8×10^{-5})
• Annual dose at 640 meters (rem) (associated probability of a fatal cancer)	2.9×10^{-7} (1.1×10^{-10})	0.0031 1.2×10^{-6}	0.0014 5.7×10^{-7}	0.073 2.9×10^{-5}
• 30-year dose at 100 meters (rem) (associated probability of a fatal cancer)	3.0×10^{-4} (1.2×10^{-7})	0.28 1.1×10^{-4}	0.14 5.4×10^{-5}	6.6 (0.003)
• 30-year dose at 640 meters (rem) (associated probability of a fatal cancer)	8.6×10^{-6} (3.4×10^{-9})	0.092 3.7×10^{-5}	0.043 1.7×10^{-5}	2.2 (0.0009)

TC

a. Supplemental facility information is provided in Appendix E.
b. Annual individual worker doses can be compared with the regulatory dose limit of 5 rem (10 CFR 835) and with the SRS administrative exposure guideline of 0.8 rem. Operational procedures ensure that the dose to the maximally exposed worker will also remain within the regulatory dose limit as is reasonably achievable.
c. The number of involved workers is estimated to be 2,184 for the expected waste forecast, 2,169 for the minimum forecast, and 2,526 for the maximum forecast.
d. Dose is due to emissions from the alpha and non-alpha vitrification facilities. Doses conservatively assume 80 hours per week of exposure.

(EPA 1988). For each facility's emissions under the expected waste forecast, employee occupational exposure would be less than Occupational Safety and Health Administration permissible exposure limits. DOE expects minimal health impacts as a result of uninvolved worker exposure to emissions from these facilities.

4.3.12.1.2 Public Health and Safety

Radiological Impacts

Table 4-54 presents the radiological doses to the public and resulting health effects associated with the alternative C – expected waste forecast. The annual doses to the offsite maximally exposed individual
TC (0.18 millirem) and to the SRS regional population (10 person-rem) would be about the same as those that resulted from total SRS operations in 1993, which were more than 10 times lower than the regulatory limits (Arnett, Karapatakis, and Mamatey 1994). For the offsite facility (assumed to be located in Oak Ridge, Tennessee, for the purposes of this assessment) under this forecast, the annual doses to the offsite maximally exposed individual (3.6×10^{-4} millirem) and to regional population
TC (2.4×10^{-3} person-rem) surrounding Oak Ridge, Tennessee, represent a very small fraction (less than 0.3 percent) of the comparable doses to the SRS regional population. These doses remain less than 0.3 percent of the comparable SRS doses for all waste forecast under this alternative (see Appendix E for facility specific data). For this waste forecast, radiologically induced health effects to the public (0.15 fatal cancers from 30 years of exposure) would be very small (Table 4-54).

Nonradiological Impacts

Potential nonradiological impacts to individuals residing offsite are considered for both criteria and carcinogenic pollutants. Maximum site boundary-line concentrations for criteria pollutants are discussed in Section 4.3.5.1.2.

For routine releases from SRS operating facilities for the expected waste forecast, criteria pollutant concentrations would be within state and federal ambient air quality standards, as discussed in Section 4.3.5.1.2. During periods of construction, the criteria pollutant concentrations at the SRS boundary would not exceed air quality standards under normal operating conditions. Neither the state nor the federal air quality standards would be exceeded by actual emissions from SRS. Emissions of criteria pollutants would have negligible health effects on offsite individuals.

Table 4-54. Radiological doses associated with the implementation of alternative C and resulting health effects to the public.[a]

	No-action alternative				Alternative C			
	Dose[b]				Dose[b]			
Waste forecast/receptor(s)	Atmospheric releases	Aqueous releases	Total	Probability[c] or number of fatal cancer	Atmospheric releases[f]	Aqueous releases	Total	Probability[c] or number of fatal cancers
Expected waste generation								
Offsite MEI[d]								
• Annual, millirem	1.2×10^{-4}	6.9×10^{-4}	8.1×10^{-4}	4.1×10^{-7}	0.18	6.9×10^{-4}	0.18	9.0×10^{-8}
• 30-year, millirem	0.0037	0.021	0.025	1.2×10^{-8}	5.4	0.021	5.4	2.7×10^{-6}
Population								
• Annual, person-rem	2.9×10^{-4}	0.0068	0.0071	3.5×10^{-6}	10	0.0068	10	0.0050
• 30-year, person-rem	0.0086	0.20	0.21	1.0×10^{-4}	302	0.20	302	0.15
Minimum waste generation								
Offsite MEI								
• Annual, millirem	NA[e]	NA	NA	NA	0.09	6.9×10^{-4}	0.09	4.6×10^{-8}
• 30-year, millirem	NA	NA	NA	NA	2.71	0.021	2.7	1.4×10^{-6}
Population								
• Annual, person-rem	NA	NA	NA	NA	4.9	0.0068	4.9	0.0025
• 30-year, person-rem	NA	NA	NA	NA	148	0.20	148	0.074
Maximum waste generation								
Offsite MEI								
• Annual, millirem	NA	NA	NA	NA	4.0	6.9×10^{-4}	4.0	2.0×10^{-6}
• 30-year, millirem	NA	NA	NA	NA	120	0.021	120	6.0×10^{-5}
Population								
• Annual, person-rem	NA	NA	NA	NA	229	0.0068	229	0.11
• 30-year, person-rem	NA	NA	NA	NA	6,880	0.20	6,880	3.4

TC

a. Supplemental facility information is provided in Appendix E.
b. For atmospheric releases, the dose is to the population within 80 kilometers (50 miles) of SRS. For aqueous releases, the dose is to the people using the Savannah River from SRS to the Atlantic Ocean.
c. For the offsite maximally exposed individual, probability of a fatal cancer; for population, number of fatal cancers.
d. MEI = maximally exposed individual.
e. NA = not applicable.

TC f. Atmospheric releases for MEI and population include contribution from offsite facilities, which contribute less than 0.3 percent to the atmospheric releases reported here.

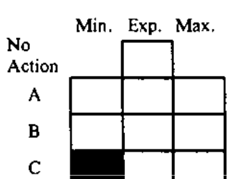
Note: The doses to the public from total SRS operations in 1993 were 0.25 millirem to the offsite maximally exposed individual and 9.1 person-rem to the regional population. These doses, when added to the doses associated with the waste management alternative that are given in this table, are assumed to equal total SRS doses. For the maximum waste forecast (which gives the highest doses), the total annual dose to the offsite maximally exposed individual and the regional population would equal 4.42 millirem (0.25 + 4.17) and approximately 248 person-rem (9.1 + 239), respectively. The individual dose would fall below the proposed annual regulatory limits of 10 millirem from airborne releases, 4 millirem from drinking water, and 100 millirem from all pathways combined (proposed 10 CFR 834); the population dose would be lower than the proposed annual notification limit of 100 person-rem (proposed 10 CFR 834).

Offsite risks due to carcinogens are calculated using the Industrial Source Complex 2 model (Stewart 1994) for the facilities listed in Section 4.3.12.1.1. Emissions of carcinogenic compounds are based on the types and quantities of waste being processed at each facility. Table 4-55 shows the individual lifetime cancer risks calculated from unit risk factors (see Section 4.1.12.2.2) derived from EPA's Integrated Risk Information System data base (EPA 1994). The estimated increased probability of an individual developing cancer over a lifetime due to routine SRS emissions under the expected waste forecast is approximately 2 in 10 million (Table 4-55). DOE expects minimal health impacts from emissions of carcinogenic compounds.

4.3.12.1.3 Environmental Justice Assessment

Section 4.1.12.2.3 describes the methodology for analyzing radiological dose emissions to determine if there would be environmental justice concerns. Figure 4-24 illustrates the results of the analysis for alternative C expected waste forecast for the 80-kilometer (50-mile) region of interest in this EIS. Supporting data for the analysis can be found in the environmental justice section of Appendix E.

TE The predicted per capita dose differs very little between types of communities at a given distance from SRS, and the per capita dose is extremely small in each type of community. This analysis indicates that people of color or low income in the 80-kilometer (50-mile) region would be neither disproportionately nor adversely impacted. Therefore, environmental justice issues would not be a concern for the alternative C – expected waste forecast.



4.3.12.2 Occupational and Public Health – Minimum Waste Forecast

Because the waste amounts for alternative C – minimum waste forecast would be smaller than for the expected forecast and the treatment operations the same, the impacts to workers and the public would be smaller than described in Section 4.3.12.1.

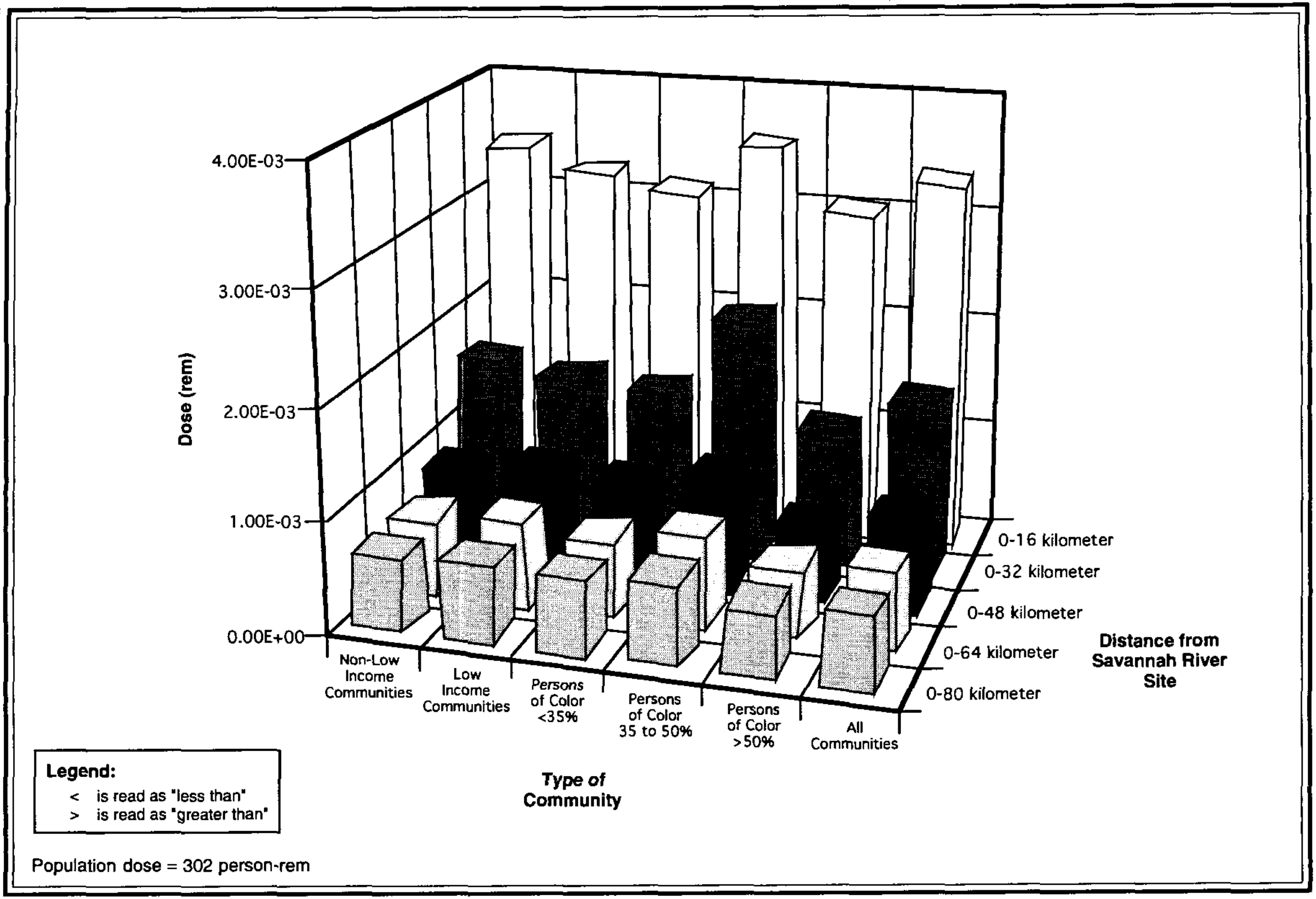
Table 4-55. Estimated probability of excess latent cancers in the offsite population from nonradiological carcinogens emitted under alternative C.

TC

Pollutant	Unit risk factor[a] (latent cancers/ μg/m³)[e]	Concentration[b,c] Expected waste forecast (μg/m³)	Minimum waste forecast (μg/m³)	Maximum waste forecast (μg/m³)	Latent cancers[d] Expected waste forecast	Minimum waste forecast	Maximum waste forecast
Acetaldehyde	2.2×10^{-6}	4.6×10^{-7}	2.4×10^{-7}	1.0×10^{-6}	4.4×10^{-13}	2.3×10^{-13}	9.6×10^{-13}
Acrylamide	0.0013	4.6×10^{-7}	2.4×10^{-7}	1.0×10^{-6}	2.6×10^{-10}	1.3×10^{-10}	5.6×10^{-10}
Acrylonitrile	6.8×10^{-5}	4.6×10^{-7}	2.4×10^{-7}	1.0×10^{-6}	1.3×10^{-11}	7.0×10^{-12}	3.0×10^{-11}
Arsenic Pentoxide	0.0043	1.0×10^{-6}	4.1×10^{-7}	2.0×10^{-6}	1.8×10^{-9}	7.6×10^{-10}	3.7×10^{-9}
Asbestos	0.23	5.9×10^{-8}	4.6×10^{-8}	2.3×10^{-7}	5.8×10^{-9}	4.5×10^{-9}	2.3×10^{-8}
Benzene	8.3×10^{-6}	0.044	0.044	0.044	1.6×10^{-7}	1.6×10^{-7}	1.6×10^{-7}
Benzidine	0.067	4.6×10^{-7}	2.4×10^{-7}	1.0×10^{-6}	1.3×10^{-8}	6.9×10^{-9}	2.9×10^{-8}
Bis(chloromethyl) ether	0.062	4.6×10^{-7}	2.4×10^{-7}	1.0×10^{-6}	1.2×10^{-8}	6.4×10^{-9}	2.7×10^{-8}
Bromoform	1.1×10^{-6}	4.6×10^{-7}	2.4×10^{-7}	1.0×10^{-6}	2.2×10^{-13}	1.1×10^{-13}	4.8×10^{-13}
Carbon Tetrachloride	1.5×10^{-5}	1.1×10^{-5}	1.1×10^{-5}	1.4×10^{-5}	7.1×10^{-11}	6.8×10^{-11}	9.0×10^{-11}
Chlordane	3.7×10^{-4}	4.6×10^{-7}	2.4×10^{-7}	1.0×10^{-6}	7.3×10^{-11}	3.8×10^{-11}	1.6×10^{-10}
Chloroform	2.3×10^{-5}	0.003	0.003	0.003	3.0×10^{-8}	3.0×10^{-8}	3.0×10^{-8}
Cr(+6) Compounds	0.012	1.4×10^{-8}	7.4×10^{-9}	3.2×10^{-8}	7.2×10^{-11}	3.8×10^{-11}	1.6×10^{-10}
Formaldehyde	1.3×10^{-5}	9.4×10^{-7}	7.2×10^{-7}	1.5×10^{-6}	5.3×10^{-12}	4.0×10^{-12}	8.3×10^{-12}
Heptachlor	0.0013	1.1×10^{-6}	5.9×10^{-7}	2.5×10^{-6}	6.4×10^{-10}	3.3×10^{-10}	1.4×10^{-9}
Hexachlorobenzene	$4.6\times10{-4}$	4.6×10^{-7}	2.4×10^{-7}	1.0×10^{-6}	9.1×10^{-11}	4.7×10^{-11}	2.0×10^{-10}
Hexachlorobutadiene	2.2×10^{-5}	4.6×10^{-7}	2.4×10^{-7}	1.0×10^{-6}	4.4×10^{-12}	2.3×10^{-12}	9.6×10^{-12}
Hydrazine	0.0049	4.6×10^{-7}	2.4×10^{-7}	1.0×10^{-6}	9.7×10^{-10}	5.0×10^{-10}	2.1×10^{-9}
1,1,2,2-Tetrachloroethane	5.8×10^{-5}	9.2×10^{-6}	4.7×10^{-6}	2.0×10^{-5}	2.3×10^{-10}	1.2×10^{-10}	5.0×10^{-10}
1,1,2-Trichloroethane	1.6×10^{-5}	4.6×10^{-7}	2.4×10^{-7}	1.0×10^{-6}	3.2×10^{-12}	1.6×10^{-12}	7.0×10^{-12}
Toxaphene	3.2×10^{-4}	1.1×10^{-6}	5.9×10^{-7}	2.5×10^{-6}	1.4×10^{-10}	8.1×10^{-11}	3.5×10^{-10}
1,1 Dichloroethene	5.0×10^{-5}	2.2×10^{-5}	2.2×10^{-5}	2.8×10^{-5}	4.8×10^{-10}	4.6×10^{-10}	6.0×10^{-10}
Methylene Chloride	4.7×10^{-7}	9.4×10^{-7}	7.2×10^{-7}	1.5×10^{-6}	1.9×10^{-13}	1.5×10^{-13}	3.0×10^{-13}
				TOTAL	2.2×10^{-7}	2.1×10^{-7}	2.7×10^{-7}

a. Source: EPA (1994).
b. Maximum annual boundary line concentration.
c. Source: Stewart (1994).
d. Latent cancer probability equals unit risk factor times concentration times 30 years divided by 70 years.
e. Micrograms per cubic meter of air.

TC



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TE | **Figure 4-24.** Dose to individuals in communities within 80 kilometers (50 miles) of SRS for alternative C – expected forecast.

4.3.12.2.1 Occupational Health and Safety

Radiological Impacts

Table 4-53 includes the worker doses and resulting health effects associated with the minimum waste forecast. Doses (0.039 rem per year) and health effects associated with this case would be smaller than those associated with the expected waste forecast. From 30 years of exposure, there would be one additional fatal cancer in the workforce of 2,169.

Nonradiological Impacts

Table E.2-3 in Appendix E presents a comparison of the nonradiological air concentrations to SRS workers exposed under the minimum waste forecast based on Occupational Safety and Health Administration permissible exposure limits values. Exposures to SRS workers are either equal to or less than those occurring in the expected waste forecast. For all facilities, employee occupational exposure would be less than Occupational Safety and Health Administration permissible exposure limits. Negligible impacts to worker's health would occur due to emissions under the minimum waste forecast. TE

4.3.12.2.2 Public Health and Safety

Radiological Impacts

Table 4-54 includes the doses to the public and the resulting health effects associated with the minimum waste forecast. Doses and health effects associated with this case would be smaller than those associated with the expected waste forecast.

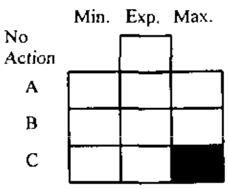
Nonradiological Impacts

Potential nonradiological impacts to individuals residing offsite are considered for both criteria and carcinogenic pollutants under the minimum waste forecast. For routine releases from operating facilities, criteria pollutant concentrations would be within state and Federal ambient air quality standards, as discussed in Section 4.3.5.2. During periods of construction, the criteria pollutant concentrations at the SRS boundary would not exceed air quality standards under normal operating conditions. DOE expects very small health impacts to the public from emissions of criteria pollutants.

TC Table 4-55 presents offsite risks from emissions of carcinogens. The overall incremental lifetime cancer risk is approximately 2 in 10 million. DOE expects very small health impacts to the public from emissions of carcinogenic compounds.

4.3.12.2.3 Environmental Justice Assessment

Figure 4-25 illustrates the results of the analysis for alternative C – minimum waste forecast for the 80-kilometer (50-mile) region of interest in this EIS. No communities would be disproportionately affected by emissions resulting from this case.



4.3.12.3 <u>Occupational and Public Health – Maximum Waste Forecast</u>

The amounts of wastes to be treated for alternative C – maximum waste forecast would be larger than for the minimum and expected waste forecasts, but the treatment operations would be the same. The maximum waste forecast would result in the greatest effects on worker and public health.

4.3.12.3.1 Occupational Health and Safety

Radiological Impacts

Table 4-53 includes the worker doses and resulting health effects associated with the maximum waste forecast. The doses would remain below the SRS administrative guideline of 0.8 rem per year. TE However, it is projected that two people in the involved workforce of 2,526 could develop a fatal cancer sometime during their lifetimes as the result of 30 years of exposure.

Nonradiological Impacts

Table E.2-3 in Appendix E presents a comparison of the nonradiological air concentrations to SRS workers exposed under the maximum waste forecast based on Occupational Safety and Health Administration permissible exposure limits values. Exposures to SRS workers are either equal to or greater than those occurring in the expected waste forecast. However, for all facilities, employee occupational exposure would be less than Occupational Safety and Health Administration permissible

TC

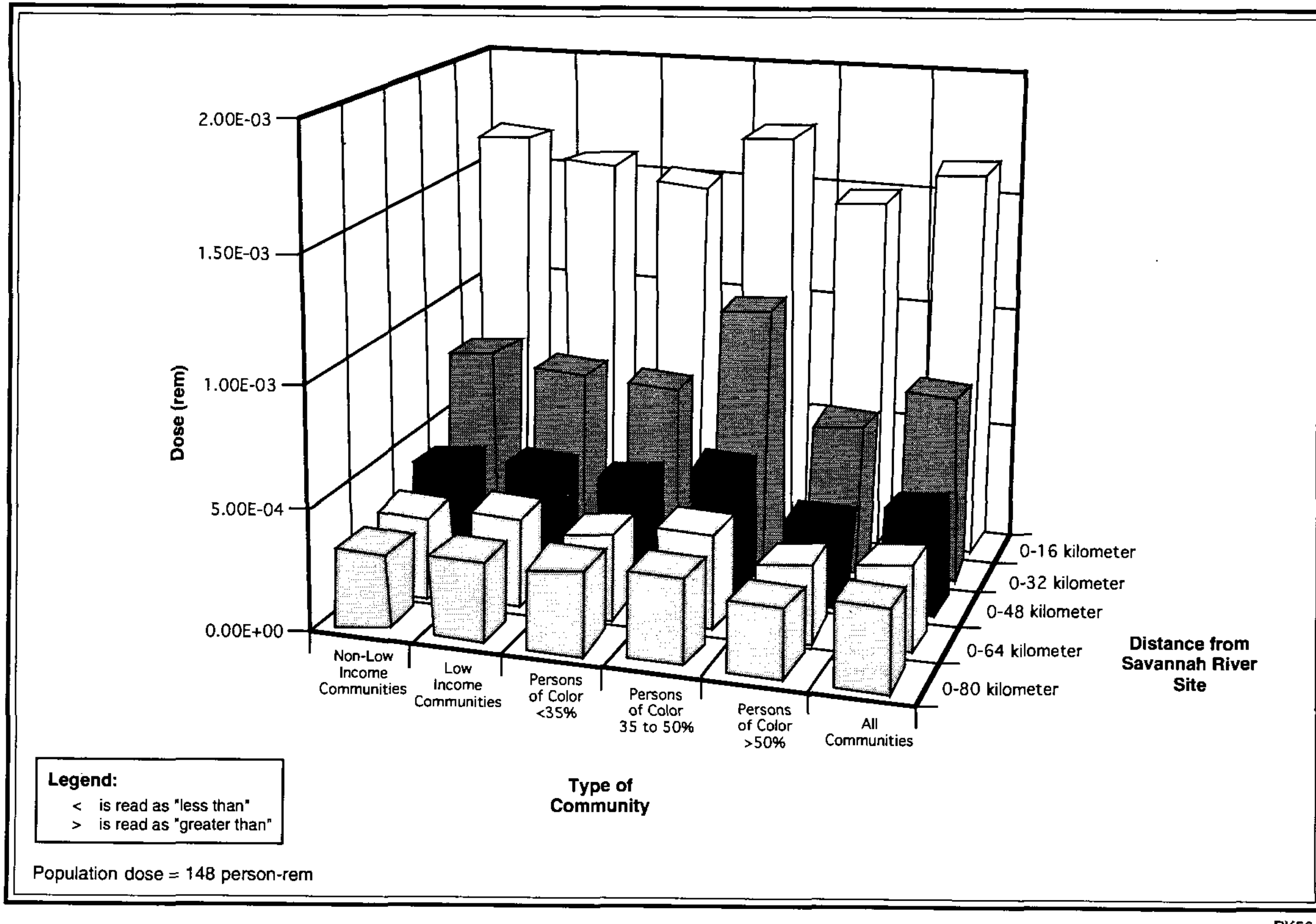


Figure 4-25. Dose to individuals in communities within 80 kilometers (50 miles) of SRS for alternative C – minimum forecast.

TE

exposure limits. DOE expects minimal health impacts from emissions from facilities under the maximum waste forecast.

4.3.12.3.2 Public Health and Safety

Radiological Impacts

TC Table 4-54 includes the doses to the public and resulting health effects associated with the maximum waste forecast. The annual doses to the offsite maximally exposed individual (4.0 millirem) and to the regional population (229 person-rem) would exceed the corresponding doses of 0.25 millirem and 9.1 person-rem, respectively, from total SRS operations in 1993 (Arnett, Karapatakis, and Mamatey 1994). However, regulatory dose limits would not be exceeded (refer to note on Table 4-54).

TE The health effects associated with the maximum waste forecast are included in Table 4-54. Based on a risk estimator of 0.0005 latent cancer fatality per rem (Section 4.1.12.2), the probability of the offsite maximally exposed individual developing a fatal cancer from 30 years of exposure to radiation TC L004-12 associated with this waste forecast would be 6 in 100,000, and the number of additional fatal cancers in the regional population could be 3.4. This probability of a fatal cancer is much smaller than the one chance in four (23.5 percent) that a member of the public will develop a fatal cancer from all causes, and the number of fatal cancers is much less than the 145,700 fatal cancers that the regional population of 620,100 can expect to develop from all causes during their lifetimes.

TE Each alternative C waste forecast would result in larger radiological doses to the public and consequent health effects than would alternative A (see Tables 4-33 and 4-54).

Nonradiological Impacts

Potential nonradiological impacts to individuals residing offsite are considered for both criteria and carcinogenic pollutants for alternative C – maximum waste forecast.

For routine releases from operating facilities, criteria pollutant concentrations would be within state and Federal ambient air quality standards, as discussed in Section 4.3.5.3. During periods of construction, the criteria pollutant concentrations at the SRS boundary would not exceed air quality standards under normal operating conditions.

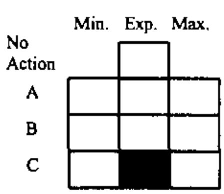
Table 4-55 presents offsite risks from carcinogens. The overall change in lifetime cancer risk is approximately 3 in 10 million, which is greater than the risk associated with expected waste forecast. TC Nonetheless, very small health effects to the public are expected from facilities in the maximum waste forecast.

4.3.12.3.3 Environmental Justice Assessment

Figure 4-26 illustrates the results of the analysis for alternative C – maximum waste forecast for the 80-kilometer (50-mile) region of interest in this EIS. No communities would be disproportionately affected by emissions resulting from this case.

4.3.13 FACILITY ACCIDENTS

This section summarizes the risks to workers and members of the public from potential facility accidents associated with the various wastes under alternative C. The methodologies used to develop the radiological and hazardous material accident scenarios are the same as those discussed in Section 4.1.13.1 for the no-action alternative.



4.3.13.1 Facility Accidents – Expected Waste Forecast

Figures 4-27 through 4-30 summarize the projected impacts of radiological accidents on the population, the offsite maximally exposed individual, and uninvolved workers at 640 meters (2,100 feet) and 100 meters (328 feet) for alternative C – expected waste forecast. An anticipated accident (i.e., one occurring between once every 10 years and once every 100 years) involving mixed waste presents the greatest risk under alternative C to the population within 80 kilometers (50 miles) of SRS (see Figure 4-27). This accident scenario would increase the risk to the population within 80 kilometers (50 miles) by 1.7×10^{-2} latent fatal cancer per year. The postulated accident scenarios associated with the various waste types are described in Appendix F.

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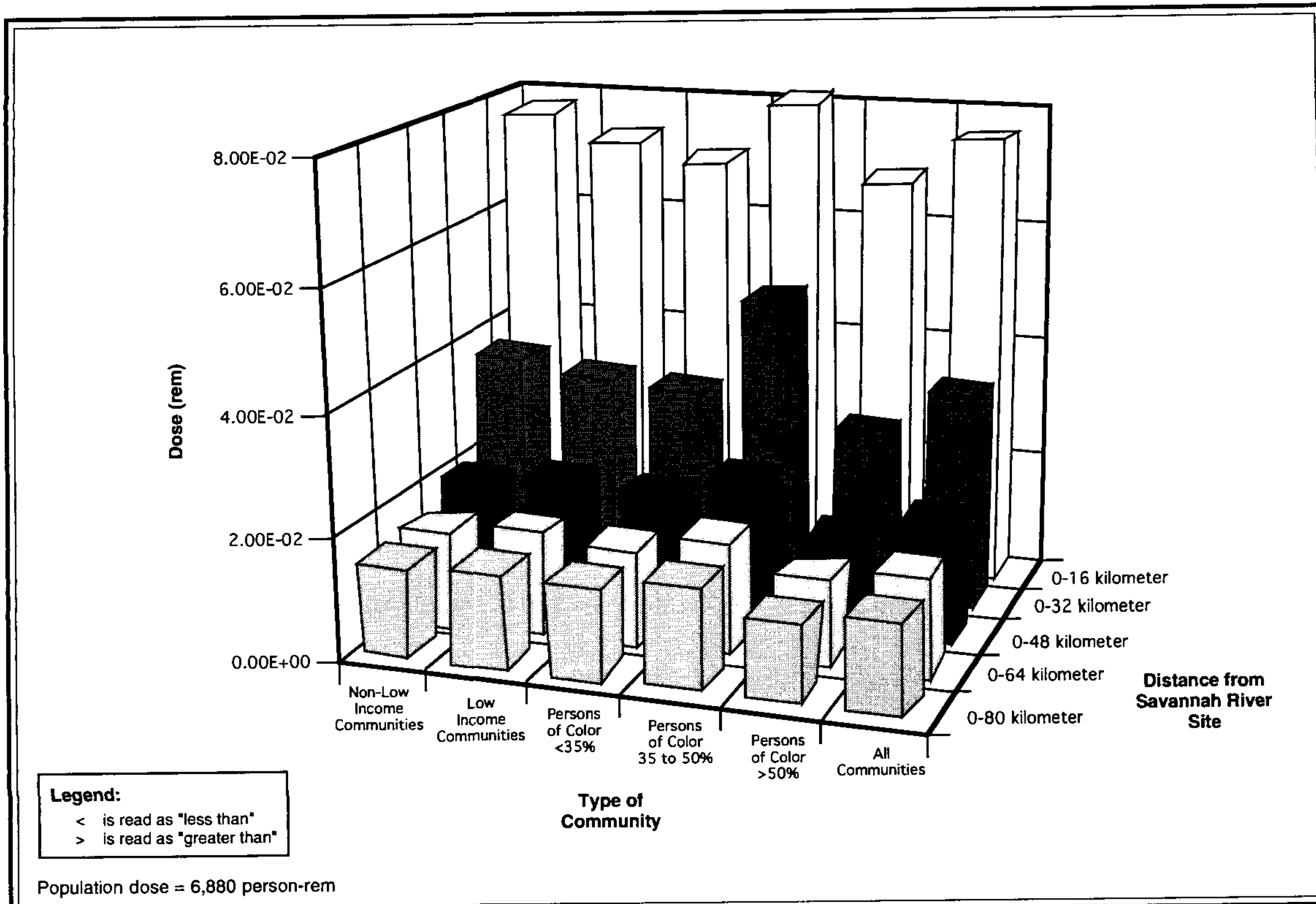

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TE **Figure 4-26.** Dose to individuals in communities within 80 kilometers (50 miles) of SRS for alternative C – maximum waste forecast.

TC

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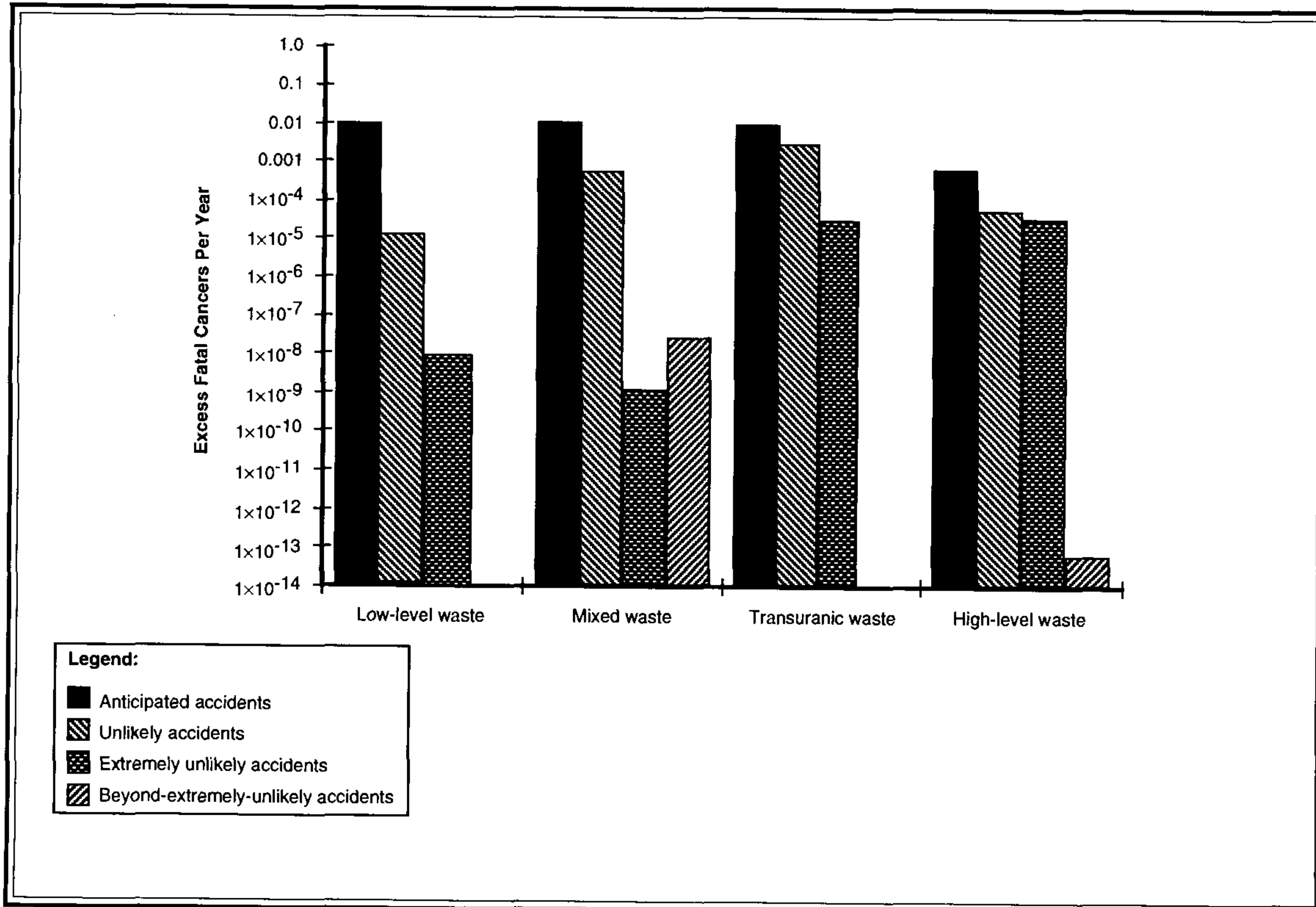

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Figure 4-27. Summary of radiological accident impacts to the population within 80 kilometers (50 miles) for alternative C – expected waste forecast

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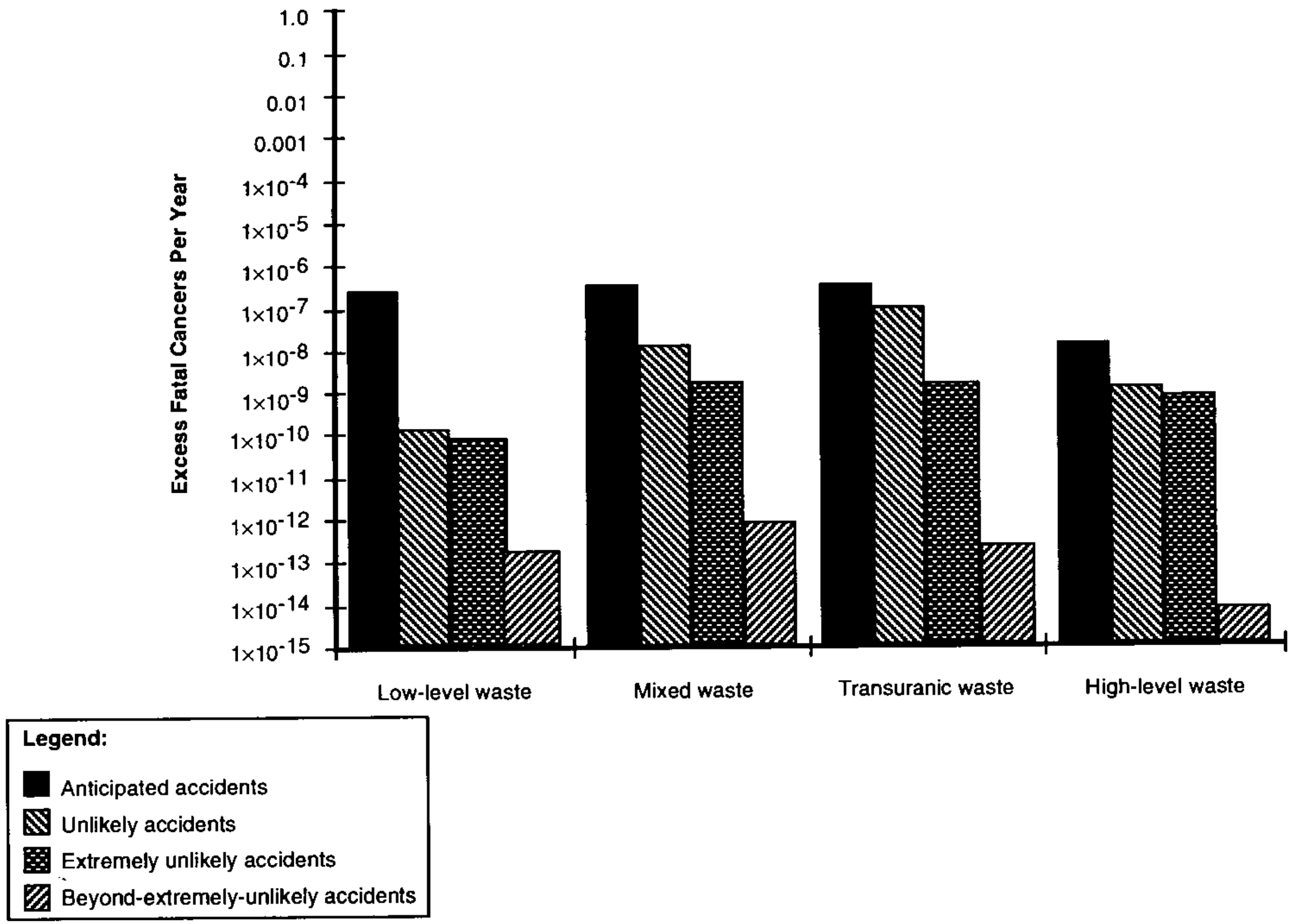

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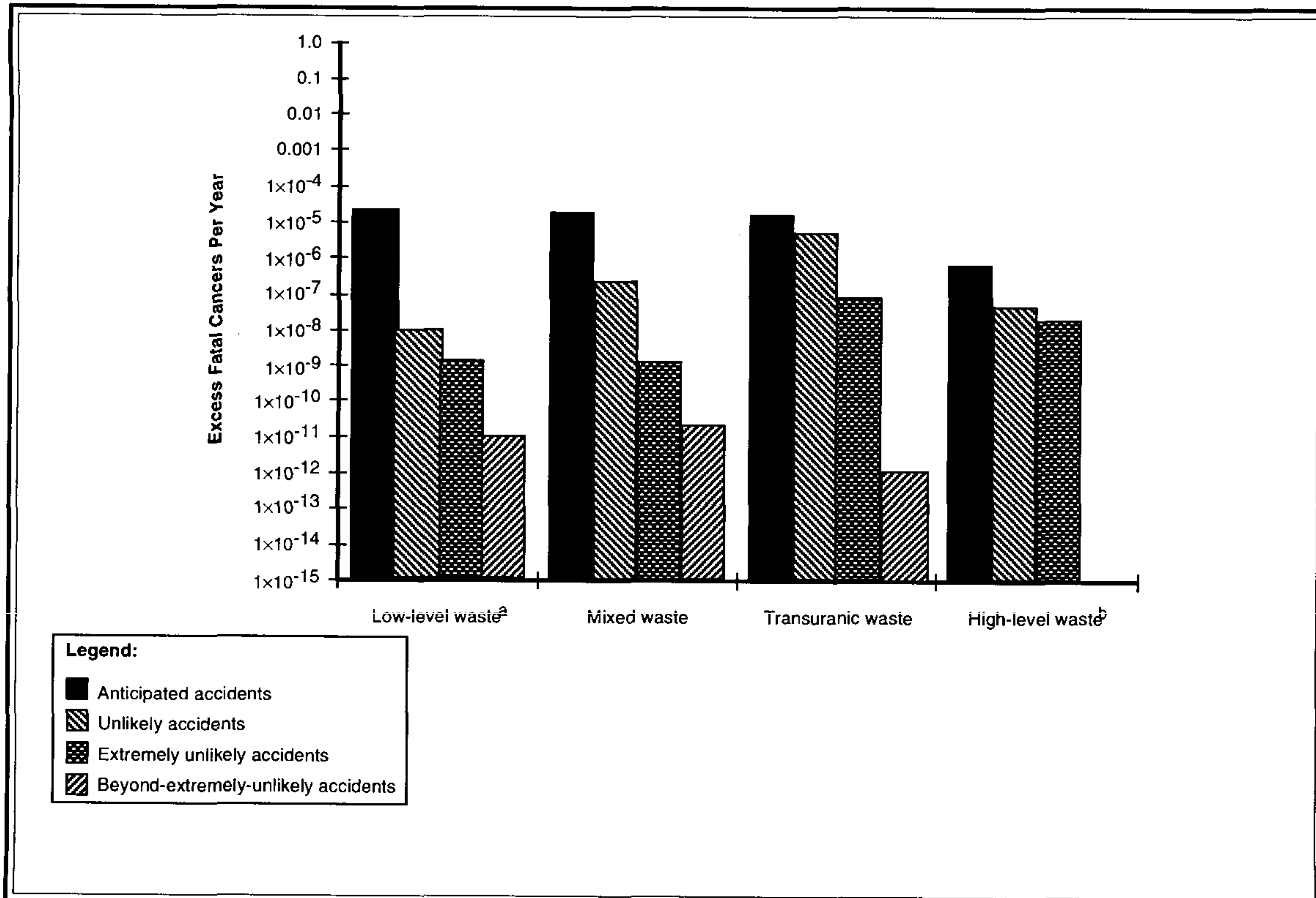
PK56-31

TE **Figure 4-28.** Summary of radiological accident impacts to the offsite maximally exposed individual for alternative C – expected waste forecast.



TC

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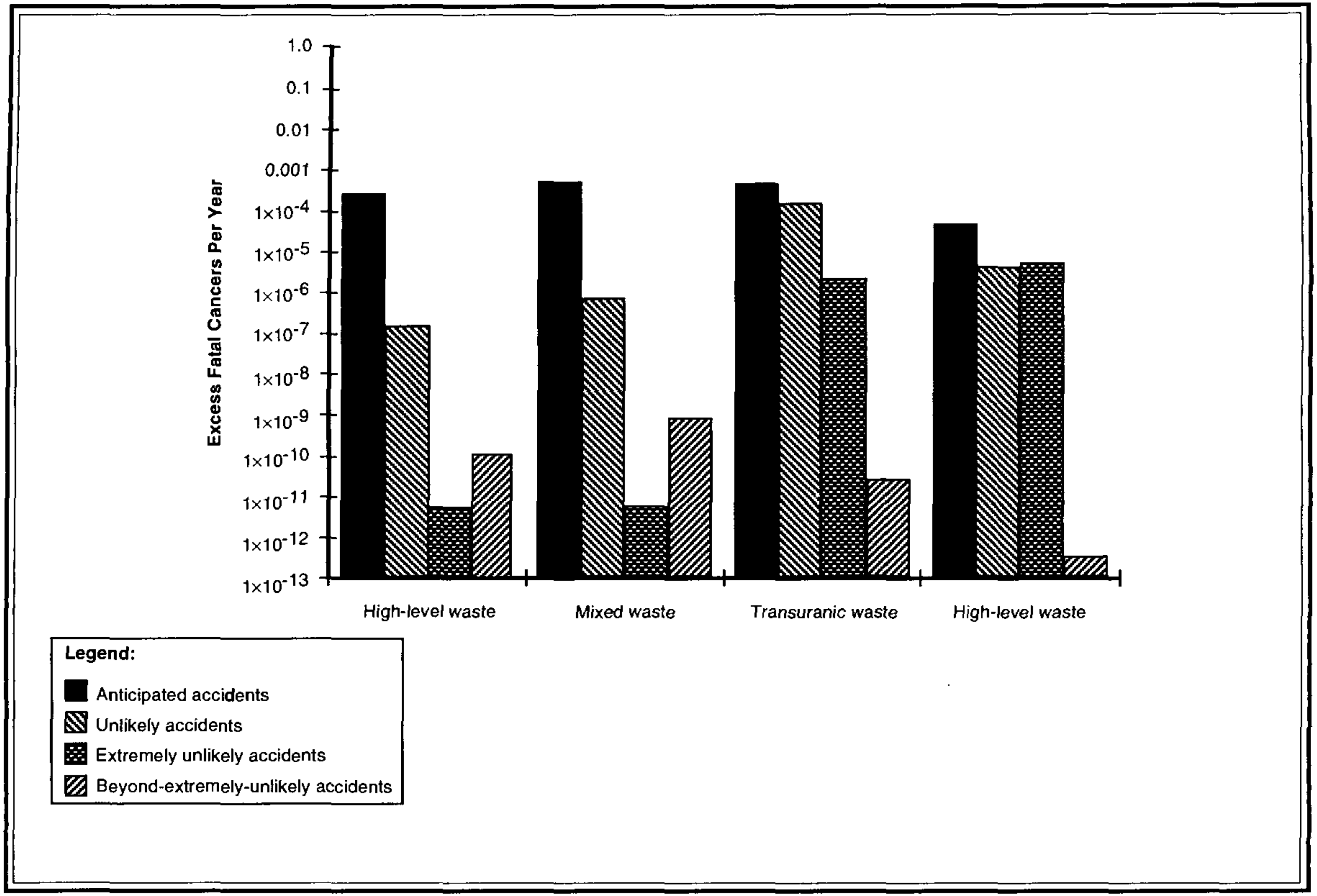
Figure 4-29. Summary of radiological accident impacts to the uninvolved worker within 640 meters (2,100 feet) for alternative C – expected waste forecast. TE



TC TE TE

Figure 4-30. Summary of radiological accident impacts to the uninvolved worker within 100 meters (328 feet) for alternative C – expected waste forecast.

An anticipated accident involving mixed waste would pose the greatest risk to the offsite maximally exposed individual (Figure 4-28) and the uninvolved worker at 640 meters (2,100 feet) (Figure 4-29). The anticipated accident scenario would increase the risk to the offsite maximally exposed individual by 3.3×10^{-7} latent fatal cancer per year and to the uninvolved worker at 640 meters (2,100 feet) by 1.8×10^{-5} latent fatal cancer per year.

An anticipated accident involving mixed waste would pose the greatest risk to the uninvolved worker at 100 meters (328 feet) (Figure 4-30). The anticipated accident scenario would increase the risk to the uninvolved worker at 100 meters (328 feet) by 1.0×10^{-3} latent fatal cancer per year. TE

Regardless of waste type for each receptor group, the greatest estimated risks associated with alternative C are identical to those for the no-action alternative. However, there could be differences in the overall risk to each receptor group for specific waste types. For example, the overall risks for low-level, mixed, and transuranic wastes are different to greater or lesser degrees between the two alternatives.

Table 4-56 provides a comparison of overall risk for specific waste types between the no-action alternative and alternative C. A multiplicative change factor is used to illustrate differences between no-action and alternative C risks. If the risks presented are identical, the multiplication factor is one. However, if the risks presented are different, the multiplication factor is the ratio of the two values. Arrows indicate whether the alternative C risks are larger or smaller than the no-action alternative risks.

A complete summary of all representative bounding accidents considered for alternative C is presented in Table 4-57. This table provides accident descriptions, annual frequency of occurrence, increased risk of latent fatal cancers for all receptor groups, and the waste type with which the accident scenario was associated. Details regarding the individual postulated accident scenarios associated with the various waste types are provided in Appendix F.

The impacts resulting from chemical hazards associated with the alternative C – expected waste forecast are the same as those discussed for alternative A in Section 4.2.13.1. Only one chemical release scenario would expose an offsite maximally exposed individual to airborne concentrations greater than ERPG-2 values. Appendix F provides further detail and discussion regarding chemical hazards associated with each waste type.

Table 4-56. Comparison of risks from accidents under the no-action alternative and alternative C.

Receptor	Waste[b]	Estimated risk[a] No-action alternative	Alternative C	Change factor[c]
Population within 80 kilometers	Low-level	0.017	0.0081	↓2.1
	Mixed	0.017	0.017	1.0
	Transuranic	0.005	1.4×10^{-5}	↑3.0
	High-level	6.3×10^{-4}	6.3×10^{-4}	1.0
Offsite maximally exposed individual	Low-level	3.3×10^{-7}	1.6×10^{-7}	↓2.1
	Mixed	3.3×10^{-7}	3.3×10^{-7}	1.0
	Transuranic	9.8×10^{-8}	2.9×10^{-7}	↑3.0
	High-level	1.3×10^{-8}	1.3×10^{-8}	1.0
Uninvolved worker to 640 meters	Low-level	1.8×10^{-5}	8.9×10^{-6}	↓2.1
	Mixed	1.8×10^{-5}	1.8×10^{-5}	1.0
	Transuranic	5.5×10^{-6}	1.6×10^{-5}	↑2.9
	High-level	6.4×10^{-7}	6.4×10^{-7}	1.0
Uninvolved worker to 100 meters	Low-level	0.001	2.5×10^{-4}	↓4.0
	Mixed	0.001	0.001	1.0
	Transuranic	3.1×10^{-4}	9.0×10^{-4}	↑2.9
	High-level	1.8×10^{-5}	1.8×10^{-5}	1.0

TE

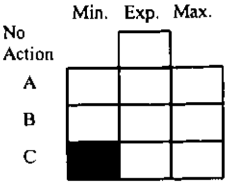
a. Increased risk of latent fatal cancers per year.
b. Wastes are described in Section 2.1 and Appendix F.
c. Change factors represent the multiplication factor required to equate no-action alternative risks to alternative C risks (e.g., no-action risk times change factor equals alternative C risk). The up arrow (↑) indicates that alternative C presents the greater risk and the down arrow (↓) indicates that alternative C presents the lesser risk.

In addition to the risk to human health from accidents, secondary impacts from postulated accidents on plant and animal resources, water resources, the economy, national defense, environmental contamination, threatened and endangered species, land use, and Native American treaty rights are considered. This qualitative assessment (see Appendix F) determined that there would be no substantial impacts from accidents for alternative C – expected waste forecast.

Table 4-57. Summary of representative bounding accidents under alternative C.[a]

Accident Description	Affected waste types[c]	Frequency (per year)	Increased risk of latent fatal cancers per year[b]: Uninvolved worker at 100 meters	Uninvolved worker at 640 meters	Maximally exposed offsite individual	Population within 80 kilometers
RHLWE[d] release due to a feed line break	High-level	0.007[e]	1.79×10^{-5}	6.38×10^{-7}	1.32×10^{-7}	6.34×10^{-4}
RHLWE release due to a design basis earthquake	High-level	2.00×10^{-4}[f]	1.54×10^{-6}	5.46×10^{-8}	1.12×10^{-9}	5.43×10^{-5}
RHLWE release due to evaporator pressurization and breech	High-level	5.09×10^{-5}[g]	1.95×10^{-6}	3.46×10^{-8}	7.13×10^{-10}	3.44×10^{-5}
Design basis ETF[h] airborne release due to tornado	High-level	3.69×10^{-7}[i]	3.20×10^{-13}	1.02×10^{-14}	7.20×10^{-15}	6.35×10^{-14}
Fire at the LLWSB[j]	Low-level	0.0830[e]	2.51×10^{-4}	8.93×10^{-6}	1.61×10^{-7}	0.00813
Container breach at the ILNTV[k]	Mixed	0.02[e]	0.00104	1.84×10^{-5}	3.31×10^{-7}	0.0168
Release due to multiple open containers at the Containment Building	Mixed	3.00×10^{-4}[f]	4.69×10^{-7}	6.91×10^{-7}	1.22×10^{-8}	5.70×10^{-4}
F3 tornado[l] at Building 316-M	Mixed	2.80×10^{-5}[g]	5.35×10^{-12}	1.29×10^{-9}	1.65×10^{-9}	1.12×10^{-9}
Aircraft crash at the Containment Building	Mixed	1.60×10^{-7}[i]	9.73×10^{-10}	3.46×10^{-11}	6.66×10^{-13}	3.19×10^{-8}
Deflagration in culvert during TRU[m] drum retrieval activities	Transuranic	0.01[e]	8.96×10^{-4}	1.59×10^{-5}	2.86×10^{-7}	0.0145
Fire in culvert at the TRU waste storage pads (one drum in culvert)	Transuranic	8.10×10^{-4}[f]	3.07×10^{-4}	5.48×10^{-6}	9.84×10^{-8}	0.00498
Vehicle crash with resulting fire at the TRU waste storage pads	Transuranic	6.50×10^{-5}[g]	4.47×10^{-6}	7.96×10^{-8}	1.43×10^{-9}	7.25×10^{-5}

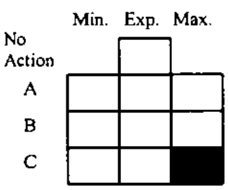
a. A complete description and analysis of the representative bounding accidents are presented in Appendix F.
b. Increased risk of fatal cancers per year is calculated by multiplying the [consequence (dose) × latent cancer conversion factor] × annual frequency. For dose consequences and latent cancer fatalities per dose, see tables in Appendix F.
c. The waste type for which the accident scenario is identified as a representative bounding accident. A representative bounding accident may be identified for more than one waste type. These waste types are listed as high-level, low-level, mixed, and transuranic waste types.
d. Replacement High-Level Waste Evaporator.
e. The frequency of this accident scenario is within the anticipated accident range.
f. The frequency of this accident scenario is within the unlikely accident range.
g. The frequency of this accident scenario is within the extremely unlikely accident range.
h. F/H-Area Effluent Treatment Facility.
i. The frequency of this accident scenario is within beyond-extremely-unlikely accident range.
j. Long-lived waste storage building.
k. Intermediate-level nontritium vault.
l. F3 tornadoes have rotational wind speeds of 254 to 331 kilometers (158 to 206 miles) per hour.
m. Transuranic.



4.3.13.2 Facility Accidents – Minimum Waste Forecast

Alternative C – minimum waste forecast is not expected to change the duration of risk for the facilities associated with the representative bounding accidents (see Appendix F).

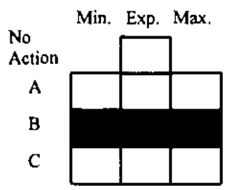
DOE does expect that a slight decrease in risk would occur for the alternative C minimum waste forecast. A comparison of the number and types of facilities needed for the minimum and expected waste forecasts is provided in Table 2-31.



4.3.13.3 Facility Accidents – Maximum Waste Forecast

The maximum waste forecast would not be expected to increase or decrease the duration of risk for the facilities associated with the representative bounding accidents identified under alternative C (see Appendix F).

DOE does expect that an increase in risk over the expected waste forecast would occur for the maximum waste forecast under alternative C. A comparison of the number and types of facilities needed for the maximum and expected waste forecasts is provided in Section 2.5.7.



4.4 Alternative B – Moderate Treatment Configuration and DOE's Preferred Treatment Alternative

This section discusses the impacts of moderate management practices (described in Section 2.6) on the existing environment (described in Chapter 3).

4.4.1 INTRODUCTION

Moderate treatment practices (alternative B) for waste at SRS include the ongoing activities listed under the no-action alternative (Section 4.1.1). In addition, DOE would:

- Construct and operate a containment building to treat mixed waste. TE
- Construct and operate a non-alpha vitrification facility for mixed waste soils and sludges.
- Sort mixed waste soils at the non-alpha vitrification facility to separate uncontaminated soils for reuse.
- Operate a mobile low-level soil sort facility to separate uncontaminated soils for reuse and low-activity and suspect soils for disposal. TE
- Decontaminate and recycle low-activity equipment waste (metals) offsite. Treatment residues would be returned to SRS for shallow land disposal. TC
- Treat small quantities of mixed and PCB wastes offsite.
- Operate the Consolidated Incineration Facility for mixed, hazardous, and low-level wastes. TC
- Construct and operate a transuranic waste characterization/certification facility.
- Construct and operate an alpha vitrification facility.
- Dispose of transuranic wastes at the Waste Isolation Pilot Plant.

- Treat small quantities of mixed and PCB wastes offsite. Treatment residuals would be returned to SRS for disposal.

- Operate the Consolidated Incineration Facility for mixed (benzene generated by the Defense Waste Processing Facility, organic and aqueous liquid wastes, decontamination solutions from the containment building, PUREX solvent, radioactive oil, sludges, and debris), hazardous, and low-level wastes.

- Treat low-activity job-control and equipment wastes offsite; residuals would be returned to SRS for treatment at the Consolidated Incineration Facility or for disposal.

- Store tritiated oil to allow time for radioactive decay.

TC

- Send elemental mercury and mercury-contaminated materials to the Idaho National Engineering Laboratory for treatment; residuals would be returned to SRS for RCRA-permitted disposal or shallow land disposal.

- Send calcium metal waste to the Los Alamos National Laboratory for treatment; residuals would be returned to SRS for shallow land disposal.

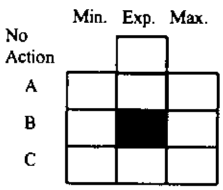
- Send lead offsite for decontamination and recycling; treatment residuals would be returned for RCRA-permitted disposal at SRS.

- Construct disposal vaults for stabilized ash and blowdown from the incineration process (Hess 1995a).

Mixed waste storage facilities would be constructed on previously cleared land in E-Area. Four of the six new waste treatment facilities (for characterization/certification of transuranic and alpha waste; for vitrification of transuranic and alpha wastes; for vitrification of mixed wastes; and for decontamination/ macroencapsulation of mixed and hazardous waste) would be built on undeveloped land northwest of TC F-Area. (See Figures 4-31 and 4-32.)

Construction under alternative B would require 0.40 square kilometer (99 acres) of undeveloped land northwest of F-Area and 0.032 square kilometer (8 acres) of undeveloped land northeast of F-Area by TC 2006. An additional 0.040 square kilometer (10 acres) of undeveloped land would be required by 2024 for construction of disposal vaults northeast of F-Area. All other construction would be on previously cleared and developed land in the eastern portion of E-Area.

4.4.2 GEOLOGIC RESOURCES



4.4.2.1 <u>Geologic Resources – Expected Waste Forecast</u>

Effects from alternative B – expected waste forecast would be mainly from the construction of new facilities. The effects discussed under the no-action alternative (Section 4.1.2) form the basis for comparison and are referenced in this section.

Waste management activities associated with alternative B – expected waste forecast would affect soils in E-Area. The number of new facilities would be substantially fewer than under the no-action alternative. Approximately 0.433 square kilometer (107 acres) of undeveloped land in E-Area would be cleared and graded for the construction of new facilities through approximately 2006. Later, an additional 0.040 square kilometer (10 acres) would be cleared for construction of additional RCRA-permitted disposal vaults. This total of 0.47 square kilometer (117 acres) is approximately 73 percent of the 0.65 square kilometer (160 acres) of undisturbed land that would be required under the no-action alternative. Approximately 0.21 square kilometer (51 acres) of developed land (by 2006) would be required for new facilities. The reduction in number of facilities and corresponding decrease in the amount of land needed would reduce the area of soils that would be affected by approximately 25 percent. TC

The potential for accidental oil, fuel, and chemical spills would be less under this scenario than under the no-action alternative because of reduced construction and operation activities. Spill prevention, control, and countermeasures for this scenario would be the same as for the no-action alternative discussed in Section 4.1.2; therefore, impacts to soils would be very small. TE

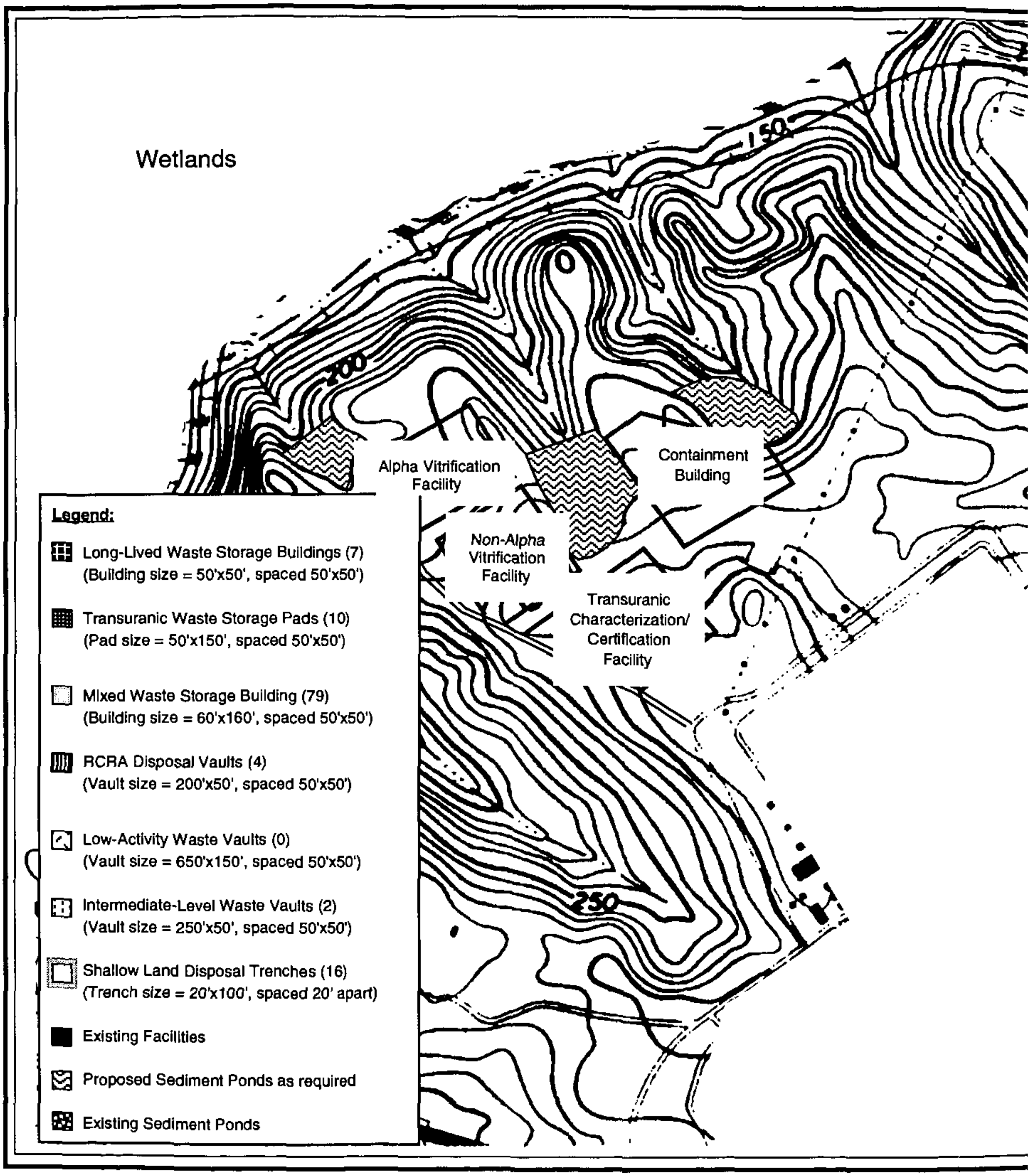
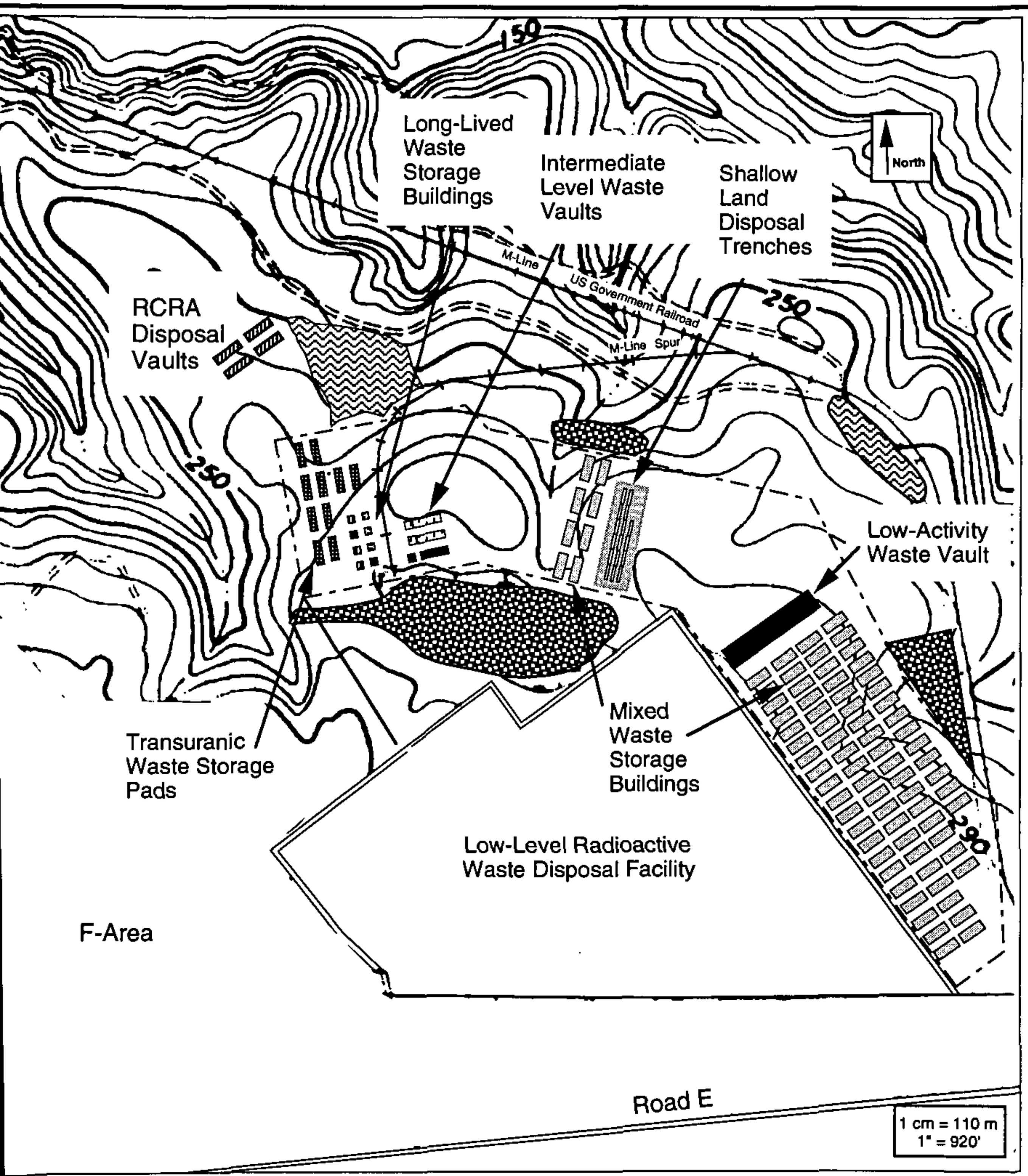
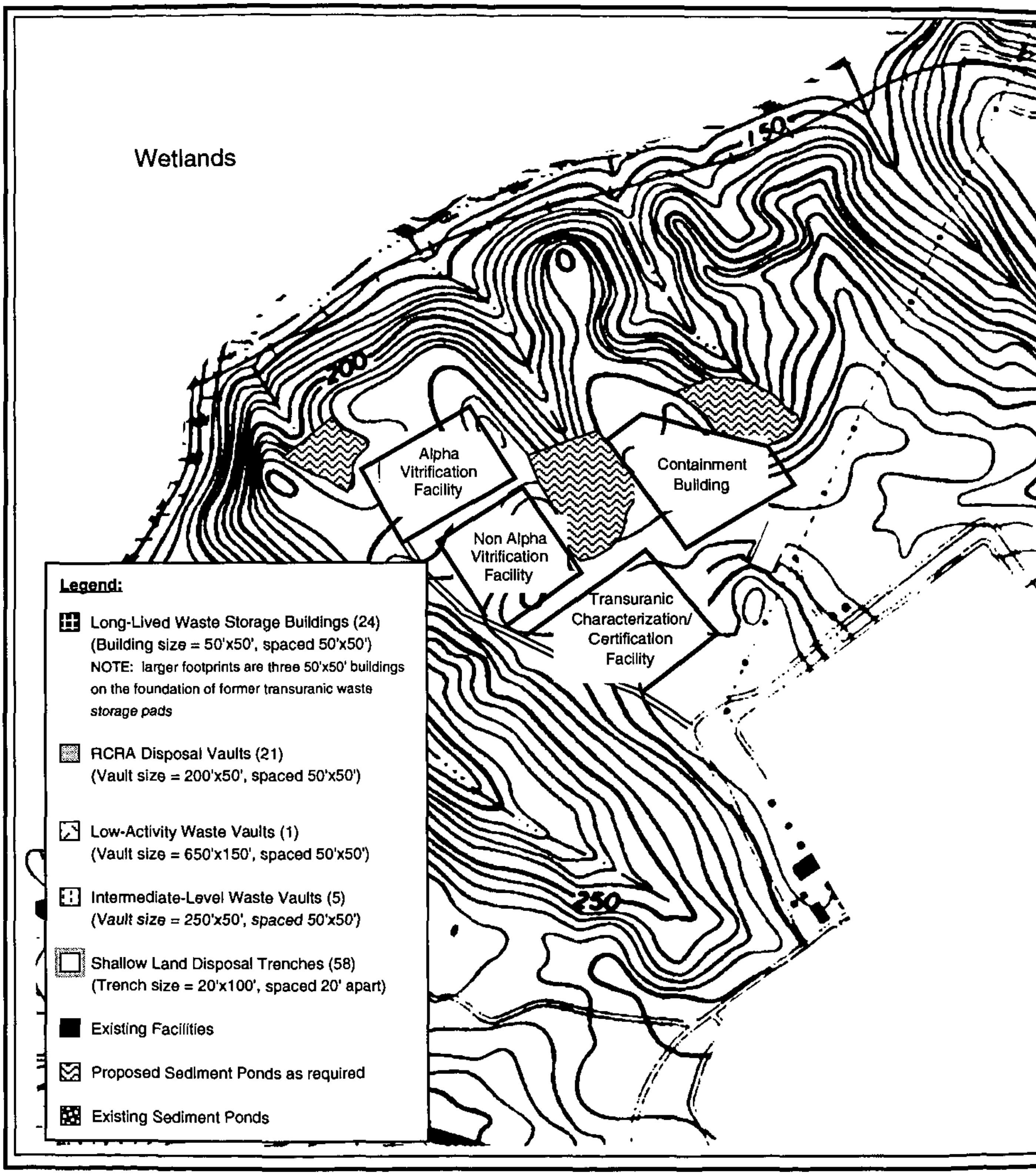


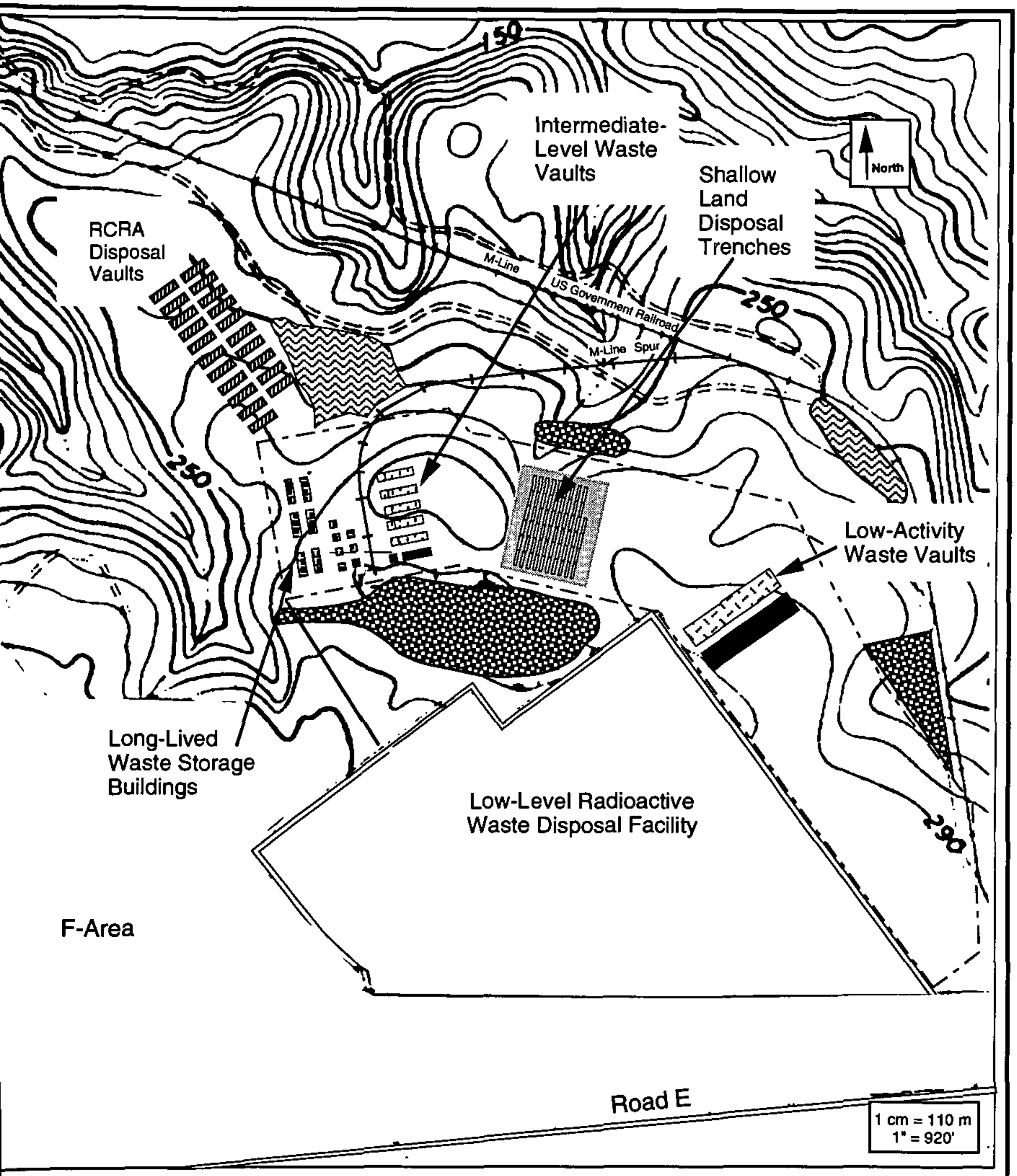
Figure 4-31. Configuration of treatment, storage, and disposal facilities in E-Area for alternative B –
TC expected waste forecast by 2006.


150
Long-Lived
Waste
Storage
Buildings
Intermediate
Level Waste
Vaults
Shallow
Land
Disposal
Trenches
North
M-Line
US Government Railroad
250
M-Line Spur
RCRA
Disposal
Vaults
250
Low-Activity
Waste Vault
Mixed
Waste
Storage
Buildings
Transuranic
Waste Storage
Pads
Low-Level Radioactive
Waste Disposal Facility
280
F-Area
Road E
1 cm = 110 m
1" = 920'

PK56-22

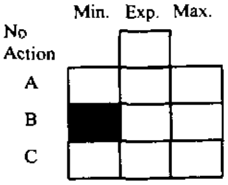


TC **Figure 4-32.** Configuration of treatment, storage, and disposal facilities in E-Area for alternative B – expected waste forecast by 2024.



Intermediate-Level Waste Vaults
Shallow Land Disposal Trenches
North
RCRA Disposal Vaults
M-Line
US Government Railroad
M-Line Spur
250
150
Low-Activity Waste Vaults
Long-Lived Waste Storage Buildings
Low-Level Radioactive Waste Disposal Facility
290
F-Area
Road E
1 cm = 110 m
1" = 920'

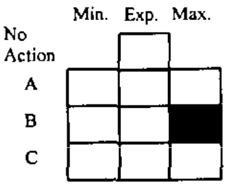
PK56-22



4.4.2.2 Geologic Resources – Minimum Waste Forecast

Effects on geologic resources from alternative B – minimum waste forecast would be less than those from the expected waste forecast, because less land would be disturbed by construction activities. TC Approximately 0.10 square kilometer (25 acres) of cleared land (by 2008) and 0.36 square kilometer (90 acres) of uncleared land (by 2024) would be used for new facilities.

For operations activities, spill prevention, control and countermeasures plans would be the same as for the no-action alternative.

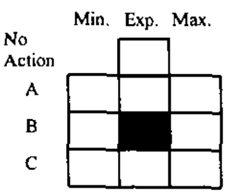


4.4.2.3 Geologic Resources – Maximum Waste Forecast

Effects on geologic resources from alternative B – maximum waste forecast would be substantially greater than from the expected waste forecast, because of the large number of new facilities. TC Approximately 0.283 square kilometer (70 acres) of cleared land and 0.745 square kilometer (184 acres) of uncleared land in E-Area, and 3.06 square kilometers (756 acres) of cleared or uncleared land outside E-Area would be used for construction.

For operations activities, spill prevention, control and countermeasures would be the same as for the no-action alternative.

4.4.3 GROUNDWATER RESOURCES



4.4.3.1 Groundwater Resources – Expected Waste Forecast

This section discusses the effects of alternative B – expected waste forecast on groundwater resources at TC SRS. Effects can be evaluated by comparing the concentrations of contaminants predicted to enter the groundwater from options under alternative B. Effects to groundwater resources under the no-action alternative (Section 4.1.3) form the basis for comparing the alternatives and are referenced in this section.

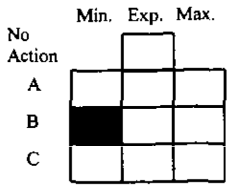
Operation and effects of the M-Area Air Stripper and the F- and H-Area tank farms would be the same as for the no-action alternative.

For this alternative and forecast and as noted in Section 4.1.3, releases to the groundwater from the disposal vaults are improbable during active maintenance; however, releases could eventually occur after loss of institutional control and degradation of the vaults. Impacts from the RCRA-permitted disposal vaults would be similar to the effects under the no-action alternative (Section 4.1.3). TE

For alternative B – expected waste forecast, the number of additional low-activity and intermediate-level radioactive waste disposal vaults would be less than half (6) the number required for the no-action alternative (15). Modeling has shown that releases from these vaults would not cause current groundwater standards to be exceeded during the 30-year planning period, the 100-year institutional control period, or at any time after disposal (Toblin 1995). As in the no-action alternative, the predicted concentrations of tritium would be a very small fraction of the drinking water standard. See the discussion in Section 4.1.3 on the basis for the 4 millirem standard for evaluating the effects of disposal in the E-Area vaults on shallow groundwater at SRS. TC TE TC

For this forecast, 58 additional slit trenches would be constructed. Fifteen (15) of these slit trenches would be used for disposal of suspect soil and have been evaluated using results from the previous Radiological Performance Assessment (Martin Marietta, EG&G, and WSRC 1994). Under this waste forecast, modeling results indicate that none of the radionuclides analyzed would at any time exceed DOE's performance objective of 4 millirem per year for drinking water (Toblin 1995). The remaining trenches would be filled with stabilized waste forms (ashcrete, glass, smelter ingots) subject to completion of performance assessments and demonstration of compliance with the performance objectives required by DOE Order 5820.2A. Therefore, DOE has conservatively assumed that groundwater concentrations as a result of radioactive releases from the RCRA-permitted vaults and all other low-level waste disposal facilities (vaults and slit trenches) would remain within the DOE performance objective of 4 millirem per year adopted by DOE in Order 5400.5. TC

In summary, effects to groundwater resources for alternative B – expected waste forecast are expected to be similar to the effects under the no-action alternative (Section 4.1.3). TC



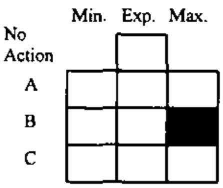
4.4.3.2 Groundwater Resources – Minimum Waste Forecast

For this forecast and as noted in Section 4.1.3, releases to the groundwater from disposal vaults would be improbable during active maintenance; however, releases could eventually occur after loss of institutional control and degradation of the vaults. Impacts from the RCRA-permitted disposal vaults would be similar to the effects under the no-action alternative (Section 4.1.3).

There would be fewer additional low-activity and intermediate-level radioactive waste disposal vaults (3) than under the no-action alternative (15). Modeling has shown that releases from these vaults would not cause groundwater standards to be exceeded during the 30-year planning period, the 100-year period of institutional control period, or at any time after disposal (Toblin 1995). Impacts to groundwater resources from disposal vaults would be similar to the impacts under the no-action alternative (Section 4.1.3). The predicted concentrations of tritium would be a very small fraction of the drinking water standard.

For alternative B – minimum waste forecast, 37 additional slit trenches would be constructed. Six (6) of these slit trenches would be used for disposal of suspect soil and have been evaluated using results from the previous Radiological Performance Assessment (Martin Marietta, EG&G, and WSRC 1994). Under this waste forecast, modeling results indicate that none of the radionuclides analyzed would at any time exceed DOE's performance objective of 4 millirem per year for drinking water (Toblin 1995). The remaining trenches will be filled with stabilized waste forms (ashcrete, glass, smelter ingots) subject to completion of performance assessments and demonstration of compliance with the performance objectives required by DOE Order 5820.2A. Therefore, DOE has conservatively assumed that groundwater concentrations as a result of radioactive releases from the RCRA-permitted vaults and all other low-level waste disposal facilities (vaults and slit trenches) would remain within the DOE performance objective of 4 millirem per year adopted by DOE in Order 5400.5.

In summary, impacts to groundwater for alternative B – minimum waste forecast would be similar to the impacts under the no-action alternative (Section 4.1.3) and expected waste forecast (Section 4.4.3.1).



4.4.3.3 Groundwater Resources – Maximum Waste Forecast

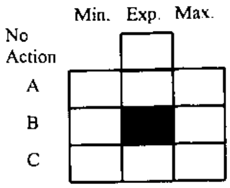
For this forecast and as noted in Section 4.1.3, releases to the groundwater from disposal vaults would be improbable during active maintenance; however, releases could eventually occur after loss of institutional control and degradation of the vaults. Impacts from the RCRA-permitted disposal vaults would be similar to the effects under the no-action alternative (Section 4.1.3). TC

There would be more additional low-activity and intermediate-level radioactive disposal vaults (17) than under the no-action alternative (15). Modeling has shown that releases from these vaults would not cause groundwater standards to be exceeded during the 30-year planning period, the 100-year period of institutional control period, or at any time after disposal (Toblin 1995). Impacts to groundwater resources from disposal vaults under this case would be similar to those impacts discussed under the expected waste forecast and the no-action alternative (Section 4.1.3). The predicted concentrations of tritium would be a very small fraction of the drinking water standard. TC

For alternative B – maximum waste forecast, 371 additional slit trenches would be constructed. Two hundred thirty eight (238) of these slit trenches would be used for disposal of suspect soil and have been evaluated using results from the previous Radiological Performance Assessment (Martin Marietta, EG&G, and WSRC 1994). Under this waste forecast, modeling results indicate that none of the radionuclides analyzed would at any time exceed DOE's performance objective of 4 millirem per year for drinking water (Toblin 1995). The remaining trenches would be filled with stabilized waste forms (ashcrete, glass, smelter ingots) subject to completion of performance assessments and demonstration of compliance with the performance objectives required by DOE Order 5820.2A. Therefore, DOE has conservatively assumed that groundwater concentrations as a result of radioactive releases from the RCRA-permitted vaults and all other low-level waste disposal facilities (vaults and slit trenches) would remain within the DOE performance objective of 4 millirem per year adopted by DOE in Order 5400.5. TC

In summary, impacts to groundwater for alternative B – maximum waste forecast would be similar to the impacts under both the no-action alternative (Section 4.1.3) and alternative B – expected waste forecast (Section 4.4.3.1). TC

4.4.4 SURFACE WATER RESOURCES



4.4.4.1 <u>Surface Water – Expected Waste Forecast</u>

Impacts to surface water were compared by evaluating the concentrations of pollutants that would be introduced.

For alternative B – expected waste forecast, the F/H-Area Effluent Treatment Facility, the M-Area Vendor Treatment Facility, and the M-Area Dilute Effluent Treatment Facility (which is the final stage of the M-Area Liquid Effluent Treatment Facility) would operate in the same manner discussed in Section 4.1.4. The wastewater would be similar in composition to wastewater already treated in these facilities and would be discharged to surface streams via existing permitted outfalls.

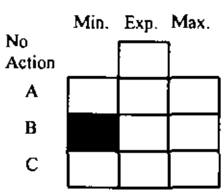
The Consolidated Incineration Facility would not directly discharge wastewater to the environment. Instead, the wastewater would be used in the ashcrete process and the stabilized ash and blowdown would be disposed of in disposal vaults or sent to shallow land disposal.

The Replacement High-Level Waste Evaporator would evaporate the liquid waste from the high-level
TE waste tanks in the F- and H-Area tank farms (as in the no-action alternative). It would be used in the same manner as the present F- and H-Area evaporators, with the distillate being sent to the F/H-Area Effluent Treatment Facility for treatment prior to being discharged to Upper Three Runs. The concentrate from the evaporator would be sent to the Defense Waste Processing Facility for vitrification. Since the Replacement High Level Waste Evaporator would be used in the same manner as the existing evaporators and would produce a distillate similar in composition to the present distillate, the effect of the effluent on Upper Three Runs would be the same as it is now.

Alternative B would require the construction and operation of two vitrification facilities, a containment building, additional storage buildings, storage pads, the transuranic waste characterization/certification facility, low-level waste disposal trenches, and vaults. As discussed in Section 4.1.4, before facilities would be constructed, DOE would prepare erosion and sedimentation control plans to comply with state regulations on stormwater discharges; after facilities began operating, they would be included in the *SRS Stormwater Pollution Prevention Plan.*

Other than through stormwater discharges, the containment building, the storage buildings, the storage pads, and the vaults would not affect SRS surface waters. Liquid waste discharged from processes in the containment building would be sent to the Consolidated Incineration Facility and not discharged to surface waters. The alpha vitrification facility and the non-alpha vitrification facility would have wastewater discharges that would be treated and recycled for reuse in the vitrification processes. Leakage or spills at the storage pads, storage buildings, or vaults would be collected in sumps or secondary containment and checked for contamination before being discharged. If the accumulated liquid were found to be contaminated, it would be treated prior to discharge. Stormwater infiltrating the vaults and trenches would eventually discharge to surface waters. Appendix E contains a detailed list of drinking water doses from these discharges. The doses would be 100,000 times less than the regulatory standards (40 CFR 141) (Toblin 1995).

TC TC TC

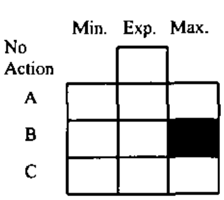


4.4.4.2 Surface Water – Minimum Waste Forecast

For the minimum waste forecast, fewer new facilities would be built than for the expected waste forecast. The amount of wastewater needing treatment would be less than that for the expected waste forecast discussed in Section 4.4.4.1. Wastewater would be treated in existing SRS treatment facilities. The receiving streams would not be additionally impacted. As in the expected waste forecast, surface water would not be impacted by groundwater discharges.

TE

Erosion and sedimentation would be controlled during construction activities, as discussed in Section 4.1.4. After the facilities are operating, they would be included in the *SRS Stormwater Pollution Prevention Plan*.



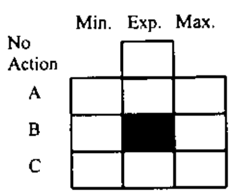
4.4.4.3 Surface Water – Maximum Waste Forecast

The wastewater from the vitrification facilities would be treated with ion exchange systems in dedicated wastewater treatment systems and recycled to the vitrification process for reuse, not discharged to a surface stream.

Wastewater from the containment building would be treated in a new wastewater treatment plant. The treated water would be discharged to surface water through a permitted outfall. SRS would comply with the permit limits established by SCDHEC. The predicted dose to the offsite maximally exposed individual would be 1.39×10^{-5} millirem per year (Appendix E). Wastewater would not be discharged from the mobile soil sort facility.

Erosion and sedimentation control plans and pollution prevention measures would be the same as for other cases.

4.4.5 AIR RESOURCES



4.4.5.1 Air Resources – Expected Waste Forecast

This section presents the impacts to air quality as a result of alternative B – expected waste forecast. The increases of pollutant concentrations at and beyond the SRS boundary from waste management under TE this alternative are small when compared to existing concentrations. Operations under alternative B would not exceed state or Federal air quality standards.

4.4.5.1.1 Construction

Potential impacts to air quality from construction activities could include fugitive dust and exhaust from earth-moving equipment. Approximately 2.90×10^5 cubic meters (2.22×10^5 cubic yards) of soil would be disturbed in E-Area for the construction of new facilities in this case.

Maximum concentrations at SRS's boundary resulting from a year of average construction are shown in Table 4-58. These concentrations are generally lower than those shown for the no-action alternative. The sum of the increase over baseline of pollutant concentrations due to construction activities plus the existing baseline concentrations would be within both state and federal air quality standards.

4.4.5.1.2 Operations

In addition to existing SRS emissions there would be nonradiological and radiological emissions due to the operation of facilities such as the Defense Waste Processing Facility, including In-Tank

Table 4-58. Maximum SRS boundary-line concentrations resulting from a year of average construction activities under alternative B (in micrograms per cubic meter of air). TE

Pollutant	Averaging time	Baseline ($\mu g/m^3$)[a]	Average increase ($\mu g/m^3$)[b] Expected	Minimum	Maximum	SCDHEC standard ($\mu g/m^3$)[c]	Baseline + increase as percent of standard Expected	Minimum	Maximum
Nitrogen oxides	1 year	14	<0.01[d]	<0.01	0.03	100	14	14	14
Sulfur dioxide	3 hours	857	28.53	14.89	334	1,300	68	67	92
	24 hours	213	0.54	0.28	6.33	365	59	58	60
	1 year	19	<0.01	<0.01	<0.01	80	21	21	21
Carbon monoxide	1 hour	171	673	323	6,645	40,000	2	1	17
	8 hours	22	106	51	1,010	10,000	1	1	10
Total suspended particulates	1 year	43	<0.01	<0.01	0.03	75	57	57	57
Particulate matter less than 10 microns in diameter	24 hours	85	1.99	1.03	22.54	150	58	57	72
	1 year	25	0.01	0.01	0.04	50	50	50	50

TC

TC

a. Source: Stewart (1994).
b. Source: Hess (1994a).
c. Source: SCDHEC (1976).
d. < is read as "less than."

TC Precipitation; the Consolidated Incineration Facility; the M-Area Vendor Treatment Facility; the mobile soil sort facility; the mixed and hazardous waste containment building; the non-alpha waste vitrification facility (including soil sorting); the transuranic waste characterization/certification facility; and the alpha waste vitrification facility.

Emissions from new or proposed facilities are estimated based on processes occurring in the facilities or similar facilities, annual average waste flow volumes, and air permit applications. Air emissions from such facilities as storage vaults and mixed waste storage buildings would be minimal.

TE Increases to maximum boundary-line concentrations of pollutants would not occur as a result of the continued operation of existing facilities. Additional emissions from the M-Area Air Stripper and the F/H-Area Effluent Treatment Facility from the expected waste forecast would be small, as discussed in Section 4.1.5.2.

TE **Nonradiological Air Emissions Impacts**

Maximum ground-level concentrations for nonradiological air pollutants were estimated from the Industrial Source Complex Version 2 Dispersion Model using calculated emissions from all facilities included in alternative B (Stewart 1994). Modeled air toxic concentrations for carcinogens are based on an annual averaging period and are presented in Section 4.4.12.1.2. Air dispersion modeling was performed with calculated emission rates for the above-listed facilities (Stewart 1994).

TC The following facilities were incorporated into the modeling analysis for alternative B air dispersion: the Consolidated Incineration Facility, including the ashcrete storage silo, the ashcrete hopper duct, and the ashcrete mixer; four new solvent tanks to support the Consolidated Incineration Facility; the Defense Waste Processing Facility, including In-Tank Precipitation; the M-Area Vendor Treatment Facility; the mixed and hazardous waste containment building; the transuranic waste characterization/certification facility; hazardous waste storage facilities; mixed waste storage facilities; the mobile soil sort facility; the non-alpha waste vitrification facility (including soil sorting); and the alpha waste vitrification facility.

TE The emissions of air toxics would be minimal. Maximum boundary-line concentrations for air toxics emanating from existing SRS sources, including the Consolidated Incineration Facility and the Defense Waste Processing Facility, would be well below SCDHEC regulatory standards and are presented in the *SCDHEC Regulation No. 62.5 Standard No. 2 and Standard No. 8 Compliance Modeling Input/Output Data.*

The Savannah River Technology Center laboratory's liquid waste and E-Area vaults would have minimal air emissions, as described in Section 4.1.5.2.

Table 4-59 shows the increase in maximum ground-level concentrations at the SRS boundary for nonradiological air pollutants due to routine releases from facilities for alternative B – expected, minimum, and maximum waste forecasts. For the expected waste forecast, maximum ground-level concentrations would be similar to those under the no-action alternative. Refer to Section 4.2.5.1.2 for a discussion of the emissions from offsite lead decontamination. TC

Radiological Air Emissions Impacts TE

Offsite maximally exposed individual and population doses were determined for atmospheric releases resulting from routine operations under alternative B. The major sources of radionuclides would be the alpha and non-alpha vitrification facilities, the transuranic waste characterization/certification facility, L004-13 and the Consolidated Incineration Facility. Other facilities with radiological releases would include the M-Area Vendor Treatment Facility, the mobile soil sort facility, and the containment building. TC

SRS-specific computer codes MAXIGASP and POPGASP were used to determine the maximum individual dose and the 80-kilometer (50-mile) population dose, respectively, resulting from routine atmospheric releases. See Appendix E for detailed facility-specific isotopic and dose data. L004-13

Table 4-60 shows the dose to the offsite maximally exposed individual and the population. The calculated maximum committed effective annual dose equivalent to a hypothetical individual is 0.032 millirem (Chesney 1995), which is well within the annual dose limit of 10 millirem from SRS TC atmospheric releases. In comparison, an individual living near the SRS receives a dose of 0.25 millirem from all current SRS releases of radioactivity (Arnett 1994). The 0.032 millirem annual dose is greater TC than the 1.3×10^{-4} millirem annual dose shown for the no-action alternative.

The annual dose to the population within 80 kilometers (50 miles) of SRS would be 1.5 person-rem. In comparison, the collective dose received from natural sources of radiation is approximately 195,000 person-rem (Arnett, Karapatakis, and Mamatey 1994). Section 4.4.12.1.2 describes the potential health effects of these releases on individuals residing offsite. The 1.5 person-rem annual dose is greater than the 2.9×10^{-4} annual dose shown for the no-action alternative.

TE

Table 4-59. Changes in maximum ground-level concentrations of air pollutants at SRS boundary for alternative B – expected, minimum, and maximum waste forecasts.

TC

Pollutant	Averaging time	Existing sources ($\mu g/m^3$)[a,b]	Regulatory standards ($\mu g/m^3$)[c]	Background concentration ($\mu g/m^3$)[d]	Increases in concentration ($\mu g/m^3$)			Percent of standard[e]		
					Expected	Minimum	Maximum	Expected	Minimum	Maximum
Nitrogen oxides	1 year	6	100	8	0.79	0.79	0.83	15	15	15
Sulfur oxides	3 hours	823	1,300	34	3.82	3.81	3.85	66	66	66
	24 hours	196	365	17	0.81	0.81	0.81	59	59	59
	1 year	14	80	3	0.05	0.05	0.05	21	21	21
Carbon monoxide	1 hour	171	40,000	NA[f]	31.45	31.46	31.46	0.5	0.5	0.5
	8 hours	22	10,000	NA	7.68	7.68	7.68	0.3	0.3	0.3
Total suspended particulates	1 year	13	75	30	2.01	2.01	2.01	60	60	60
Particulate matter less than 10 microns in diameter	24 hours	51	150	34	4.61	4.61	4.61	60	60	60
	1 year	3	50	22	0.10	0.10	0.10	50	50	50
Lead	3 months	4.0×10^{-4}	1.5	0.011	3.00E-05	3.00E-05	5.00E-05	0.8	0.8	0.8
Gaseous fluorides (as hydrogen fluoride)	12 hours	2	3.7	NA	0.00187	0.00187	0.00187	54	54	54
	24 hours	1	2.9	NA	9.30×10^{-4}	9.30×10^{-4}	9.30×10^{-4}	35	35	35
	1 week	0.4	1.60		7.00×10^{-5}	7.00×10^{-5}	7.00×10^{-5}	25	25	25
	1 month	0.1	0.80	NA	9.00×10^{-5}	9.00×10^{-5}	9.00×10^{-5}	13	13	13

a. Micrograms per cubic meter of air.
b. Source: Stewart (1994).
c. Source: SCDHEC (1976).
d. Source: SCDHEC (1992).

TE

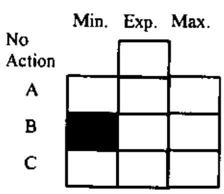
e. Percent of standard = 100 × (actual + background + increment) divided by regulatory standard.
f. NA = not applicable.

Table 4-60. Annual radiological doses to individuals and the population within 80 kilometers (50 miles) of SRS from atmospheric pathways under alternative B.[a]

	Offsite maximally exposed individual	Population
Waste Forecast	Dose (millirem)	Dose (person-rem)
Expected	0.032	1.5
Minimum	0.02	0.98
Maximum	0.33	14

TC

a. Source: Chesney (1995).



4.4.5.2 Air Resources – Minimum Waste Forecast

The minimum waste forecast would have fewer adverse effects than the expected waste forecast.

4.4.5.2.1 Construction

Impacts were evaluated for the construction of facilities listed in Section 2.6.7. Maximum concentrations at the SRS boundary resulting from a year of average construction are presented in Table 4-58. These concentrations are less than those for the expected waste forecast. The construction-related emissions would meet both state and federal air quality standards.

4.4.5.2.2 Operations

Increases in radiological and nonradiological impacts were determined for the same facilities listed in Section 4.4.5.1.2.

Nonradiological Air Emissions Impacts TE

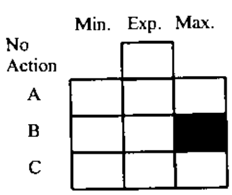
Nonradiological air emissions would be less than those estimated for the expected waste forecast. Maximum boundary-line concentrations are presented in Table 4-59. Modeled concentrations would be less than those shown for the expected waste forecast. Total concentrations would be less than applicable state and federal ambient air quality standards.

TE **Radiological Air Emissions Impacts**

Table 4-60 shows the dose to the offsite maximally exposed individual and the population due to atmospheric releases. The calculated maximum committed annual dose equivalent to a hypothetical TC individual is 0.02 millirem (Chesney 1995), which is less than the dose for the expected waste forecast and below the annual dose limit of 10 millirem from SRS atmospheric releases.

TC The annual dose to the population within 80 kilometers (50 miles) of SRS would be 0.98 person-rem, which would be less than the population dose calculated for the expected waste forecast.

Air quality would change as a result of construction and operation activities. The minimum waste forecast would have less impact than the expected waste forecast.



4.4.5.3 <u>Air Resources – Maximum Waste Forecast</u>

4.4.5.3.1 Construction

Impacts were evaluated for the construction of facilities discussed in Section 2.6.7. Maximum TE concentrations at the SRS boundary resulting from a year of average construction are presented in Table 4-58. These concentrations are greater than those in the expected waste forecast. Construction management procedures would require wetting of roads to reduce particulate emissions.

During a year of average construction, the sum of the additional concentrations of air pollutants resulting from construction activities plus the existing baseline concentrations would be less than both state and federal air quality standards.

4.4.5.3.2 Operations

Both radiological and nonradiological impacts were determined for the facilities listed in Section 4.4.5.1.2. Air emissions would be greater than in the expected waste forecast, and effects on air quality would also be greater.

Nonradiological Air Emissions Impacts TE

Nonradiological air emissions would be greater than those estimated for the expected waste forecast. Maximum boundary-line concentrations are presented in Table 4-59. Modeled concentrations are greater than those in the expected waste forecast. Cumulative concentrations would be less than applicable state and federal ambient air quality standards.

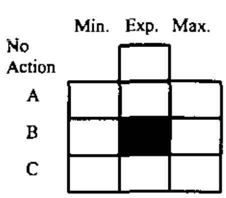
Radiological Air Emissions Impacts TE

Offsite maximally exposed individual and population doses were determined for atmospheric releases resulting from routine operations at the facilities presented in Section 4.3.5.2.2.

Table 4-60 shows the dose to the offsite maximally exposed individual and the population due to atmospheric releases. The calculated maximum committed annual dose equivalent to a hypothetical individual is 0.33 millirem (Chesney 1995), which would be greater than the dose for the expected waste forecast, but within the annual dose limit of 10 millirem from SRS atmospheric releases. TC

The annual dose to the population within 80 kilometers (50 miles) of SRS would be 14 person-rem, which is greater than the population dose calculated for the expected waste forecast. In comparison, the collective dose to the same population from natural sources of radiation is approximately 195,000 person-rem (Arnett, Karapatakis, and Mamatey 1994). Section 4.4.12.1.2 describes the potential health effects of these releases on individuals.

4.4.6 ECOLOGICAL RESOURCES



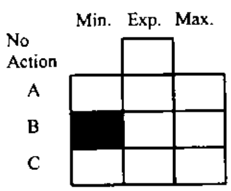
4.4.6.1 Ecological Resources – Expected Waste Forecast

For alternative B – expected waste forecast, undisturbed land would be cleared and graded to build new facilities. (The land areas are given in acres; to convert to square kilometers, multiply by 0.004047.)

TC Clearing and grading would affect 107 acres of woodland by 2006 and an additional 10 acres by 2024, as follows:

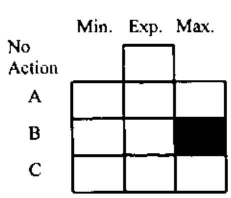
- 26 acres of loblolly pine planted in 1987
- 20 acres of white oak, red oak, and hickory regenerated in 1922
- 57 acres of longleaf pine regenerated in 1922, 1931, or 1936
- 4 acres from which mixed pine/hardwood have recently been harvested
- TC 10 acres of loblolly pine planted in 1987, which would be cleared between 2006 and 2024

Effects of clearing and grading the land are described in Section 4.1.6. The land required for this
TC alternative is less than that required under the no-action alternative or alternative C, but 21 acres more than under alternative A.



4.4.6.2 Ecological Resources – Minimum Waste Forecast

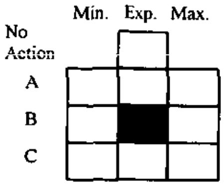
TC Approximately 90 acres of undeveloped land located between the M-Line railroad and the E-Area expansion and extending northwest of F-Area would be required for alternative B – minimum waste
TC forecast by 2024. Impacts to the ecological resources of the area would be slightly less than those described in Section 4.4.6.1.



4.4.6.3 Ecological Resources – Maximum Waste Forecast

Approximately 184 acres of undeveloped land located between the M-Line railroad and the E-Area expansion and extending northwest of F-Area would be required for the maximum waste forecast. By
TC 2008, an additional 756 acres of land in an undetermined location would also be required. Impacts to the ecological resources of the area would be considerably greater than described in Section 4.4.6.1 due to the greater area (see Section 4.2.6.3 for some possible adverse effects). Additional threatened and endangered species surveys and wetlands assessments would be required as part of the site-selection process should this case be implemented.

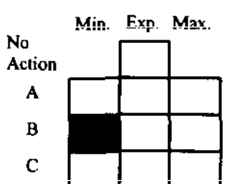
4.4.7 LAND USE



4.4.7.1 Land Use – Expected Waste Forecast

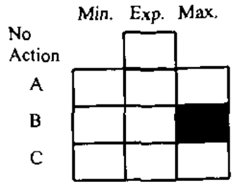
DOE would use approximately 158 acres (107 acres of undeveloped land; 51 acres of developed land) in E-Area through 2006 for activities associated with alternative B – expected waste forecast. By 2024, the total would have been reduced to about 136 acres because as wastes are treated and disposed of, the storage buildings would be taken out of service and decontaminated and decommissioned; some would be demolished. SRS has about 181,000 acres of undeveloped land, which includes wetlands and other areas that cannot be developed, and 17,000 acres of developed land. TC TC

Activities associated with alternative B would not affect current SRS land-use plans; E-Area was designated as an area for nuclear facilities in the draft *1994 Land-Use Baseline Report*. Furthermore, no part of E-Area has been identified as a potential site for future new missions. And according to the *FY 1994 Draft Site Development Plan*, proposed future land management plans specify that E-Area be characterized and remediated for environmental contamination in its entirety, if necessary. DOE will make decisions on future SRS land uses through the site development, land-use, and future-use planning processes, including public input through avenues such as the Citizens Advisory Board. TE



4.4.7.2 Land Use – Minimum Waste Forecast

Activities associated with alternative B – minimum waste forecast would not impact current SRS land uses. DOE would use approximately 107 acres (51 fewer than for the expected waste forecast) in E-Area through 2008 for the facilities described in Section 4.4.1. TC

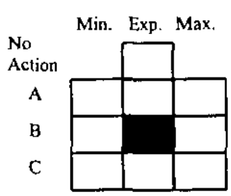


4.4.7.3 Land Use – Maximum Waste Forecast

Activities associated with alternative B – maximum waste forecast would not affect current SRS land TC uses. By 2006, DOE would use a total of 1,010 acres (254 acres in E-Area and 756 acres elsewhere) for the facilities described in Section 4.2.1. This acreage is nearly 10 times the land that would be required for the expected or minimum waste forecasts, but is less than 1 percent of the total undeveloped land on SRS (DOE 1993d). However, considerably more acreage than this may be affected (see Section 4.2.6.3). TC Current land uses in E-Area would not be impacted. The location of the 756 acres outside of E-Area has not been identified and would be the subject of further impact analyses (see Appendix J). However, DOE would minimize the impact of clearing 756 acres by using the central industrialized portion of the site, as described in Section 2.1.2 and Figure 2-1.

4.4.8 SOCIOECONOMICS

This section describes the potential effects of alternative B on the socioeconomic resources in the region of influence discussed in Section 3.8.



4.4.8.1 Socioeconomics – Expected Waste Forecast

4.4.8.1.1 Construction

DOE anticipates that construction employment would peak during 2004 through 2005 with TC approximately 170 jobs (Table 4-61), 120 more than during peak employment under the no-action alternative. This employment demand represents much less than 1 percent of the forecast employment in 2005. Given the normal fluctuation of employment in the construction industry, DOE does not expect a net change in regional construction employment from implementation of alternative B. Given no net change in employment, neither population nor personal income in the region would change. As a result, socioeconomic resources would not be affected.

Table 4-61. Estimated construction and operations employment for alternative B – minimum, expected, and maximum waste forecasts.[a]

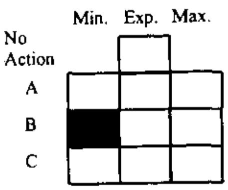
	Waste Forecast				
	Minimum		Expected		Maximum[b]
Year	Construction	Operations	Construction	Operations	Construction
1995	20	920	50	1,640	200
1996	20	1,110	30	1,940	70
1997	20	1,110	30	1,940	70
1998	20	1,110	30	1,940	170
1999	20	1,110	30	2,050	170
2000	20	1,120	40	2,270	180
2001	20	1,120	40	2,270	180
2002	40	1,170	70	2,330	250
2003	70	1,170	120	2,330	330
2004	120	1,250	170	2,330	330
2005	120	1,320	170	2,330	330
2006	90	1,420	100	2,360	240
2007	60	1,360	80	2,250	60
2008	20	1,600	40	2,550	100
2009	20	1,530	40	2,550	100
2010	20	1,530	40	2,550	100
2011	20	1,530	40	2,550	100
2012	20	1,530	40	2,550	100
2013	20	1,530	40	2,550	100
2014	20	1,530	40	2,550	100
2015	20	1,530	40	2,550	100
2016	20	1,530	40	2,550	100
2017	20	1,570	40	2,550	100
2018	20	1,570	40	2,550	100
2019	20	1,430	30	2,390	60
2020	20	1,430	30	2,390	60
2021	20	1,430	30	2,390	60
2022	20	1,430	30	2,390	60
2023	20	1,430	30	2,390	60
2024	20	1,430	30	2,390	60

TC

a. Source: Hess (1995a).
b. Operations employment for the maximum waste forecast is provided in Table 4-62.

4.4.8.1.2 Operations

Operations employment associated with implementation of the alternative B – expected waste forecast is expected to peak in 2008 through 2018 with an estimated 2,550 jobs (Table 4-61), 100 more than during TC peak employment under the no-action alternative. This employment demand represents less than 1 percent of forecast employment in 2015 (see Chapter 3) and approximately 12 percent of 1995 SRS employment. DOE believes these jobs would be filled from the existing SRS workforce. Thus, DOE does not anticipate an impact on socioeconomic resources from changes in operations employment.



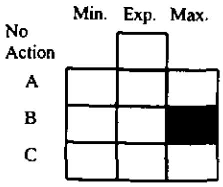
4.4.8.2 Socioeconomics – Minimum Waste Forecast

4.4.8.2.1 Construction

Construction employment associated with alternative B – minimum waste forecast would be slightly less TC than that for the expected waste forecast and would peak during 2004 through 2005 with approximately 120 jobs (Table 4-61), which represents much less than 1 percent of the forecast employment in 2005. DOE does not expect a net change in regional construction employment from implementation of this alternative. As a result, socioeconomic resources in the region would not be affected.

4.4.8.2.2 Operations

Operations employment associated with implementation of the minimum waste forecast is expected to peak during 2017 and 2018 with an estimated 1,570 jobs (Table 4-60), 980 fewer than the expected waste TC forecast. This employment demand represents less than 1 percent of the forecast employment in 2018 and approximately 8 percent of 1995 SRS employment. DOE believes these jobs would be filled from the existing SRS workforce and, therefore, anticipates that socioeconomic resources would not be affected by changes in operations employment.



4.4.8.3 Socioeconomics – Maximum Waste Forecast

4.4.8.3.1 Construction

Construction employment associated with alternative B – maximum waste forecast would be greater than that for the expected waste forecast and would peak during 2003 through 2005 with approximately 330 jobs (Table 4-61), which represents much less than 1 percent of the forecast employment in 2005. DOE does not expect a net change in regional construction employment from implementation of this alternative. As a result, DOE does not expect socioeconomic resources in the region to be affected. TC

4.4.8.3.2 Operations

Operations employment associated with the implementation of alternative B – maximum waste forecast is expected to peak between 2002 through 2005 with an estimated 10,010 jobs (Table 4-62), which represents 3.7 percent of the forecast regional employment in 2005 and approximately 50 percent of SRS's employment in 1995. DOE assumes that approximately 50 percent of the total SRS workforce would be available to support implementation of this case. If DOE transfers 50 percent of the SRS workforce, an additional 2,110 new employees would be required in the peak years. Based on the number of new jobs predicted, DOE calculated changes in regional employment, population, and personal income using the Economic-Demographic Forecasting and Simulation Model developed for the six-county region of influence (Treyz, Rickman, and Shao 1992). TC

Results of the modeling indicate that the peak regional employment change would occur in 2002 with a total of approximately 4,800 new jobs (Table 4-63) (HNUS 1995b). This would represent a 1.8 percent increase in baseline regional employment and would have a substantial positive impact on the regional economy.

Potential changes in regional population would lag behind the peak change in employment because of migration lags and because new residents may have children after they move into the area. As a result, the maximum change in population would occur in 2005 with an estimated 8,340 additional people in the six-county region (Table 4-63) (HNUS 1995b). This increase is approximately 1.7 percent above the baseline population forecast and could affect the demand for community resources and services such as housing, schools, police, health care, and fire protection.

Table 4-62. Estimated new operations jobs required to support alternative B, – maximum waste forecast.[a]

Year	Projected total site employment	Site employment available for WM activities[b]	Total operations employment for alternative B maximum case	New hires[c]
1995	20,000	10,000	2,620	0
1996	15,800	7,900	4,000	0
1997	15,800	7,900	4,000	0
1998	15,800	7,900	9,470	1,570
1999	15,800	7,900	9,470	1,570
2000	15,800	7,900	9,680	1,780
2001	15,800	7,900	9,680	1,780
2002	15,800	7,900	10,010	2,110
2003	15,800	7,900	10,010	2,110
2004	15,800	7,900	10,010	2,110
2005	15,800	7,900	10,010	2,110
2006	15,800	7,900	9,310	1,410
2007	15,800	7,900	4,040	0
2008	15,800	7,900	6,020	0
2009	15,800	7,900	6,020	0
2010	15,800	7,900	6,020	0
2011	15,800	7,900	6,020	0
TC 2012	15,800	7,900	6,020	0
2013	15,800	7,900	6,020	0
2014	15,800	7,900	6,020	0
2015	15,800	7,900	6,020	0
2016	15,800	7,900	6,020	0
2017	15,800	7,900	6,020	0
2018	15,800	7,900	6,020	0
2019	15,800	7,900	4,040	0
2020	15,800	7,900	4,040	0
2021	15,800	7,900	4,040	0
2022	15,800	7,900	4,040	0
2023	15,800	7,900	4,040	0
2024	15,800	7,900	4,040	0

a. Source: Hess (1995a).
b. DOE assumed that approximately 50 percent of the total site workforce would be available to work on waste management activities.
c. New hires are calculated by comparing the required employment (column 4) to available employment (column 3); new hires would result only in those years when required employment exceeds available employment.

Table 4-63. Changes in employment, population, and personal income for alternative B – maximum waste forecast.[a]

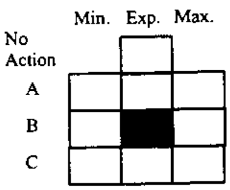
Year	New hires[b]	Change in indirect regional employment[c]	Net change in total regional employment	Percent change in regional employment	Change in regional population	Percent change in regional population	Change in regional personal income (millions)	Percent change in regional personal income
1998	1,570	2,260	3,830	1.55	1,350	0.29	180	1.73
1999	1,570	2,190	3,760	1.50	2,990	0.63	210	1.91
2000	1,780	2,390	4,170	1.65	4,170	0.88	250	2.15
2001	1,780	2,290	4,070	1.59	5,200	1.09	270	2.19
2002	2,110	2,690	4,800	1.86	6,250	1.31	330	2.52
2003	2,110	2,610	4,720	1.81	7,190	1.50	350	2.52
2004	2,110	2,550	4,660	1.76	7,840	1.64	370	2.51
2005	2,110	2,510	4,620	1.73	8,340	1.74	390	2.50
2006	1,410	1,430	2,840	1.05	8,080	1.68	280	1.69

TC

a. Source: Hess (1995a); HNUS (1995b).
b. From Table 4-62.
c. Change in employment related to changes in population.

Potential changes in total personal income would peak in 2005 with a $390 million increase over forecast TC regional income levels for that year (Table 4-63) (HNUS 1995b). This would be a 2.5 percent increase over baseline income levels and would have a substantial, positive effect on the regional economy.

4.4.9 CULTURAL RESOURCES

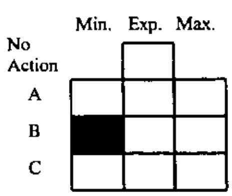


4.4.9.1 Cultural Resources – Expected Waste Forecast

This section discusses the effects of alternative B – expected waste forecast on cultural resources. As illustrated in Figure 4-31, waste management facilities under alternative B would be constructed primarily within the currently developed, fenced portion of E-Area. Construction within this area would not affect archaeological resources because this area has been disturbed.

Construction of disposal vaults to the northwest of the currently developed portion of E-Area (Figure 4-31) would not affect archaeological resources because when this area was surveyed, no important sites were discovered. No additional archaeological work is planned.

Archaeological sites in the area of proposed expansion could be impacted as described in Section 4.1.9. If this occurred, DOE would protect the cultural resources as described in Section 4.1.9.

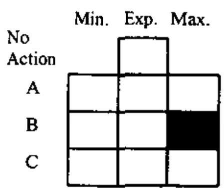


4.4.9.2 Cultural Resources – Minimum Waste Forecast

Construction of new waste management facilities for this forecast would require approximately TC 0.21 square kilometer (51 acres) less than for the expected waste forecast. Although the precise configuration of facilities is currently undetermined, construction would take place within the areas discussed in Section 4.4.9.1.

As discussed in Section 4.4.9.1, construction within the developed and fenced portion of E-Area or to the northwest of this area would have no effect on cultural or archaeological resources. Before construction could be initiated in the undeveloped area northwest of F-Area, the Savannah River Archaeology

Research Program and DOE would complete the consultation process with the State Historic Preservation Officer and develop mitigation action plans to ensure that important archaeological resources would be protected and preserved (Sassaman 1994).

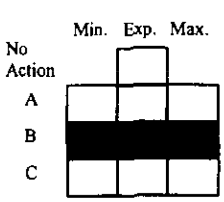


4.4.9.3 Cultural Resources - Maximum Waste Forecast

Construction of new waste management facilities for this forecast would require approximately 4.1 square kilometers (1,010 acres), 3.4 square kilometers (852 acres) more than for the expected waste forecast. Much of the proposed construction would take place within E-Area. However, this area is not large enough to support all of the new facilities. DOE would need an additional estimated 3.1 square kilometers (756 acres) outside of the areas addressed in Section 4.4.9.1. TC TC

Construction within the developed and fenced portion of E-Area or to the northwest of this area would not affect archaeological resources. Before construction could begin in the undeveloped area northwest of F-Area, the Savannah River Archaeology Research Program and DOE would complete the consultation process with the State Historic Preservation Officer and develop mitigation action plans, as described in Section 4.3.9.2.

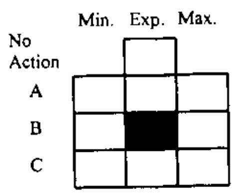
Until DOE has determined the precise location of the additional 3.1 square kilometers (756 acres) that would be used outside of E-Area, effects on cultural resources cannot be predicted. The potential disturbance of important cultural resources would be proportional to the amount of land disturbed. However, in compliance with the Programmatic Memorandum of Agreement, DOE would survey all areas proposed for construction activities prior to disturbance. If important resources were discovered, DOE would avoid or remove them. TC



4.4.10 AESTHETICS AND SCENIC RESOURCES - EXPECTED, MINIMUM, AND MAXIMUM WASTE FORECASTS TE

Activities associated with alternative B and the three waste forecasts would not adversely affect scenic resources or aesthetics. E-Area is already dedicated to industrial use. New construction would not be visible from off SRS or from public access roads on SRS. The new facilities would not produce emissions to the atmosphere that would be visible or that would indirectly reduce visibility.

4.4.11 TRAFFIC AND TRANSPORTATION



4.4.11.1 Traffic

4.4.11.1.1 Traffic – Expected Waste Forecast

This section discusses the effects of alternative B – expected waste forecast on traffic and transportation.

TC TE This case would require 119 more construction workers than the no-action alternative. Traffic on all roads would remain within carrying capacity (Table 4-64), and effects on traffic would be minimal.

Table 4-64. Number of vehicles per hour during peak hours under alternative B.

Road	Design capacity, vehicles per hour	No-action alternative (percentage of capacity)[a]	Waste forecast Minimum	Waste forecast Expected	Waste forecast Maximum
Offsite			Percentage of design capacity		
SC 19	3,000[b]	2,821 (94)	2,852 (95)	2,875 (96)	2,948 (98)
SC 125	3,200[b]	2,720 (85)	2,750 (86)	2,772 (87)	2,842 (89)
SC 57	2,100[b]	706 (34)	713 (34)	719 (34)	737 (35)
Onsite					
Road E at E-Area	2,300[c]	788[d] (34)	856[e] (37)	907[e] (39)	1,068[e] (46)

a. Number in parentheses represents percentage of design capacity.
b. Adapted from Smith (1989).
c. Adapted from TRB (1985).
d. Includes baseline plus the maximum number (47) of construction workers (Hess 1995a).
e. Includes baseline plus the maximum number (115 for the minimum, 166 for the expected, and 327 for the maximum waste forecast) of construction workers (Hess 1995a).

There would be four additional daily waste shipments over the no-action estimate (Table 4-65). These additional shipments are due primarily to the shipment of low-level waste to offsite processing facilities. Offsite trucks with shipments of low-level waste would travel approximately 340,000 miles per year and would be expected to result in 0.04 prompt fatality annually. DOE does not expect effects on traffic. TC

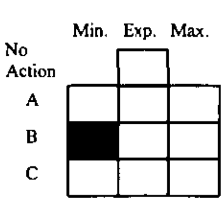
Table 4-65. SRS daily hazardous and radioactive waste shipments by truck under alternative B.[a]

Waste type	1994 no-action alternative traffic[a]	Change from no-action Minimum	Expected	Maximum
Hazardous	14	-6	<1[c]	6
Low-level	7	<1	4	22
Mixed	8	-4	<1	14
Transuranic[b]	1	<1	<1	15
Total change	NA	-10	4	57
Total shipments per day	30	19	34	87

TC

a. Shipments per day: To arrive at shipments per day, the total number of waste shipments estimated for the 30 years considered in this EIS was divided by 30 to determine estimated shipments per year. These numbers were divided by 250, which represents working days in a calendar year, to determine shipments per day. Supplemental information is provided in the traffic and transportation section of Appendix E.
b. Includes mixed and nonmixed transuranic waste shipments.
c. Values less than 1 are treated as zero for purposes of comparison.

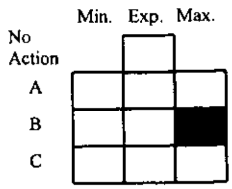
As discussed in Section 4.1.11.1, the 1992 South Carolina highway fatality rate of 2.3 per 100 million miles driven leads to a baseline estimate of 5.5 traffic fatalities annually. Under alternative B, the largest increase in construction workers would occur for the maximum waste forecast (280 more workers than under the no-action alternative). These workers would be expected to drive 3.3 million miles annually (2.8 million miles more than under the no-action alternative), which is predicted to result in 1.4 additional prompt fatalities per year. TC



4.4.11.1.2 Traffic – Minimum Waste Forecast

Alternative B – minimum waste forecast would require 68 more construction workers (Table 4-64) than the no-action alternative. Traffic on all roads would remain within design capacity, and the effects of increased traffic would be minimal. TC

TC There would be 11 fewer waste shipments per day compared to estimates for the no-action alternative (Table 4-65). This would be due to smaller volumes of all types of waste. The effects of decreased truck traffic would be minimal.



4.4.11.1.3 Traffic – Maximum Waste Forecast

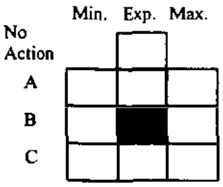
TC Alternative B – maximum waste forecast would require 280 more construction workers than the no-action alternative (Table 4-64). However, traffic on all roads would remain within carrying capacity, and effects to traffic would be minimal.

TC There would be 57 additional daily waste shipments over the no-action estimate (Table 4-65), primarily due to the larger volumes of wastes [offsite shipments of low-level waste would be approximately equal to the expected case (2 per day)]. Except for offsite shipments, these shipments would originate at various SRS locations (primarily F- and H-Areas) and terminate at the E-Area treatment and disposal facilities. Shipments from the transuranic waste characterization/certification facility, alpha vitrification and non-alpha vitrification facilities, and containment building are not considered because these shipments would occur on a dedicated road that would be designed to accommodate expected traffic TC TE flows. The addition of 57 trucks during normal work hours would be expected to have a very small adverse effect on traffic.

4.4.11.2 <u>Transportation</u>

Consequences of incident-free onsite transportation over 30 years under alternative B were based on those calculated for the no-action alternative adjusted for changes in number of shipments (as a result of changes in volume of waste shipped). Consequences and health effects of onsite transportation accidents for any given shipment are independent of the number of shipments and are, therefore, the same as for the no-action alternative (Table 4-8). The probability of an accident occurring for each type of waste shipped is shown in Table 4-26.

For alternative B, DOE analyzed the impacts from offsite shipments of mixed waste (lead) and low-level waste. Other offsite shipments were excluded from the analyses because the volumes over the 30-year period are very small or the shipments occur only once. The methodology and receptors are defined in Section 4.2.11.



4.4.11.2.1 Transportation – Expected Waste Forecast

Incident-Free Radiological Impacts

For the expected waste forecast, there would be a small increase in dose and in the number of excess fatal cancers compared to the no-action alternative because of the addition of stabilized ash and blowdown from the Consolidated Incineration Facility that would be shipped onsite (Table 4-66) for this alternative. TC

The probability per year of an individual uninvolved worker developing an additional fatal cancer from incident-free onsite shipments is about 1 in 200,000 (Table 4-66). Members of the involved and uninvolved worker populations could expect less than one fatal cancer from transportation exposure. TE

Table 4-66. Annual dose (percent change from the no-action alternative) and excess latent cancer fatalities from incident-free onsite transport of radioactive material for alternative B – expected waste forecast.

Waste[a]	Uninvolved worker [b] (rem)		Uninvolved workers (person-rem)		Involved workers (person-rem)	
Low-level	0.011	(0%)	2.1	(5%)	240	(64%)
Mixed	6.7×10^{-5}	(21%)	0.14	(19%)	4.8	(10%)
Transuranic	1.3×10^{-4}	(0%)	0.0095	(0%)	0.15	(0%)
Totals[c]	0.011[d]		2.2[e]		240[e]	
Excess latent cancer fatalities	4.6×10^{-6}[f]		8.9×10^{-4}[g]		0.098[g]	

TC

a. See Appendix E for a list of waste streams which make up each waste type. Dose is based on exposure to all waste streams of a particular waste type.
b. See Section 4.1.11.2 for descriptions of receptors.
c. Totals rounded to two significant figures.
d. Assumes the same individual has maximal exposure to each waste (Appendix E) for a single year.
e. Dose from 1 year of exposure to incident-free transportation of waste (Appendix E).
f. Additional probability of an excess latent cancer fatality.
g. Values equal the total dose × the risk factor (0.0004 excess latent fatal cancers per person-rem).

TE

Radiological effects of offsite shipments would be similar to those under alternative A and are summarized in Table 4-67. The probability of an individual member of the public developing an additional fatal cancer would be about 1 in 15 million per year from incident-free offsite transportation of radioactive material (Table 4-67). The number of additional fatal cancers that could be expected among TC

Table 4-67. Annual dose and excess latent cancer fatalities from incident-free offsite transport of radioactive material for alternative B – expected waste forecast.

Waste	Involved workers[a] (person-rem)	Remote MEI[b] (rem)	Remote population[c] (person-rem)
Low-level	0.57	5.2×10^{-5}	0.87
Mixed	0.012	3.2×10^{-8}	0.0025
Low-level volume reduction[d]	16	8.1×10^{-5}	6.4
Totals[e]	17	1.3×10^{-4}	7.3
Excess latent cancer fatalities	6.6×10^{-3}	6.5×10^{-8}[f]	3.6×10^{-3}

TC

a. See Section 4.1.11.2 for descriptions of receptors.
b. MEI = maximally exposed individual.
c. Offsite population along the transportation route.
d. Includes only low-level waste sent offsite for size reduction, supercompaction, or incineration. This represents a change from the draft EIS.
e. Dose for the remote MEI assumes exposure to each waste (see Appendix E) in a year; for the populations, dose is the result of exposure to 1 year of incident-free transportation of waste (see Appendix E).
f. Additional probability of an excess latent cancer fatality.

TC

members of the public and involved workers would be less than one per year from incident-free onsite transportation. This analysis assumes that offsite shipments occur between SRS and a facility located in Oak Ridge, Tennessee. This route was selected as representative of possible offsite vendor locations.

Transportation Accident Impacts

The probability of an onsite accident would be similar to that under the no-action alternative because similar waste volumes would be shipped; the consequences due to a particular accident would be the same as described in Section 4.1.11.3. Probabilities of an accident involving each waste type are given in Table 4-26.

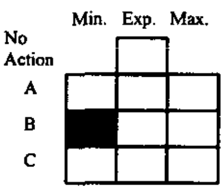
The consequences and associated excess latent cancer fatalities in the offsite population along the transportation route ("remote population") from offsite shipments under this alternative are similar to those for the uninvolved workers from onsite shipments as summarized in Table 4-67 and Table 4-27. An offsite accident would be less severe than one involving onsite shipments due to the smaller volume of waste in an individual shipment (Table 4-68). The number of fatal cancers that could be expected among members of the public would be less than one from incident-free offsite transport.

Table 4-68. Probability of an accident during 30 years of offsite transport of radioactive material for each waste forecast under alternative B, dose, and excess latent cancer fatalities from an accident.

Waste	Probability of an accident: Minimum forecast	Probability of an accident: Expected forecast	Probability of an accident: Maximum forecast	Dose (person rem)	Number of excess latent fatal cancers
Low-level	1.1×10^{-6}	2.1×10^{-6}	6.5×10^{-6}	4.8×10^{-4}	2.4×10^{-7}
Mixed	4.6×10^{-4}	1.1×10^{-3}	2.7×10^{-3}	0.0047	2.4×10^{-6}
Low-level volume reduction[a]	1.2×10^{-6}	1.6×10^{-6}	1.6×10^{-6}	370	0.19

a. Includes only low-level waste sent offsite for size reduction, supercompaction, or incineration. This represents a change from the draft EIS.

TC



4.4.11.2.2 Transportation – Minimum Waste Forecast

Incident-Free Radiological Impacts

For the minimum waste forecast, there would be decreases in dose to all onsite receptors from all radioactive shipments compared to doses from the expected waste forecast (Table 4-69) due to the decrease in volumes of waste.

The annual probability of an uninvolved worker developing an additional fatal cancer from incident-free onsite transport would be about 1 in 430,000 (Table 4-69). Involved workers and uninvolved workers could expect less than one additional excess fatal cancer per year.

For the minimum waste forecast, the annual probability of a member of the public developing an additional fatal cancer would be about 1 in 21 million from incident-free offsite transport of radioactive material (Table 4-70). The number of additional fatal cancers that could be expected among members of the public and involved workers would be less than one. TC

Table 4-69. Annual dose (percent change from the expected waste forecast) and excess latent cancer fatalities from incident-free onsite transport of radioactive material for alternative B – minimum waste forecast.

Waste[a]	Uninvolved worker[b] (rem)		Uninvolved workers (person-rem)		Involved workers (person-rem)	
Low-level	5.7×10^{-3}	(-49%)	1.0	(-51%)	120	(-49%)
Mixed	4.4×10^{-5}	(-34%)	0.091	(-53%)	2.5	(-47%)
Transuranic	9.0×10^{-5}	(-30%)	0.0066	(-30%)	0.1	(-30%)
Totals[c]	5.9×10^{-3}[d]		1.1[e]		120[e]	
Excess latent cancer fatalities	2.3×10^{-6}[f]		4.4×10^{-4}[g]		0.050[g]	

TC

TE
a. See Appendix E for a list of waste streams which make up each waste type. Dose is based on exposure to all waste streams of a particular waste type.
b. See Section 4.1.11.2 for descriptions of receptors.
c. Totals rounded to two significant figures.
d. Assumes the same individual has maximal exposure to each waste type (Appendix E) for a single year.
e. Dose from 1 year of exposure to incident-free transportation of waste (see Appendix E).
TC
f. Probability of an additional excess latent fatal cancer.
g. Value equals the total dose × the risk factor (0.0004 excess latent fatal cancers per person-rem).

Table 4-70. Annual dose and excess latent cancer fatalities from incident-free offsite transport of radioactive material for alternative B – minimum waste forecast.

Waste	Involved workers[a] (person-rem)	Remote MEI[b] (rem)	Remote population (person-rem)
Low-level	0.29	2.7×10^{-5}	0.45
Mixed	0.0052	1.4×10^{-8}	0.0011
Low-level volume reduction	20	6.6×10^{-5}	5.2
Totals[c]	20	9.3×10^{-5}	5.7
Excess latent cancer fatalities	8.0×10^{-3}[d]	4.7×10^{-8}[e]	2.8×10^{-3}[d]

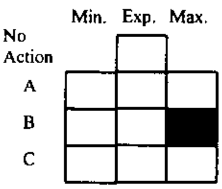
TC

TE

a. See Section 4.1.11.2 for descriptions of receptors.
b. MEI = maximally exposed individual.
TE
c. Dose for the remote MEI assumes exposure to each waste (see Appendix E) by the same individual in a year; for the populations, dose is the result of exposure to 1 year of incident-free transport of waste (see Appendix C).
TE
Totals are rounded to two significant figures.
L004-14
d. Value equals the total dose times the risk factor (0.0004 excess fatal cancers per person-rem for involved workers; 0.0005 excess fatal cancers per person rem for the remote population).
e. Additional probability of an excess latent fatal cancer.

Transportation Accident Impacts

The probability of an onsite accident involving radioactive wastes would decrease slightly for the minimum waste forecast (Table 4-26) because of the decreased volumes that would be shipped compared to those for the expected waste forecast; however, the consequences due to a particular accident would be the same as described in Section 4.1.11.2.2. Effects of offsite shipments would be the same as in Table 4-8; however, the probability of an offsite accident would decrease by about one half compared to the expected waste forecast due to the decrease in volume of waste shipped (Table 4-68).



4.4.11.2.3 Transportation – Maximum Waste Forecast

Incident-Free Radiological Impacts

For the maximum waste forecast, there would be large increases in dose to all receptors compared to the expected waste forecast (Table 4-71), due to the increases in volumes of all wastes that would be shipped. These increases would be similar to those described under alternative A – maximum waste forecast.

Table 4-71. Annual dose (percent change from the expected waste forecast) and excess latent cancer fatalities from incident-free onsite transport of radioactive material for alternative B – maximum waste forecast.

Waste[a]	Uninvolved worker[b] (rem)		Uninvolved workers (person-rem)		Involved workers (person-rem)	
Low-level	0.014	(27%)	2.7	(31%)	540	(126%)
Mixed	2.1×10^{-4}	(211%)	0.47	(228%)	19	(296%)
Transuranic	0.0021	(1,550%)	0.16	(1,550%)	2.4	(1,550%)
Totals[c]	0.017[d]		3.3[e]		560[e]	
Excess latent cancer fatalities	6.6×10^{-6}[f]		0.0013[g]		0.22[g]	

TC

a. See Appendix E for a list of waste streams which make up each waste type. Dose is based on exposure to all waste streams of a particular waste type.
b. See Section 4.1.11.2 for descriptions of receptors.
c. Totals are rounded to two significant figures.
d. Assumes the same individual has maximal exposure to each waste type (Appendix E) for a single year. TE
e. Dose from 1 year of exposure to incident-free transportation.
f. Additional probability of an excess latent fatal cancer.
g. Values equal the total dose × the risk factor (0.0004 excess latent fatal cancers per person-rem for involved workers; 0.0005 excess latent fatal cancers per person-rem for the uninvolved population).

The annual probability of an uninvolved worker developing an additional fatal cancer would be about 1 in 150,000 (Table 4-71). The involved workers population and the uninvolved workers could expect less than one additional excess fatal cancer from 30 years of incident-free onsite transportation under the maximum waste forecast.

The annual probability of a member of the public developing an additional fatal cancer is about
TC 1 in 7,700,000 from incident-free offsite transport of radioactive material (Table 4-72). The number of additional fatal cancers that could be expected among members of the public and involved workers would be less than one.

Table 4-72. Annual dose and excess latent cancer fatalities from incident-free offsite transport of radioactive material for alternative B – maximum waste forecast.

	Waste	Involved workers (person-rem)	Remote MEI[a] (rem)	Remote population (person-rem)
	Low level	1.8	1.6×10^{-4}	2.7
	Mixed	0.031	8.2×10^{-8}	6.4×10^{-3}
TC	Low-level volume reduction	80	9.6×10-5	7.5
	Totals[b]	82	2.6×10^{-4}	10
	Excess latent cancer fatalities	0.033[c]	1.3×10^{-7}[d]	0.051[c]

a. MEI = maximally exposed individual.
b. Dose for the remote MEI assumes exposure to each waste in a year; for the population, dose is the result of exposure to 1 year of incident-free transportation of waste. Totals are rounded to two significant figures.
TE c. Values equal the total dose times the risk factor (0.0004 excess latent fatal cancers per person-rem for involved workers; 0.0005 excess latent fatal cancers per person-rem for the uninvolved population).
d. Additional probability of an excess latent fatal cancer.

Transportation Accident Impacts

The probability of an onsite accident involving radioactive wastes would increase (Table 4-26) because more waste would be shipped compared to the expected waste forecast; however, the consequences due to a particular accident would be the same as described in Section 4.1.11.3. Effects of offsite shipments would be the same as for the expected case (Table 4-68); however, the probability of an offsite accident would be three times greater than the expected waste forecast because of the increase in volume of waste shipped.

4.4.12 OCCUPATIONAL AND PUBLIC HEALTH

Radiological and nonradiological impacts to workers and the public are presented in this section for alternative B. As expected, the impacts are smallest for the minimum waste forecast and largest for the maximum waste forecast.

Under alternative B, the Consolidated Incineration Facility, the alpha and non-alpha vitrification facilities, the mixed and hazardous waste containment building, the mobile soil sort facility, compaction facilities, and the transuranic waste characterization/certification facility would operate. Emissions from these facilities (see Appendix E for detailed facility dose information) would increase adverse health effects over the no-action alternative for the three waste forecasts. However, effects would remain small relative to those normally expected in the worker and regional population groups from all causes. In addition, significant quantities of low-level radioactive waste would be shipped offsite for processing (supercompacting, sorting, incinerating, or smelting). TC

Under this alternative the major sources of potential exposure the involved workers would be the transuranic waste storage pads, the F- and H-Area tank farms, and the transuranic characterization/certification facility; for the public and uninvolved workers, the major sources of potential exposure would be environmental releases from the alpha and non-alpha vitrification facilities, the transuranic characterization/certification facility, and the Consolidated Incineration Facility (Consolidated Incineration Facility impacts are summarized in Appendix B.5). The report *Dose Comparison for Air Emissions From Incineration and Compaction of SRS Low-level Radioactive Job Control Waste* (Mulholland and Robinson 1994) compared radionuclide releases from treating solid low-level waste by incineration and compaction. The report evaluated release mechanisms and control equipment efficiencies to estimate quantities of radionuclides released by each process. These emissions were used to estimate doses to the nearest uninvolved worker and the maximally exposed offsite individual based on treatment of similar volumes of job-control waste by each technology. The report estimated that the annual dose to the uninvolved worker (baseline emissions estimate) at a distance of 350 meters (1,148 feet) from the Consolidated Incineration Facility and to the maximally exposed offsite individual would be 7.7×10^{-4} millirem and 8.6×10^{-4} millirem, respectively. As a perspective, these dose rates are 400,000 times lower than the background radiation dose (357 millirem, see Section 3.12.1.1) that the average member of the population within 80 kilometers (50 miles) of SRS receives. L004-13 TE

The Mulholland and Robinson (1994a) report estimated the annual dose to the maximally exposed offsite individual from compaction of low-level job control waste to range from 1.3×10^{-6} millirem to 4.1×10^{-5}millirem, depending on the percentage of tritium assumed to be released in the process. TE

TC storage; the mobile soil sort facility; four new solvent tanks; the transuranic waste characterization/certification facility; the containment building, the non-alpha vitrification facility (including soil sorting); and the alpha vitrification facility. Occupational health impacts to employees in the Defense Waste Processing Facility, including In-Tank Precipitation were discussed in the *Final Supplemental* TE *Environmental Impact Statement Defense Waste Processing Facility*. Occupational health impacts to employees associated with the Consolidated Incineration Facility were discussed in the *Environmental Assessment for the Consolidated Incineration Facility*.

Table E.2-3 in Appendix E presents a comparison between Occupational Safety and Health Administration permissible exposure limit values and potential exposures to uninvolved workers at both 100 meters (328 feet) and 640 meters (2,100 feet) from each facility for the expected, minimum, and maximum waste forecasts. Downwind concentrations were calculated using EPA's TSCREEN model TE (EPA 1988). For each facility's emissions, under the expected waste forecast, employee occupational exposure would be less than Occupational Safety and Health Administration permissible exposure limits. Worker exposure is approximately the same as would occur in the no-action alternative due to the M-Area Vendor Treatment Facility and Building 645-2N mixed waste storage operations. In most instances, downwind concentrations would be less than 1 percent of the applicable Occupational Safety and Health Administration permissible exposure guidelines. DOE expects minimal health impacts to uninvolved workers due to air emissions from these facilities.

4.4.12.1.2 Public Health and Safety

Radiological Impacts

Table 4-74 presents the doses to the public and resulting health effects that are associated with the TC expected waste forecast. The annual doses to the maximally exposed individual (0.032 millirem) and to the SRS regional population (1.5 person-rem) would be lower than those that resulted from total SRS operations in 1993, which were much lower than the regulatory limits (Arnett, Karapatakis, and Mamatey 1994). For the offsite facility (assumed to be located in Oak Ridge, Tennessee, for the purposes of this assessment) under this forecast, the annual doses to the offsite maximally exposed individual (1.7×10^{-3} millirem) and to regional population (1.2×10^{-2} person-rem) surrounding Oak Ridge, TC Tennessee, represent a small fraction (less than 6 percent) of the comparable doses to the SRS regional population. These doses remain less than 6 percent of the comparable SRS doses for all waste forecast under this alternative (see Appendix E for facility specific data). For this waste forecasts, radiologically induced health effects to the public (0.023 fatal cancers from 30 years of exposure) would be very small (Table 4-74).

TE | **Table 4-74.** Radiological doses associated with implementation of alternative B and resulting health effects to the public.[a]

Waste forecast/receptor(s)[c]	No-action alternative: Dose[b] Atmospheric releases	No-action alternative: Dose[b] Aqueous releases	No-action alternative: Total	No-action alternative: Probability[d] or number of fatal cancers	Alternative B: Dose[b] Atmospheric releases[g]	Alternative B: Dose[b] Aqueous releases	Alternative B: Total	Alternative B: Probability[d] or number of fatal cancers
Expected waste forecast								
Offsite MEI[e]								
• Annual millirem	1.2×10^{-4}	6.9×10^{-4}	8.1×10^{-4}	4.1×10^{-10}	0.035	6.9×10^{-4}	0.036	1.8×10^{-8}
• 30-year, millirem	0.0037	0.021	0.025	1.2×10^{-8}	1.046	0.021	1.067	5.3×10^{-7}
Population								
• Annual, person-rem	2.9×10^{-4}	0.0068	0.0071	3.5×10^{-6}	1.6	0.0068	1.6	8.0×10^{-4}
• 30-year, person-rem	0.0086	0.20	0.21	1.1×10^{-4}	48	0.20	48	0.024
Minimum waste forecast								
Offsite MEI								
• Annual, millirem	NA[f]	NA	NA	NA	0.023	6.9×10^{-4}	0.024	1.2×10^{-8}
• 30-year, millirem	NA	NA	NA	NA	0.69	0.021	0.71	3.6×10^{-7}
Population								
• Annual, person-rem	NA	NA	NA	NA	1.025	0.0068	1.032	5.2×10^{-4}
• 30-year, person-rem	NA	NA	NA	NA	31	0.20	31	0.015
Maximum waste forecast								
Offsite MEI								
• Annual, millirem	NA	NA	NA	NA	0.36	6.9×10^{-4}	0.36	1.8×10^{-7}
• 30-year, millirem	NA	NA	NA	NA	10.7	0.021	10.7	5.4×10^{-6}
Population								
• Annual, person-rem	NA	NA	NA	NA	15	0.0068	15	0.008
• 30-year, person-rem	NA	NA	NA	NA	437	0.20	437	0.22

TC

a. Supplemental facility information provided in Appendix E.

b. For atmospheric releases, the dose is to the population within 80 kilometers (50 miles) of SRS. For aqueous releases, the dose is to the people using the Savannah River from SRS to the Atlantic Ocean.

c. The doses to the public from total SRS operations in 1993 were 0.25 millirem to the offsite maximally exposed individual and 9.1 person-rem to the regional population. These doses, when added to the incremental doses associated with the proposed action that are given in this table, are assumed to equal total SRS doses. For the maximum waste forecast (which gives the highest doses), the total annual doses to the offsite maximally exposed individual and the regional population would equal 0.58 millirem (0.25 + 0.33) and approximately 23.1 person-rem (9.1 + 14), respectively. The individual dose would fall below the proposed annual regulatory limits of 10 millirem from airborne releases, 4 millirem from drinking water, and 100 millirem from all pathways combined (proposed 10 CFR 834); the population dose would be lower than the proposed annual notification limit of 100 person-rem (proposed 10 CFR 834).

d. For the offsite maximally exposed individual, probability of a fatal cancer; for population, number of fatal cancers.

e. MEI = maximally exposed individual.

f. NA = Not applicable.

TC | g. Atmospheric releases for MEI and population include contributions from offsite facilities, which contribute less than 6 percent to the atmospheric releases reported here.

Nonradiological Impacts

Potential nonradiological impacts to individuals residing offsite are considered for both criteria and carcinogenic pollutants. Maximum site boundary-line concentrations for criteria pollutants are discussed in Section 4.4.5.1.2.

For routine releases from SRS operating facilities under the expected waste forecast, criteria pollutant concentrations would be within state and federal ambient air quality standards, as discussed in Section 4.4.5.1.2. During periods of construction, the criteria pollutant concentrations at the SRS boundary would not exceed air quality standards under normal operating conditions.

Risks due to carcinogens for the SRS offsite population were calculated using the Industrial Source Complex 2 model for the same facilities discussed in Section 4.4.12.1.1. Emissions of carcinogenic compounds are based on the types and quantities of waste being processed at each facility. Table 4-75 shows the individual lifetime cancer risks calculated from unit risk factors (see Section 4.1.12.2.2) derived from EPA's Integrated Risk Information System data base (EPA 1994). As shown in Table 4-75, the estimated increased probability of an individual developing cancer over a lifetime due to routine SRS
TC emissions under the expected waste forecast is approximately 2 in 10 million. This risk is equal to the calculated excess latent cancer risk for the no-action alternative. DOE expects minimal health impacts from offsite exposures.

4.4.12.1.3 Environmental Justice Assessment

Section 4.1.12.2.3 describes the methodology for analyzing radiological dose emissions to determine if there would be disproportionate and adverse impacts on people of color or low income. Figure 4-33
TE illustrates the results of the analysis for alternative B – expected waste forecast for the 80-kilometer (50-mile) region of interest in this EIS. Supporting data for the analysis can be found in Appendix E.

TE The predicted per capita dose differs very little between types of communities at a given distance from SRS, and the per capita dose is extremely small in each type of community. This analysis indicates that people of color or low income in the 80-kilometer (50-mile) region would be neither disproportionately nor adversely impacted. Therefore, environmental justice issues would not be a concern in this alternative.

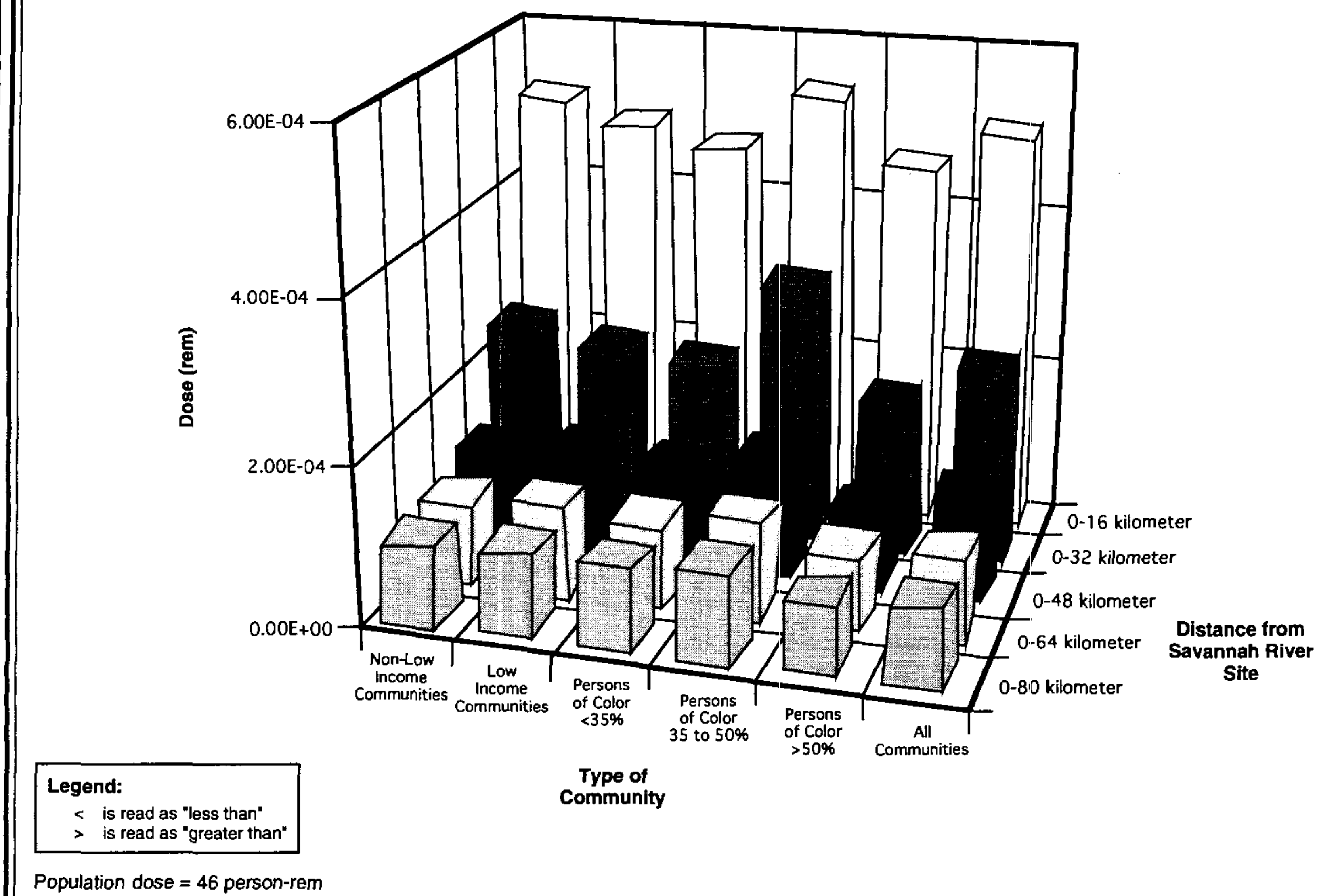
Table 4-75. Estimated number of excess latent cancers in the offsite population from nonradiological carcinogens emitted under alternative B.[a]

Pollutant	Unit risk factor[a] (latent cancers/ μg/m³)[e]	Concentration[b,c] Expected waste forecast (μg/m³)	Minimum waste forecast (μg/m³)	Maximum waste forecast (μg/m³)	Latent Cancers[d] Expected waste forecast[d]	Minimum waste forecast	Maximum waste forecast
Acetaldehyde	2.2×10^{-6}	1.4×10^{-7}	6.9×10^{-8}	1.2×10^{-7}	1.3×10^{-13}	6.5×10^{-14}	1.2×10^{-13}
Acrylamide	0.0013	1.4×10^{-7}	6.9×10^{-8}	1.2×10^{-7}	7.8×10^{-11}	3.8×10^{-11}	6.9×10^{-11}
Acrylonitrile	6.8×10^{-5}	1.4×10^{-7}	6.9×10^{-8}	1.2×10^{-7}	4.1×10^{-12}	2.0×10^{-12}	3.6×10^{-12}
Arsenic Pentoxide	0.0043	7.1×10^{-7}	4.6×10^{-7}	6.9×10^{-7}	1.3×10^{-9}	8.5×10^{-10}	1.3×10^{-9}
Asbestos	0.23	2.7×10^{-8}	1.5×10^{-8}	7.5×10^{-8}	2.7×10^{-9}	1.5×10^{-9}	7.4×10^{-9}
Benzene	8.3×10^{-6}	0.044	0.044	0.044	1.6×10^{-7}	1.6×10^{-7}	1.6×10^{-7}
Benzidine	0.067	1.4×10^{-7}	6.9×10^{-8}	1.2×10^{-7}	4.0×10^{-9}	2.0×10^{-9}	3.5x10-9
Bis(chloromethyl)ether	0.062	1.4×10^{-7}	6.9×10^{-8}	1.2×10^{-7}	3.7×10^{-9}	1.8×10^{-9}	3.3×10^{-9}
Bromoform	1.1×10^{-6}	1.4×10^{-7}	6.9×10^{-8}	1.2×10^{-7}	6.6×10^{-14}	3.3×10^{-14}	5.8×10^{-14}
Carbon Tetrachloride	1.5×10^{-5}	1.2×10^{-5}	9.9×10^{-6}	1.4×10^{-5}	7.4×10^{-11}	6.4×10^{-11}	9.3×10^{-11}
Chlordane	3.7×10^{-4}	1.4×10^{-7}	6.9×10^{-8}	1.2×10^{-7}	2.2×10^{-11}	1.1×10^{-11}	2.0×10^{-11}
Chloroform	2.3×10^{-5}	0.003	0.003	0.003	3.0×10^{-8}	2.9×10^{-8}	3.0×10^{-8}
Cr(+6) Compounds	0.012	4.7×10^{-9}	2.3×10^{-9}	4.1×10^{-9}	2.4×10^{-11}	1.2×10^{-11}	2.1×10^{-11}
Formaldehyde	1.3×10^{-5}	1.4×10^{-7}	6.9×10^{-8}	1.2×10^{-7}	7.8×10^{-13}	3.8×10^{-13}	6.9×10^{-13}
Heptachlor	0.0013	3.5×10^{-7}	1.7×10^{-7}	3.1×10^{-7}	1.9×10^{-10}	9.6×10^{-11}	1.7×10^{-10}
Hexachlorobenzene	4.6×10^{-4}	1.4×10^{-7}	6.9×10^{-8}	1.2×10^{-7}	2.8×10^{-11}	1.4×10^{-11}	2.4×10^{-11}
Hexachlorobutadiene	2.2×10^{-5}	1.4×10^{-7}	6.9×10^{-8}	1.2×10^{-7}	1.3×10^{-12}	6.5×10^{-13}	1.2×10^{-12}
Hydrazine	0.0049	1.4×10^{-7}	6.9×10^{-8}	1.2×10^{-7}	2.9×10^{-10}	1.4×10^{-10}	2.6×10^{-10}
1,1,2,2-Tetrachloroethane	5.8×10^{-5}	2.8×10^{-6}	1.4×10^{-6}	2.4×10^{-6}	6.9×10^{-11}	3.4×10^{-11}	6.0×10^{-11}
1,1,2-Trichloroethane	1.6×10^{-5}	1.4×10^{-7}	6.9×10^{-8}	1.2×10^{-7}	9.6×10^{-13}	4.7×10^{-13}	8.4×10^{-13}
Toxaphene	3.2×10^{-4}	3.5×10^{-7}	1.7×10^{-7}	2.5×10^{-7}	4.8×10^{-11}	2.4×10^{-11}	3.5×10^{-11}
1,1 Dichloroethene	5.0×10^{-5}	2.7×10^{-5}	2.3×10^{-5}	3.4×10^{-5}	5.7×10^{-10}	5.0×10^{-10}	7.3×10^{-10}
Methylene chloride	4.7×10^{-7}	1.4×10^{-7}	9.3×10^{-8}	1.4×10^{-7}	2.9×10^{-14}	1.9×10^{-14}	2.8×10^{-14}
				TOTAL	2.0×10^{-7}	1.9×10^{-7}	2.0×10^{-7}

TC

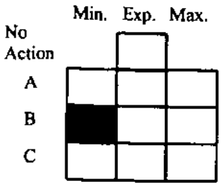
a. Source: EPA (1994).
b. Maximum annual boundary-line concentration.
c. Source: Stewart (1994).
d. Latent cancer probability equals unit risk factor times concentration times 30 years divided by 70 years.
e. Micrograms per cubic meter of air.
f. Under the maximum waste forecast, wastewater would be treated in the containment building, which would lower the amount of wastewater going to the Consolidated Incineration Facility. Therefore, slightly higher impacts would occur in the expected waste forecast than in the maximum waste forecast.

TE



PK56-4

TE | **Figure 4-33.** Dose to individuals in communities within 80 kilometers (50 miles) of SRS for the alternative B – expected waste forecast.



4.4.12.2 Occupational and Public Health – Minimum Waste Forecast

Because the waste amounts for alternative B – minimum waste forecast would be smaller than for the expected waste forecast and the treatment operations would be basically the same, the impacts to workers and the public would be smaller than described in Section 4.4.12.1.

4.4.12.2.1 Occupational Health and Safety

Radiological Impacts

Table 4-73 includes the worker doses and resulting health effects associated with the minimum waste forecast. Doses (0.036 rem per year) and health effects associated with this case would be smaller than those associated with the expected waste forecast. The dose from 30 years of waste management could result in one additional fatal cancer in the involved workforce.

Nonradiological Impacts

Table E.2-4 in Appendix E presents a comparison of the nonradiological air concentrations to permissible exposure limits under the Occupational Safety and Health Administration. Exposures to SRS workers are either equal to or less than those occurring in the expected waste forecast. However, for all facilities, employee occupational exposure would be less than Occupational Safety and Health Administration permissible exposure limits. Worker exposure is less than that which would occur under the no-action alternative due to the M-Area Vendor Treatment Facility and Building 645-2N mixed waste storage operations.

4.4.12.2.2 Public Health and Safety

Radiological Impacts

Table 4-74 includes the doses and resulting health effects to the public that are associated with the TE
minimum waste forecast. Doses and health effects associated with this case would be smaller than those
associated with the expected waste forecast. An 0.015 additional fatal cancer in the exposed public could TC
occur from 30 years of minimum waste generation under alternative B.

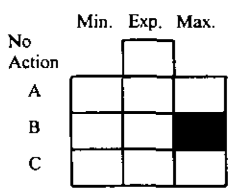
Nonradiological Impacts

Potential nonradiological impacts to individuals residing offsite are considered for both criteria and carcinogenic pollutants for the minimum waste forecast. For routine releases from operating facilities, criteria pollutant concentrations would be within state and federal ambient air quality standards, as discussed in Section 4.4.5.2. During periods of construction, the criteria pollutant concentrations at the site boundary would not exceed air quality standards under normal operating conditions.

Table 4-75 presents offsite risks due to emissions of carcinogens. The overall increased lifetime cancer risk is approximately 3 in 10 million, which is less than for the expected waste forecast. DOE expects minimal health impacts from the minimum waste forecast.

4.4.12.2.3 Environmental Justice Assessment

TE Figure 4-34 illustrates the results of the analysis for alternative B – minimum waste forecast for the 80-kilometer (50-mile) region of interest in this EIS. No communities would be disproportionately affected by emissions resulting from this scenario.



4.4.12.3 Occupational and Public Health – Maximum Waste Forecast

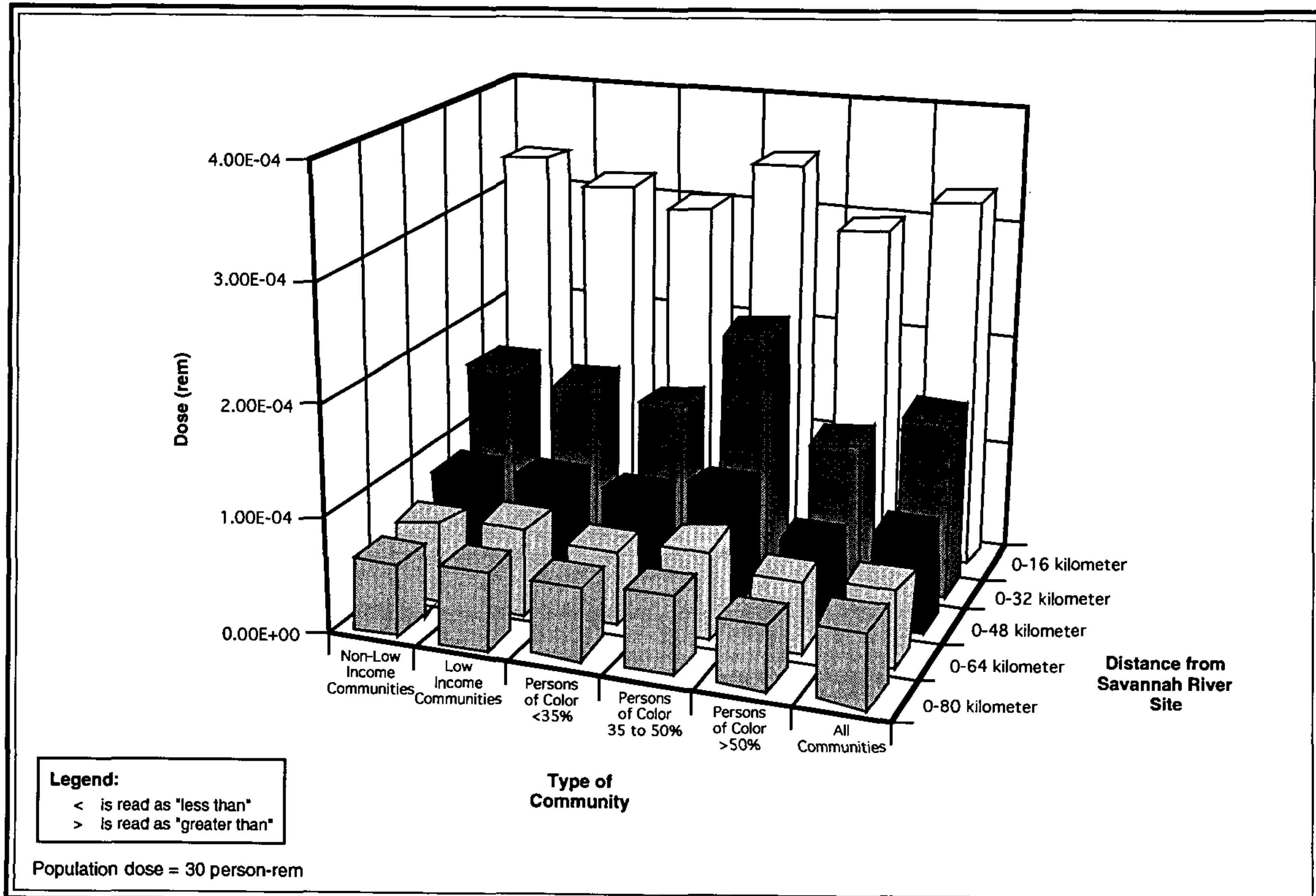
The amounts of wastes to be treated for alternative B – maximum waste forecast would be greater than for the minimum and expected waste forecasts, but the treatment operations would be the same. The maximum waste forecast would result in the largest health impacts to workers and the public for this alternative.

4.4.12.3.1 Occupational Health and Safety

Radiological Impacts

TE Table 4-73 includes the worker doses and resulting health effects associated with the maximum waste forecast. The doses would remain below the SRS administrative guideline of 0.8 rem per year. Based on a risk estimator of 0.0004 latent cancer fatality per rem (Section 4.1.12.1), the probability of a worker contracting a fatal cancer as the result of a 30-year occupational exposure to radiation would be about

TC



PK56-4

TE

Figure 4-34. Dose to individuals in communities within 80 kilometers (50 miles) of SRS for the alternative B – minimum waste forecast.

TC 7 chances in 10,000. It is also projected that 2 people in the workforce of 2,501 could develop a fatal cancer sometime during their lifetimes as the result of a 30-year exposure. Based on a lifetime fatal cancer risk from all causes of 23.5 percent (refer to Section 4.1.12.1), 588 people in this workforce would be expected to develop a fatal cancer independent of their occupational exposure.

Nonradiological Impacts

Nonradiological air concentrations were assessed for exposure by SRS workers under the maximum waste forecast. Table E.2-4 in Appendix E presents a comparison of these concentrations to permissible exposure limits under the Occupational Safety and Health Administration. Exposures to SRS workers
TE would be either equal to or greater than those that would occur under the expected waste forecast. However, for all facilities, employee occupational exposure would be less than Occupational Safety and Health Administration permissible exposure limits.

4.4.12.3.2 Public Health and Safety

Radiological Impacts

Table 4-74 includes the doses associated with the maximum waste forecast and resulting health effects to the public. The annual doses to the maximally exposed individual (0.33 millirem) and to the regional population (14 person-rem) would exceed the corresponding doses (0.25 millirem and 9.1 person-rem) from total SRS operations in 1993 (Arnett, Karapatakis, and Mamatey 1994). However, regulatory dose limits would not be exceeded (refer to Note on Table 4-54).

The health effects associated with the maximum waste forecast are included in Table 4-74. Based on a risk estimator of 0.0005 latent cancer fatality per rem (see Section 4.1.12.2), the probability of the maximally exposed member of the public developing a fatal cancer from 30 years of exposure to radiation associated with this waste forecast would be about 5 in 1 million. The number of additional fatal cancers in the regional population could be 0.20 (effectively zero). This probability of a fatal cancer is much smaller than the 1 chance in 4 that a member of the public would contract a fatal cancer from all causes, and the total fatal cancers would be much fewer than the 145,700 cancers that would be expected in the regional population of 620,100 from all causes sometime during their lifetimes.

Alternative B would result in radiological doses and health effects to the public that are intermediate between those associated with the alternatives A and C (Tables 4-33, 4-54, and 4-74). This would be true regardless of the amount of waste generated.

Nonradiological Impacts

Potential nonradiological impacts to individuals residing offsite were considered for both criteria and carcinogenic pollutants under the maximum waste forecast.

For routine releases from operating facilities, criteria pollutant concentrations would be within state and Federal ambient air quality standards, as discussed in Section 4.4.5.3. During periods of construction, the criteria pollutant concentrations at the SRS boundary would not exceed air quality standards under normal operating conditions. With good construction management procedures, such as wetting dirt roads twice a day, particulate emissions would be approximately 50 percent of the levels shown in Section 4.4.5.3. DOE does not expect adverse health impacts due to routine air releases from operating facilities and construction activities.

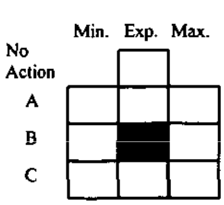
Table 4-75 presents offsite risks due to carcinogens. The overall increased lifetime cancer risk is approximately 3 in 10 million, which is approximately equal to the expected waste forecast risk. DOE expects minimal health impacts from emissions of carcinogenic compounds. TE

4.4.12.3.3 Environmental Justice Assessment

Figure 4-35 illustrates the results of the analysis for alternative B – maximum waste forecast for the 80-kilometer (50-mile) region of interest in this EIS. Emissions resulting from this case would not disproportionately affect any communities.

4.4.13 FACILITY ACCIDENTS

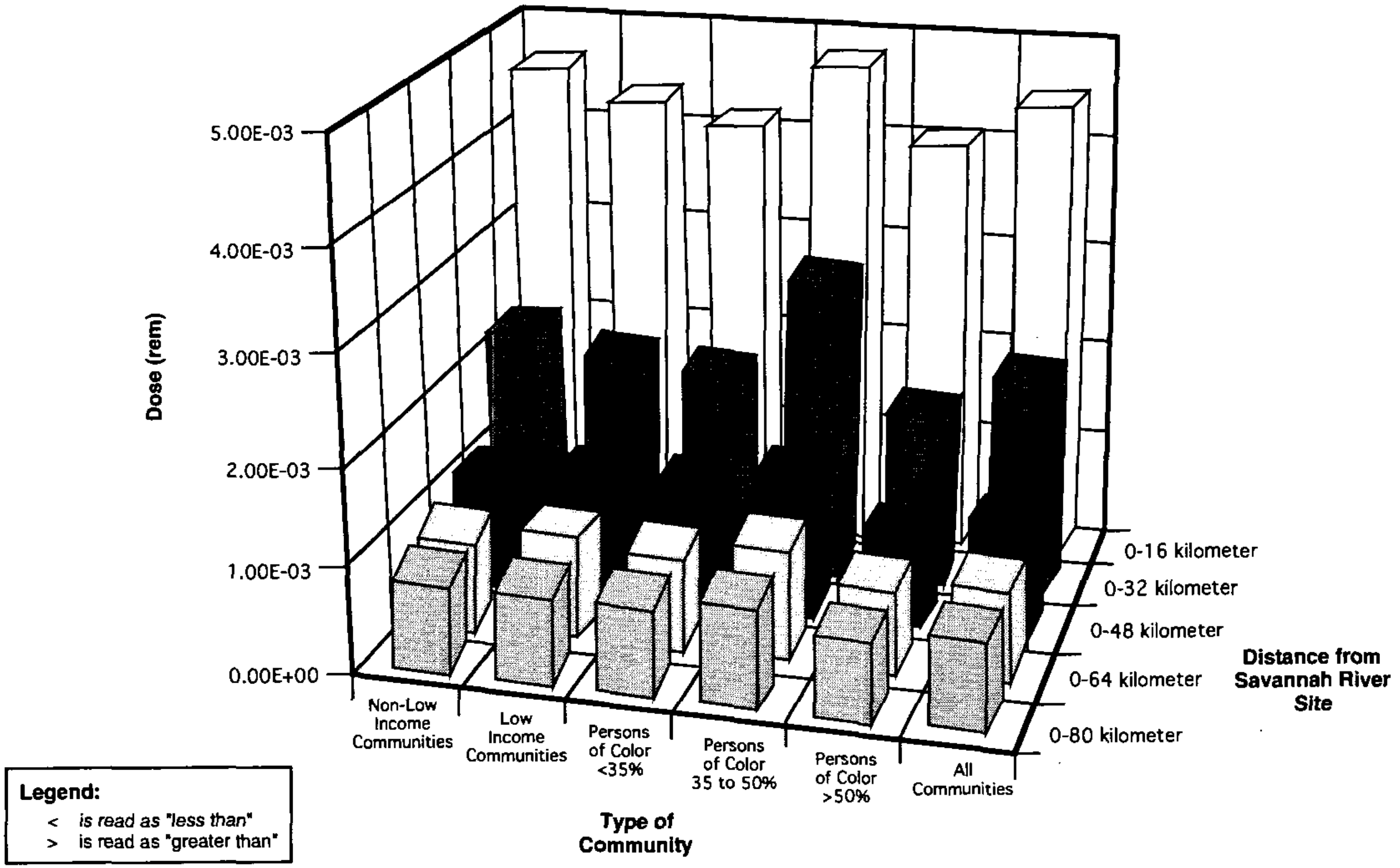
This section summarizes the risks to workers and members of the public from potential facility accidents associated with the various wastes under alternative B. The methodologies used to develop the radiological and hazardous material accident scenarios are the same as those discussed in Section 4.1.13.1 for the no-action alternative.



4.4.13.1 Facility Accidents – Expected Waste Forecast

Figures 4-36 through 4-39 summarize the projected impacts of radiological accidents on the population, offsite maximally exposed individual, and uninvolved workers at 640 meters (2,100 feet) and 100 meters

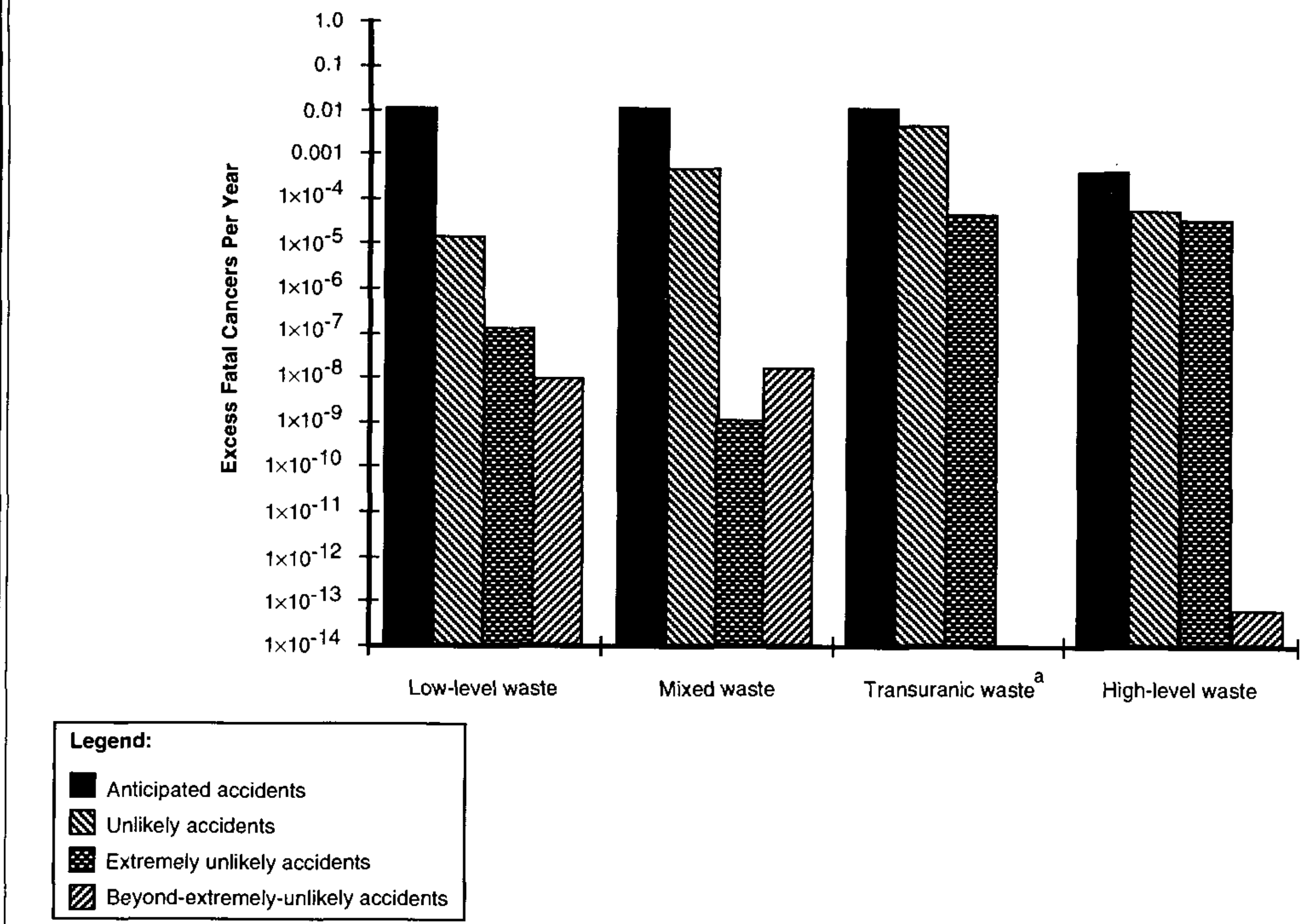
TC



Population dose = 407 person-rem

PK56-4

TE | **Figure 4-35.** Dose to individuals in communities within 80 kilometers (50 miles) of SRS for the alternative B – maximum waste forecast.

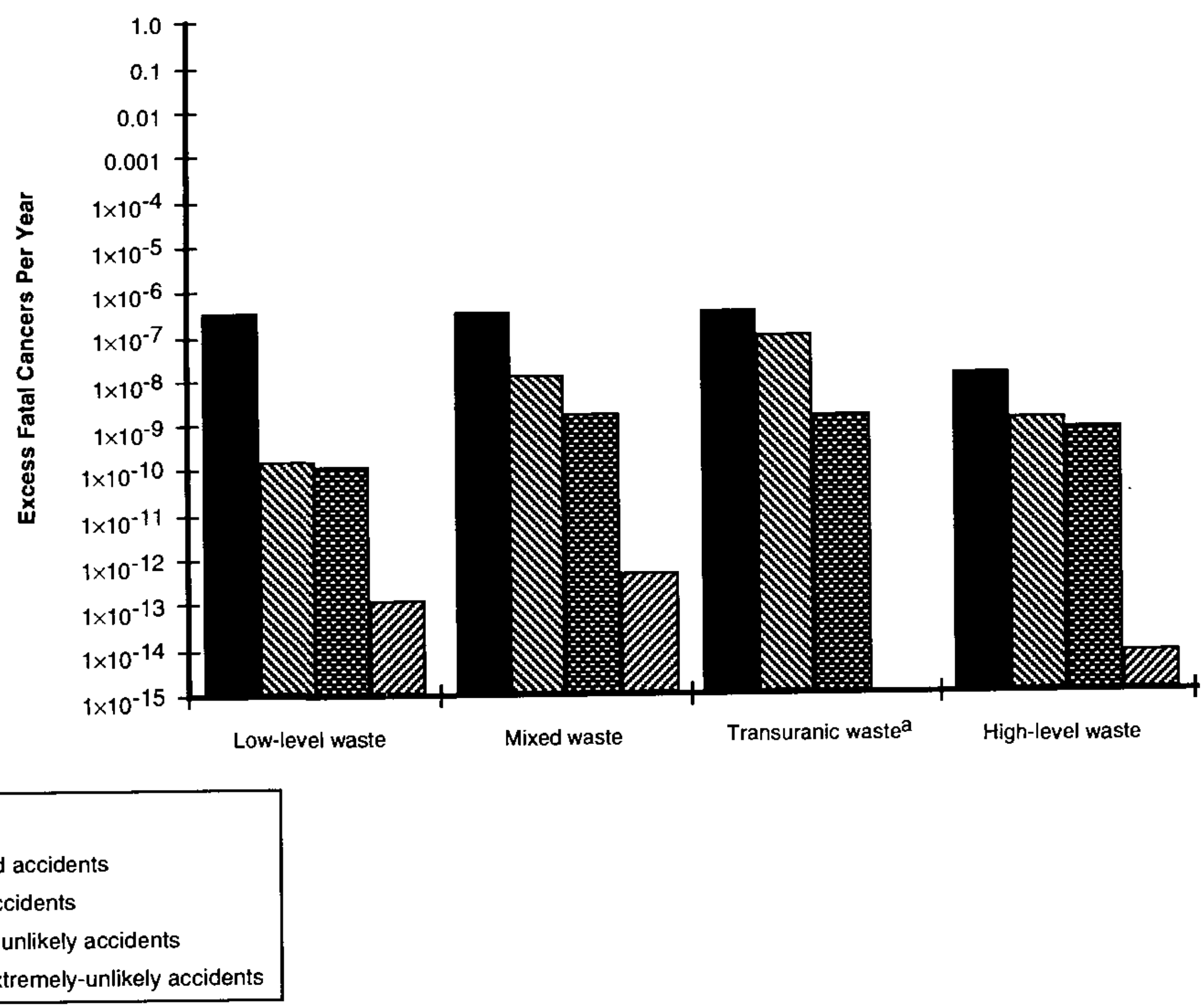


Notes:
a. No beyond-extremely-unlikely accidents were identified for transuranic waste.

PK56-31

TC

Figure 4-36. Summary of radiological accident impacts to the population within 80 kilometers (50 miles) for alternative B – expected waste forecast. TE



Notes:
a. No beyond-extremely-unlikely accidents were identified for transuranic waste.

PK56-31

TE | **Figure 4-37.** Summary of radiological accident impacts to the maximally exposed offsite individual for alternative B – expected waste forecast.

TC

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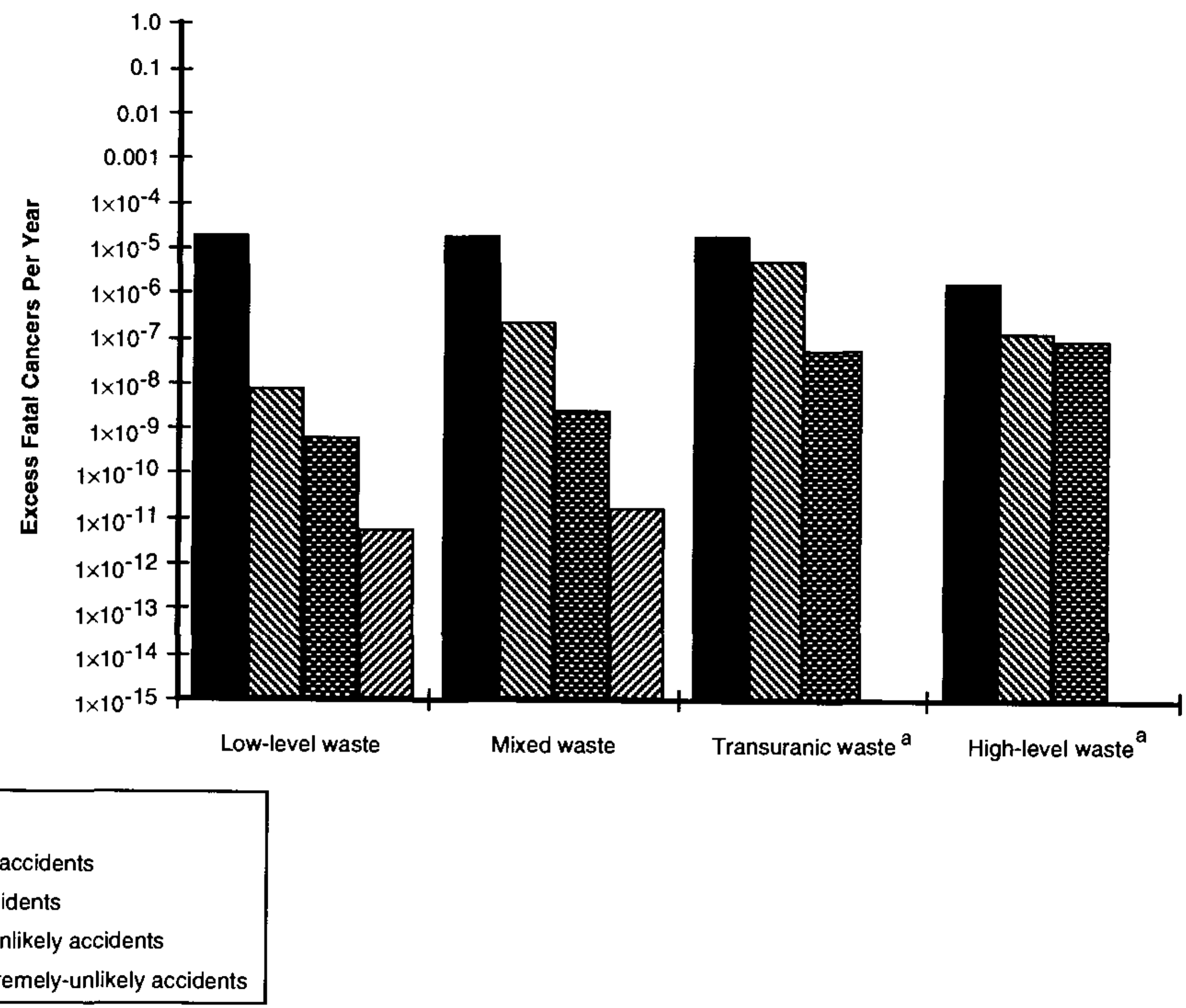

Notes:
a. No beyond-extremely-unlikely accidents were identified for transuranic waste or high-level waste.

PK56-31

Figure 4-38. Summary of radiological accident impacts to the uninvolved worker within 640 meters (2,100 feet) for alternative B – expected waste forecast.

TE

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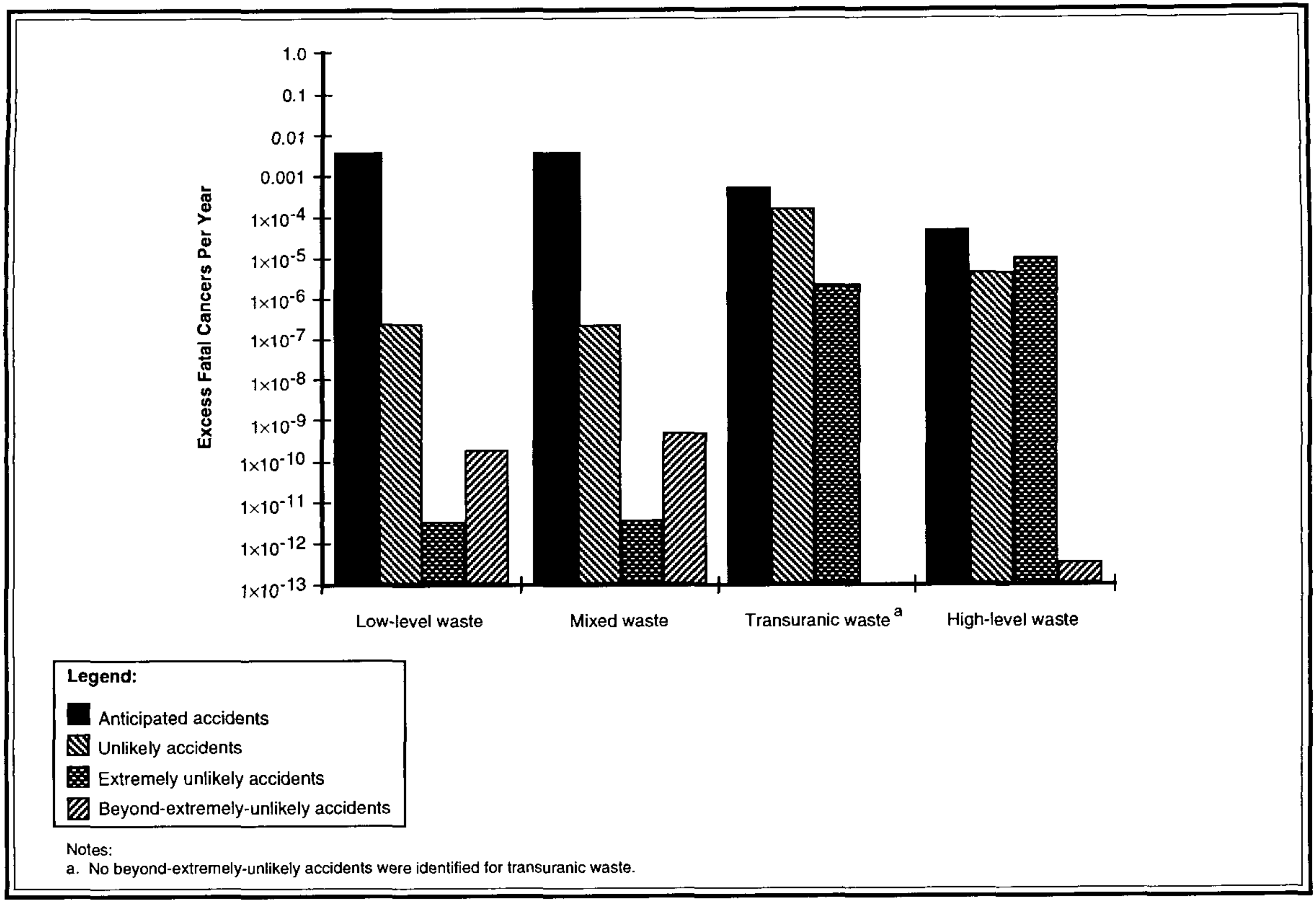


PK56-31

TE **Figure 4-39.** Summary of radiological accident impacts to the uninvolved worker within 100 meters (328 feet) for alternative B – expected waste forecast.

(328 feet) for alternative B expected waste forecast. An anticipated accident (i.e., one occurring between once every 10 years and once every 100 years) involving either low-level waste or mixed waste is the accident scenario under alternative B that presents the greatest risk to the population within 80 kilometers (50 miles) of SRS (see Figure 4-27). This accident scenario would increase the risk to the population within 80 kilometers (50 miles) by 1.7×10^{-2} latent fatal cancer per year. The postulated accident scenarios associated with the various waste types are described in Appendix F.

An anticipated accident involving either low-level waste or mixed waste would pose the greatest risk to the offsite maximally exposed individual (Figure 4-37) and the uninvolved worker at 640 meters (2,100 feet) (Figure 4-38). The anticipated accident scenario would increase the risk to the offsite maximally exposed individual by 3.3×10^{-7} latent fatal cancer per year and to the uninvolved worker at 640 meters (2,100 feet) by 1.8×10^{-5} latent fatal cancer per year.

An anticipated accident involving either low-level waste or mixed waste would also pose the greatest risk to the uninvolved worker at 100 meters (328 feet) (Figure 4-39). The anticipated accident scenario would increase the risk to the uninvolved worker at 100 meters (328 feet) by 1.0×10^{-3} latent fatal cancer per year.

For each receptor group, regardless of waste type, the greatest estimated risks associated with the no-action alternative and alternative B are identical. However, there could be differences in the overall risk to each receptor group for specific waste types. Table 4-76 provides a comparison of overall risk for specific waste types between the no-action alternative and alternative B. A multiplicative change factor is used to illustrate differences between no-action and alternative B risks. If the risks presented are identical, a multiplication factor of one is used. However, if the risks presented are different, a multiplication factor that would equate the two values is used. Arrows indicate whether the alternative B risks were larger or smaller than the no-action risks.

A complete summary of all representative bounding accidents considered for alternative B is presented in Table 4-77. This table provides accident descriptions, annual frequency of occurrence, increased risk of latent fatal cancers for all receptor groups, and the waste type with which the accident scenario was associated. Details regarding the individual postulated accident scenarios associated with the various waste types are provided in Appendix F. TE

The impacts resulting from chemical hazards associated with alternative B are the same as those discussed for alternative A in Section 4.2.13.1. Only one chemical release scenario would expose an

TE **Table 4-76.** Comparison of risks from accidents under the no-action alternative and alternative B.

Receptor	Waste[b]	Estimated risk[a] No action	Estimated risk[a] Alternative B	Change factor[c]
Population within 80 kilometers	Low-level	0.017	0.017	1.0
	Mixed	0.017	0.017	↑1.0
	Transuranic	0.005	0.015	↑3.0
	High-level	6.3×10^{-4}	6.3×10^{-4}	1.0
Offsite maximally exposed individual	Low-level	3.3×10^{-7}	3.3×10^{-7}	1.0
	Mixed	3.3×10^{-7}	3.3×10^{-7}	1.0
	Transuranic	9.8×10^{-8}	2.9×10^{-7}	↑3.0
	High-level	1.3×10^{-8}	1.3×10^{-8}	1.0
Uninvolved worker to 640 meters	Low-level	1.8×10^{-5}	1.8×10^{-5}	1.0
	Mixed	1.8×10^{-5}	1.8×10^{-5}	1.0
	Transuranic	5.5×10^{-6}	1.6×10^{-5}	↑2.9
	High-level	3.4×10^{-7}	3.4×10^{-7}	1.0
Uninvolved worker to 100 meters	Low-level	0.001	0.001	1.0
	Mixed	0.001	0.001	1.0
	Transuranic	3.1×10^{-4}	9.0×10^{-4}	↑2.9
	High-level	1.8×10^{-5}	1.8×10^{-5}	1.0

TE

a. Increased risk of latent fatal cancers per year.
b. Wastes are described in Section 2.1 and Appendix F.
c. Change factors represent the multiplication factor required to equate the no-action alternative risks to the alternative B risks (e.g., no-action alternative risk times change factor equals alternative B risk). The up arrow (↑) indicates that the alternative B risk is the greater risk.

offsite maximally exposed individual to airborne concentrations greater than ERPG-2 values. Appendix F provides further detail and discussion regarding chemical hazards associated with each waste type.

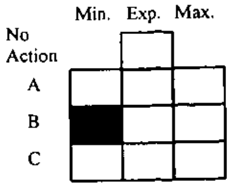
In addition to the risk to human health from accidents, secondary impacts from postulated accidents on plant and animal resources, water resources, the economy, national defense, environmental contamination, threatened and endangered species, land use, and Native American treaty rights are considered. This qualitative assessment (see Appendix F) determined that there would be no substantial impacts from accidents under alternative B expected waste forecast.

TE

Table 4-77. Summary of representative bounding accidents under alternative B.[a]

Accident Description	Affected waste types[c]	Frequency (per year)	Increased risk of latent fatal cancers per year[b]: Uninvolved worker at 100 meters	Uninvolved worker at 640 meters	Maximally exposed offsite individual	Population within 80 kilometers
RHLWE[d] release due to a feed line break	High-level	0.07[e]	1.79×10^{-5}	6.38×10^{-7}	1.32×10^{-7}	6.34×10^{-4}
RHLWE release due to a design basis earthquake	High-level	2.00×10^{-4}[f]	1.54×10^{-6}	5.46×10^{-8}	1.12×10^{-9}	5.43×10^{-5}
RHLWE release due to evaporator pressurization and breech	High-level	5.09×10^{-5}[g]	1.95×10^{-6}	3.46×10^{-8}	7.13×10^{-10}	3.44×10^{-5}
Design basis ETF[h] airborne release due to tornado	High-level	3.69×10^{-7}[i]	3.20×10^{-13}	1.02×10^{-14}	7.20×10^{-15}	6.35×10^{-14}
Container breach at the ILNTV[j]	Low-level Mixed	0.02[e]	0.00104	1.84×10^{-5}	3.31×10^{-7}	0.0168
Large fire at the CIF[k]	Low-level	2.34×10^{-4}[f]	2.39×10^{-7}	7.63×10^{-9}	1.64×10^{-10}	1.12×10^{-5}
Tornado at the ILNTV	Low-level	2.00×10^{-5}[g]	3.26×10^{-12}	6.18×10^{-10}	1.18×10^{-10}	1.18×10^{-7}
Explosion at CIF	Low-level	3.40×10^{-7}[i]	1.74×10^{-10}	5.54×10^{-12}	1.19×10^{-13}	8.14×10^{-9}
Release due to multiple open containers at the Containment Building	Mixed	0.003[f]	4.69×10^{-7}	6.91×10^{-7}	1.22×10^{-8}	5.70×10^{-4}
F3 tornado[l] at Building 316-M	Mixed	2.80×10^{-5}[g]	5.35×10^{-12}	1.29×10^{-9}	1.65×10^{-9}	1.12×10^{-9}
Aircraft crash at the Containment Building	Mixed	1.60×10^{-7}[i]	9.73×10^{-10}	3.46×10^{-11}	6.66×10^{-13}	3.19×10^{-8}
Deflagration in culvert during TRU[m] drum retrieval activities	Transuranic	0.01[e]	8.96×10^{-4}	1.59×10^{-5}	2.86×10^{-7}	0.0145
Fire in culvert at the TRU waste storage pads (one drum in culvert)	Transuranic	8.10×10^{-4}[f]	3.07×10^{-4}	5.48×10^{-6}	9.84×10^{-8}	0.0498
Vehicle crash with resulting fire at the TRU waste storage pads	Transuranic	6.50×10^{-5}[g]	4.47×10^{-6}	7.96×10^{-8}	1.43×10^{-9}	7.25×10^{-5}

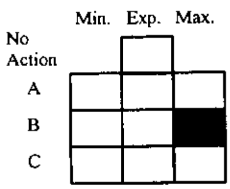
a. A complete description and analysis of the representative bounding accidents are presented in Appendix F.
b. Increased risk of fatal cancers per year is calculated by multiplying the [consequence (dose) × latent cancer conversion factor] × annual frequency. For dose consequences and latent cancer fatalities per dose, see tables in Appendix F.
c. The waste type for which the accident scenario is identified as a representative bounding accident. A representative bounding accident may be identified for more than one waste type. These waste types are high-level, low-level, mixed, and transuranic.
d. Replacement High-Level Waste Evaporator.
e. The frequency of this accident scenario is within the anticipated accident range.
f. The frequency of this accident scenario is within the unlikely accident range.
g. The frequency of this accident scenario is within the extremely unlikely accident range.
h. F/H-Area Effluent Treatment Facility.
i. The frequency of this accident scenario is within the beyond-extremely-unlikely-accident range.
j. Intermediate-Level Non-Tritium Vault.
k. Consolidated Incineration Facility.
l. F3 tornadoes have rotational wind speeds of 254 to 331 kilometers (158 to 206 miles) per hour.
m. Transuranic.



4.4.13.2 Facility Accidents – Minimum Waste Forecast

The minimum waste forecast is not expected to change the duration of risk for the facilities associated with the representative bounding accidents identified under alternative B (see Appendix F).

DOE expects that a slight decrease in risk would occur for alternative B – minimum waste forecast. A comparison of the number and types of facilities needed for the minimum and expected waste forecasts is provided in Section 2.6.7.



4.4.13.3 Facility Accidents – Maximum Waste Forecast

The maximum waste forecast is not expected to change the duration of risk for the facilities associated with the representative bounding accidents identified under alternative B (see Appendix F).

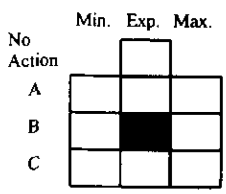
DOE expects that an increase in risk would occur for the alternative B maximum waste forecast over the expected waste forecast. A comparison of the number and type of facilities needed for the maximum and expected waste forecasts is provided in Section 2.6.7.

4.4.14 UNAVOIDABLE ADVERSE IMPACTS AND IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES UNDER ALTERNATIVE B

This section describes adverse impacts that would result from alternative B that cannot be avoided. It also describes the irreversible and irretrievable commitment of resources that would be associated with alternative B. As indicated in the preceding sections, the major variations in impacts are much more strongly influenced by the amount of wastes to be managed than by variations in the degree of treatment
TE applied. Accordingly, the unavoidable adverse impacts and the irretrievable commitments of resources for the various waste forecasts for alternative B are also representative of the same forecasts under alternatives A and C.

4.4.14.1 Unavoidable Adverse Impacts

Several unavoidable adverse impacts would be expected as a result of implementing alternative B. The following sections identify impacts for the expected, minimum, and maximum waste forecasts.



4.4.14.1.1 Expected Waste Forecast

Construction activities would generate transient and minor air quality impacts as a result of fugitive dust and vehicle emissions.

Unavoidable radiation exposures to workers and the public from normal operation for alternative B – expected waste forecast would be well below established DOE limits. The hypothetical offsite maximally exposed individual would receive an annual average effective dose equivalent of 0.032 millirem from facility operations, compared to about 300 millirem from natural radiation sources. The two radioisotopes contributing the most to the potential exposure would be cesium-137 and plutonium-239.

New facilities would require the conversion of approximately 0.64 square kilometer (158 acres; both developed and undeveloped) to waste management use by 2006. Long-term impacts are expected to be limited to the loss of 0.47 square kilometer (117 acres) of undeveloped terrestrial habitat and associated natural resources. Small mammals, reptiles, and birds occupying this habitat would be displaced, disturbed, or killed by land clearing and associated construction activities, but local and regional populations of these wildlife species would not be severely affected. TC

Construction of waste management facilities would prohibit use of associated land areas for other purposes (e.g., agriculture or timber production) for the foreseeable future. However, E-Area was designated as an area for nuclear facilities in the *1994 Draft Land-Use Baseline Report,* and is being used as intended.

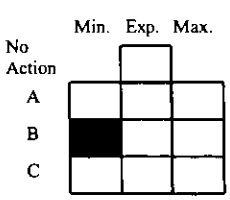
Releases of radioactive constituents from low-level and mixed waste disposal facilities (vaults and slit trenches) would introduce radioactive contaminants to groundwater. Resulting concentrations would remain within the performance of objective of 4 millirem per year adopted by DOE in Order 5400.5. Hazardous constituents would also be released from the disposal facilities. Groundwater would TE eventually carry contaminants to the onsite streams. In addition, onsite streams would receive wastewater discharges containing hazardous and radioactive constituents, such as the discharge from the TE F/H-Area Effluent Treatment Facility to Upper Three Runs. These streams would eventually carry the hazardous and radioactive constituents to the Savannah River. Impacts on groundwater resources, surface water resources, and aquatic organisms would be small.

Traffic increases under alternative B are expected to be small and the impacts on onsite and offsite roads TE small.

DOE anticipates that only minor unavoidable adverse impacts on public or worker health would result from the expected waste forecast. The calculated discharges and exposures of pollutants (including radioactivity) to the public and facility workers would be many times below normal risk levels. This case would result in an additional 7.5×10^{-4} latent cancer fatality per year to the offsite population from airborne releases of radioactivity.

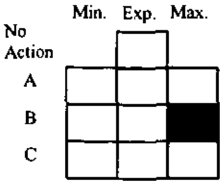
Archaeological sites eligible for the National Register of Historic Places could be affected during construction of waste management facilities on undeveloped land within E-Area. Mitigation action plans developed by the Savannah River Archaeological Research Program and approved by the South Carolina State Historic Preservation Office would protect, recover, or preserve these resources.

An unavoidable adverse impact resulting from operation of the proposed waste management facilities would be the generation of new waste, including low-level radioactive, hazardous, mixed, and nonhazardous solid waste. Disposal of these wastes has been accounted for in planning the proposed waste management facilities, with the exception of nonhazardous solid waste, which would be accommodated in existing onsite sanitary and industrial landfills and their successors.



4.4.14.1.2 Minimum Waste Forecast

The adverse impacts associated with the minimum waste forecast that cannot be avoided would be TC slightly less than those associated with the expected waste forecast. For example, only 0.36 square kilometer (90 acres) of undeveloped woodland would be cleared and graded. A maximum of 107 acres (both developed and undeveloped) would be converted to waste management use by 2008.



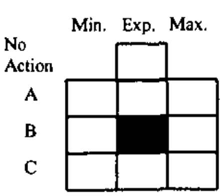
4.4.14.1.3 Maximum Waste Forecast

The adverse impacts associated with the maximum waste forecast that cannot be avoided would be greater than those associated with the expected waste forecast. For example, 3.8 square kilometers (940 acres) of undeveloped woodland would be cleared and graded. A maximum of 1,010 acres (both developed and undeveloped) would be converted to waste management use by 2006. The loss of this much natural habitat could adversely affect protected natural resources such as wetlands and threatened and endangered species. Impacts would require mitigation measures.

There would be 57 additional daily waste shipments over the 1994 baseline, primarily due to the larger volume of waste and the shipment of stabilized ash and blowdown from the Consolidated Incineration Facility to E-Area. This would almost triple the 1994 baseline traffic, but would be expected to slightly increase the total volume of onsite traffic and would not be expected to impact the SRS road system. TE

4.4.14.2 Irreversible or Irretrievable Commitment of Resources

Several irreversible or irretrievable commitments of resources would be expected to result from implementing alternative B. The sections which follow identify these commitments for the expected, minimum, and maximum waste forecasts.



4.4.14.2.1 Expected Waste Forecast

The implementation of alternative B – expected waste forecast would commit approximately 0.47 square kilometer (117 acres) of undeveloped land and associated natural resources and a total of 158 acres (both developed and undeveloped) to waste management use for an indefinite period of time. TE

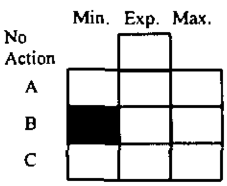
Construction and operation of the facilities needed for alternative B – expected waste forecast would involve the commitment of land resources. At present, most of this land is dedicated to industrial, nuclear, and waste management uses. With the exception of the land supporting existing facilities, all other land could be recommitted to other purposes, if required.

Construction of the various facilities would require the consumption of materials such as concrete and steel. Operation of the non-alpha vitrification facility and the Consolidated Incineration Facility would consume chemicals such as nitrogen, sodium hydroxide, nitric acid, glass frit, sodium nitrite, and others. Operation of the waste management facilities would generate small volumes of nonhazardous solid, hazardous mixed, and low-level radioactive wastes and would require additional land area for disposal of these wastes.

TE

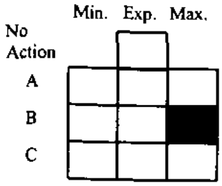
Construction and operation of the waste management facilities associated with alternative B – expected waste forecast would include consumption of fossil fuels. Gasoline and diesel fuel would be consumed by heavy equipment used to clear and grade land and construct facilities. Fuel oil would be used as auxiliary fuel in each of the thermal treatment facilities. Auxiliary fuel consumption by the Consolidated Incineration Facility under alternative B has been evaluated in this EIS and is presented in Table B.5-2 of Appendix B. Comparable amounts of auxiliary fuel would be consumed by the thermal pretreatment units of the non-alpha and alpha vitrification facilities. Fuels would also be consumed to provide electrical power, including diesel fuel for emergency generators.

Releases from low-level and mixed waste disposal facilities (vaults and slit trenches) would introduce radioactive and hazardous contaminants to groundwater and streams. Concentrations of radioactive constituents in groundwater would remain within the performance objective of 4 millirem per year adopted by DOE in Order 5400.5.



4.4.14.2.2 Minimum Waste Forecast

The irreversible and irretrievable commitment of resources for alternative B – minimum waste forecast would be slightly less than for the expected waste forecast. For example, approximately 0.43 square kilometer (107 acres) of land (both developed and undeveloped) would be committed to waste management.



4.4.14.2.3 Maximum Waste Forecast

The irreversible and irretrievable commitment of resources for alternative B – maximum waste forecast would be substantially greater than for the expected waste forecast. For example, approximately 0.74 square kilometer (184 acres) of undeveloped woodland in E-Area and 3.1 square kilometers (756 acres) of undeveloped woodland in an undetermined location would be required for the maximum waste forecast. A maximum of 1,010 acres (both developed and undeveloped) would be used for waste management by 2006.

4.4.15 CUMULATIVE IMPACTS RESULTING FROM ALTERNATIVE B

This section presents potential cumulative impacts from alternative B when it is added to impacts from past, present, and reasonably foreseeable onsite activities and impacts of offsite industrial facilities. TE

Cumulative impacts were assessed only for the moderate treatment alternative with the expected waste forecast because the impacts for this case generally fall between the other cases, and impacts do not vary greatly between alternatives. Despite some variation in impacts, using this approach allows for an assessment of the cumulative impacts that are representative of the magnitude of the cumulative impacts of the other alternatives. Assessing the cumulative impacts of one case also simplifies the presentation of the analysis. TE

4.4.15.1 Existing Facilities

The existing facilities and activities that are included in the analysis of baseline impacts are summarized in the following sections. Projected releases from normal operations of these facilities are reflected in the descriptions of baseline environmental conditions in Chapter 3 and are included in the analysis of impacts in Sections 4.1 through 4.3 and 4.4.1 through 4.4.13. TC

4.4.15.1.1 Savannah River Technology Center

The Savannah River Technology Center is the major research and development laboratory at SRS. It conducts research on fuels and targets, waste management, and process modifications and provides support for SRS improvements (WSRC 1994i).

TE

4.4.15.1.2 F- and H-Area Separations Facilities

At the F- and H-Area separations facilities, irradiated fuel and target elements are dissolved in nitric acid. A solvent-extraction process yields (1) a solution of plutonium, uranium, and neptunium and (2) a highly radioactive liquid waste containing nonvolatile fission products. After the product solutions are separated from the fission products, further processing converts plutonium, uranium, and other products in solution to solid forms for shipment, recycling, or further processing. Chemical processing in F-Area was suspended in March 1992 pending resolution of a potential safety concern and resumed after resolution of the safety concerns (DOE 1994c) and issuance of the Record of Decision on the F-Canyon Plutonium Solutions at SRS EIS (DOE 1995a). H-Area chemical processing has continued in support of a National Aeronautics and Space Administration space exploration program (DOE 1994b).

TC

4.4.15.1.3 Reactors

Of the five production reactors, four are permanently shut down, and the remaining reactor is defueled and mothballed but capable of being restarted (WSRC 1994i).

4.4.15.1.4 Replacement Tritium Facility

The Replacement Tritium Facility, a 1-acre underground facility in H-Area, is designed to minimize tritium losses to the environment and reduce waste generation. The Replacement Tritium Facility separates, mixes, and loads tritium in one facility (WSRC 1994i).

TE

TE

4.4.15.1.5 F/H-Area Effluent Treatment Facility

The F/H-Area Effluent Treatment Facility, located in H-Area, stores and treats wastewater from the chemical separations facilities in F- and H-Areas. The F/H-Area Effluent Treatment Facility will treat wastewater from the Defense Waste Processing Facility when it begins operating, and would treat wastewater from some facilities proposed in this EIS. Spills and inadvertently contaminated water from any of the waste management facilities would be treated at the F/H-Area Effluent Treatment Facility (DOE 1992, 1994d).

4.4.15.1.6 Offsite Facilities

Radiological impacts from the operation of the Vogtle Electric Generating Plant (Plant Vogtle), a two-unit commercial nuclear electric facility operated by Georgia Power directly across the Savannah River from SRS, are very small (for example, annual latent cancer fatalities are estimated to be 2.9×10^{-5}) and have been included in the analysis.

Radiological impacts from the operation of the Chem-Nuclear Services facility, a commercial low-level waste disposal facility just east of SRS in the Barnwell County Industrial Park (see Figure 3-2), are very small and are not included in this analysis. TC

South Carolina Electric and Gas Company's Urquhart Station, a three-unit, 250-megaWatt, coal- and natural-gas-fired steam electric plant in Beech Island, South Carolina, is about 32 river kilometers (20 river miles) north of SRS. Because of the distance between SRS and the Urquhart Station and the regional wind direction frequencies, there is little opportunity for any interaction of plant emissions, and no significant cumulative impact on air quality (DOE 1990). TE

4.4.15.2 New and Proposed Facilities or Programs TE

In addition to the ongoing SRS and offsite operations, there are a number of planned actions and facilities at SRS included in the cumulative impacts analysis.

4.4.15.2.1 Defense Waste Processing Facility

The Defense Waste Processing Facility is almost complete, and the high-level waste pre-treatment processes and the vitrification process are nearly ready to begin operating. The decision to operate the Defense Waste Processing Facility is the subject of a separate NEPA document (DOE 1994d). The EIS on the Defense Waste Processing Facility has been completed, and a Record of Decision was issued in April 1995 (DOE 1995a). The decision stated that DOE will complete facility construction and begin operating the Defense Waste Processing Facility to pretreat, immobilize, and store high-level radioactive waste. The environmental impacts from the operation of the Defense Waste Processing Facility are included in all alternatives and are therefore included in this cumulative analysis. TE

4.4.15.2.2 F-Canyon Plutonium Solutions

In March 1992, DOE suspended chemical processing in F-Area until potential safety concerns could be adequately addressed. Those concerns were addressed; however, before processing resumed, the Secretary of Energy directed SRS to phase out defense-related chemical separations. There have been no operations since March 1992. Approximately 3.03×10^5 liters (80,000 gallons) of solutions containing plutonium have been held in tanks in the processing facility since the suspension of operations. DOE proposed to process these solutions into forms that can be stored with less risk to the public, worker health and safety, and the environment and prepared a separate NEPA review for that proposal (DOE 1994c). Processing resumed in F-Canyon following issuance of a Record of Decision on this EIS (DOE 1995b). The environmental impacts associated with the processing of these solutions to plutonium metal are included in this cumulative impact analysis.

4.4.15.2.3 Interim Management of Nuclear Materials

The cessation of nuclear reprocessing operations at SRS resulted in significant amounts of materials in various stages of the production and recovery cycle. These materials include irradiated and unirradiated fuel, targets, and control rods; acidic solutions containing dissolved targets or fuels and recovered isotopes; product forms of isotopes (oxide powders and metals) packaged in storage containers; and irradiated fuel and targets stored in the Receiving Basin for Offsite Fuels in H-Area. The *Draft Interim Management of Nuclear Materials EIS* (DOE 1995c) evaluates how to manage these existing SRS nuclear materials in a safe and environmentally sound manner until disposition decisions can be made, while maintaining the required inventory of usable forms of special isotopes. The environmental impacts identified from the processes evaluated in the *Draft Interim Management of Nuclear Materials EIS* are included in this cumulative analysis.

4.4.15.2.4 Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs

DOE prepared a separate EIS to inform two related decisionmaking processes concerning: (1) the transport, receipt, processing, and storage of spent nuclear fuel at the DOE Idaho National Engineering Laboratory over the next 10 years; and (2) programmatic decisions on spent nuclear fuel management over the next 40 years. SRS is a candidate for spent nuclear fuel management operations under several alternatives that DOE considered in the EIS (DOE 1995d). In that EIS, alternative 5 for spent nuclear fuel [Centralization, Processing option; see DOE (1995d)] would have had the greatest onsite impacts to SRS; SRS would have had to manage approximately 2,700 metric tons of spent nuclear fuel, most of which would have been transported to SRS from other DOE sites. The environmental effects at SRS of spent nuclear fuel actions under alternative 5 are included in this cumulative impact analysis. In the Record of Decision (DOE 1995e), however, DOE selected the regionalization alternative. Under the regionalization alternative, SRS will manage approximately 213 metric tons of spent nuclear fuel. TE

4.4.15.3 Moderate Treatment Configuration Alternative

For the alternative B, the following new or additional facilities are proposed to manage the wastes projected under the expected waste forecast and were the basis for predicting impacts in Sections 4.4.1 through 4.4.13 as summarized in Table 2-38: TE

- 24 long-lived low-level waste storage buildings
- 79 mixed waste storage buildings
- 10 transuranic and alpha waste storage pads TC
- a mixed waste containment building
- a non-alpha vitrification facility
- an alpha vitrification facility
- a mobile soil sort facility TC
- the Consolidated Incineration Facility
- a transuranic waste characterization/certification facility
- 58 shallow land disposal slit trenches
- 1 low-activity waste vault
- 5 intermediate-level waste vaults
- 21 RCRA-permitted disposal vaults
- the M-Area Vendor Treatment Facility

Refer to Appendix B for complete descriptions of the facilities and actions.

4.4.15.4 Cumulative Impacts

This section presents data on potential impacts from alternative B – expected waste forecast which, when added to impacts from past, present, and reasonably foreseeable SRS operations and offsite facilities, constitute the cumulative impacts on the affected environment. TE

TE Discussions of cumulative impacts for the following subjects are omitted because the impacts of the proposed waste management activities would be so small that their potential contribution to cumulative impacts would be negligible:

- geologic resources
- ecological resources
- aesthetics and scenic resources
- environmental justice
- cultural resources
- traffic

4.4.15.4.1 *Groundwater Resources*

TE Cumulative impacts to groundwater resources would be very small from stabilizing the plutonium solutions, the interim management of nuclear materials, the Defense Waste Processing Facility, or waste management activities.

TC Under alternative B – expected waste forecast, only small impacts to groundwater resources are anticipated. Any releases from shallow land disposal, disposal of low-level waste in vaults, or disposal in RCRA permitted vaults would not cause current groundwater standards to be exceeded during the 30-year planning period, the 100-year period of institutional control, or any time after disposal (see Section 4.1.3). Releases from RCRA storage facilities are unlikely.

TC Groundwater contamination resulting from the waste disposal under this EIS would be in addition to existing contamination from past waste disposal. By the time that concentrations resulting from waste disposal activities evaluated in this EIS reached their peak (at least 97 to 130 years in the future), the concentrations of contaminants introduced by past disposal will have been substantially reduced below present concentrations as a result of natural decay processes and any environmental restoration programs.

TE Radioactive releases from the Defense Waste Processing Facility that result in future doses to the offsite maximally exposed individual of 0.03 millirem per year (via groundwater infiltration to surface water) are projected from saltstone disposal in the vaults (DOE 1994d). In comparison, total SRS aqueous releases in 1993 resulted in doses to the offsite maximally exposed individual of 0.14 millirem (WSRC 1994i). For spent nuclear fuel activities, additional groundwater withdrawals would total about 67.7 million liters (17.9 million gallons) per year compared to current site withdrawals of 34.1 to 45.4 million liters (9 to 12 million gallons) per day.

4.4.15.4.2 Surface Water Resources

Cumulative impacts to surface water resources would be very small. Few or no impacts are expected from spent fuel management, plutonium stabilization, interim management of nuclear materials, the Defense Waste Processing Facility, or waste management.

For alternative B – expected waste forecast, very small impacts to surface water resources are anticipated. Stormwater infiltrating the vaults and trenches and migrating into surface waters would contain radionuclides; however, doses in the Savannah River would be 10,000 times less than the municipal system drinking water limits of 4 millirem per year. Additional wastewater directed to the F/H-Area Effluent Treatment Facility would meet applicable effluent permit limits, and calculated radionuclide doses would be very small.

4.4.15.4.3 Air Resources

Cumulative maximum boundary-line ground-level concentrations due to nonradiological air emissions from existing facilities (using actual emissions) and proposed facilities (using calculated emissions) are shown in Table 4-78. The cumulative concentration for each criteria pollutant would be less than either state or federal ambient air quality standards. Non-SRS facilities (such as Plant Vogtle and Chem-Nuclear Services) make very small contributions by comparison to air emissions over the area surrounding SRS.

As discussed in previous sections of this chapter, toxic air emissions from existing facilities and new facilities such as the Defense Waste Processing Facility and the Consolidated Incineration Facility would be very small, and compliance with SCDHEC standards has been demonstrated in the *SCDHEC Regulation No. 62.5 Standard No. 2 and Standard No. 8 Compliance Modeling Input/Output Data*. Collective emissions of air toxics from the proposed facilities, such as the transuranic waste certification/characterization facility, the non-alpha vitrification facility, or the mixed waste containment building, would be very small.

4.4.15.4.4 Land Use

As indicated in Section 4.4.7.1, implementation of alternative B – expected waste forecast would require 0.64 square kilometer (158 acres) in E-Area; implementation of the centralization option for spent nuclear fuel management at SRS would require an additional 0.53 square kilometer (130 acres)

Table 4-78. Cumulative maximum SRS boundary-line ground-level concentrations for criteria pollutants (in micrograms per cubic meter of air).[a]

Criteria pollutant	Averaging time	Concentrations due to existing sitewide emissions[b] (μg/m^3)	Background concentrations[c] (μg/m^3)	Increased concentrations, alternative B[b,d] (μg/m^3)	Increased concentrations, plutonium solutions[e] (μg/m^3)	Increased concentrations, spent nuclear fuel[f] (μg/m^3)	Increased concentrations, *interim management* nuclear materials[g] (μg/m^3)	Regulatory standards[h] (μg/m^3)	Percent of standard[i] (%)
Nitrogen oxides	Annual	6	8	0.79	0.32	11.1	1.3	100	27.5
Sulfur dioxide	3 hours	823	34	3.82	2.7	3.5	0.040	1,300	66.7
	24 hours	196	17	0.81	0.33	0.49	0.0089	365	58.8
	Annual	14	3	0.05	0.006	0.02	0.00056	80	21.3
Carbon monoxide	1 hour	171	NA[j]	31.45	22	37	68	40,000	0.8
	8 hours	22	NA	27.07	2.7	5.1	16	10,000	0.7
Total suspended particulates	Annual	13	30	2.01	0.005	<0.01	(k)	75	60.0
Particulate matter less than 10 microns in diameter	24 hours	51	34	4.61	0.16	0.4	(k)	150	60.5
	Annual	3	22	0.10	0.005	0.01	(k)	50	50.2
Lead	Quarterly	4.0×10^{-4}	0.011	2.8×10^{-5}	(k)	(k)	(k)	1.5	0.8
Gaseous fluorides (as hydrogen fluoride)	12 hours	2.0	NA	0.0019	0.045	0.4	0.18	3.7	71.0
	24 hours	1.0	NA	9.3×10^{-4}	0.024	0.1	0.095	2.9	42.1
	1 week	0.4	NA	7.0×10^{-5}	0.0094	0.1	0.037	1.60	34.2
	Monthly	0.1	NA	9.0×10^{-5}	0.0026	0.02	0.010	0.80	16.6

TC

a. The scope of cumulative impacts as displayed in this table is based on the best information available in 1994. DOE recognizes that other actions may be underway.
b. Source: Stewart (1994).
c. SCDHEC (1992)
d. Alternative B includes Defense Waste Processing Facility and Consolidated Incineration Facility operation.
e. Preferred alternative from *F-Canyon Plutonium Solutions EIS* (DOE 1994c).
f. Alternative 5 from the *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs EIS* (DOE 1995d).
g. Preferred alternative from the *Draft Interim Management of Nuclear Materials EIS* (DOE 1995c).
h. SCDHEC (1976).
i. Percent of standard = 100 × (actual + background + increment) divided by regulatory standard.
j. NA = not available.
k. Not reported.

TE

(locations undetermined) (DOE 1995c). Additional land commitments are not anticipated for the Defense Waste Processing Facility or the plutonium solutions operations. The cumulative land commitment of 1.2 square kilometers (288 acres) associated with these potential activities constitutes about 0.1 percent of the SRS land area.

4.4.15.4.5 Socioeconomics

The maximum potential change in employment associated with alternative B – expected waste forecast, spent nuclear fuel management, interim management of nuclear materials, stabilization of plutonium solutions, and other SRS activities would occur around 2002, when approximately 3,000 (mostly construction) jobs would be created. This compares to a predicted regional labor force of 258,300 in 2002. This small increase, roughly 1 percent, in direct employment would have correspondingly small and temporary impacts on socioeconomics in the six-county region of influence.

4.4.15.4.6 Transportation

The cumulative radiological doses and resulting health effects from incident-free transportation are presented in Table 4-79. Data for the Defense Waste Processing Facility and the stabilization of plutonium solutions are not included because transportation was not a factor in these EISs.

Table 4-79. Estimated annual average radiological doses and potential health effects from transportation activities.

	Normal (incident-free) transportation			
	Waste management[a]	Interim management of nuclear material[b]	Spent nuclear fuel[c]	Total
Remote population dose (person-rem)	7.3	(d)	0.23	7.53
Remote population excess LCFs[e]	3.6×10^{-3}	(d)	1.2×10^{-4}	3.7×10^{-3}
Uninvolved workers dose (person-rem)	2.2	105	(f)	107
Onsite population excess LCFs	8.9×10^{-4}	4.20×10^{-2}	(f)	4.3×10^{-2}
Involved workers dose (person-rem)	240	6.09	2.5	249
Involved workers excess LCFs	0.098	2.44×10^{-3}	1.0×10^{-3}	0.101

a. Alternative B – expected waste forecast.
b. Preferred alternative from the *Draft Interim Management of Nuclear Materials EIS* (DOE 1995c).
c. Highest consequence option; from DOE (1995d).
d. Not calculated - no offsite transport.
e. Latent cancer fatalities.
f. Not calculated - little onsite transport.

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TC
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4.4.15.4.7 Occupational and Public Health

Radiological

Table 4-80 summarizes the cumulative radiological doses and resulting health effects to the offsite population from airborne and liquid releases from current activities (1993 SRS baseline conditions), operation of the proposed waste management facilities, actions planned for spent nuclear fuel management, stabilization of plutonium solutions, operation of the Defense Waste Processing Facility, actions associated with interim management of nuclear materials, and operation of Georgia Power Company's Plant Vogtle. Doses and resulting health effects are also presented for involved workers from direct radiation exposure for the same activities (except Plant Vogtle). Health effects from alternative B represent a small fraction of the minimal health effects due to current SRS practices. Doses and health effects due to alternative B represent less than 10 percent of the cumulative values listed in Table 4-80.

TE

For all activities listed in Table 4-80, the annual cumulative dose to the offsite maximally exposed individual would increase approximately tenfold over the dose received from current SRS practices (to 0.0020 rem from 0.00025 rem). Alternative B would contribute less than 2 percent of the total increment. The resulting cumulative health effects for all activities would increase the excess annual risk to the offsite maximally exposed individual of developing a fatal cancer from approximately 1 in 1.0×10^7 to 1 in 1.0×10^6. Alternative B would contribute only about 2 percent of this increase.

TE TC

Offsite cumulative population doses from all activities presented in Table 4-80 would increase by less than tenfold compared to current levels (to 70 person-rem from 9.1 person-rem). Alternative B would contribute slightly more than 2 percent of the total. The resulting cumulative dose from all activities would increase the annual expected excess latent cancer fatalities from 0.0046 to 0.035. Alternative B would contribute slightly more than 2 percent of the increase.

TC

For all activities listed in Table 4-80, the annual cumulative collective dose to involved workers would increase by a factor of 3 compared to the dose from current practices (to 799 person-rem from 263 person-rem). Alternative B would contribute approximately 10 percent of the total. The resulting cumulative dose to the involved workers would increase from 0.11 latent cancer fatality per year for current practices to 0.32 latent cancer fatality per year from all activities presented in Table 4-80. Alternative B would contribute approximately 10 percent of the total increase.

TE TC

Table 4-80. Estimated maximum annual cumulative radiological doses and resulting health effects to offsite population and facility workers.

Activity	Offsite maximally exposed individual (rem)				Total collective[a] (to 80-kilometer population) (person-rem)				All Workers (person-rem)	
	Dose from airborne releases[b]	Dose from aqueous releases[b]	Total dose[b]	Fatal cancer risk[c]	Dose from airborne releases[d]	Dose from aqueous releases[d]	Total dose[d]	Latent cancers fatalities[e]	Dose[d]	Latent cancer fatalities[e]
Waste Management-Alternative B	3.2×10^{-5}	6.9×10^{-7}	3.3×10^{-5}	1.7×10^{-8}	1.5	0.0068	1.5	7.5×10^{-4}	81	0.032
Current SRS practices	1.1×10^{-4}	1.4×10^{-4}	2.5×10^{-4}	1.3×10^{-7}	7.6	1.5	9.1	0.0046	263	0.11
Interim management of nuclear materials[f]	0.00097	2.4×10^{-5}	0.00099	5.0×10^{-7}	40	0.09	40	0.02	127	0.051
Stabilization of plutonium solutions[g]	8.61×10^{-6}	2.9×10^{-7}	8.9×10^{-6}	4.5×10^{-9}	0.38	3.7E-4	0.38	1.9×10^{-4}	131	0.052
Defense Waste Processing Facility[h]	1.0×10^{-6}	NA[i]	1.0×10^{-6}	5.0×10^{-10}	0.07	NA[j]	0.07	3.5×10^{-5}	118	0.047
Plant Vogtle[k]	3.7×10^{-7}	1.7×10^{-4}	1.7×10^{-4}	8.5×10^{-8}	0.047	0.0097	0.057	2.9×10^{-5}	NA	NA
SRS spent nuclear fuel[l]	4.0×10^{-4}	1.0×10^{-4}	5.0×10^{-4}	2.5×10^{-7}	16.0	2.4	18.4	0.0092	79	0.032
Total	0.0015	4.4E-04	0.0020	9.9E-07	66	4.0	70	0.035	799	0.32

TC

TC

a. Collective dose: for the 80-kilometer (50-mile) population after atmospheric releases; for downstream users of Savannah River water after liquid releases.
b. Dose in rem.
c. Probability of an excess fatal cancer.
d. Dose in person-rem.
e. Incidence of excess latent fatal cancers.
f. Preferred alternative from the *Draft Interim Management of Nuclear Materials EIS* (DOE 1995c).
g. Source: DOE (1994c).
h. Source: DOE (1994d)
i. NA = not applicable. There are no direct radioactive releases to surface water from the Defense Waste Processing Facility operations.
j. NA = not applicable.
k. NRC (1994).
l. Highest values from Appendix C of DOE (1995d).

TE

Nonradiological

The cumulative occupational health impacts resulting from the operation of the proposed waste management facilities and the Defense Waste Processing Facility, in addition to facilities associated with spent nuclear fuel management, stabilization of plutonium solutions, are analyzed qualitatively because TE most of the facilities associated with these programs are not yet operating. Each EIS for the above facilities concludes that nonradiological air emissions from routine operations for the facilities involved with these programs would be well below applicable Occupational Safety and Health Administration guidelines. In addition, concentrations of air contaminants near facilities operating under alternative B would be less than 1 percent of the applicable permissible exposure guidelines under the Occupational Safety and Health Administration.

Cumulative maximum boundary-line ground-level concentrations from the routine operation of facilities associated with alternative B, spent nuclear fuel management, and the stabilization of plutonium solutions were calculated for criteria pollutants, as shown in Table 4-78. For each criteria pollutant, maximum boundary-line concentrations would be less than either state or federal ambient air quality standards. EPA considers ambient air not to be harmful to the public when concentrations of air contaminants are less than federal standards.

Cumulative public health impacts due to carcinogenic emissions from facilities associated with the proposed programs are presented in Table 4-81. Unit risk factors for latent nonfatal cancers were obtained from EPA's Integrated Risk Information System. Total estimated latent nonfatal cancers due to the routine operation of the proposed facilities would be approximately 5 in 100 million.

Table 4-81. Maximum SRS boundary-line concentrations (in micrograms per cubic meter of air) and cumulative public health impacts from carcinogenic emissions.

Pollutant[a]	Unit risk factor (latent cancers probability/μg/m³)[b]	SRS baseline (μg/m³)[c]	Alternative B (μg/m³)[d]	Spent nuclear fuel (μg/m³)[e]	F-Canyon plutonium solutions (μg/m³)	Interim management nuclear materials (μg/m³)	Latent cancer probability[f]	
Acetaldehyde	2.2×10^{-6}	N/A	1.4×10^{-7}	N/A[g]	N/A	N/A	1.3×10^{-13}	
Acrylamide	0.0013	N/A	1.4×10^{-7}	N/A	N/A	N/A	1.3×10^{-13}	
Acrylonitrile	6.8×10^{-5}	0.002	1.4×10^{-7}	N/A	N/A	N/A	1.9×10^{-9}	
Arsenic pentoxide	0.0043	N/A	7.1×10^{-7}	N/A	N/A	N/A	6.7×10^{-13}	
Asbestos	0.23	N/A	2.7×10^{-8}	N/A	N/A	N/A	2.5×10^{-14}	
Benzene	8.3×10^{-6}	0.17	0.044	0.005	0.001	N/A	2.1×10^{-7}	TC
Benzidine	0.067	N/A	1.4×10^{-7}	N/A	N/A	N/A	1.3×10^{-13}	
Bis (chloromethyl) ether	0.062	N/A	1.4×10^{-7}	N/A	N/A	N/A	1.3×10^{-13}	
Bromoform	1.1×10^{-6}	0.002	1.4×10^{-7}	N/A	N/A	N/A	1.6×10^{-9}	
Carbon tetrachloride	1.5×10^{-5}	2.6×10^{-4}	1.2×10^{-5}	N/A	N/A	N/A	2.6×10^{-10}	
Chlordane	3.7×10^{-4}	2.3×10^{-4}	1.4×10^{-7}	N/A	N/A	N/A	2.1×10^{-10}	
Chloroform	2.3×10^{-5}	0.62	0.003	N/A	N/A	N/A	5.9×10^{-7}	
Cr (+6) compounds	0.012	N/A	4.9×10^{-9}	N/A	N/A	N/A	4.4×10^{-15}	
Formaldehyde	1.3×10^{-5}	1.6×10^{-4}	1.4×10^{-7}	0.0013	N/A	N/A	1.3×10^{-9}	
Heptachlor	0.0013	N/A	3.5×10^{-7}	N/A	N/A	N/A	3.3×10^{-13}	
Hexachlorobenzene	4.6×10^{-4}	N/A	1.4×10^{-7}	N/A	N/A	N/A	1.3×10^{-13}	
Hexachlorobutadlene	2.2×10^{-5}	N/A	1.4×10^{-7}	N/A	N/A	N/A	1.3×10^{-13}	
Hydrazine	0.0049	N/A	1.4×10^{-7}	N/A	N/A	N/A	1.3×10^{-13}	
1,1,2,2-Tetrachloroethane	5.8×10^{-5}	9.9×10^{-5}	2.8×10^{-6}	N/A	N/A	N/A	9.6×10^{-11}	
1,1,2-Trichloroethane	1.6×10^{-5}	0.002	1.4×10^{-7}	N/A	N/A	N/A	1.9×10^{-9}	
Toxaphene	3.2×10^{-4}	N/A	3.5×10^{-7}	N/A	N/A	N/A	3.3×10^{-13}	
1,1 Dichloroethene	5.0×10^{-5}	6.3×10^{-6}	2.7×10^{-5}	N/A	N/A	N/A	3.1×10^{-11}	
Methylene chloride	4.7×10^{-7}	1.31	1.4×10^{-7}	0.0025	N/A	N/A	1.2×10^{-6}	TC
Total							2.0×10^{-6}	

a. Background values are not available because there is no ambient air monitoring existing for air toxics.
b. Source: EPA (1994).
c. Calculated maximum potential annual concentration from WSRC (1993b).
d. Alternative B includes Defense Waste Processing Facility and Consolidated Incineration Facility operations.
e. Spent nuclear fuel values are adjusted from 24-hour concentrations to annual concentrations.
f. Latent cancer probability adjusted for 30 years of waste management activities. Total probability for each pollutant equals unit risk factor × concentration × 30 years/70 years.
g. NA = not applicable.

4.5 Environmental Restoration and Decontamination and Decommissioning

TE TC There are 407 waste storage facilities that would be constructed under the no-action alternative. These facilities consist of storage buildings, pads, and tanks. About 100 new waste handling and storage facilities would be required by the action alternatives – expected forecast. Decisions on decontaminating and decommissioning these facilities would not be made until the facilities' missions have been completed, which in most cases will be 30 or more years in the future.

DOE requires that new waste storage and handling facilities use pollution control systems that meet applicable regulatory requirements and ensure that the environmental restoration of these facilities will be minimized or unnecessary (DOE Order 6430.1A "General Design Criteria"). In addition, DOE requires that these facilities be designed to simplify periodic decontamination and ultimate facility decommissioning or reuse. Measures that simplify future decontamination include minimizing and limiting the use of items such as service piping, conduits, and ductwork to areas designed to facilitate decontamination. Walls, ceilings, and floors are to be finished with washable or strippable coverings. Cracks, crevices, and joints are to be caulked or sealed and finished smooth to prevent the accumulation of contaminated material in inaccessible areas. DOE also requires special design principles that preclude contamination of fixed portions of the structure, avoid buried pipelines, provide visual inspection points, use materials that are easily decontaminated, and other measures that anticipate the need for eventual decommissioning of the facilities.

More than 6,000 buildings on SRS will eventually be declared surplus and will need to be decommissioned, as described in Section 3.14. The decommissioning of new waste storage and handling facilities proposed in the alternatives will result in minimal additional decontamination and decommissioning at SRS; however, some of these facilities could contain radioactive or hazardous material. Regardless of the alternative selected, environmental restoration and decontamination and decommissioning of these facilities would be subject to environmental and public review as the facilities' missions are completed.

4.6 Mitigation Measures

As required by the Council on Environmental Quality, this section considers mitigation measures that could reduce or offset the potential environmental consequences of waste management activities and that are not part of the proposed action or its alternatives. DOE has not identified specific measures, other than management controls and standard engineering practices, that would reduce impacts beyond measures that are part of each alternative. If future activities lead to impacts beyond those described herein, mitigation action planning would begin concurrent with consideration of the appropriate NEPA documentation. Based on the potential environmental effects described in this chapter for each alternative, DOE will consider establishing additional programs to reduce environmental impacts. TE

Many mitigation measures have been implemented as a result of current waste management. Current mitigation measures include administrative or management controls and engineered systems (e.g., backup systems, failsafe designs) that are required by environmental regulations or DOE Orders, and implemented through operating procedures. These activities would continue under each alternative described in this EIS.

Management controls include erosion and sedimentation control plans instituted through stormwater pollution prevention plans and their permits; spill prevention control and countermeasures plans; and best management plans. These plans and others are referenced throughout Chapter 4.

As described in Section 4.1.9, DOE has surveyed the undeveloped portions of E-Area for cultural resources and identified 12 archaeological sites that might be eligible for listing on the National Register of Historic Places. Mitigation of potential impacts on these sites will be by avoidance, if possible. If avoidance is not possible, effects of facility construction and operation will be mitigated by data recovery (i.e., an archaeological excavation of the site). Mitigation will be conducted in consultation with the South Carolina State Historic Preservation Office in accordance with the Programmatic Memorandum of Agreement between the South Carolina State Historic Preservation Office, DOE, and the Advisory Council on Historic Preservation. TE

4.7 References

Arnett, M. W., 1994, *Savannah River Site Environmental Data for 1993*, WSRC-TR-94-077, Westinghouse Savannah River Company, Aiken, South Carolina.

Arnett, M. W., L. K. Karapatakis, and A. R. Mamatey, 1994, *Savannah River Site Environmental Report for 1993*, WSRC-TR-94-075, Westinghouse Savannah River Company, Aiken, South Carolina.

TE Bauer, L. R., 1991, *Modeling Chronic Atmospheric Releases at the SRS: Evaluation and Verification of XOQDOQ*, WSRC-RP-91-320, Savannah River Laboratory, Aiken, South Carolina.

Brooks, M. J., G. T. Hanson, and R. D. Brooks, 1986, *An Intensive Archaeological Survey and Testing of Alternative, New Low-Level Radioactive and Hazardous/Mixed Waste Storage/Disposal Facilities, Savannah River Plant, Aiken and Barnwell Counties, South Carolina*, Manuscript on file with the Savannah River Archaeological Research Program, South Carolina Institute of Archaeology and Anthropology, University of South Carolina, Columbia, South Carolina.

CDC (Centers for Disease Control and Prevention), 1993, "Advance Report of Final Mortality Statistics, 1990," *Monthly Vital Statistics Report 41*, No. 7 Supplement, U.S. Public Health Service, Department of Health and Human Services, Washington, D.C., January 7.

Chesney, S. D., 1995, Halliburton NUS Corporation, Aiken, South Carolina, Interoffice Memorandum to B. H. Bradford, Halliburton NUS Corporation, Aiken, South Carolina, "Dose Analysis for Waste Management Environmental Impact Statement," RHSES-002, Revision 1, June 30.

DOE (U.S. Department of Energy), 1987, *Final Environmental Impact Statement, Waste Management Activities for Groundwater Protection, Savannah River Plant, South Carolina*, DOE/EIS-0120, Savannah River Operations Office, Aiken, South Carolina.

DOE (U.S. Department of Energy), 1990, *Final Environmental Impact Statement, Continued Operation of K-, L-, and P-Reactors, Savannah River Site, Aiken, South Carolina*, DOE/EIS-0147, Savannah River Operations Office, Aiken, South, Carolina.

DOE (U.S. Department of Energy), 1991, *Draft Environmental Impact Statement for the Siting, Construction, and Operation of New Production Reactor Capacity*, DOE/EIS-0144D, Office of New Production Reactors, Washington, D.C.

DOE (U.S. Department of Energy), 1992, *Environmental Assessment, Consolidated Incineration Facility, Savannah River Site*, DOE/EA-0400, Office of Environmental Restoration and Waste Management, Savannah River Plant, Aiken, South Carolina.

DOE (U.S. Department of Energy), 1993a, *Environmental Assessment, Treatment of M-Area Mixed Wastes at the Savannah River Site*, DOE/EA-0918, Savannah River Operations Office, Aiken, South Carolina, August.

DOE (U.S. Department of Energy), 1993b, *Occupational Injury and Property Damage Summary, January - December 1992*, DOE/EH/10570-H1, SPMS Maintenance and Operations, EG&G Idaho, Inc., Idaho Falls, Idaho.

DOE (U.S. Department of Energy), 1993c, *Introduction to Natural Resources Management at the Savannah River Site*, Savannah River Operations Office, Aiken, South Carolina.

DOE (U.S. Department of Energy), 1993d, *Environmental Assessment for Natural Resource Management Activities at the Savannah River Site*, DOE-EA-0826, Savannah River Operations Office, Aiken, South Carolina, July.

DOE (U.S. Department of Energy), 1994a, *FY 1994 Draft Site Development Plan,* Savannah River Operations Office, Aiken, South Carolina, June.

DOE (U.S. Department of Energy), 1994b, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports,* DOE-STF-3009-94, Washington, D.C.

DOE (U.S. Department of Energy), 1994c, *Final F-Canyon Plutonium Solutions Environmental Impact Statement*, DOE/EIS-0219, Savannah River Operations Office, Aiken, South Carolina.

DOE (U.S. Department of Energy), 1994d, *Final Supplemental Environmental Impact Statement Defense Waste Processing Facility,* DOE/EIS-0082S, Savannah River Operations Office, Aiken, South Carolina.

DOE (U.S. Department of Energy), 1995a, Record of Decision, *Defense Waste Processing Facility at the Savannah River Site*, Savannah River Operations Office, Aiken, South Carolina, 60 *Federal Register* 18589, April 12. TE

DOE (U.S. Department of Energy), 1995b, Record of Decision, *Final F-Canyon Plutonium Solutions Environmental Impact Statement*, Savannah River Operations Office, Aiken, South Carolina, 60 *Federal Register* 9824, February 22.

TC DOE (U.S. Department of Energy), 1995c, *Draft Interim Management of Nuclear Materials Environmental Impact Statement*, DOE/EIS-0220D, Savannah River Operations Office, Aiken, South Carolina, March.

DOE (U.S. Department of Energy), 1995d, *Final Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Environmental Impact Statement, Volume 1, Appendix C, Savannah River Spent Nuclear Fuel Management Program*, DOE/EIS-0203-F, Idaho Operations Office, Idaho Falls, Idaho.

DOE (U.S. Department of Energy), 1995e, "Record of Decision *for Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs*," 60 FR 28680, June 1.

DOT (U.S. Department of Transportation), 1982, *Large Truck Accident Causation*, DOT-HS-806300, National Highway Traffic Safety Administration, Washington, D.C.

Ebasco, 1992, *Master Plan for Solid Waste Treatment Complex Document*, WSRC-TR-92-362, Westinghouse Savannah River Company, Aiken, South Carolina.

Eckerman, K. F., F. J. Congel, A. K. Roecklein, and W. J. Pasciak, 1980, *Users Guide to GASPAR Code*, NUREG-0597, U.S. Nuclear Regulatory Commission, Washington, D.C.

EPA (U.S. Environmental Protection Agency), 1984, *Assessing the Releases and Costs Associated with Truck Transport of Hazardous Waste*, PB84-224468, Washington, D.C.

EPA (U.S. Environmental Protection Agency), 1985, *Office of Air Quality Planning and Standards - Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources*, Section 11.2.3.1, Fourth Edition, Research Triangle Park, North Carolina, September.

EPA (U.S. Environmental Protection Agency), 1988, *A Workbook of Screening Techniques for Assessing Impacts of Toxic Air Pollutants*, EPA-450/4-88-009, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina, September.

EPA (U.S. Environmental Protection Agency), 1990, *Toxic Air Pollution Emission Factors – A Compilation for Selected Air Toxic Compounds and Sources*, EPA-450/2-90-011, October.

EPA (U.S. Environmental Protection Agency), 1993, Federal Facility Agreement between the U.S. Environmental Protection Agency Region IV, the U.S. Department of Energy, and the South Carolina Department of Health and Environmental Control, Docket No. 89-05-FF, August 16.

EPA (U.S. Environmental Protection Agency), 1994, *Integrated Risk Information System*, "Toxicology Information Program," National Library of Medicine, October 2, 1994. TC

Hamby, D. M., 1991, *LADTAP XL: An Improved Electronic Spreadsheet Version of LADTAP II*, WSRC-RP-91-975, Westinghouse Savannah River Company, Aiken, South Carolina.

TE

Hamby, D. M., 1992, *Verification of the GASPAR Dose Assessment Module Used in MAXIGASP and POPGASP*, WSRC-RP-92-418, Savannah River Laboratory, Aiken, South Carolina.

Henry, V. G., 1986, U.S. Department of the Interior, Fish and Wildlife Service, Asheville, North Carolina, personal communication with C. G. Halsted, U.S. Department of Energy, Savannah River Operations Office, Aiken, South Carolina, February 21.

Hess, M. L., 1994a, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to H. L. Pope, U.S. Department of Energy, Savannah River Operations Office, Aiken, South Carolina, "Air Emissions from Construction Activities," ESH-NEP-94-0196, October 14.

Hess, M. L., 1994b, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to H. L. Pope, U.S. Department of Energy, Savannah River Operations Office, Aiken, South Carolina, "Facilities with Negligible Emissions," ESH-NEP-94-0190, October 13.

Hess, M. L., 1994c, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to H. L. Pope, U.S. Department of Energy, Savannah River Operations Office, Aiken, South Carolina, "WMEIS Transportation Data," ESH-NEP-94-0134, September 22.

Hess, M. L., 1994d, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to H. L. Pope, U.S. Department of Energy, Savannah River Operations Office, "Truck Traffic Associated with Construction," ESH-NEP-94-0162, August 30.

Hess, M. L., 1995a, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to H. L. Pope, U.S. Department of Energy, Savannah River Operations Office, Aiken, South Carolina, "WSRC Data Transmittal - Complete Copy of Cost Model for WMEIS," ESH-NEP-95-0078, May 5.

TC

Hess, M. L., 1995b, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to H. L. Pope, U.S. Department of Energy, Savannah River Operations Office, "WSRC Data Transmittal - Revised Facility Costs for the No-Action Alternative and Revised Employees for Alternative A Minimum Forecast (U)," ESH-NEP-95-0085, May 16.

TC

Hess, M. L., 1995c, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to H. L. Pope, U.S. Department of Energy, Savannah River Operations Office, Aiken, South Carolina, "WSRC Data Transmittal – Hamby's Computer Calculations," ESH-EP-95-0011, June 5.

TE

TC

HNUS (Halliburton NUS Corporation), 1995a, *Transportation Radiological Analysis for the Waste Management Environmental Impact Statement*, Savannah River Center, Aiken, South Carolina.

HNUS (Halliburton NUS Corporation), 1995b, *Computer printouts generated from the Regional Economic Models, Inc. (REMI), Economic-Demographic Forecasting and Simulation Model for the SRS Region of Influence*, Savannah River Center, Aiken, South Carolina.

ICRP (International Commission on Radiological Protection), 1991, *1990 Recommendations of the International Commission of Radiological Protection*, ICRP Publication 60, Annals of the ICRP, Volume 21, Number 1-3, Pergammon Press, New York, New York.

LeMaster, E. T., 1994a, Savannah River Forest Station, Aiken, South Carolina, Personal communication to R. K. Abernethy, Halliburton NUS Corporation, Aiken, South Carolina, "Red-cockaded woodpecker survey of compartment 49 stands 6 and 8," November 3.

LeMaster, E. T., 1994b, Savannah River Forest Station, Aiken, South Carolina, Personal communication to R. K. Abernethy, Halliburton NUS Corporation, Aiken, South Carolina, "Locations of rare plants located during 1992 and 1994 surveys of E-Area," September 27.

Martin Marietta (Martin Marietta Energy Systems), EG&G (EG&G-Idaho), and WSRC (Westinghouse Savannah River Company), 1994, *Radiological Performance Assessment for the E-Area Vaults Disposal Facility*, WSRC-RP-94-218, Westinghouse Savannah River Company, Aiken, South Carolina.

Mulholland, J. A., and M. G. Robinson, 1994, *Dose Comparison for Air Emissions from the Incineration and Compaction of SRS Low-Level Radioactive Job Control Wastes*, GT/ERDA-94041-001, Revision 3.

Neuhauser, K. S. and F. L. Kanipe, 1992, *RADTRAN: Volume 3 User Guide*, SAND89-2370; TTC-0943; UC-722, Sandia National Laboratories, Albuquerque, New Mexico.

NIOSH (National Institute of Safety and Health), 1990, *Pocket Guide to Chemical Hazards*, National Institute for Occupational Safety and Health, Cincinnati, Ohio.

NRC (U.S. Nuclear Regulatory Commission), 1977, *Final Environmental Impact Statement on the Transportation of Radioactive Material by Air and Other Modes*, NUREG-0170, Washington, D.C.

NRC (U.S. Nuclear Regulatory Commission), 1994, *Dose Commitments Due to Radioactive Releases from Nuclear Power Plant Sites in 1991*, NUREG/CR-2850, Washington, D.C.

NUS (NUS Corporation), 1991, *Update to the Air Quality Cooling Tower, and Noise Impact Analyses in Support of the New Production Reactor Environmental Impact Statement*, Aiken, South Carolina.

Rollins, E. M., 1995, Halliburton NUS Corporation, Aiken, South Carolina, Interoffice Memorandum to B. H. Bradford, Halliburton NUS Corporation, Aiken, South Carolina, "Traffic Analysis for Waste Management Environmental Impact Statement," RHSES-001, Revision 1, June 30.

Sagendorf, J. F., J. T. Croll, and W. F. Sandusky, 1982, *XOQDOQ: Computer Program for the Meteorological Evaluations of Routine Effluent Releases at Nuclear Power Stations, Final Report*, NUREG/CR-2919, U.S. Nuclear Regulatory Commission, Washington, D.C.

Sassaman, K. E., 1994, Savannah River Archaeological Research Program, The University of South Carolina, Columbia, South Carolina, Interoffice Memorandum to L. S. Moore, Halliburton NUS Corporation, Aiken, South Carolina, "E-Area Archaeological Survey," September 19.

SCDHEC (South Carolina Department of Health and Environmental Control), 1976, South Carolina Code of Laws, SCDHEC Regulation 61-62, "Air Pollution Control Regulations and Standards," Columbia, South Carolina.

SCDHEC (South Carolina Department of Health and Environmental Control), 1992, *1992 Air Pollution Measurements of the South Carolina Air Quality Surveillance Network*, Columbia, South Carolina.

SCDOT (South Carolina Department of Transportation), 1992, *1992 South Carolina Traffic Accident Fact Book*, Columbia, South Carolina.

Simpkins, A. A., 1994a, Westinghouse Savannah River Company, Aiken, South Carolina, Internal Memorandum to J. J. Mayer, "Waste Management EIS - Environmental Dosimetry Calculations," SRT-ETS-940121, August 26.

Simpkins, A. A., 1994b, Westinghouse Savannah River Company, Aiken, South Carolina, Internal Memorandum to C. B. Shedrow, "Interim Management of Nuclear Materials EIS - Environmental Dosimetry Calculations," SRT-ETS-940079, June 3.

Smith, W. B., 1989, *Draft Traffic Services Report, Savannah River Plant*, Wilbur B. Smith Associates, Columbia, South Carolina, March 24.

SRARP (Savannah River Archaeological Research Program), 1989, *Archaeological Resource Management Plan of the Savannah River Archaeological Research Program*, Savannah River Archaeological Research Program, South Carolina Institute of Archaeology and Anthropology, University of South Carolina, Columbia, South Carolina, December.

Stewart, J., 1994, *Air Dispersion Modeling for Waste Management Environmental Impact Statement (U)*, WSRC-RP-94-1271, Westinghouse Savannah River Company, Aiken, South Carolina.

Swygert, R., 1994, Westinghouse Savannah River Company, Aiken, South Carolina, Interoffice Memorandum to E. M. Rollins, Halliburton NUS Corporation, Aiken, South Carolina, "Savannah River Site Truck Traffic," September 30.

Toblin, A., 1995, Halliburton NUS Corporation, Aiken, South Carolina, Interoffice Memorandum, "Calculations of Groundwater and Surface Water Radionuclide Concentrations Resulting from Disposal in Vaults and Trenches for SRS - Waste Management EIS," May 15.

TRB (Transportation Research Board), 1985, "Highway Capacity Manual," *National Research Council Special Report 209*, Washington, D.C.

Treyz, G. I., D. S. Rickman, and G. Shao, 1992, "The REMI Economic - Demographic Forecasting and Simulation Model," *International Regional Science Review*, Vol. 14, No. 3, pp. 221-253.

Turner, K., 1994, Westinghouse Savannah River Company, Human Resources, Aiken, South Carolina, personal communication with E. M. Rollins, Halliburton NUS Corporation, Aiken, South Carolina, "SRS Headcount," March 31.

USDA (U. S. Department of Agriculture), 1990, *Soil Survey of Savannah River Plant Area, Parts of Aiken, Barnwell, and Allendale Counties, South Carolina*, Soil Conservation Service, Washington, D.C.

USFWS (U.S. Fish and Wildlife Service), 1993, 58 FR 188, "50 CFR Part 17, Endangered and Threatened Wildlife and Plants; Review of Plant Taxa for Listing as Endangered or Threatened Species," p. 51144-51190.

Wike, L. D., R. W. Shipley, J. A. Bowers, A. L. Bryan, C. L. Cummins, B. R. Del Carmen, G. P. Friday, J. E. Irwin, H. E. Mackey, J. J. Mayer, E. A. Nelson, M. H. Paller, V. A. Rogers, W. L. Specht, and E. W. Wilde, 1994, *SRS Ecology Environmental Information Document*, WSRC-TR-93-496, Westinghouse Savannah River Company, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1991a, *Savannah River Site Best Management Practices Plan*, WSRC-IM-90-49, Aiken, South Carolina, February.

WSRC (Westinghouse Savannah River Company), 1991b, *Savannah River Site Spill Prevention, Control, and Countermeasure Plan*, WSRC-IM-90-48, Aiken, South Carolina, January 21.

WSRC (Westinghouse Savannah River Company), 1991c, *Support Facilities Descriptions for the New Production Reactor at Savannah River - Heavy Water Reactor (U)*, WSRC-RP-89-263, Version 4, Aiken, South Carolina, April.

WSRC (Westinghouse Savannah River Company), 1992a, *Solid Waste Operations Erosion and Sedimentation Control Maintenance Program Plan - E-Area*, WSRC-IM-92-0693, Aiken, South Carolina, December.

WSRC (Westinghouse Savannah River Company), 1992b, *Evaluation of Accident Risks in the Transportation of Hazardous Materials by Truck and Rail at the Savannah River Site (U)*, WSRC-RP-89-715, Revision 1, Aiken, South Carolina, September.

WSRC (Westinghouse Savannah River Company), 1992c, *Toxic Chemical Hazard Classification and Risk Acceptance Guidelines for Use in DOE Facilities (U),* WSRC-MS-92-206, Revision 1, Aiken, South Carolina, June.

WSRC (Westinghouse Savannah River Company), 1993a, *Savannah River Site Storm Water Pollution Prevention Plan*, WSRC-IM-93-28, Aiken, South Carolina, April 1.

WSRC (Westinghouse Savannah River Company), 1993b, *SCDHEC Regulation No. 62.5 Standard No. 2 and Standard No. 8, Compliance Modeling Input/Output Data*, ESH-ESS-93-0531, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1994a, *DOE Directive Compliance Assessment and Implementation Report*, WSRC-RP-93-668-044, Revision 1, Aiken, South Carolina, September 20.

WSRC (Westinghouse Savannah River Company), 1994b, *HLW System Plan Revision 2*, HLW-OVP-94-0005, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1994c, *Draft 1994 Land-Use Baseline Report Savannah River Site*, Aiken, South Carolina, September.

WSRC (Westinghouse Savannah River Company), 1994d, *1994 Savannah River Site ALARA Goals*, ESH-PAS-9400112, Aiken, South Carolina, March 4.

WSRC (Westinghouse Savannah River Company), 1994e, *Bounding Accident Determination for the Accident Input Analysis of the SRS Waste Management Environmental Impact Statement*, WSRC-TR-94-0469, Revision 0, Aiken, South Carolina, October.

WSRC (Westinghouse Savannah River Company), 1994f, *Solid Waste Accident Analysis in Support of the Savannah River Waste Management Environmental Impact Statement*, WSRC-TR-94-0265, Revision 0, Savannah River Site, Aiken, South Carolina, July.

WSRC (Westinghouse Savannah River Company), 1994g, *Liquid Waste Accident Analysis in Support of the Savannah River Waste Management Environmental Impact Statement,* WSRC-TR-94-0271, Revision 0, Savannah River Site, Aiken, South Carolina, July.

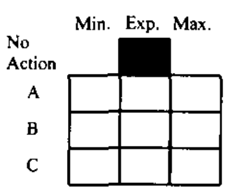
WSRC (Westinghouse Savannah River Company), 1994h, *AXAIR89Q Users Manual,* WSRC-RP-94-313, Aiken, South Carolina.

WSRC (Westinghouse Savannah River Company), 1994i, *Savannah River Site Environmental Report for 1993,* WSRC-TR-94-075, Aiken, South Carolina. TC

CHAPTER 5. FEDERAL AND STATE LAWS, CONSULTATIONS, AND REQUIREMENTS

This chapter identifies regulatory requirements and evaluates their applicability to the alternatives considered in this environmental impact statement (EIS). These requirements are established by major federal statutes that impose requirements on the U.S. Department of Energy (DOE). In addition, there are other federal and state laws, Executive Orders, DOE Orders, regulations, and other compliance orders and agreements applicable to the management of waste at the Savannah River Site (SRS). More detailed TE information on SRS regulatory requirements for waste management is available in *Final Environmental Impact Statement, Waste Management Activities for Groundwater Protection* (DOE 1987). Existing environmental permits at SRS are listed in Appendix B of the *Savannah River Site Environmental Report for 1993* (Arnett, Karapatakis, and Mamatey 1994). Table 5-1 summarizes the permit and approval status of SRS waste management facilities.

Section 5.1 discusses regulatory requirements applicable to the no-action alternative. Section 5.2 addresses differences in the regulatory requirements that apply to the no-action alternative and the other alternatives, and any differences related to the waste volumes. A number of requirements apply to all the alternatives. When that is the case, Section 5.1 includes a discussion of the requirement, which is not repeated in Section 5.2.



5.1 No-Action Alternative

5.1.1 NATIONAL ENVIRONMENTAL POLICY ACT

The National Environmental Policy Act (NEPA) of 1969 (42 USC §4321 *et seq.*) requires federal agencies to evaluate the effect proposed actions would have on the quality of the human environment and to document this evaluation with a detailed statement. NEPA requires consideration of environmental impacts of an action during the planning and decisionmaking stages of a project.

Table 5-1. Permit and approval status of existing and planned SRS waste management facilities.

		Permitting and reporting requirements							Subjects considered in NEPA			
Facility	NEPA[a]	AEA[b]	CERCLA[c]	EPCRA[d]	RCRA[e]	CWA[f]	SDWA[g]	CAA[h]	Wetlands/ floodplain Exec. Orders	Endangered Species Act/others	Environmental justice[i]	Cultural resources
E-Area Vaults	No action[j] Other NEPA[k]	S	NA	ON	NA	NA	P	NA	√	★	–	★
Low-Level Radioactive Waste Disposal Facility	No action Other NEPA	S	NA	ON	NA	NA	P	NA	★	★	–	★
Compactors	No action	S	NA	ON	NA	NA	P	NA	★	√	√	√
Consolidated Incineration Facility - Construction	No action Other NEPA	S	NA	ON	P	NA	P	CP	★	★	–	★
Consolidated Incineration Facility - Operation	Proposed action	S	NA	ON	NA	NA	P	PR	√	√	√	√
HW/MW Disposal Vaults	No action Other NEPA	S	NA	ON	PS	NA	P	NA	★	★	–	★
Mixed Waste Storage Buildings and Pads 20-22	No action Other NEPA	S	NA	ON	I/PS	NA	P	NA	★	★	–	★
Hazardous Waste Storage Facility	No action	NA	NA	ON	P	NA	P	NA	√	√	√	√
M-Area Vendor Treatment Facility	No action Other NEPA	S	NA	ON	NA	PS	P	CP/ OPS	★	★	–	★
M-Area Liquid Effluent Treatment Facility	No action	S	NA	ON	NA	P	P	PR	√	√	√	√
Process Waste Interim Treatment/Storage Facility	No action	S	NA	ON	I/PS	NA	P	PR	√	√	√	√
Burial Ground Solvent Tanks	No action	S	NA	ON	I	NA	P	NA	√	√	√	√
SRTC Mixed Waste Storage Tanks	No action	S	NA	ON	I	NA	P	NA	√	√	√	√
Transuranic Waste Storage Pads	No action Other NEPA	S	NA	ON	I	NA	P	NA	★	★	–	★
Experimental Transuranic Waste Assay Facility	No action	S	NA	ON	I	NA	P	NA	√	√	√	√
F- and H-Area Tank Farms	No action Other NEPA	S	NA	ON	NA	P	P	NA	★	★	–	★
Replacement HLW Evaporator	No action Other NEPA	S	NA	ON	NA	P	P	NA	★	★	√	★

Table 5-1. (continued).

Facility	NEPA[a]	Permitting and reporting requirements							Subjects considered in NEPA			
		AEA[b]	CERCLA[c]	EPCRA[d]	RCRA[e]	CWA[f]	SDWA[g]	CAA[h]	Wetlands/ floodplain Exec. Orders	Endangered Species Act/others	Environmental justice[i]	Cultural resources
F/H-Area Effluent Treatment Facility	No action	S	NA	ON	NA	P	P	NA				
	Other NEPA								★	★	–	★
Defense Waste Processing Facility	No action	S	NA	ON	NA	P	P	CP				
	Other NEPA								★	★	★	★
Organic Waste Storage Tank	No action	S	NA	ON	I/PS	NA	P	OP				
	Other NEPA								★	★	★	★

a. NEPA = National Environmental Policy Act.
b. AEA = Atomic Energy Act.
c. CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act.
d. EPCRA = Emergency Planning and Community Right-to-Know Act.
e. RCRA = Resource Conservation and Recovery Act.
f. CWA = Clean Water Act.
g. SDWA = Safe Drinking Water Act.
h. CAA = Clean Air Act.
i. The Executive Order on environmental justice was issued in 1994. NEPA documents prepared for facilities built before 1994 do not address environmental justice.
j. Included in the no-action alternative of this EIS.
k. Subject of a previous NEPA review (i.e., EIS, environmental assessment, or categorical exclusion).

S = subject to requirements.
NA = requirements not applicable.
ON = ongoing consultation/reporting requirements.
P = permitted or approved.
Unk = requirements unknown.
CP = construction permit.
PS = permit application submitted.
I = operating under an interim permit.
OPS = operating permit has been submitted.
PR = permit will be required.
OP = operating permit.
HW/MW = hazardous waste/mixed waste.
TRU = transuranic waste.
HLW = high-level waste.
SRTC = Savannah River Technology Center.

★ = considered in previous NEPA review.
√ = considered in this EIS.
– = previous NEPA documentation did not require an analysis of environmental justice.

The Council on Environmental Quality has issued regulations that federal agencies must follow (40 CFR
TE 1500 - 1508); agencies were also directed to develop their own regulations to ensure compliance with NEPA requirements. DOE's regulations can be found at 10 CFR 1021. An agency is required to prepare
TE an EIS when it proposes a major federal action that may significantly affect the environment.

<u>**Status**</u> – Analyses presented in this EIS describe the environmental impacts of the alternatives.
TE Additional NEPA analyses may be required before some facilities could be constructed.

5.1.2 ATOMIC ENERGY ACT

The Atomic Energy Act of 1954 (42 USC § 201 *et seq.*) makes the federal government responsible for regulatory control of the production, possession, and use of three types of radioactive material: source, special nuclear, and byproducts. The Atomic Energy Act also requires DOE to establish standards that protect health and minimize dangers to life or property from activities under DOE's jurisdiction. Pursuant to the Atomic Energy Act, DOE established an extensive system of standards and requirements, called DOE Orders, to ensure compliance with the Atomic Energy Act. The Atomic Energy Act and the Reorganization Plan No. 3 of 1970 [5 USC (app. at 1343)] and other related statutes gave the U.S. Environmental Protection Agency (EPA) responsibility and authority for developing generally applicable
TE environmental standards for protecting the environment from radioactive material. EPA has promulgated several regulations under this authority, including "Environmental Radiation Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes" (40 CFR 191).

In response to public comments during the scoping period, DOE presents in Appendix H a comparison of alternative regulatory approaches for the disposal of low-level waste. The appendix presents an analysis of the similarities and differences in requirements established by DOE and the Nuclear Regulatory Commission for the disposal of low-level waste. Table H-1 correlates specific DOE and Nuclear Regulatory Commission requirements. The conclusion of the analysis is that DOE regulations are
TE substantially equivalent to Nuclear Regulatory Commission regulations.

Appendix H also provides a comparative analysis of DOE and Nuclear Regulatory Commission low-level waste disposal requirements with EPA requirements for a hazardous waste landfill. The analysis indicates that the vaults proposed for disposal of low-level waste at SRS (discussed in Appendix B.8) exceed the EPA hazardous waste landfill requirements.

Status – Construction, prestartup evaluations, and operation of radioactive waste management facilities will meet the requirements in DOE Orders and other applicable regulations.

5.1.3 COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT

The Comprehensive Environmental Response, Compensation, and Liability Act (42 USC §9601 *et seq.*) (CERCLA; also called the Superfund Act) is administered by EPA. It provides a statutory framework for the cleanup of waste sites containing hazardous substances and requires that facilities have an emergency response program in the event of a release (or threat of release) of a hazardous substance to the environment. CERCLA also includes requirements of reporting to state and federal agencies releases of certain hazardous substances in excess of specified amounts. CERCLA and Executive Order 12580, "Superfund Implementation," require that federal facilities comply with the Act. Releases of hazardous substances occurring during cleanups at waste management facilities are subject to both CERCLA's requirements and to the requirements of DOE Order 5000.3B, "Occurrence Reporting and Processing of Operations Information."

Status – DOE, the South Carolina Department of Health and Environmental Control (SCDHEC), and EPA have signed a Federal Facility Agreement to coordinate cleanups at SRS, as required by Section 120 of CERCLA. Since 1989, SRS has conducted cleanup activities under the framework established in the draft Federal Facility Agreement. The comprehensive remediation of SRS will continue as directed by the Federal Facility Agreement.

5.1.4 EMERGENCY PLANNING AND COMMUNITY RIGHT-TO-KNOW ACT

The Emergency Planning and Community Right-to-Know Act of 1986 (42 USC §11001 *et seq.*) requires emergency planning and notice to communities and government agencies of the presence and release of specific chemicals. EPA implements the Act under regulations found at 40 CFR 355, 370, and 372. Under Subtitle A of this Act, federal facilities, including those owned by DOE, provide a variety of information (such as inventories of specific chemicals used or stored, and releases that occur from these facilities) to state emergency response commissions and local emergency planning committees to ensure that emergency plans are ready to respond to accidental releases of hazardous substances. Executive Order 12856, "Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements," requires federal agencies to comply with the Act.

Status – Each year SRS submits hazardous chemical inventory and toxic release inventory reports to SCDHEC and to local emergency planning organizations in Aiken, Allendale, and Barnwell Counties, South Carolina. Changes in facility operating status will lead to changes in chemical inventories and use of toxic chemicals; the hazardous chemical inventory and toxic release inventory reports will reflect these changes.

5.1.5 RESOURCE CONSERVATION AND RECOVERY ACT

The Resource Conservation and Recovery Act (RCRA) regulates the treatment, storage, and disposal of hazardous and solid waste. RCRA and Executive Order 12088, "Federal Compliance with Pollution Control Standards," require federal facilities to comply with RCRA's requirements. Any state that wants to administer and enforce a hazardous waste program under the requirements of RCRA may apply to EPA for authorization of its program. EPA regulations implementing RCRA are found at 40 CFR 260 - 280. These regulations define hazardous wastes and set forth requirements governing
TE transporting, handling, treating, storing, and disposing of hazardous wastes.

TE The regulations imposed on managing hazardous wastes vary according to the type and quantity of waste. The method of treatment, storage, and disposal also impacts the extent and complexity of the requirements. RCRA establishes three distinct regulatory programs for different types of waste:

Hazardous and Mixed Waste – EPA has delegated regulatory responsibility over hazardous and mixed (containing both radioactive and hazardous components) wastes to SCDHEC. EPA retains authority to restrict storage and disposal of certain kinds of hazardous wastes, which are referred to as "land disposal restriction wastes." Under the authority of the South Carolina Hazardous Waste Management Act, SCDHEC has established a program for regulating hazardous waste management (South Carolina
TC Hazardous Waste Management Regulations R.61-79.260 through 270). SCDHEC is currently developing programs that will allow EPA to delegate authority over land-disposal-restriction wastes.

DOE and EPA signed a Federal Facility Compliance Agreement regarding land disposal restriction mixed wastes. Among other things, the Agreement requires SRS to provide status reports on construction and operation of various waste management facilities and to obtain permits for the construction and operation of additional facilities to meet SRS's treatment needs for mixed waste. SRS has provided, and will continue to provide, these reports and is preparing the required permit applications.

Underground Storage Tanks – Requirements under RCRA for underground storage tanks apply to tanks containing hazardous substances or petroleum products. Under the South Carolina Underground Storage Tank Act, SCDHEC established a program for implementing RCRA requirements and has issued permits for diesel fuel storage tanks at several SRS waste management facilities. Tanks with high-level radioactive waste are not regulated under RCRA; they are regulated under the Clean Water Act. Below-grade hazardous waste storage tanks are not regulated as underground storage tanks but as hazardous waste.

Nonhazardous Solid Waste – Under the authority of the South Carolina Pollution Control Act and the South Carolina Solid Waste Policy and Management Act, SCDHEC established a program for regulating nonhazardous solid waste disposal units. South Carolina Municipal Solid Waste Landfill Regulations (R.61-107.258) implement RCRA regulations. South Carolina Construction, Demolition, and Land Clearing Debris Landfill Regulations (R.61-107.11) regulate landfills for the disposal of construction debris. South Carolina Industrial Landfill Regulations (R.61-66) regulate industrial landfills. Nonhazardous solid waste is not within the scope of this EIS.

<u>Status</u> – The SRS RCRA Part B permit was issued in 1987 and modified in 1992. The permit covers storage of wastes at four buildings, treatment at the Consolidated Incineration Facility, and maintenance and groundwater remediation at three closed waste units. Other waste management facilities at SRS are presently operating under interim status: SRS submitted to SCDHEC a permit application that covers those facilities' activities and they can continue to operate in conformance with regulatory requirements while applications are reviewed by the regulatory agencies and a final permit decision is issued. Additional waste management facilities (e.g., F- and H-Area tank farms, Replacement High-Level Waste Evaporator) are currently operating under or will operate under Clean Water Act permits. Although these facilities manage hazardous wastes, they are exempt from RCRA permitting requirements under its exclusion for wastewater treatment facilities.

Under the no-action alternative, commitments under the Land Disposal Restrictions Federal Facility Compliance Agreement to treat mixed waste would not be met because only ongoing waste management activities (primarily storage) would be continued.

The no-action alternative includes continued storage and limited ongoing treatment activities at existing waste management facilities that are permitted or operating under interim status. The no-action alternative includes several additional waste management activities that have not yet occurred, but for which NEPA reviews have been completed or will be completed prior to issuing a Record of Decision for this EIS. These activities include retrieval, sampling, and overpacking of transuranic waste drums from mounded storage pads; preparation of waste (size reduction and repackaging) in anticipation of treatment; construction and operation of the M-Area Vendor Treatment Facility; and operation of the Mixed Waste Storage Buildings.

5.1.6 FEDERAL FACILITY COMPLIANCE ACT

The Federal Facility Compliance Act, enacted on October 6, 1992, waives sovereign immunity for fines and penalties for violations of RCRA at federal facilities. However, DOE's immunity continues if DOE prepares plans for developing the treatment capacity for mixed waste stored or generated at its facilities. The appropriate state agency or EPA must then issue a consent order requiring compliance with the plan. DOE is not subject to fines and penalties for RCRA violations involving mixed waste as long as it is in compliance with an approved plan and meets all other applicable regulations.

Status – DOE published the Interim Mixed Waste Inventory Report in April 1993, annual updates, and periodic updates since, describing its inventory of mixed wastes and treatment capabilities. SRS prepared a site treatment plan (WSRC 1995), which identifies DOE's preferred approach for treating mixed waste at SRS. Under the no-action alternative, commitments under the site treatment plan would not be met because only ongoing waste management activities would be continued. The treatment capacity required by SRS's plan would not be available and SRS would probably lose its immunity from fines and penalties.

5.1.7 CLEAN WATER ACT

The objectives of the Clean Water Act are to restore and maintain the chemical, physical, and biological integrity of the nation's waters. The Clean Water Act prohibits the "discharge of toxic pollutants in toxic amounts" to navigable waters of the United States. Section 313 requires all branches of the federal government to comply with federal, state, interstate, and local requirements.

In addition to setting water quality standards for the nation's waterways, the Clean Water Act establishes guidelines and limitations for discharges from point-sources and a permitting program known as the National Pollutant Discharge Elimination System. The National Pollutant Discharge Elimination System program is administered by the Water Management Division of EPA pursuant to regulations at 40 CFR 122 *et seq.*

The Clean Water Act also requires that EPA establish regulations for permits for stormwater discharges associated with industrial activity. Although such discharges require National Pollutant Discharge

Elimination System permits, regulations for separate stormwater permits have not yet been issued by EPA. TC TE

EPA has overall responsibility for enforcing the Clean Water Act, but has delegated to SCDHEC primary enforcement authority for waters located within South Carolina. Under the South Carolina Pollution Control Act, SCDHEC operates a permitting program. The Clean Water Act and state regulations do not apply to DOE discharges of radionuclides, which are subject to the Atomic Energy Act.

<u>Status</u> – SCDHEC has issued Clean Water Act permits for the F- and H-Area tank farms, Defense Waste Processing Facility, Z-Area Saltstone Facility, Replacement High-Level Waste Evaporator, F/H-Area Effluent Treatment Facility, and M-Area Liquid Effluent Treatment Facility. SCDHEC approved certain discharges from the outfalls at these facilities. DOE has submitted an industrial wastewater treatment permit application for the M-Area Vendor Treatment Facility. SRS is currently in compliance with Clean Water Act requirements.

5.1.8 SAFE DRINKING WATER ACT

The Safe Drinking Water Act protects the quality of public water supplies and other sources of drinking water. It establishes drinking water quality standards that must be met. The Act and Executive Order 12088 direct federal facilities to comply with the Safe Drinking Water Act. EPA has promulgated regulations implementing the Safe Drinking Water Act at 40 CFR 100 - 149. The regulations specify that the average annual concentration of man-made radionuclides in drinking water as delivered to the user shall not produce a dose equivalent to the total body or an internal organ greater than 4 millirem of beta activity per year. EPA has overall regulatory responsibility for the Safe Drinking Water Act, but has delegated primary enforcement responsibility to SCDHEC for public water systems in South Carolina. Under the authority of the South Carolina Safe Drinking Water Act, SCDHEC has established a drinking water regulatory program. At SRS, Westinghouse Savannah River Company operates under the SCDHEC permit program for construction of water supplies. Under this program, Westinghouse Savannah River Company may construct water line extensions that are less than or equal to 2,500 feet long without obtaining construction and operating permits; water line extensions longer than 2,500 feet require formal construction and operating permits.

<u>Status</u> – Westinghouse Savannah River Company obtained a construction permit for the water line extension that will serve the Consolidated Incineration Facility. TE

5.1.9 CLEAN AIR ACT

The Clean Air Act establishes a national program to protect air quality and regulates sources of air pollution. Requirements include permits, emissions and operating standards, and monitoring. The Act is intended to "protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population." Section 118 of the Act and Executive Order 12028 require that each federal agency, such as DOE, with jurisdiction over any property or facility that might result in the discharge of air pollutants, comply with "all federal, state, interstate, and local requirements" with regard to the control and abatement of air pollution.

The Act requires EPA to establish National Ambient Air Quality Standards as necessary to protect public health, with an adequate margin of safety, from any known or anticipated effect of a regulated pollutant. It also requires establishment of national standards of performance for new or modified stationary sources of air pollutants (42 USC §7411) and requires specific emission increases to be evaluated to prevent significant deteriorations in air quality. Hazardous air pollutants, including radionuclides, are regulated separately. Air emissions are regulated by EPA in 40 CFR 50 - 99. In particular, radionuclide emissions are regulated under the National Emission Standard for Hazardous Air Pollutants program (40 CFR 61).

EPA has overall enforcement responsibility through a regulatory program (40 CFR 50 - 87); it can delegate primary authority to states. For facilities located within South Carolina, EPA has retained authority over DOE radionuclide emissions (40 CFR 61) and has delegated to SCDHEC lead responsibility for the rest of the regulated pollutants and other requirements. Under the authority of the South Carolina Pollution Control Act, SCDHEC established the state's air pollution control program. SCDHEC issues construction permits for construction and testing of facilities, and operating permits after satisfactory startup testing and inspection.

Status – The Air Quality Control construction permit for the Consolidated Incineration Facility was granted by SCDHEC on November 25, 1992. Emergency power diesel generators are covered under this permit. The M-Area Vendor Treatment Facility emergency diesel generator is exempt from permitting requirements because of its limited capacity and expected use. SCDHEC has granted a permitting exemption for the emergency diesel generator at the Replacement High-Level Waste Evaporator. SRS is currently in compliance with the requirements of the Clean Air Act.

5.1.10 ENDANGERED SPECIES ACT AND OTHER STATUTES

The Endangered Species Act is intended to prevent the further decline of endangered and threatened species and to restore these species and their habitats. The Endangered Species Act also promotes biodiversity of genes, communities, and ecosystems. The U.S. Department of Commerce (National Marine Fisheries Service) and the U.S. Department of the Interior (U.S. Fish and Wildlife Service) jointly administer the Act. Section 7 of the Act requires federal agencies to consult with the National Marine Fisheries Service or the U.S. Fish and Wildlife Service, as appropriate, to ensure that any action it authorizes, funds, or performs is not likely to jeopardize the continued existence of any endangered or threatened species or to result in the destruction or adverse modification of any critical habitat of such species unless the agency receives an exemption in accordance with Section 7(h).

Several other statutes require federal and state agencies to consider impacts that their actions would have on biological resources. These acts include the Fish and Wildlife Coordination Act, the Anadromous Fish Conservation Act, the Migratory Bird Treaty Act, the Bald Eagle Protection Act, and the South Carolina Nongame and Endangered Species Conservation Act.

Status – Prior to disturbing undeveloped land, DOE would consult with the U.S. Fish and Wildlife Service to determine the type and scope of a required biological assessment. This consultation would provide DOE with the information necessary to avoid or mitigate impacts to threatened and endangered species. Appendix J documents DOE's consultation with the U.S. Fish and Wildlife Service.

TE

TC

5.1.11 EXECUTIVE ORDERS 11990 AND 11988

Executive Order 11990, "Protection of Wetlands," requires government agencies to avoid short- and long-term adverse impacts to wetlands whenever a practicable alternative exists. Executive Order 11988, "Floodplain Management," directs federal agencies to establish procedures to ensure that the potential effects of flood hazards and floodplain management are considered for any action undertaken. Impacts to floodplains are to be avoided to the extent practicable. DOE issued regulations (10 CFR 1022) that establish procedures for compliance with these Executive Orders.

Status – Because no activities in wetlands would occur under the no-action alternative, no wetlands would be destroyed.

TC

5.1.12 EXECUTIVE ORDER 12898

Executive Order 12898, "Environmental Justice in Minority and Low-Income Populations," requires that each federal agency "make environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects due to its programs, policies, or activities on minority or low-income populations."

TE **Status** – This EIS incorporates environmental justice into its analyses of the no-action alternative.

5.1.13 CULTURAL RESOURCES

Cultural resources on SRS are subject to the American Indian Religious Freedom Act (42 USC § 1996), the Native American Graves Protection and Repatriation Act (25 USC § 3001), and the National Historic Preservation Act (16 USC § 470 *et seq.*). The American Indian Religious Freedom Act of 1978 reaffirms Native American religious freedom under the First Amendment and protects and preserves the inherent and constitutional right of American Indians to believe, express, and exercise their traditional religions. TE The Act requires that federal actions avoid interfering with access to sacred locations and traditional resources that are integral to the practice of those religions. The Native American Graves Protection and Repatriation Act of 1990 directs the Secretary of the Interior to promote repatriation of federal archaeological collections and collections held by museums receiving federal funding that are culturally affiliated with Native American tribes. The American Indian Religious Freedom Act and the Native American Graves Protection and Repatriation Act require DOE to notify affected tribes if sites and items of religious importance or human remains and other objects belonging to Native Americans are discovered on SRS.

Construction of waste management facilities might unearth artifacts and destroy historic sites regulated by these statutes. Upon discovery (and before excavation) of human remains, the affiliated tribe(s) would be consulted to ensure the appropriate disposition of the human remains and any other objects. DOE has committed to providing the Yuchi Tribal Organization, Inc., the National Council of the Muskogee Creek, and the Indian People's Muskogee Tribal Town Confederacy copies of environmental impact documentation for DOE activities in the Central Savannah River Valley.

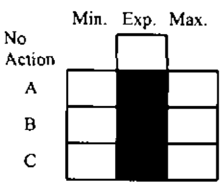
The National Historic Preservation Act, as amended, provides that sites with significant national historic value be placed on the National Register of Historic Places. There are no permits or certifications required under the Act. However, if a particular federal activity may impact a historic property, consultation with the Advisory Council on Historic Preservation is required and will usually lead to a

Memorandum of Agreement containing stipulations that must be followed to minimize adverse impacts. Coordination with the State Historic Preservation Officer also ensures that potentially significant sites are properly identified and appropriate mitigation actions are implemented.

<u>Status</u> – DOE will comply with these Acts with regard to artifacts discovered during implementation of the no-action alternative.

5.2 Other Alternatives

This section discusses the permit status for the construction and operation of waste management facilities that would be implemented under the moderate treatment configuration (alternative B). It also applies to facilities that would be implemented under the limited treatment (alternative A) and extensive treatment (alternative C) configurations.



5.2.1 EXPECTED WASTE FORECAST

<u>National Environmental Policy Act</u> – No change from the no-action alternative.

<u>Atomic Energy Act</u> – No change from the no-action alternative.

<u>Comprehensive Environmental Response, Compensation, and Liability Act</u> – No change from the no-action alternative.

<u>Emergency Planning and Community Right-to-Know Act</u> – No change from the no-action alternative.

<u>Resource Conservation and Recovery Act</u> – Facilities required for implementation of the moderate treatment alternative would be subject to RCRA, the South Carolina Hazardous Waste Management Act, and the South Carolina Hazardous Waste Management Location Standards.

All activities under the moderate treatment configuration would have to be coordinated and compatible with requirements of the Land Disposal Restrictions Federal Facility Compliance Agreement.

Treatment of low volume and one-time only waste streams in accordance with generator accumulation requirements (South Carolina Code of Laws of 1976, as amended, R.61-79.262.34) or via treatability studies is being considered. RCRA permitting requirements would not apply to these situations.

TE **Federal Facility Compliance Act** – The *SRS Proposed Site Treatment Plan* (WSRC 1995), which identifies DOE's preferred approach to treating mixed wastes at SRS, was submitted to the state of South Carolina in accordance with requirements of the Federal Facility Compliance Act. The site treatment plan addresses mixed wastes currently stored and those wastes SRS anticipates will be generated in the next 5 years. All mixed waste management activities would have to comply with the requirements of the approved site treatment plan and its implementing order. TE

Clean Water Act – No change from the no-action alternative.

TE **Safe Drinking Water Act** – DOE does not know at this time which permitting requirements would apply to proposed projects, because the precise location and water supply requirements for these projects are unknown. Permits may be required if water-line extensions are needed for additional waste management facilities considered in the alternatives.

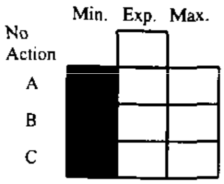
Clean Air Act – The emission permit for construction of the Consolidated Incineration Facility was issued by SCDHEC in November 1992. Before the Consolidated Incineration Facility can operate, approval for startup must be granted. Air permits would be required for emergency power diesel generators for proposed new waste management facilities. At SRS, air quality permits must also be acquired before a construction permit is granted. TE

TC **Endangered Species Act and Other Statutes** – The U.S. Fish and Wildlife Service has concurred with DOE's conclusion that DOE's plans to construct and operate additional waste management facilities within the uncleared portions of E-Area should not affect any threatened or endangered species. The concurrence letters are included in Appendix J.

Executive Orders 11990 and 11988 – Facilities and activities considered under the three alternatives may affect wetlands or floodplains, but this cannot be determined until the precise location of any additional facilities is known. Impacts to any wetland that could not be avoided would need to be identified as an unavoidable and irretrievable loss in this EIS. Under the alternatives, any impacts to wetlands would be lessened by mitigation as required by the Clean Water Act. Under 10 CFR 1022, floodplain and wetland assessments would be required for any proposed action in a floodplain or wetland. TE

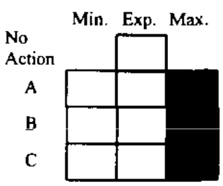
Executive Order 12898 – No change from the no-action alternative.

Cultural Resources – No change from the no-action alternative.



5.2.2 MINIMUM WASTE FORECAST

The difference between the minimum and expected waste forecasts is that certain facilities may not be needed. Since the waste volumes anticipated in these configurations would require less treatment capacity, SRS may be able to implement additional low-volume or one-time only waste management options that would not require permit modifications (Clean Air Act, Clean Water Act, RCRA). SRS would receive wastes that it had the best capability to treat or dispose of, and would ship some of its own wastes to facilities better equipped to manage them. TE



5.2.3 MAXIMUM WASTE FORECAST

Regulatory requirements for the maximum waste forecast are the same as those for the expected case. However, permit modifications (Clean Air Act, Clean Water Act, and RCRA) might be required to accommodate the larger volumes of waste. Waste volumes anticipated under this forecast would require additional treatment, storage, and disposal capacity. Under this forecast, the current SRS RCRA permit would need to be modified to increase permitted and/or interim status waste management process capacities. The potential exists to impact wetlands with this forecast. Any impacts to wetlands would be mitigated, as required by the Clean Water Act. TE

5.3 References

Arnett, M. W., L. K. Karapatakis, and A. R. Mamatey, 1994, *Savannah River Site Environmental Report for 1993*, WSRC-TR-94-075, Westinghouse Savannah River Company, Aiken, South Carolina.

DOE (U.S. Department of Energy), 1987, *Final Environmental Impact Statement, Waste Management Activities for Groundwater Protection, Savannah River Plant, Aiken, South Carolina,* DOE/EIS-0120, Savannah River Operations Office, Aiken, South Carolina.

TE WSRC (Westinghouse Savannah River Company), 1995, *Savannah River Site Proposed Site Treatment Plant,* Westinghouse Savannah River Company, Aiken, South Carolina, WSRC-TR-94-0608.

LIST OF PREPARERS

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TE

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EIS RESPONSIBILITY:	Prepared socioeconomics and cultural resources sections in Chapters 3 and 4. Coordinated project scheduling for *final* EIS. TE

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EIS RESPONSIBILITY:	Editor.

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B.S., Biology, Newberry College, 1984

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EIS RESPONSIBILITY: Prepared waste minimization and pollution prevention sections in Chapter 2. Provided technical input to waste minimization and pollution prevention strategy for low-level waste, storage and disposal; waste management/pollution prevention strategy for mixed waste; and waste management/pollution prevention strategy for transuranic waste sections in Chapter 2.

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B.S., Biological Sciences, University of Connecticut, 1978

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EIS RESPONSIBILITY: Co-authored Appendix D.

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EDUCATION: B.S.M.E., Mechanical Engineering, University of Florida, 1991

TECHNICAL EXPERIENCE: Ten years experience including the preparation of system analysis reports, special programs, and procedures regarding nuclear operations at SRS.

EIS RESPONSIBILITY: Co-authored accidents sections in Chapter 4 and Appendix F.

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TECHNICAL EXPERIENCE:	Eleven years experience including senior engineer responsibilities in the areas of hazardous waste management and air.
EIS RESPONSIBILITY:	Contributing author of waste forecast and hazardous waste sections in Chapter 2 and Appendix A. Assisted in preparation of Appendix B.

NAME:	**ANNE C. LOVELL**
AFFILIATION:	PRC Environmental Management, Inc.
EDUCATION:	B.S., Chemical Engineering, Colorado School of Mines, 1985
TECHNICAL EXPERIENCE:	Ten years experience in waste management including incineration, process engineering, engineering design, and innovative technologies.
EIS RESPONSIBILITY:	Co-authored Appendix D.

NAME:	**LISA A. MATIS**
AFFILIATION:	Halliburton NUS Corporation
EDUCATION:	M.S., Mechanical Engineering, Stevens Institute of Technology, 1989 B.S., Chemical Engineering, Stanford University, 1984
TECHNICAL EXPERIENCE:	Ten years experience as a chemical-environmental engineer including technical support in planning and controlling Resource Conservation and Recovery Act and Comprehensive Environmental Response, Compensation, and Liability Act compliance activities.
EIS RESPONSIBILITY:	Prepared hazardous and mixed waste treatment, storage, and disposal sections in Chapter 2. Provided technical input to Chapter 4 analyses. Technical reviewer.

NAME:	**ANDREW F. McCLURE, JR.**
AFFILIATION:	Halliburton NUS Corporation
EDUCATION:	B.S., Chemical Engineering, Carnegie Mellon University, 1966
TECHNICAL EXPERIENCE:	Forty years experience in the water/wastewater field, with an emphasis on wastewater treatment activities including permit applications, and permit implementation and monitoring/reporting.
EIS RESPONSIBILITY:	Prepared surface water sections in Chapters 3 and 4.

NAME:	**KEVIN M. MEEHAN**
AFFILIATION:	Halliburton NUS Corporation
EDUCATION:	B.S., Mechanical Engineering, The Pennsylvania State University, 1990
TECHNICAL EXPERIENCE:	Four years experience in safety engineering and safety analysis.
EIS RESPONSIBILITY:	Co-authored accidents sections in Chapter 4 and Appendix F.

TE

NAME:	**ROBERT P. MOLINOWSKI**
AFFILIATION:	PRC Environmental Management, Inc.
EDUCATION:	B.S., Electrical Engineering, Florida Institute of Technology, 1988
TECHNICAL EXPERIENCE:	Five years experience including engineering design and analysis review, and Naval nuclear operations and engineering.
EIS RESPONSIBILITY:	Co-authored Appendix D.

NAME:	**LOUISE S. MOORE**
AFFILIATION:	Halliburton NUS Corporation
EDUCATION:	B.A., Geography, University of Maryland, 1968
TECHNICAL EXPERIENCE:	Twenty years experience in developing and leading environmental projects, including 16 years in the energy field.
EIS RESPONSIBILITY:	Assistant Project Manager. Prepared Chapter 1. Prepared land use, aesthetic and scenic resources sections in Chapters 3 and 4. Coordinated project scheduling. Technical reviewer.

NAME:	**PHILIP R. MOORE**
AFFILIATION:	Halliburton NUS Corporation
EDUCATION:	M.S., Wildlife Biology (Fisheries), Clemson University, 1983 Post-baccalaureate study, Zoology, Clemson University, 1977-1979 B.A., English, University of South Carolina, 1975
TECHNICAL EXPERIENCE:	Ten years experience in environmental impact assessment of hydroelectric, fossil, and nuclear powerplants.
EIS RESPONSIBILITY:	Reviewed ecological resources section in Chapters 3 and 4.

NAME:	**J. LYNN MYRICK**
AFFILIATION:	Halliburton NUS Corporation
EDUCATION:	M.S., Geosciences, University of Arizona, 1993 B.S., Geology and English, Vanderbilt University, 1991
TECHNICAL EXPERIENCE:	Four years experience as a technical author and one year in environmental assessments.
EIS RESPONSIBILITY:	Editor. Assisted with preparation of references sections. Performed number conversions.

NAME:	**RICHARD S. NUGENT, Ph.D.**
AFFILIATION:	Halliburton NUS Corporation
EDUCATION:	Ph.D., Marine Sciences, University of Miami, 1970 M.S., Biology, Boston College, 1967 B.S., Biology, Boston College, 1964
TECHNICAL EXPERIENCE:	Twenty-five years experience in aquatic ecology, water quality, thermal studies, and environmental impact statements.
EIS RESPONSIBILITY:	Assisted in document planning and identifying independent reviewers.

NAME:	**MEGHAN O. SHIKOSKI**
AFFILIATION:	Halliburton NUS Corporation
EDUCATION:	M.S., Technical and Science Communication, Drexel University, 1989 B.S., Biology, Louisiana Tech University, 1986
TECHNICAL EXPERIENCE:	Five years experience in environmental programs in both technical and management aspects.
EIS RESPONSIBILITY:	Prepared low-level waste treatment, storage and disposal, and liquid high-level waste treatment storage, and disposal sections in Chapter 2.

NAME:	**JAMES L. OLIVER**
AFFILIATION:	Halliburton NUS Corporation
EDUCATION:	B.S., Biology (Fisheries), Murray State University, 1971
TECHNICAL EXPERIENCE:	Twenty years experience in research and impact assessment projects for the U.S. Department of Interior and DOE. As Deputy Director of the Office of Environmental Sciences, provides reviews of environmental and natural resource management issues, and performs strategic planning for National Environmental Policy Act documentation for DOE.
EIS RESPONSIBILITY:	Co-authored waste management technology screening and selection section of Chapter 2. Management reviewer.

NAME:	**RICHARD F. ORTHEN, Jr.**
AFFILIATION:	Halliburton NUS Corporation
EDUCATION:	B.S., Chemistry, Emory University, 1979
TECHNICAL EXPERIENCE:	Thirteen years experience in commercial and defense health physics programs, with an emphasis on effluent and environmental assessment.
EIS RESPONSIBILITY:	Contributed to and reviewed hazardous waste transportation sections in Chapters 2 and 4 and supporting data in Appendix E.

NAME:	**KAREN K. PATTERSON**
AFFILIATION:	Halliburton NUS Corporation
EDUCATION:	M.A., Biology, Wake Forest University, 1977 B.A., Biology, Randolph-Macon Woman's College, 1973
TECHNICAL EXPERIENCE:	Twenty-one years experience in technical and management roles in multidisciplinary environmental programs.
EIS RESPONSIBILITY:	Technical Editor. Contributed to Chapters 1, 2, 3, 4, and 5.

NAME:	**HOWARD L. POPE**
AFFILIATION:	U.S. Department of Energy, Savannah River Operations Office
EDUCATION:	B.S., Mathematics and Physical Science, Tennessee Wesleyan College, 1986
TECHNICAL EXPERIENCE:	Fifteen years experience in commercial nuclear power and transportation of hazardous wastes.
TE **EIS RESPONSIBILITY:**	Document Manager. Principal DOE-SR reviewer of Draft and Final EIS.

NAME:	**EUGENE M. ROLLINS**
AFFILIATION:	Halliburton NUS Corporation
EDUCATION:	M.S.P.H., Health Physics, University of North Carolina, 1976 B.S., Nuclear Engineering, North Carolina State University, 1973
TECHNICAL EXPERIENCE:	Seventeen years experience in radiological health protection in the commercial nuclear industry and DOE weapons complex.
EIS RESPONSIBILITY:	Prepared traffic and transportation sections and occupational and public health sections in Chapters 3 and 4; and site contamination, and decontamination and decommissioning sections in Chapter 3. Provided technical input to low-level waste sections in Chapter 2, and decontamination and decommissioning and environmental restoration sections in Chapter 4.

NAME: **ROBERT L. SCHLEGEL, PE**

AFFILIATION: Halliburton NUS Corporation

EDUCATION: M.S., Nuclear Engineering, Columbia University, 1961
B.S., Chemical Engineering, Massachusetts Institute of Technology, 1959

TECHNICAL EXPERIENCE: Thirty-two years experience in radiological dose assessments.

EIS RESPONSIBILITY: Supported the preparation of occupational and public health sections in Chapter 4.

NAME: **MICHAEL SEPTOFF**

AFFILIATION: Halliburton NUS Corporation

EDUCATION: M.S., Meteorology/Oceanography, New York University, 1968
B.S., Meteorology, City College of New York, 1966

TECHNICAL EXPERIENCE: Twenty-nine years experience in meteorology, oceanography, regulatory compliance and permitting, air pollution assessments, risk assessments, and noise and cooling tower assessments.

EIS RESPONSIBILITY: Provided technical input to the atmospheric releases sections in Chapter 4.

NAME: **PATRICIA L. SHAW-ALLEN**

AFFILIATION: Halliburton NUS Corporation

EDUCATION: M.S., Zoology/Ecotoxicology, Oklahoma State University, 1990
B.S., Wildlife Management, University of New Hampshire, 1987

TECHNICAL EXPERIENCE: Four years experience in aquatic toxicology/water quality, ecological risk assessments, natural resource management, and ecotoxicology.

EIS RESPONSIBILITY: Provided technical input to ecological resources sections in Chapter 4. Prepared Chapter 5.

NAME:	**JUDITH A. SHIPMAN**
AFFILIATION:	Halliburton NUS Corporation
EDUCATION:	A.A., General Studies, University of South Carolina - Aiken, 1991
TECHNICAL EXPERIENCE:	Seventeen years experience producing environmental-related documentation.
EIS RESPONSIBILITY:	Editor. Readability reviewer.

NAME:	**JOSEPH A. SIGNORELLI**
AFFILIATION:	Halliburton NUS Corporation
EDUCATION:	M.S., Engineering, George Washington University, 1963 B.S., Marine Engineering, Webb Institute, 1954
TECHNICAL EXPERIENCE:	Thirty-one years experience including mechanical engineering for the DOE/Atomic Energy Commission, and the U.S. Navy.
EIS RESPONSIBILITY:	Contributed to the preparation of Appendix C.

NAME:	**G. THOMAS ST. CLAIR, Ph.D.**
AFFILIATION:	Halliburton NUS Corporation
EDUCATION:	Ph.D., Environmental Policy, Michigan State University, 1990 M.S., Environmental Sciences, University of Michigan, 1972 B.S., Biology, Adrian College, 1968
TECHNICAL EXPERIENCE:	Twenty years experience managing environmental and regulatory projects and programs including technical management and direction as Director of Office of Environmental Services. Experience also includes solid and hazardous waste management; regulatory compliance oversight; environmental assessment and planning, and audits and appraisals; preparation of permit applications; and coordination of public involvement programs.
EIS RESPONSIBILITY:	Prepared unavoidable adverse impacts and irreversible or irretrievable commitment of resources sections in Chapter 4.

NAME:	**KEVIN E. TAYLOR**
AFFILIATION:	PRC Environmental Management, Inc.
EDUCATION:	M.S., Nuclear Engineering, Georgia Institute of Technology, 1994 B.S., Physics, Clemson University, 1991
TECHNICAL EXPERIENCE:	One-and-a-half years experience in hydrodynamics, mechanical engineering, thermodynamics, and environmental studies.
EIS RESPONSIBILITY:	Co-authored Appendix D.

NAME:	**TOM J. TEMPLES**
AFFILIATION:	U.S. Department of Energy, Savannah River Operations Office
EDUCATION:	M.S., Geology, University of Georgia, 1978 B.S., Geology, Clemson University, 1976
TECHNICAL EXPERIENCE:	Fifteen years experience as a petroleum exploration geologist and geophysicist. Recent experience includes coordinating National Environmental Policy Act document preparation and managing the geoscience and groundwater program for DOE-SR.
EIS RESPONSIBILITY:	DOE-SR reviewer of Draft EIS.

NAME:	**CATHERINE J. THOMAS**
AFFILIATION:	Halliburton NUS Corporation
EDUCATION:	B.A., Journalism, Texas A&M University, 1983
TECHNICAL EXPERIENCE:	Ten years experience writing and editing for DOE-Savannah River procedures, National Environmental Policy Act documents, and newspapers.
EIS RESPONSIBILITY:	Editor.

NAME:	**ALAN L. TOBLIN**
AFFILIATION:	Halliburton NUS Corporation
EDUCATION:	M.S., Chemical Engineering, University of Maryland, 1970 B.E., Chemical Engineering, The Cooper Union, 1968
TECHNICAL EXPERIENCE:	Twenty-two years experience in analyzing radiological and chemical contaminant transport in water resources.
EIS RESPONSIBILITY:	Provided technical input to surface and groundwater resources in Chapter 4.

NAME:	**TIMOTHY A. WASHBURN**
AFFILIATION:	Halliburton NUS Corporation
EDUCATION:	M.S., Biology, University of Richmond, 1979 B.S., Biology, University of Richmond, 1977
TECHNICAL EXPERIENCE:	Eighteen years experience in environmental and occupational health physics at commercial and government nuclear facilities.
EIS RESPONSIBILITY:	Prepared transportation sections in Chapters 2 and 4 and supporting appendix data.

ACRONYMS, ABBREVIATIONS, USE OF SCIENTIFIC NOTATION, AND EXPLANATION OF NUMBER CONVERSIONS

Acronyms

AEA	Atomic Energy Act
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CWA	Clean Water Act
DOE	Department of Energy
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ERPG	Emergency Response Planning Guidelines
FONSI	Finding of No Significant Impact
FR	Federal Register
FY	Fiscal Year
HWMF	Hazardous Waste Management Facility
NEPA	National Environmental Policy Act
PCB	Polychlorinated biphenyl
RCRA	Resource Conservation and Recovery Act
SCDHEC	South Carolina Department of Health and Environmental Control
SDWA	Safe Drinking Water Act
SREL	Savannah River Ecology Laboratory
SRL	Savannah River Laboratory (renamed SRTC)
SRS	Savannah River Site
SRTC	Savannah River Technology Center

Abbreviations for measurements

cfm	cubic feet per minute
cfs	cubic feet per second
g	percentage of gravity (seismology)
g/L	grams per liter
gpm	gallons per minute
L	liter
lb	pound
mg	milligram
μ	micron
μCi	microcurie
μg	microgram
°C	degrees Celsius
°F	degrees Fahrenheit

Visualizing units of measure

1 mg/L	1 part per million; an example of a unit of one millionth is 1 second in 11.6 days
1 μg/L	1 part per billion; an example of a unit of one billionth is 1 second in 31.7 years

Use of scientific notation

Very small and very large numbers are sometimes written using "scientific notation" or "E-notation" rather than as decimals or fractions. Both types of notation use exponents to indicate the power of ten as a multiplier (i.e., 10^n, or the number 10 multiplied by itself "n" times; 10^{-n}, or the reciprocal of the number 10 multiplied by itself "n" times).

For example: $10^3 = 10 \times 10 \times 10 = 1{,}000$

$$10^{-2} = \frac{1}{10 \times 10} = 0.01$$

In scientific notation, large numbers are written as a decimal between 1 and 10 multiplied by the appropriate power of 10:

4,900 is written $4.9 \times 10^3 = 4.9 \times 10 \times 10 \times 10 = 4.9 \times 1{,}000 = 4{,}900$

0.049 is written 4.9×10^{-2}

1,490,000 or 1.49 million is written 1.49×10^6

A positive exponent indicates a number larger than or equal to one, a negative exponent indicates number less than one.

In some cases, a slightly different notation ("E-notation") is used, where "× 10" is replaced by "E" and the exponent is not superscripted. Using the above examples

$4{,}900 = 4.9 \times 10^3 =$ 4.9E+03

$0.049 = 4.9 \times 10^{-2} =$ 4.9E-02

$1{,}490{,}000 = 1.49 \times 10^6 =$ 1.49E+06

EXPLANATION OF NUMBER CONVERSIONS

The following rules were used in the conversion and rounding of numbers for this EIS:

1. Original numbers were converted from metric to English equivalents (or vice versa) according to standard conversion factors.

2. Original numbers were not rounded before they were converted.

3. Converted numbers were rounded to their appropriate level of precision; normally they were rounded to two significant figures including decimals, for numbers below 10,000. Numbers greater than 10,000 were normally rounded to three significant figures.

4. Figures greater than 100,000 were expressed in scientific notation to three significant figures (e.g., 1,450,000 would be expressed as 1.45×10^6).

5. Metric units are referred to first, with English units in parentheses, regardless of which was the original number.

6. No conversions from English acres were computed for the Ecological Impacts sections in the Summary, Section 2.7, or Chapter 4.

Note: Slight variations in the same number used in different sections may occur because different computer spreadsheet software rounds or truncates numbers differently, or because the analysts rounded the numbers before or after calculations.

GLOSSARY

activity - See *radioactivity*.

adsorption

The adhesion (attachment) of a substance to the surface of a solid or solid particles.

aggregate

Any of several hard, inert materials such as sand or gravel used for mixing with a cementing material to form concrete, mortar, or plaster.

air dispersion coefficients

Parameters that represent the dispersion of air pollutants with respect to distance from the source.

air quality

A measure of the levels of *constituents* in the air; they may or may not be pollutants.

air quality standards

The prescribed level of *constituents* in the outside air (*ambient air*) that should not be exceeded legally during a specified time in a specified area. (See *criteria pollutant.*)

air sampling

The collection and analysis of air samples for the purpose of measuring pollutants.

alpha particle

A positively charged particle consisting of two protons and two neutrons that is emitted from the nucleus of certain nuclides during radioactive decay. It is the least penetrating of the four common types of radiation (alpha, *beta*, *gamma*, and *neutron*).

alpha waste

Waste contaminated with alpha radioactivity measuring 10 to 100 *nanocuries* per gram of waste.

amalgam

An alloy of mercury with another metal that is solid or liquid at room temperature according to the amount of mercury present.

ambient air

The surrounding atmosphere, usually the outside air, as it exists around people, plants, and structures. It is not the air closest to emission sources.

annulus

The space between the two walls of a double-wall tank.

aqueous

Made from, with, or by water.

aquifer

A geologic formation that contains enough saturated, porous material to permit movement of groundwater and to yield groundwater to wells and springs.

ash basin

Settling pond where ash-laden water is retained to allow the ash to settle before the water is discharged.

ashcrete

The solid that results from mixing a liquid waste with cement.

atmosphere

The layer of air surrounding the Earth.

Atomic Energy Commission (AEC)

A five-member commission established after World War II to supervise the use of nuclear energy. The AEC was dissolved in 1975 and its functions transferred to the Nuclear Regulatory Commission (NRC) and the Energy Research and Development Administration (ERDA), which later became the Department of Energy (DOE).

atomic weight

The relative weight of an atom of a chemical element based on the weight of the most abundant isotope of carbon, which is taken to be 12 (or, prior to 1962, the most abundant isotope of oxygen, which was taken as 16).

attainment

A measure of through-put capacity of a facility or system expressed as a percentage.

backfill

Material used to refill an excavation. In this EIS, backfill refers to material placed around waste storage containers.

background exposure

See *exposure to radiation.*

background radiation

Normal *radiation* present in the lower atmosphere from cosmic rays and earth sources. Background radiation varies considerably with location depending on elevation above sea level and natural *radioactivity* present in the earth or building materials such as granite.

baseline

Assessment of existing conditions before the addition of pollutants.

becquerel

The international unit of *radioactivity*, equal to one disintegration or other nuclear transformation per second.

benthic region

The bottom of a body of water. This region supports the benthos, a type of life that not only lives on but contributes to the character of the bottom of the body of water.

benzene

A clear, flammable, hazardous, aromatic organic compound (C_6H_6); it is a carcinogen.

beta particle

An elementary particle emitted from a nucleus during radioactive decay. It is negatively charged, is identical to an electron, and is easily stopped by a thin sheet of metal.

biodiversity

The variety of life, including all plants and animals within a region.

biological dose

The radiation dose, measured in *rem*, absorbed in biological material.

biological half-life

The time required by the body to eliminate half of an introduced substance through normal channels of elimination.

biota

The plant and animal life of a region.

blackwater

Water in coastal plains, creeks, swamps, and/or rivers that is dark or black due to dissolution of naturally occurring organic matter and certain minerals from soils and decaying vegetation.

blowdown

The withdrawal of water from an evaporating process to maintain a solid balance within specified limits of concentrations of those solids.

borehole

Fiberglass-lined circular hole (9-foot-diameter) augered to a depth of approximately 30 feet that holds forty-two 55-gallon drums of waste grouted in place.

borosilicate glass

A chemically resistant glass made primarily of silica and boron. As a waste form, high-level waste has been incorporated into the glass to form a leach-resistant nondispersible (immobilized) material.

bottomland hardwood forest

Forested wetlands containing a predominance of hardwood species such as oak, hickory, sweetgum, tulip poplar, bald cypress, and blackgum found adjacent to streams and rivers in the southeastern United States.

°C

Degree Celsius. $°C = \frac{5}{9} \times (°F - 32)$.

calcareous sands

Sands containing calcium carbonate; when these sands are treated with cold dilute hydrochloric acid, bubbling (effervescing) can be observed, representing the evolution of carbon dioxide.

cancer

A malignant tumor of potentially unlimited growth, capable of invading surrounding tissue or spreading to other parts of the body.

canister

A stainless-steel container in which immobilized radioactive waste is sealed.

canyon

A heavily shielded building used in the chemical processing of radioactive materials to recover special isotopes for national defense or other programmatic purposes. Operation and maintenance are by remote control.

capable

Determination if a geological *fault* has moved at or near the ground surface within the past 35,000 years.

capping

The process of sealing or covering a waste unit with an impermeable medium.

carcinogen

An agent capable of producing or inducing cancer.

carcinogenic

Capable of producing or inducing cancer.

Carolina bay

Shallow depressional wetland area found on the southeastern Atlantic Coastal Plain.

catchment basin

A basin to catch drainage or runoff.

Category 2 species

Plant or animal species for which there is some evidence of vulnerability, but for which presently there is not enough data to support listing as threatened or endangered.

celsius

Of or relating to a temperature scale that registers the freezing point of water as 0°C and the boiling point as 100°C under normal atmospheric pressure.

Citizens Advisory Board

A formally chartered group of local private citizens who provide DOE with a consensus of public opinion on SRS issues.

collective dose

The sum of the individual doses to all members of a specific population.

committed dose equivalent

The dose equivalent calculated to be received by a tissue or organ over a 50-year period after the intake of a radionuclide into the body.

committed effective dose equivalent

The sum of the committed dose equivalents to various tissues in the body.

concentration

The quantity of a substance contained in a unit quantity of a medium (e.g., micrograms of aluminum per liter of water).

condensate

Liquid water obtained by cooling the steam produced in an evaporator system.

confidence level

The certainty of a particular point (measurement, amount, value) being within a statistically determined range.

constituents

Parts or components of a chemical system.

criteria pollutant

Air pollutants for which the U.S. Environmental Protection Agency has established concentration standards; concentrations below the standards do not pose a threat to public health and welfare.

cumulative effects

Additive environmental, health, or socioeconomic effects that result from a number of similar activities in an area.

curie (Ci)

A unit of measure of radioactivity equal to 37,000,000,000 decays per second. A curie is also a quantity of any nuclide or mixture of nuclides having one curie of radioactivity.

daughter

A nuclide (also called decay product) formed by the radioactive decay of another nuclide, which is the "parent."

decay product

See *daughter*.

decay, radioactive

The spontaneous transformation of one nuclide into a different nuclide or into a different energy state of the same nuclide. The process results in the emission of nuclear radiation (alpha, beta, gamma, or neutron radiation).

decommissioning

The removal from service of facilities such as processing plants, waste tanks, and shallow land disposal units, and the reduction or stabilization of radioactive contamination. Decommissioning concepts include:

- Decontaminate, dismantle, and return area to original condition without restrictions.
- Partially decontaminate, isolate remaining residues, and continue surveillance and restrictions.

decontamination

The act of removing a chemical, biological, or radiologic contaminant from, or neutralizing its potential effect on, a person, object, or environment by washing, chemical action, mechanical cleaning, or other techniques.

defense waste

Nuclear waste generated by government defense programs as distinguished from waste generated by commercial and medical facilities.

derived concentration guide (DCG)

The concentration of a radionuclide in air or water that, under conditions of continuous exposure for 1 year by one exposure mode (i.e., ingestion of water, submersion in air, or inhalation), would result in an effective dose equivalent of 100 millirem. DCGs do not consider decay products when the parent radionuclide is the cause of the exposure.

destruction capability

The ability of a process to destroy an undesirable constituent or element.

detritiation

Removal of tritium.

direct disposal

Disposal without treatment.

disposal

Placement of waste in a safe place in such a manner that the materials remain permanently isolated from the environment.

dissociate (dissociation)

Separation of chemicals into their elemental or ionic state.

distillate

A liquid product condensed from vapor during evaporation.

dose

The energy imparted to matter by ionizing radiation. The unit of absorbed dose is the *rad*, equal to 0.01 *joules* per kilogram of irradiated material in any medium.

dose conversion factor

Factor used to calculate the cancer risk for a radiation dose.

dose equivalent

A term used to express the amount of effective radiation when modifying factors have been considered. It is the product of absorbed dose (*rads*) multiplied by a quality factor and other modifying factors. It is measured in rem (*Roentgen* equivalent man). (See *effective dose equivalent.*)

dose rate

The radiation dose delivered per unit time (e.g., rem per year).

E-Area vault

Project that consists of several types of facilities (i.e., below-grade concrete structures, on-grade concrete structures within an excavated area) that will store designated waste types (low-activity, intermediate-level tritiated and nontritiated, and long-lived waste) of low-level radioactive waste materials.

ecology

The study of the relationships between living things and their environments.

ecosystem

The community of living things and the physical environment in which they live.

effective dose equivalent

A quantity used to estimate the biological effect of *ionizing radiation.* It is the sum over all body tissues of the product of absorbed *dose*, the quality factor (to account for the different penetrating abilities of the various types of radiation), and the tissue weighting factor (to account for the different radiosensitivities of the various tissues of the body).

effluent

A liquid discharged into the environment, usually into surface streams. In this EIS, effluent refers to discharged wastes that are nonpolluting in their natural state or as a result of treatment.

effluent standards

Defined limits of waste discharge in terms of volume, content of contaminants, temperature, etc.

EIS

Environmental impact statement; a legal document required by the National Environmental Policy Act (NEPA) of 1969, for Federal actions involving significant or potentially significant environmental impacts.

eluate

The liquid resulting from removing the trapped material from an *ion-exchange* resin.

Emergency Response Planning Guidelines (ERPG)

Values used to determine potential health effects from chemical accidents.

emission standards

Legally enforceable limits on the quantities and kinds of air contaminants that may be emitted to the atmosphere.

endangered species

Plant or animal species that are threatened with extinction.

endemic

Found only within a certain locality.

engineered trench

Reinforced, concrete-formed, walled 100-foot-long, 50-foot-wide disposal trench with steel covers over each area to minimize rainwater intrusion and direct drainage away from the trench. A leachate collection system installed below the floor of the trench monitors the performance of the disposal cells.

environment

The sum of all external conditions and influences affecting the life, development, and ultimately, the survival of an organism.

environmental justice

The fair treatment of people of all races, cultures, incomes, and educational levels with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment implies that no population of people should be forced to shoulder a disproportionate share of the negative environmental impacts of pollution or environmental hazards due to a lack of political or economic strength.

environmental restoration

The assessment, cleanup, and restoration of sites contaminated with radioactive or hazardous substances during past production or disposal activities.

environmental transport

The movement through the environment of a substance, including the physical, chemical, and biological interactions undergone by the substance.

erosion

The process in which actions of wind or water carry away soil.

exceedance

A value over a prescribed limit.

exothermic

Of or indicating a chemical change accompanied by a release of heat.

Experimental Transuranic Waste Assay Facility (ETWAF)

The assay facility is utilized in alternative A - limited treatment configuration for each of the three waste forecasts.

exposure to radiation

The incidence of radiation on living or inanimate material by accident or intent. Background exposure is the exposure to natural background *ionizing radiation.* Occupational exposure is the exposure to *ionizing radiation* that occurs during a person's working hours. Population exposure is the exposure to a number of persons who inhabit an area.

external radiation

Being exposed to radiation from sources outside your body.

°F

Degree Fahrenheit. $°F = °C \times \frac{9}{5} + 32$.

fall line

A line drawn through the falls (or rapids) of successive rivers and roughly defining the area where streams pass from the harder rocks of the Piedmont to the softer rocks of the Coastal Plain.

fallout

The descent to earth and deposition on the ground of particulate matter (which is usually radioactive) from the atmosphere.

fault

A break in the Earth's crust along which movement has occurred.

fauna

Animals.

fecal coliform

Type of bacterial count used to show fecal (bodily waste) contamination levels in water.

filtercake

The dewatered residue from a filter, centrifuge, or other dewatering device.

fiscal year

Period of one year used to calculate financial data. As defined by the Federal government, this EIS uses a fiscal year which begins on October 1 and ends on September 30.

fission products

Nuclei from the fission of heavy elements (primary fission products); also, the nuclei formed by the decay of the primary fission products, many of which are radioactive.

floodplain

Level land built up by flowing stream deposition and periodically submerged by floodwater from that stream.

flora

Plants.

gamma rays

High-energy, short-wavelength electromagnetic radiation accompanying fission, radioactive decay, or nuclear reactions. Gamma rays are very penetrating and require relatively thick shields to absorb the rays effectively.

genus/genera

A group of structurally or phylogenetically related species.

geology

The science that deals with the Earth: the materials, processes, environments, and history of the planet, especially the lithosphere, including the rocks and their formation and structure.

greater confinement disposal facility or vaults

Storage facility (boreholes and engineered trenches) that will require minimum maintenance after closure for disposal of the high activity fraction of the low-level solid beta-gamma waste and low-level alpha waste.

gross alpha radioactivity

A measure of total alpha radioactivity.

groundwater

The supply of fresh water in an aquifer under the Earth's surface.

half-life (radiological)

The time in which half the atoms of a radioactive substance disintegrate to another nuclear form. Half-lives vary from millionths of a second to billions of years.

hazardous waste storage facility

Resource Conservation and Recovery Act (RCRA) *interim-status* or permitted temporary holding area of hazardous waste prior to treatment or disposal.

heavy metals

Metallic elements of high atomic mass, such as mercury, chromium, cadmium, lead, or arsenic, that are toxic to plants and animals at known concentrations.

HEPA filter

High-efficiency particulate air filter designed to remove 99.95 percent of the particles down to as small as 0.3 micrometer from a flowing air stream.

high-heat waste

Freshly generated waste that contains a large concentration of short-lived radionuclides from the first extraction cycle of a separations process. High-heat waste is aged to allow radioactive decay to prevent the potential discharge of harmful levels of radiation.

historic resources

The sites, districts, structures, and objects considered limited and nonrenewable because of their association with historic events, persons, or social or historic movements.

hydrolysis

A process of decomposition in which a compound is broken down and changed into other compounds by taking up the elements of water.

hydrostratigraphy

Names used to identify the water-bearing properties of rocks.

immobilization

Conversion of a material into a form that will resist environmental dispersion.

incineration

The burning of waste.

inhibited water

Water treated with chemicals to retard or halt corrosion, especially of metals.

insoluble sludge

A thick layer of various heavy metals and long-lived radionuclides that will not dissolve and that separate out of the waste over time and settle to the bottom of the waste tank.

institutional controls

Actions that limit human activities at or near facilities where hazardous and/or radioactive wastes exist. They may include land and resource use restrictions, well drilling, prohibitions, building permit restrictions, and other types of restrictions.

interim status

The period of operation for facilities that require Resource Conservation and Recovery Act permits until the permitting process is complete.

internal radiation

Being exposed to radioactive materials inside the body.

investigation-derived waste

Contaminated material resulting from investigation activities at hazardous or radiological waste sites.

ion

An atom or molecule that has gained or lost one or more electrons and has become electrically charged.

ion exchange

Process in which a solution containing soluble ions to be removed is passed through a column of material that removes the soluble ions by exchanging them with ions from the material in the column. The process is usually reversible so that the trapped ions can be collected (eluted) and the column regenerated.

ion-exchange medium

A substance (e.g., a resin) that allows cesium or some other soluble ion to be removed from a solution.

ionization

The process that creates ions. Nuclear radiation, X-rays, high temperatures, and electric discharges can cause ionization.

ionizing radiation

Radiation capable of displacing electrons from atoms or molecules to produce ions.

irradiation

Exposure to radiation.

isotope

An atom of a chemical element with a specific atomic number and atomic mass. Isotopes of the same element have the same number of protons but different numbers of neutrons. Isotopes are identified by the name of the element and the total number of protons and neutrons in the nucleus. For example, plutonium-239 is a plutonium atom with 239 protons and neutrons.

joule

A unit of energy equal to the work done by a force of 1 newton acting through a distance of 1 meter. A newton is the unit of force needed to accelerate a mass of 1 kilogram 1 meter per second per second.

latent cancer fatalities

Deaths resulting from cancer that has become active following a period of inactivity.

leachate

Liquid that has percolated through solid waste or other media and that contains dissolved or suspended contaminants extracted from those materials.

leaching

The process in which a soluble component of a solid or mixture of solids is extracted as a result of percolation of water around and through the solid.

lithosphere

The solid part of the earth composed predominantly of rock.

lithostratigraphy

Description of geological formations based on the physical characteristics of rocks.

loam

A soil textural class with about equal proportions of sand, clay, and silt particles.

long-lived radionuclides

Radioactive isotopes with half-lives greater than approximately 30 years.

long-lived waste

Radioactive waste with a *half-life* which is sufficiently long to remain dangerous beyond the time its retention in a disposal unit can be assured (e.g., carbon-14 has a half-life of 5,730 years and so is considered a long-lived waste).

low-activity vaults

On-grade concrete module structures within an excavated area that provides waste storage capacity for waste containers of low-activity waste.

low-heat waste

Second or subsequent extraction cycle waste generated from a separations process. Low-heat waste contains few radionuclides and does not require aging (radioactive decay). Low-heat waste is also generated in reactor areas, the Defense Waste Processing Facility and other SRS production support facilities. (See *high-heat waste*.)

low-income communities

A community in which 25 percent or more of the population is identified as living in poverty.

low-level radioactive waste disposal facility

Disposal facility located within E-Area and consisting of E-Area Vaults, slit trenches, boreholes, greater confinement disposal vaults, and engineered low-level trenches.

lower limit of detection

The smallest concentration/amount of the component being measured that can be reliably detected in a sample at a 95 percent *confidence level.*

macroencapsulate

To seal (e.g., in a box or polymer) a contaminated component so that the contamination is contained.

material substitution

Replacing a hazardous material with a nonhazardous material to reduce the amount of hazardous waste generated.

MAXIGASP

A computer program used to calculate doses or airborne releases of radioactivity to the maximally exposed member of the public.

maximally exposed individual

A hypothetical member of the public assumed to receive the highest calculated dose.

maximum contaminant levels (MCLs)

The maximum permissible level of a contaminant in water that is delivered to a user of a public water system.

migration

The natural travel of a material through the air, soil, or groundwater.

mothball

To place and maintain facilities in a condition practical to restart, conducting only those activities necessary for routine maintenance or to protect human health and the environment.

nano

A prefix meaning one billionth (10^{-9}) of any measurement.

National Register of Historic Places

A list maintained by the National Park Service of architectural, historical, archaeological, and cultural sites of local, state, or national importance.

natural radiation or natural radioactivity

Background radiation. Some elements are naturally radioactive, whereas others are induced to become radioactive by bombardment in a reactor or accelerator.

NEPA

National Environmental Policy Act of 1969; it requires the preparation of an EIS for Federal projects that could present significant impacts to the environment.

neutralization wastewater

Wastewater to which acid or alkali is added to adjust the *pH* to a preferred range.

neutron

An elementary particle with no electrical charge used to bombard the nuclei of various elements to produce fission and other nuclear reactions.

non-alpha waste

Waste contaminated with alpha radioactivity measuring less than 10 nanocuries per gram of waste.

nonprocess water

At SRS, *potable* water.

nonvolatile beta radioactivity

A measure of total beta radioactivity less the volatile isotopes.

NRC

Nuclear Regulatory Commission; the independent Federal commission that licenses and regulates commercial nuclear facilities.

nuclear energy

The energy liberated by a nuclear reactor (fission or fusion) or by radioactive decay.

nuclear radiation

Radiation, usually alpha, beta, gamma, or neutron, which emanates from an unstable atomic nucleus.

offgas

Exhaust emission from an air-emission control unit.

offsite population

In this EIS, all individuals located within an 80-kilometer (50-mile) radius of SRS.

organic compounds

Chemical compounds containing carbon and usually hydrogen and/or oxygen.

outcropping

Place where groundwater is discharged to the surface. Springs, swamps, and beds of streams and rivers are outcrops of the water table.

outfall

Place where liquid *effluents* enter the environment and may be monitored.

parameter

A characteristic element; any of a set of physical properties whose values determine the characteristics or behavior of something.

particulates

Solid particles small enough to become airborne.

pH

A measure of the hydrogen ion concentration in *aqueous* solution. Pure water has a pH of 7, acidic solutions have a pH less than 7, and basic solutions have a pH greater than 7.

people of color communities

A population that is classified by the U.S. Bureau of the Census as Black, Hispanic, Asian and Pacific Islander, American Indian, Eskimo, Aleut, or other nonwhite persons, the composition of which is at least equal to or greater than the state minority average of a defined area or jurisdiction.

percent attainment

Percent of the time a facility is available for operations.

permeability

Ability of rock, soil, or other substance to transmit a fluid.

person-rem

The radiation dose to a given population; the sum of the individual doses received by a population segment.

physiographic

Regions classified based on their physical geographic and geologic setting.

pollution

The addition of any undesirable agent to an *ecosystem* in excess of the rate at which natural processes can degrade, assimilate, or disperse it.

pollution prevention

The prevention, rather than control, of pollution using engineering solutions, material substitutions, and procedural changes to reduce the volume and/or toxicity of pollutants produced.

postulated accident

An accident that is forwarded as having occurred to produce the described effects.

potable

Drinkable; for domestic use.

precipitate

A solid (used as a noun).

To form a solid substance in a solution by a chemical reaction (used as a verb).

precipitation

The process of forming a precipitate from a solution.

process well/water

At SRS, water used within a system or process and not used as *potable* water.

production well/water

At SRS, water treated and used as *potable* water.

prompt fatality

Death that occurs immediately or within a short time (e.g., a few weeks) as a direct result of an event (e.g., accident).

PSD (Prevention of significant deterioration)

Establishes the acceptable amount of deterioration in air quality. When the air quality of an area meets the standards for a specific pollutant, the area is declared to be in attainment for that pollutant. When the air quality of an area does not meet the standard for a specific pollutant, the area is said to be a nonattainment area for that pollutant. PSD requirements allow maximum increases in ambient air pollutant concentrations (sulfur dioxide, particulates, nitrogen oxide) for construction or modification of facilities, which by definition do not "significantly deteriorate" the existing baseline air quality. (See *criteria pollutant*.)

PUREX

An acronym for plutonium-uranium extraction.

rad

Radiation absorbed dose; the basic unit of absorbed dose equal to the absorption of 0.01 *joules* per kilogram of absorbing material.

radiation

The emitted particles and/or photons from the nuclei of radioactive atoms. A shortened term for ionizing radiation or nuclear radiation as distinguished from nonionizing radiation (microwaves, ultra-violet rays, etc.).

radiation shielding

Reduction of radiation by interposing a shield of absorbing material between a radioactive source and a person, laboratory area, or radiation-sensitive device.

radioactive waste

Materials from nuclear operations that are radioactive or are contaminated with radioactive materials for which there is no practical use or for which recovery is impractical.

radioactivity

The spontaneous decay of unstable atomic nuclei, accompanied by the emission of radiation.

radioisotopes

Radioactive isotopes. Some radioisotopes are naturally occurring (e.g., potassium-40), while others are produced by nuclear reactions.

radiolysis

The decomposition of a material (usually water) into different molecules due to ionizing radiation. In water, radiolysis results in the production of hydrogen gas and oxygen.

recycling

Return of a waste material either to the process that generated the waste or to another process to use or reuse the waste material beneficially; recovery of a useful or valuable material from waste.

rem (*Roentgen* equivalent man)

The unit of dose for biological absorption. It is equal to the product of the absorbed dose in *rads* and a quality factor and a distribution factor.

repository

A place for the disposal of immobilized high-level waste to isolate it from the environment.

resin

An *ion-exchange* medium; organic polymer used for the preferential removal of certain ions from a solution.

Richter scale

A scale of measure used in the United States to quantify earthquake intensity.

risk

In accident analysis, a measure of the impact of an accident considering the probability of the accident occurring and the consequences if it does occur (risk = probability × consequences).

roast, retort, and amalgamate

Heating mercury-contaminated equipment to drive off the mercury as a vapor, collecting and condensing the mercury to a liquid form. Amalgamate - alloying the liquid metal with other metals to create a semi-solid.

Roentgen

A measure of radiation exposure to gamma radiation in air.

runoff

The portion of rainfall, melted snow, or irrigation water that flows across the ground surface and eventually is returned to water bodies. Runoff can carry pollutants or harmless chemical constituents into receiving waters.

saltcake

Concentrated waste in the form of crystallized salts resulting from the evaporation of liquid high-level waste.

saltstone

Low-radioactivity fraction of high-level waste mixed with cement, flyash, and slag to form a concrete block.

sanitary landfill

A solid-waste disposal facility which is constructed in a manner that protects the environment; waste is spread in thin layers, compacted to the smallest practical volume, and covered with soil at the end of each work day.

satellite accumulation area

Hazardous waste collection points "at or near the point of generation" (as defined by RCRA).

scintillation

A flash of light produced in a fluorescent material by ionizing radiation. A technique used to measure the radioactivity of a sample.

scrub-shrub wetlands

Wetland areas dominated by woody vegetation less than 6 meters (20 feet) tall, including shrubs, young trees, and trees and shrubs that are small or stunted due to environmental conditions.

scrubber

Engineered equipment used to remove *constituents* from a gas stream by absorption and/or chemical reaction.

sedimentation

The settling of excess soil and mineral solids of small particle size (silt) contained in water.

sedimentation pond

Pond constructed specifically to trap excess soil and mineral solids and prevent their deposition in downstream waters and wetlands.

seepage basin

An excavation that receives wastewater. Insoluble materials settle out on the floor of the basin and soluble materials seep with the water through the soil column where they are removed partially by *ion exchange* with the soil. Construction may include dikes to prevent overflow or surface *runoff*.

seismic load

The force due to earthquakes.

seismicity

Refers to earth-movement events, usually earthquakes.

shield

Material used to reduce the intensity of radiation that would irradiate personnel or equipment.

siltation

The act of depositing sediment, as by a river.

slit trench

In this EIS, an excavated trench 6 meters wide and 6 meters deep of variable length used to store intermediate-level, bulky noncontainerized low-level (alpha and beta-gamma) and containerized offsite wastes.

sludge

The precipitated solids (primarily oxides and hydroxides) that settle to the bottom of the storage tanks containing liquid high-level waste.

slurry

A suspension of solid particles (*sludge*) in water.

socioeconomic

The societal and economic configuration of a group of people.

solvent

A substance, usually liquid, that can dissolve other substances.

source reduction

Activities that reduce or eliminate wastes before they are generated.

source term

The initial amount of radioactivity used to calculate exposure and doses to various receptor groups.

standby (cold standby)

Facility is maintained such that it can be brought back into operation with minimum effort.

still bottoms

The sludge that remains in the bottom of a distillation apparatus after the desired product has been evaporated and removed.

storage

Retention of radioactive waste in man-made containment, such as tanks or *vaults*, in a manner permitting retrieval (as distinguished from disposal, which implies no retrieval).

stratigraphy

Branch of geologic science concerned with the description, organization, and classification of layered rock units and associated non-layered rock units.

sump

An impermeable point of collection for liquids in a building or facility.

Superfund

A trust fund established by the Comprehensive Environmental Response, Compensation, and Liability Act and amended by the Superfund Amendment and Reauthorization Act that finances long-term remedial action for hazardous waste sites.

supernatant, supernate

The radioactive layer of highly mobile liquid containing soluble salts; the supernatant remains above the saltcake and/or insoluble sludge in a waste tank.

surface water

All the water on the Earth's surface (streams, ponds, etc.), as distinguished from groundwater, which is below the surface.

suspect soil

Soil that could be radiologically contaminated.

standard pressure and temperature

Air pressure at mean sea level (1 atmosphere); a temperature of 0°C.

tank farm

An installation of (usually interconnected) underground tanks for the storage of high-level radioactive liquid wastes.

toxicity

The quality or degree of being poisonous or harmful to plant or animal life.

turbidity

The degree to which water is muddied or clouded by suspended sediments.

vault

A reinforced concrete structure for storing strategic nuclear materials used in national defense or other programmatic purposes.

vitrification

Incorporation of a material into a glass form.

volatile organic compounds

An organic compound with a vapor pressure greater than 0.44 pounds per square inch at standard temperature and pressure.

volatilized

Caused to pass off as a vapor.

waste acceptance criteria

Criteria put forth by a waste management facility which defines the waste it will accept.

waste certification criteria

Criteria that must be met for transport, treatment, and disposal of waste.

Waste Isolation Pilot Plant

DOE facility located near Carlsbad, New Mexico, built to demonstrate the safe underground disposal of transuranic waste from numerous facilities owned by DOE.

waste minimization

Reduction of waste before treatment, storage, or disposal by source reduction or recycling activities.

water quality standard

Provisions of state or Federal law that consist of a designated use or uses for the waters of the United States and water quality standards for such waters based upon those uses. Water quality standards are used to protect the public health or welfare, enhance the quality of water, and serve the purposes of the Clean Water Act.

wind rose

A map showing the direction and magnitude of the wind.

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DOE is providing copies of the final EIS to federal, state, and local elected and appointed officials and agencies of government; Native American groups; federal, state, and local environmental and public interest groups; and other organizations and individuals listed below. Copies will be provided to other interested parties upon request.

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United States Senate

The Honorable Ernest F. Hollings
United States Senate

The Honorable Lauch Faircloth
United States Senate

The Honorable Bill Frist
United States Senate

The Honorable Jesse Helms
United States Senate

The Honorable Sam Nunn
United States Senate

The Honorable Fred Thompson
United States Senate

The Honorable Strom Thurmond
United States Senate

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