Appendix F

F.1 Introduction

The potential for facility Accidents and the magnitude of their effects are important factors in evaluating the waste management alternatives addressed in this environmental impact statement (eis). This appendix presents accident information related to the facilities that are or could be involved with the waste management alternatives. By using postulated accident scenarios associated with the existing and proposed waste processing, storage, and disposal facilities, this appendix describes the potential consequences and risks of waste management activities to workers, the public, and the environment.

Postulated accident scenarios were developed for each waste type under the alternatives evaluated in this eis. This appendix considers the five waste types generated and managed at SRS: high-level radioactive waste, low-level radioactive waste, hazardous waste, mixed waste, and transuranic waste.

F.2 General Accident Information

An accident, as discussed in this appendix, is an inadvertent release of radioactive or hazardous material from its confinement to the environment resulting in serious physical injury or substantial property damage. Initiating events are typically defined in three broad categories:

- *External initiators* originate outside the facility and potentially affect the ability of the facility to keep the material confined. Examples of external initiators are aircraft crashes, nearby explosions, and hazardous chemical releases from nearby facilities that could affect the ability of personnel to properly manage the radioactive/hazardous materials facility and its contents.

- *Internal initiators* originate within a facility and are usually the result of facility operation. Examples of internal initiators are equipment failures and human error.

- *Natural phenomena initiators* are natural occurrences such as floods, tornadoes, and earthquakes.

Sabotage and terrorist activities (i.e., intentional human initiators) could be either external or internal initiators.

For this appendix, "facility Accidents " are accidents associated with facilities that support or are involved in the treatment, storage, or disposal of the five waste types identified in Section F.1. Accident scenarios associated with waste management activities performed at a specific facility are also considered "facility accidents."

The probability of an accident (i.e., annual frequency) and its consequences depend on the type of initiator(s), how often that initiator occurs, and the frequency with which the resulting chain of events would lead to a release of material. Potential Accidents (and their effects) are grouped into four categories -- anticipated accidents, unlikely accidents, extremely unlikely accidents, and beyond extremely unlikely accidents -- based on their estimated annual frequency. Table F-1 lists, in decreasing order, these accident categories and their corresponding frequency ranges. For example, if an earthquake of sufficient magnitude to cause a release of material to the environment is expected to occur once every 5,000 years, the frequency for this accident is presented as 1 in 5,000, or 0.0002 (expressed as 2.0E-04; see Acronyms, Abbreviations, and the Use of Scientific Notation) per year (i.e., it is an unlikely accident per Table F1).
DOE does not consider events that are expected to occur less often than once every 10 years to be "Accidents ." This does not imply that undesirable releases of radioactive or hazardous materials cannot occur more than once every 10 years. However, events with a probability of occurring more than once every 10 years are considered "abnormal events" because

their occurrence is expected during the life of the facility, and they usually do not result in substantial onsite or offsite consequences. Potential effects from these releases are addressed in the Occupational and Public Health sections of this eis. DOE implements physical and administrative controls on facility operations and activities to minimize the likelihood and impacts of such events. Personnel are trained and drilled on how to respond to and mitigate potential releases from abnormal events.

Table F-2 presents the relative risk of a one-in-a-million chance of dying from several different common-place activities (WSRC 1994a).

Table F-1. Accident frequency categories.

Frequency category	Frequency range (Accidents per year)
Anticipated accidentsaccidents	Occurs between once in 10 years and once in 100 years
Unlikely accidentsaccidents	Occurs between once in 100 years and once in 10,000 years
Extremely unlikely accidentsaccidents	Occurs between once in 10,000 years and once in 1,000,000 years
Beyond extremely unlikely accidentsaccidents	Occurs less than once in 1,000,000 years

a. DOE (1994a).

Table F-2. Activities that have a one-in-one-million chance of causing death.

Smoking 1.4 cigarettes	(lung cancer)
Eating 40 tablespoons of peanut butter	(aflatoxins)
Eating 100 charcoal-broiled steaks	(carcinogens from charcoal broiling)
Spending 2 days in New York City	(air pollution)
Driving 40 miles in a car	(accident)
Flying 2,500 miles in a jet	(accident)
Canoeing for 6 minutes	(accident)

F.3 Historic Perspective

Many of the actions proposed under the waste management alternatives considered in this eis are continuations or variations of past SRS operations. DOE studies historic nonroutine events, abnormal occurrences, and Accidents so similar events in present or future operations can be minimized or prevented. Historic events at facilities in the DOE complex are documented and tracked in two different computer data bases maintained by the U.S. Department of Energy (DOE) Office of Nuclear Energy at the Idaho National Engineering Laboratory: the Occurrence Reporting and Processing

System (ORPS) and the Safety Performance Measurement System (SPMS). In addition, Savannah River Site (SRS) maintains computer data bases, such as the Waste Management Fault Tree Data Storage and Retrieval System, which track historic occurrence information and lessons learned specific to SRS facilities and operations.

Since the implementation of the Site Item Reportability and Issue Management (SIRIM) program in 1991, which assigns the responsibilities and requirements for reporting abnormal events and Accidents at SRS, more than 425 abnormal events involving waste management activities and operations have been documented (WSRC 1994b, c). These events were reviewed to determine whether (1) workers were physically injured, (2) radioactive or hazardous material was inadvertently released to the environment, or (3) the occurrence, if not resolved, could have caused significant consequences to workers, members of the public, or the environment. One event, involving a procedural violation of the nuclear criticality safety limits (maximum permissible plutonium inventory per waste container) established for the Solid Waste Disposal Facility, was considered to have the potential to have caused major impacts (an inadvertent criticality and potential worker fatality). The criticality limits were exceeded because the plutonium inventory placed in the waste containers was incorrectly calculated. As an immediate corrective action, DOE suspended all shipments of transuranic waste to the Solid Waste Disposal Facility from SRS facilities that generate transuranic waste. Before resuming shipments, DOE (1) ensured that no potential criticality hazards existed as a result of the limits being exceeded and (2) independently evaluated each facility that generates transuranic waste to ensure that the deficiencies had been resolved and that the facilities could correctly calculate the inventories of waste materials being sent to the Solid Waste Disposal Facility.

DOE also evaluated events that occurred prior to implementation of the Site Item Reportability and Issue Management System in 1991. The Waste Management Fault Tree Data Storage and Retrieval System data base documents several hundred events occurring between 1988 and 1991. Eight of the 13 events involving the management of liquid high-level radioactive wastes (such as is done at the F- and HArea tank farms) involved worker doses in excess of established DOE limits; 2 involved liquid releases of radioactive material to Fourmile Branch; 1 involved an airborne release of radioactive particulates to the atmosphere; and 2 involved personnel assimilations of radioactive particulates.

Most of the abnormal events resulting from nontank farm operations were nonradiological in nature, such as minor physical injuries (e.g., cuts, falls), or involved minor leaks of radioactive material that did not result in airborne releases to the environment or a measurable dose to personnel. However, one event involved the flooding of a shallow land disposal unit as a result of heavy rains over a period of several days. This event, which occurred in August 1990, caused several metal boxes containing low-level radioactive waste to flood. In addition, when the trench flooded, several of the boxes floated, causing the stacking configuration of waste containers in the disposal unit to change. DOE assessments concluded that there were no releases of radioactive material to the environment.

Abnormal events from the beginning of Solid Waste Disposal Facility and the tank farm facilities operations in early 1953 through 1988 are discussed in the safety analysis reports for these facilities. At the tank farms, 17 occurrences were noted as significant: 9 liquid releases to Fourmile Branch, 6 personnel assimilations, and 2 airborne releases of radioactive particulates to the atmosphere. At the Solid Waste Disposal Facility, events primarily involved spills or leaks of organic solvents and small fires (limited to only one or a few waste containers) attributed to spontaneous chemical combustion resulting from improper packaging and did not result in measurable or significant releases of radioactive material. Since 1981, no fires have occurred in the transuranic waste storage drums, culverts, or carbon steel boxes at the Solid Waste Disposal Facility.

F.4 Accident Analysis Methodology

National Environmental Policy Act (NEPA) guidance issued by the DOE Office of NEPA Oversight (DOE 1993) recommends that accident impact analyses "...reference Safety Assessments and Safety Analysis Reports, if available." Most of the facilities considered in this eis have pre-existing safety documentation that analyzes the consequences and risks associated with operating the facilities. In accordance with this NEPA guidance, existing safety documentation was referred to during the preparation of the accident analysis portion of this eis. This appendix used three Westinghouse Savannah River Company technical reports (WSRC 1994c, d, and e) as the basis for the accident analysis information presented. These technical reports used safety analysis reports, preliminary safety analysis reports, hazard assessment documents, basis for interim operations documents, safety assessments, and other safety evaluations.

This analysis assessed the effects of radiological releases on four receptor groups in order to compare results among the alternatives. They are:

- uninvolved worker at 100 meters: an individual 100 meters (328 feet) from the point of a release

- uninvolved worker at 640 meters: an individual 640 meters (2,100 feet) from the point of a release

- offsite maximally exposed individual: a hypothetical member of the public who lives along the SRS boundary and who would receive the largest exposure from a release

- offsite population within 80 kilometers (50 miles): all the people within an 80-kilometer (50mile) radius of SRS

AXAIR89Q (WSRC 1994f), a computer code developed specifically for analyzing the consequences of accidental releases of airborne radioactive particulates from SRS, was used to calculate the consequences to the receptor groups identified above for each of the accident scenarios postulated in this appendix. Consequences for the uninvolved workers and the offsite maximally exposed individual were calculated using 50 percentile meteorological assumptions (meaning that half the time meteorological conditions such as wind speed and barometric pressure are better than the assumption, and half the time they are worse), in accordance with DOE guidance (DOE 1993). DOE believes that the 50 percentile meteorological assumptions provide an estimate of the consequences under more realistic exposure conditions than would be expected if one of the postulated Accidents occurs. The AXAIR89Q computer code, which calculates population doses differently than doses for individuals, is not programmed to determine the population dose for meteorological conditions not exceeded 50 percent of the time. Therefore, for the offsite population within 80 kilometers (50 miles), DOE assumed very conservative meteorological conditions within 99.5 percentile. As a result, the consequences from postulated accidents are higher than would normally be expected for the offsite population.

As noted above, uninvolved workers are evaluated at 100 and 640 meters (328 and 2,100 feet). Typically, uninvolved workers at 100 meters (328 feet) are in a facility's emergency planning zone, which generally extends to the facility's boundary. However, uninvolved workers at 640 meters (2,100 feet) are likely to be outside a facilityís emergency planning zone, and it typically would take longer to notify these workers of an accident at the facility. The purpose of presenting accident impacts for the uninvolved workers at these two distances is to provide a comparison of results for uninvolved workers who are likely to be initially aware of an accident and those who are not. It should be noted that the methodology described in the following sections does not take credit for emergency responses to Accidents (e.g., evacuating personnel to a safe distance or notifying the public to take shelter) in determining potential effects on workers or members of the public. To minimize the potential for human exposures and impacts to the environment if an accident occurs, SRS has established an emergency plan (WSRC 1994d) that governs responses to accidents. Section F.8 summarizes the *SRS Emergency Plan.*

A maximum credible design basis earthquake at SRS, estimated to occur once every 5,000 years, could potentially impact multiple facilities within a single facility area, resulting in the release of radioactive and/or toxic materials. It is also possible, although probably less likely, that an earthquake of the same magnitude could damage facilities in more than one facility area (e.g., F- and H-Areas), resulting in simultaneous releases to the environment. See Section F.6.

F.4.1 RADIOLOGICAL ACCIDENT ANALYSIS METHODOLOGY

This appendix presents quantitative impacts to SRS workers and members of the public from postulated radiological Accidents using the following parameters: dose, accident frequency, latent fatal cancers, and risk of latent fatal cancers per year. These parameters were either referenced in or developed from information provided in the following technical reports: *Bounding Accident Determination for the Accident Input Analysis of the SRS Waste Management Environmental Impact Statement* (WSRC 1994e), *Solid Waste Accident Analysis in Support of the Savannah River Waste Management Environmental Impact Statement* (WSRC 1994c), and the *Liquid Waste Accident Analysis in Support of the Savannah River Waste Management Environmental Impact Statement* (WSRC 1994b). The quantities of radioactive materials and how these materials affect humans are important in determining health effects. The International Commission on Radiological Protection has made specific recommendations for quantifying these health effects. Results are presented in terms of latent fatal cancers calculated using the ICRP-60 conversion factors of 0.0005 latent fatal cancers per rem for the public and 0.0004 latent fatal cancers per rem for workers if the dose is less than 20 rem. For doses of 20 rem or more, the ICRP-60 conversion factors are doubled (ICRP 1991).

A quantitative analysis of these facilities is not possible because some of the facilities proposed for waste management activities are in the pre-design or conceptual stage of development. Therefore, a qualitative discussion of accident impacts is provided for proposed facilities for which a quantitative accident analysis does not exist.

Additionally, this analysis presents potential impacts to involved workers from postulated Accidents qualitatively rather than quantitatively for several reasons, the most relevant being that no adequate methodology exists for calculating meaningful consequences at or near the location where the accidental release occurs. The following example illustrates this concept.

A typical method for calculating the dose to an involved worker is to assume that the material is released in a room occupied by the individual and that the material instantly disperses throughout the room. Because the involved worker is assumed to be in the room when the release occurs, this worker probably would breathe some fraction of the radioactive (or hazardous) materials for some number of seconds before leaving the room. Typically, estimates of exposure time are based on assumptions made about worker response to the incident (e.g., how long before the worker leaves the room, or whether during evacuation the worker passes through an area of higher airborne concentration). The uncertainty of estimation is extremely great, and no additional insight into the activity is available because the occurrence is assumed to be undesirable; therefore, it is not necessary to perform the calculations. Historical evidence indicates that room contaminations are nonfatal Accidents with the potential for minor personnel contamination and assimilation.

DOE accepts that if the exposed individual is close enough to the location of the accident, it will be impossible to show acceptable dose consequences against typical guidelines. This is especially true if all Accidents with a frequency as low as once in a million years -- beyond which it is not possible to statistically demonstrate protection of worker life from standard hazards in the workplace -- must be considered. For example, it is more likely that an employee would be fatally injured by falling equipment during an earthquake severe enough to occur only once every 5,000 years than from the radiological dose that individual would receive from materials released during the earthquake. Therefore, this appendix addresses potential consequences to involved workers qualitatively. DOE assumes that the immediate impacts of the accident (in this case an earthquake) to the worker would be from the facility in which the worker was located at the time of the accident; while the consequences from another facility affected during the earthquake would have little immediate impact upon an "involved" worker.

Many accident scenarios can be postulated for each SRS facility; to attempt to analyze all potential accident scenarios and their impacts would not be useful or meaningful. However, a broad spectrum of Accidents can usually be identified and analyzed for a given facility to provide an understanding of the risks associated with performing activities in that facility. Safety analysis reports and other safety documentation usually analyze a broad spectrum of accidents that are considered credible (i.e., they are expected to occur at least once every one million years) and estimate their potential impacts on workers, the environment, and the public.

For this eis, the term "representative bounding accident" means postulated events or Accidents that have higher risks (i.e., consequences times frequencies) than other accidents postulated within the same frequency range. For example, the accident scenario within each frequency range (defined in Table F-1) that presents the highest risk (i.e., consequence times frequency) to the offsite maximally exposed individual is the representative bounding accident for that frequency range because its risk is higher than that of other accidents within the same frequency range. Determining the representative bounding accident is part of a "binning" process, whereby all the accident scenarios identified for a facility under a specific alternative would be assigned to a selected frequency range. The highest-risk accident scenario within each frequency range is then designated the representative bounding accident. It should be noted that the consequence value used to calculate risk is dose to the offsite maximally exposed individual.

Once the representative bounding Accidents are identified, it is not necessary to further consider other accident scenarios for that particular alternative. The bounding accident scenarios are further evaluated to provide accident impacts for the receptor groups. An evaluation of the risks associated with the representative bounding accidents for facilities associated with a given alternative can establish an understanding of the overall risk to workers, members of the public, and the environment from operating facilities under a specific alternative. However, since some accident impacts are not represented in quantitative terms, the term "representative" must preface the phrase "bounding accident." This is because without a complete list of quantitative impacts from accidents for all facilities (existing and proposed), the true bounding accidents may not be absolutely defined. Figure F-1 shows the concept of bounding risk Accidents . Section F.5 identifies the representative bounding accidents postulated for the facilities considered in this eis.

Figure F-1.

F.4.2 CHEMICAL HAZARDS ANALYSIS METHODOLOGY

To fully understand the hazards associated with SRS facilities associated with the alternatives considered in this eis, it is necessary to analyze potential Accidents involving hazardous as well as radiological materials. 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 of accidents involving hazardous materials postulated in this appendix are presented in terms of airborne concentrations at various distances from the accident. The quantities and airborne concentrations at various receptor locations were extracted from technical reports (WSRC 1994b, c) supporting this eis.

Because safety documentation exists for many of the facilities within the scope of this eis, it was used whenever possible to determine potential events involving hazardous materials and the health effects that could result from inadvertent releases of these materials to the environment. However, because these safety documents were developed for different purposes, the methodologies used to analyze potential events at the facilities are sometimes different. In general, the methodology used to develop most of the existing safety documentation included: (1) identifying hazardous materials present in quantities greater than reportable quantities (40 CFR 302.4), threshold planning quantities (40 CFR 355), or threshold quantities (40 CFR 29:1910.1000, Subpart Z); (2) modeling an unmitigated release of those hazardous materials to the atmosphere to determine airborne concentrations at the various receptor locations [100 meters (328 feet), 640 meters (2,100 feet), and the nearest SRS boundary]; and (3) comparing those airborne concentrations to Emergency Response Planning Guideline (ERPG) values established by the American Industrial Hygiene Association (AIHA 1991).

Three ERPG values (ERPG-1, -2, or -3) are typically assigned to hazardous materials or chemicals in terms of airborne concentration (milligrams per cubic meter or parts per billion). The types of emergency response actions required to minimize worker and public exposure are determined by considering which of the three ERPG values is exceeded. The three types of ERPG values defined are:

- ERPG-1: The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor.

- ERPG-2: The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.

- ERPG-3: The maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.

The American Industrial Hygiene Association has not established ERPG values for some hazardous materials. When such materials would be present at SRS facilities in substantial quantities (exceeding the various threshold criteria), airborne concentrations of these materials at the various receptor locations were compared to the most restrictive exposure limits established by other recognized organizations to control worker exposures to hazardous materials. Table F-3 lists the hierarchy of exposure limits that DOE used in place of ERPG values to determine potential health effects resulting from the postulated hazardous material releases.

For facilities for which safety documentation was not developed in accordance with the methodology described above, the typical difference in the methodology involved which hazardous materials were required to be evaluated, not how the evaluations were performed. In the case of the Defense Waste Processing Facility's Organic Waste Storage Tank, for example, which was recently evaluated in the *Final Supplemental Environmental Impact Statement, Defense Waste Processing Facility* (DOE 1994b), hazardous materials designated "Extremely Hazardous Substances" in accordance with the Emergency Planning and Community Right-to-Know Act of 1986 were evaluated, rather than materials that exceed the reportable, threshold, or threshold planning quantities.

The potential events at the various facilities analyzed in this eis that could release hazardous materials to the environment were evaluated using one of the methodologies described above. DOE further analyzes potential events involving hazardous materials at the Consolidated Incineration Facility and

E-, B-, and N-Areas (WSRC 1994c). DOE further discusses the analysis methodology for events involving hazardous materials at the F/H-Area Effluent Treatment Facility, the F/H-Area tank farms, the Defense Waste Processing Facility's Organic Waste Storage Tank, and waste storage tanks at the Savannah River Technology Center (WSRC 1994b).

Although safety documentation exists for most of the facilities and facility areas that perform waste management activities, there is no safety documentation that analyzes potential events involving hazardous materials in M-Area. Using the second methodology described above, it was determined that sulfuric acid would be the only chemical present in M-Area in sufficient quantities to warrant further evaluation in this eis. Consistent with the methodologies, DOE analyzed an unmitigated release of the entire sulfuric acid inventory in M-Area using a commercially available computer code called EPICode (Homann 1988) that models the atmospheric dispersion of chemicals released to the environment. DOE then compared the resulting airborne concentrations against the ERPG values for sulfuric acid to determine the potential health effects.

Table F-3. Hierarchy of established limits and guidelines used to determine impacts from postulated hazardous material Accidents

Primary airborne concentration guideline	Hierarchy of alternative guidelines (if primary guidelines are unavailable)	Reference of alternative guideline
ERPG-3	EEGLb (30-minute exposure) IDLHc	NAS (1985) NIOSH (1990)
ERPG-2	EEGL (60-minute exposure) LOCd PEL-Ce TLV-Cf TLV-TWAg multiplied by 5	NAS (1985) EPA (1987) CFR (1990) ACGIH (1992) ACGIH (1992)
ERPG-1	TWA-STELh TLV-STELi TLV-TWA multiplied by 3	CFR (1990) ACGIH (1992) ACGIH (1992)

a. This table is based on information presented in the *Toxic Chemical Hazard Classification and Risk Acceptance Guidelines for Use in DOE Facilities* (WSRC 1992).

b. Emergency Exposure Guidance Level (EEGL): "A concentration of a substance in air (as a gas, vapor, or aerosol) that may be judged by the Department of Defense to be acceptable for the performance of specific tasks during emergency conditions lasting for a period of 1 to 24 hours. Exposure at an EEGL might produce reversible effects that do not impair judgment and do not interfere with proper responses to an emergency." The EEGL is "...a ceiling guidance level for a single emergency exposure, usually lasting from 1 to 24 hours -- an occurrence expected to be infrequent in the lifetime of a person."

c. Immediately Dangerous to Life and Health (IDLH): "The maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without a respirator and without experiencing any escape-impairing (e.g., severe eye irritation) or irreversible health effects."

d. Level of Concern (LOC): "The concentration of an extremely hazardous substance in air above which there may be serious irreversible health effects or death as a result of a single exposure for a relatively short period of time."

e. Permissible Exposure Limit - Ceiling (PEL-C): "The employeeís exposure which shall not be exceeded during any part of the work day."

f. Threshold Limit Value - Ceiling (TLV-C): "The concentration that should not be exceeded during any part of the working exposure."

g. Threshold Limit Value - Time Weighted Average (TLV-TWA): "The time-weighted average concentration for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect."

h. Time Weighted Average - Short-Term Exposure Limit (TWA-STEL): "The employeeís 15minute time weighted average exposure which shall not be exceeded at any time during a work day unless another time limit is specified...."

i. Threshold Limit Value - Short-Term Exposure Limit (TLV-STEL): "The concentration to which workers can be exposed continuously for a short period of time without suffering from (1) irritation, (2) chronic or irreversible tissue damage, or (3) narcosis of sufficient degree to increase the likelihood of accidental injury, impair self-rescue, or materially reduce work efficiency, and provided that the daily TLV-TWA is not exceeded."

F.5 Accident Analysis by Waste Type

This section presents potential impacts from postulated radiological and chemical Accidents at the facilities that are or could be involved in the management of waste materials at SRS. This section has been organized according to waste type, with an analysis for each of the alternatives presented in this eis. Each of the following sections includes a list of the facilities, postulated radiological accident impacts, and postulated chemical accident impacts associated with the waste type.

F.5.1 HIGH-LEVEL WASTE

The following sections address the impacts of postulated Accidents associated with the alternatives considered in this eis for the management of liquid high-level waste.

F.5.1.1 Facilities and Accidents: High-Level Waste

The accident analyses considered all facilities and processes involved in the management of liquid highlevel waste. The facilities were identified from the information on high-level waste provided in Chapter 2 of this eis. The facilities involved in the management of high-level waste for all alternatives considered in this eis are the F/H-Area Evaporators, the Replacement High-Level Waste Evaporator, the New Waste Transfer Facility, the F/H-Area tank farms, and the F/H-Area Effluent Treatment Facility. Descriptions of these facilities are provided in Appendix B. For each of these facilities, a list of postulated accident scenarios was developed to support high-level waste accident analyses for each alternative.

Table F-4 lists potential Accidents associated with the management of high-level waste. These accidents were extracted from the technical reports supporting this eis (WSRC 1994b, c, and e).

Table F-4. List of potential Accidents associated with the management of high-level waste.

No.	Accident description	Annual freq.	Dosea (rem)	RiskRisk (rem/yr)
1	RHLWEb release due to a feed line break	7.00E-02	2.73E-03	1.91E-04
2	H-Area airborne release due to waste tank filter fire	2.50E-02	3.68E-03	9.20E-05
3	RHLWEb release due to design basis earthquake	2.00E-04	8.16E-02	1.63E-05
4	F-Area airborne release due to waste tank filter fire	2.50E-02	6.39E-04	1.60E-05
5	RHLWEb release due to evaporator pressurization and breach	5.09E-05	2.03E-01	1.04E-05
6	RHLWEb release due to hydrogen explosion	1.71E-04	4.58E-02	7.83E-06
7	H-Area airborne release due to organic fire - waste tank	5.00E-03	1.35E-03	6.75E-06
8	RHLWEb release due to HEPAc filter fire	1.00E-02	4.55E-04	4.55E-06
9	H-Area airborne release due to hydrogen fire - waste tank	5.00E-03	7.37E-04	3.69E-06
10	F-Area liquid release due to waste tank overflow	9.00E-02	2.37E-05	2.13E-06
11	H-Area liquid release due to waste tank overflow	9.00E-02	2.00E-05	1.80E-06
12	F-Area airborne release due to organic fire - waste tank	5.00E-03	2.34E-04	1.17E-06
13	H-Area liquid release due to earthquake	2.00E-04	3.41E-03	6.82E-07
14	F-Area airborne release due to hydrogen fire - waste tank	5.00E-03	1.28E-04	6.40E-07
15	H-Area airborne release due to hydrogen explosion - pump tank	2.00E-05	1.13E-02	2.26E-07
16	F-Area airborne release due to hydrogen explosion - pump tank	2.00E-05	7.80E-03	1.56E-07
17	H-Area airborne release due to waste tank overpressurization	1.00E-01	9.80E-07	9.80E-08
18	RHLWEb release due to design basis tornado	4.00E-05	6.20E-04	2.50E-08
19	Normal processing with tritiumtritium ETFd airborne release due to straight wind	1.20E-03	1.47E-05	1.76E-08
20	Normal processing other than tritiumtritium ETFd airborne release due to straight wind	1.20E-03	1.46E-05	1.75E-08
21	F-Area airborne release due to waste tank overpressurization	1.00E-01	1.70E-07	1.70E-08
22	Normal processing with tritiumtritium ETFd liquid release due to straight wind	1.20E-03	9.40E-06	1.13E-08
23	F-Area liquid release due to hydrogen explosion - pump tank	2.00E-05	5.47E-04	1.09E-08
24	Normal processing other than tritiumtritium ETFd liquid release due to straight wind	1.20E-03	7.70E-06	9.24E-09
25	Normal processing with tritiumtritium ETFd airborne release due to tornado	4.50E-05	2.04E-04	9.18E-09
26	Normal processing other than tritiumtritium ETFd airborne release due to tornado	4.50E-05	2.03E-04	9.14E-09
27	F-Area liquid release due to earthquake	2.00E-04	3.38E-05	6.76E-09
28	Normal processing with tritiumtritium ETFd airborne release due to earthquake	2.00E-04	2.77E-05	5.54E-09
29	H-Area liquid release due to hydrogen explosion - pump tank	2.00E-05	2.57E-04	5.14E-09
30	H-Area liquid release due to vehicle crash (scenario A; see #63)	3.50E-05	1.36E-04	4.76E-09
31	H-Area waste release from feed pump riser	1.90E-04	1.87E-05	3.55E-09
32	F-Area waste release from feed pump riser	1.90E-04	1.10E-05	2.09E-09

33	Normal processing with tritiumtritium ETFd liquid release due to earthquake	2.00E-04	9.40E-06	1.88E-09
34	Normal processing other than tritiumtritium ETFd liquid release due to earthquake	2.00E-04	7.70E-06	1.54E-09
35	H-Area airborne release due to hydrogen explosion - evaporator	5.00E-06	2.93E-04	1.47E-09
36	H-Area airborne release due to hydrogen explosion - CTSe tank	5.00E-06	2.93E-04	1.47E-09
37	H-Area liquid release due to waste tank overpressurization	1.00E-01	9.34E-09	9.34E-10
38	F-Area liquid release due to waste tank overpressurization	1.00E-01	5.52E-09	5.52E-10
39	H-Area liquid release due to tank leak	3.00E-02	1.76E-08	5.28E-10
40	Normal processing other than tritiumtritium ETFd airborne release due to earthquake	2.00E-04	2.50E-06	5.00E-10
41	Design basis ETFd liquid release due to straight wind	9.84E-06	4.70E-05	4.62E-10

Table F-4. (continued).

No.	Accident description	Annual freq.	Dosea (rem)	RiskRisk (rem/yr)
42	Normal processing with tritiumtritium ETFd liquid release due to tornado	4.50E-05	9.40E-06	4.23E-10
43	Normal processing other than tritiumtritium ETFd liquid release due to tornado	4.50E-05	7.70E-06	3.47E-10
44	H-Area airborne release due to tornado	3.00E-05	9.90E-06	2.97E-10
45	F-Area liquid release due to tank leak	3.00E-02	8.82E-09	2.65E-10
46	F-Area airborne release due to tornado	3.50E-05	6.00E-06	2.10E-10
47	F-Area airborne release due to hydrogen explosion - evaporator	5.00E-06	3.25E-05	1.63E-10
48	F-Area airborne release due to hydrogen explosion - CTSe tank	5.00E-06	3.25E-05	1.63E-10
49	F-Area liquid release due to hydrogen explosion - CTSe tank	5.00E-06	3.04E-05	1.52E-10
50	H-Area liquid release due to hydrogen explosion - CTSe tank	5.00E-06	2.57E-05	1.29E-10
51	F-Area liquid release due to hydrogen explosion - evaporator	5.00E-06	2.37E-05	1.19E-10
52	Design basis ETFd airborne release due to straight wind	9.84E-06	1.12E-05	1.10E-10
53	Design basis ETFd airborne release due to tornado	3.69E-07	2.83E-04	1.04E-10
54	H-Area liquid release due to a hydrogen explosion - evaporator	5.00E-06	2.00E-05	1.00E-10
55	Normal processing with tritiumtritium ETFd airborne release due to transfer error	1.80E-02	4.46E-09	8.03E-11
56	Design basis ETFd liquid release due to earthquake	1.64E-06	4.70E-05	7.71E-11
57	Normal processing with tritiumtritium ETFd airborne release due to corrosion damage	8.80E-02	8.75E-10	7.70E-11
58	F-Area liquid release during catherization	7.00E-02	6.76E-10	4.73E-11
59	H-Area liquid release during catherization	7.00E-02	5.70E-10	3.99E-11
60	Normal processing other than tritiumtritium ETFd airborne release due to transfer error	1.80E-02	1.72E-09	3.10E-11
61	Normal processing other than tritiumtritium ETFd airborne release due to corrosion damage	8.80E-02	3.38E-10	2.97E-11
62	Design basis ETFd airborne release due to leaks	2.13E-02	1.35E-09	2.88E-11
63	H-Area liquid release due to a vehicle crash (scenario B; see #30)	3.50E-05	7.10E-07	2.49E-11
64	Design basis ETFd airborne release due to overflow	1.48E-03	1.44E-08	2.13E-11

65	Design basis ETFd liquid release due to tornado	3.69E-07	4.70E-05	1.73E-11
66	Design basis ETFd airborne release due to earthquake	1.64E-06	8.40E-06	1.38E-11
67	Normal processing with tritiumtritium ETFd airborne release due to a siphoning incident	2.60E-03	1.12E-09	2.91E-12
68	Design basis ETFd airborne release due to spill	1.48E-03	1.88E-09	2.78E-12
69	Normal processing other than tritiumtritium ETFd airborne release due to siphoning incident	2.60E-03	4.34E-10	1.13E-12
70	Design basis ETFd airborne release due to transfer error	1.48E-04	6.86E-09	1.02E-12
71	Design basis ETFd airborne release due to corrosion damage	7.22E-04	1.35E-09	9.75E-13
72	Design basis ETFd airborne release due to a siphoning incident	2.13E-05	1.73E-09	3.68E-14

a. The dose given is for the offsite maximally exposed individual using 99.5 percentile meteorology.

b Replacement High-Level Waste Evaporator.

c. High efficiency particulate air.

d. Effluent Treatment Facility.

e. Concentrate transfer system.

F.5.1.2 Accident Analysis for the High-Level Waste No-Action Alternative

This section addresses the effects of postulated Accidents associated with the no-action alternative considered for high-level waste.

Impacts from Postulated Radiological AccidentsAccidents

DOE identified the representative bounding accident scenarios for the no-action alternative from the list of potential radiological Accidents presented in Table F-4. Figure F-2 identifies the highest-risk accident scenarios in each frequency range. As shown in Figure F-2, for all but the lowest frequency range, the representative bounding accidents are associated with the operation of the Replacement High-Level Waste Evaporator. Table F-5 lists the high-level waste representative bounding accidents, accident consequences, and latent fatal cancers for exposed workers and the public.

Accident Scenario 1 -Replacement High-Level Waste Evaporator release due to a feed line break: A break in the feed line to the Replacement High-Level Waste Evaporator could occur if feed was pumped after the feed line became plugged. The feed line can become plugged due to excess sludge and suspended solids collecting and solidifying in stagnation points within the feed line. If feed pumping continued, the excess pressure would eventually cause a rupture in the feed line or jumper connection. Numerous indicators would alert the operator of a feed line rupture. In the event of a break, the automatic level control system in the evaporator would indicate decreased lift activity as the level of liquid in the evaporator dropped. Because supernatant would now be accumulating in the evaporator cell, the evaporator sump and differential pressure sensors in the ventilation system would also indicate leakage. Finally, the radiation monitor in the stack would register an increase in the radiation level of material leaving the ventilation system.

The Replacement High-Level Waste Evaporator is planned to operate from 1999 to 2018, when DOE expects to have completed high-level waste management activities. Between 1994 and 1999 -- before the Replacement High-Level Waste Evaporator is operational -- the highest-risk accident in the anticipated accident range would be Accident Scenario 2: H-Area airborne release due to waste tank filter fire.

Accident Scenario 3 -Replacement High-Level Waste Evaporator release due to a design basis earthquake: Studies reported in the supporting technical report (WSRC 1994c) indicate that SRS is located in an area where moderate damage could occur from earthquakes. In this accident scenario, an earthquake is assumed to disrupt the operation of the evaporator facility. The feed input and bottoms output are assumed not to be affected during the earthquake, and the steam supply is assumed to continue to flow at the normal rate; therefore, the evaporator contents continue to be boiled off as normal. However, the demister is assumed to be damaged and its performance is degraded. The accident results in a release to the environment through a broken process line between the evaporator vessel demister and condenser. The highest-risk accident in this frequency range between 1994 and 1999 would be Accident Scenario 7: H-Area airborne release due to waste tank organic fire.

Figure F-2.

Accident Scenario 5 -Replacement High-Level Waste Evaporator release due to evaporator pressurization and breach: An evaporator breach would be possible if the internal pressure in the evaporator exceeded the design pressure, which could be caused by demister mesh pad blockage; excessive levels of condensate and vent line blockage; or steam bundle failures. A breach of the evaporator would result in an energetic release of the vessel contents into the evaporator cell and a subsequent unfiltered airborne release of waste into the atmosphere when the high efficiency particulate air filters become overloaded. The associated pressure increase would be detected by independent bubble tube pressure sensors within the evaporator vessel. These sensors are tied to interlocks that would provide for mitigation of the event. These devices must fail for an overpressurization to occur. From 1994 to 1999 -- before the Replacement High-Level Waste Evaporator is operational -- the highest-risk accident in this frequency range would be Accident Scenario 15: H-Area airborne release due to pump tank hydrogen explosion.

Accident Scenario 53 -Design basis F/H-Area Effluent Treatment Facility airborne release due to a tornado: Damage to equipment that would result in a release of radioactivity could occur during a sustained wind or tornado. The F/H-Area Effluent Treatment Facility is designed for a sustained wind speed of 137 kilometers (85 miles) per hour. Outside tanks and piping would be subjected to the full force of the wind and could be struck by windblown objects, either of which could result in a release of radioactivity. Equipment and piping located inside a process building could be damaged by roof debris and falling portions of the upper structure. Some of the liquid released would evaporate and become airborne and some would drain to surface water streams. No credit is taken for tank dikes, high efficiency particulate air filtration, or for a release from an elevated stack.

F.5.1.3 Accident Analysis for the High-Level Waste for Minimum, Expected, and Maximum Waste Forecasts

This section addresses the impacts of postulated Accidents associated with alternatives A, B, and C considered for high-level waste. The facilities that support alternative A, alternative B, and alternative C and their periods of operation are identical to the facilities and periods of operation that support the
no-action alternative. Thus, postulated radiological accident scenarios and their impacts are the same as described in Section F.5.1.2.

DOE assumes that conclusions for representative bounding accident scenarios for high-level waste management under the alternatives would not be changed by the minimum, maximum, and expected waste forecasts. Since the accident analysis for each accident scenario is based on a conservative assumption of peak utilization of the facility, differences between minimum, maximum, and expected waste forecast would only affect how long the facility would operate. Therefore, while consequence or frequency for postulated Accidents are not changed, the expected duration of risk from a facility-specific accident scenario could be longer or shorter, as appropriate. Impacts for these cases are addressed in the representative bounding accident descriptions.

F.5.1.4 Impacts to Involved Workers from Accidents Involving High-Level Waste

The highest risk accident scenarios for high-level waste involve releases from the Replacement HighLevel Waste

Evaporator, tank farm tanks, or the F/H-Area Effluent Treatment Facility. These releases would be due to feed line breaks, overpressurizations and breaches, explosions, or natural disasters. Of these accident scenarios and their postulated releases, the ones associated with the Replacement HighLevel Waste Evaporator are assumed to have the greatest potential for adverse effects on involved workers. This assumption is based on the higher consequences for the Replacement HighLevel Waste Evaporator accident scenarios than those for the tank farm or F/HArea Effluent Treatment Facility. While some exposure to involved workers could occur due to an accidental release, timely evacuation as the result of monitoring activities would prevent substantial radiological exposure. DOE assumes no fatalities would be likely from radiological consequences.

F.5.1.5 Impacts from High-Level Waste Chemical Accidents

The results of the chemical hazards assessment completed for chemicals stored or processed in facilities located in the area of the F/H-Area tank farms as addressed in the *Final Supplemental Environmental Impact Statement, Defense Waste Processing Facility* are presented in Table F-6. The calculated 100meter (328foot), 640meter (2,100-foot), and offsite chemical concentrations are compared to the appropriate ERPG-1, -2, and -3 guideline concentrations. A nitric acid release from Building 24161H is the only accident with calculated concentrations that exceed the ERPG-3 limit at 100 and 640 meters (328 and 2,100 feet).

Because the concentrations calculated for the SRS boundary for every chemical do not exceed the respective ERPG-1 concentrations (even assuming a total unmitigated release of all chemicals), specific accident scenarios (i.e., an accident initiator and resulting accident progression resulting in a release to the environment) were not developed, nor were corresponding frequencies of occurrence identified. More realistic accident scenarios and associated frequencies were not necessary because the bounding consequences for the unmitigated release of the entire inventory, however improbable, were within established guidelines.

The nitric acid concentrations that exceed the ERPG-3 limit could pose a risk of major reversible tissue damage. Because the chemical concentration in air decreases with distance from the release location, offsite individuals would be exposed to chemical concentrations less than the ERPG-1 limit. However, onsite personnel in the immediate area of a release could encounter concentrations that exceed the ERGP-3 limit. While perhaps not instantly lethal, even short exposures could be extremely dangerous.

The F/H-Area Effluent Treatment Facility is classified as a low-hazard facility based on the chemical hazards assessment contained in the *Effluent Treatment Facility Hazards Assessment Document* (WSRC 1993). Table F-7 lists the results of this chemical assessment. The calculated 100-meter (328-foot), 640-meter (2,100-foot), and offsite chemical concentrations are compared to the appropriate ERPG-1, -2, and -3 guideline concentrations. A nitrogen dioxide release from the storage area and a nitric acid release from process chemical storage tanks are the only postulated Accidents with calculated concentrations that exceed the ERPG-3 limit at 100-meters (328-feet). However, no accidents resulted in air concentrations at 640-meters (2,100-feet) or the SRS boundary that exceeded ERPG-3 guidelines. Additionally, the nitrogen dioxide release scenario had a calculated concentration at the SRS boundary that exceeded the ERPG-1 guideline but remained under the ERPG-2 guideline.

No chemical hazards analysis or accident consequence analysis exist for the chemicals at the Replacement High-Level Waste Evaporator. However, it is assumed that the chemical hazards posed by this facility would be bounded by those posed by existing evaporators in the F/HArea tank farms.

F.5.2 LOW-LEVEL WASTE

This section evaluates the impacts of postulated Accidents associated with the alternatives considered in this eis for the management of low-level waste.

F.5.2.1 Facilities and Accidents: Low-Level Waste

The accident analyses considered all facilities and processes involved in the management of low-level waste. The facilities were identified from the low-level waste information provided in Chapter 2 of this eis. Table F-8 lists the facilities associated with each of the alternatives. Descriptions of these facilities are provided in Appendix B. For each facility, a list of postulated accident scenarios was developed to support the low-level waste accident analysis for each alternative.

Table F-9 lists potential Accidents associated with the management of low-level waste. This list was extracted from the technical reports supporting this eis (WSRC 1994b, c, d, and e). All the accidents listed in Table F-9 are supported by quantitative analyses. It should be noted that because accident impacts for proposed facilities are mainly qualitative, they are not listed in the table.

Table F-5. Representative bounding radiological accidents under the no-action alternative.

			Accident consequences				Point estimate of increased risk per yeara (increased risk of fatal cancers per occurrence)b Latent fatal cancers			
No.	Accident description	Frequency per year (accident range)	Uninvolved worker at 100 meters (rem)	Uninvolved worker at 640 meters (rem)	Offsite maximally exposed individual (rem)	Population within 80 kilometersc (person-rem)	Uninvolved worker at 100 meters	Uninvolved worker at 640 meters	Offsite maximally exposed individual	Population within 80 kilometers
1	RHLWEd release due to a feed line break	7.00E-02e (anticipated)	6.41E-01	2.28E-02	3.76E-04	1.81E+01	1.79E-05 (2.56E-04)	6.38E-07 (9.12E-06)	1.32E-08 (1.88E-07)	6.34E-04 (9.05E-03)
3	RHLWEd release due to a design basis earthquake	2.00E-04 (unlikely)	1.92E+01	6.83E-01	1.12E-02	5.43E+02	1.54E-06 (7.68E-03)	5.46E-08 (2.73E-04)	1.12E-09 (5.60E-06)	5.43E-05 (2.72E-01)
5	RHLWEd release due to evaporator pressurization and breach	5.09E-05 (extremely unlikely)	4.79E+01	1.70E+00	2.80E-02	1.35E+03	1.95E-06 (3.83E-02)	3.46E-08 (6.80E-04)	7.13E-10 (1.40E-05)	3.44E-05 (6.75E-01)
53	Design basis ETFe airborne release due to tornado	3.69E-07 (beyond-extremely-unlikely)	2.17E-03	6.91E-05	3.90E-05	3.44E-04	3.20E-13 (8.68E-07)	1.02E-14 (2.76E-08)	7.20E-15 (1.95E-08)	6.35E-14 (1.72E-07)

a. Point estimate of increased risk per year is calculated by multiplying the consequence (dose) ¥ latent cancer conversion factor ¥ annual frequency.

b. Increased risk of fatal cancers per occurrence is calculated by multiplying the consequence (dose) ¥ latent cancer conversion factor.

c. A conservative assumption of 99.5 percentile meteorology was assumed for determining accident consequences for the exposed population within 80 kilometers. A less conservative meteorology (50 percentile) was used to determine the accident consequences for exposed individuals.

d. Replacement High-Level Waste Evaporator.

e. Effluent Treatment Facility.

Table F-6. Chemical hazards analysis results for the F/H-Area tank farm facilities.

Chemical	Release location	Quantity (kg)a	100-meter (328foot) concentration (mg/m3)b	640-meter (2,100foot) concentration (mg/m3)b	Offsite concentration (mg/m3)b	ERPG-1c (mg/m3)b	ERPG-2 (mg/m3) b	ER (mg
Nitric acid	Bldg. 241-61H	42,620.90	8.30E+02	1.00E+02	2.00E+00	5.20E+00	3.9E+01	7.70
Phosphorous pentoxide	Bldg. 241-84H	0.45	7.50E-02	2.90E-02	3.10E-04	5.00E+00	2.50E+01	1.00
Ammonia	Bldg. 242-24H	13.6	4.50E-03	1.80E-03	2.40E-05	1.70E+01	1.40E+02	7.00
Hydrochloric acid	Bldg. 280-1H	22.7	7.60E-03	3.00E-03	3.90E-05	4.50E+00	3.00E+01	1.50
Sulfuric acid	Bldg. 280-1F	3,828.80	3.70E-06	2.20E-07	3.20E-09	2.00E+00	1.00E+01	3.00

a. Kilograms. To convert to pounds multiply by 2.2046.

b. Milligrams per cubic meters of air.

c. Emergency Response Planning Guideline. See Table F-3.

Table F-7. F/H-Area Effluent Treatment Facility chemical hazards analysis results.

Segment description	Chemical	Quantity (kg)a	Onsite concentration 100 meters (328 feet) (mg/m3)b	Onsite concentration 640 meters (2,100 feet) (mg/m3)b	Offsite concentration (mg/m3)b	ERPG-1c (mg/m3)b	ERPG-2c (mg/m3)b	ERPG-3c (mg/m3)b

Waste water collection tanks	Lead	4.41E-01	1.07E-02	4.24E-04	2.15E-05	1.50E-01	2.50E-01	7.00E+02
Waste water collection tanks	Ammonia	5.51E+01	1.34E+00	5.31E-02	2.68E-03	1.74E+01	1.39E+02	6.95E+02
Treatment building chemicals	Ammonia	5.85E+01	1.42E+00	5.36E-02	2.85E-03	1.74E+01	1.39E+02	6.95E+02
Treatment building chemicals	Lead	3.39E-01	8.24E-03	3.27E-04	1.65E-05	1.50E-01	2.50E-01	7.00E+02
Treatment building chemicals	Mercury	5.79E+00	1.41E-01	5.59E-03	2.82E-04	1.50E-01	2.00E-01	2.80E+01
Outside tanks and HEPA[d] filters	Mercury	3.09E+00	7.53E-01	2.99E-02	1.50E-03	1.50E-01	2.00E-01	2.80E+01
Storage area	Nitrogen dioxide	3.30E+01	7.96E+01	3.16E+00	1.59E-01	8.00E-02	1.88E+00	5.64E+01
Storage area	Sodium hydroxide	3.02E+02	7.34E-02	2.91E-03	1.47E-04	2.00E+00	4.00E+01	1.00E+02
Storage area	Nitric acid	2.12E+02	5.17E+00	2.05E-01	1.03E-02	5.15E+00	3.87E+01	7.73E+01
Storage area	Oxalic acid	1.13E+04	2.76E+02	1.09E+01	5.52E-01	2.00E+00	5.00E+00	5.00E+02
Process chemical storage tanks	Sodium hydroxide	2.81E+03	6.83E-01	2.71E-02	1.37E-03	2.00E+00	4.00E+01	1.00E+02
Process chemical storage tanks	Nitric acid	7.41E+03	1.81E+02	7.18E-00	3.61E-01	5.15E+00	3.87E+01	7.73E+01
Acid and caustic tanks	Nitric acid	(e)	5.87E+00	2.33E-01	1.17E-02	5.15E+00	3.87E+01	7.73E+01
Acid and caustic tanks	Sodium hydroxide	4.01E+00	9.90E+00	3.93E-01	1.98E-02	2.00E+00	4.00E+01	1.00E+02

a. Kilograms. To convert to pounds multiply by 2.2046.

b. Milligrams per cubic meters of air.

c. Emergency Response Planning Guideline. See Table F-3.

d. High efficiency particulate air.

e. Quantity not available but is assumed to be bounded by the quantity for nitric acid in the Process Chemical Storage Tanks based upon comparison of airborne concentrations at 100 meters (328 feet).

Table F-8. Low-level waste facilities identified by alternative.

List of facilities	No action	Alternative A (limited treatment configuration)	Alternative C (extensive treatment configuration)	Alternative B (moderate treatment configuration)
E-Area vaults[a]	X	X	X	X
Reactor compactor	X	X	X[b]	X[b]
253-H compactor	X	X	X[b]	X[b]
M-Area compactor	X	X	X[b]	X[b]

Soil sort facility[c]				X
Non-alpha vitrification facility[c]			X	
Consolidated Incineration Facility			X	X
Offsite smelter			X	X
Shallow land disposal[d]	X	X	X	X

a. E-Area vaults includes low-activity waste vaults, intermediate-level tritium vaults, intermediate-level nontritium vaults; long-lived waste storage buildings.

b. These facilities are assumed to remain in operation until proposed facilities come on line.

c. Proposed facility.

d. Shallow land disposal includes the engineered low-level trenches, greater confinement disposal (boreholes and engineered trenches), and naval reactor hardware storage.

Table F-9. List of potential Accidents associated with the management of low-level waste.

No.	Accident description	Annual frequency	Dose[a] (rem)	RiskRisk (rem/yr)
1	Container breach at the eaV/ILNTV[b]	2.00E-02	2.60E-01	5.20E-03
2	Fire at the eaV/LLWSB[c]	8.30E-02	4.70E-02	3.90E-03
3	Fire at the eaV/LAWV[d]	8.30E-02	2.10E-02	1.74E-03
4	Fire at the eaV/ILTV[e]	8.30E-02	1.90E-02	1.58E-03
5	Container breach at the eaV/LAWV[d]	2.00E-02	4.00E-02	8.00E-04
6	Container breach at the eaV/ILTV[e] (scenario A; see #8)	2.00E-02	3.60E-02	7.20E-04
7	Fire at the eaV/ILNTV[b]	8.30E-02	8.60E-03	7.14E-04
8	Container breach at the eaV/ILTV[e] (scenario B; see #6)	2.00E-02	3.10E-02	6.20E-04
9	Container breach at the eaV/LLWSB[c]	2.00E-02	3.10E-02	6.20E-04
10	Explosion at CIF[g] - tank farm sump and diked area	1.90E-07	6.85E-03	1.30E-04
11	Fire at the ELLT[f]	8.30E-02	5.35E-05	4.44E-06
12	Large fire at CIF[g]	2.34E-04	1.07E-02	2.50E-06
13	High wind at the eaV/ILNTV[b]	1.00E-03	3.04E-04	3.04E-07
14	Earthquake at CIF[g]	1.00E-03	2.65E-04	2.65E-07
15	Tornado at the eaV/ILNTV[b]	2.00E-05	1.18E-02	2.36E-07
16	Explosion at CIF[g] - Rotary Kiln	1.50E-04	1.57E-03	2.36E-07
17	High velocity straight winds at CIF[g]	2.00E-02	5.23E-06	1.05E-07

18	Tornado at the eaV/LAWVd	2.00E-05	4.90E-03	9.80E-08
19	Tornado at the eaV/ILTVe	2.00E-05	4.40E-03	8.80E-08
20	Unintentional exhumation of ELLTf	8.30E-02	3.90E-07	3.24E-08
21	Explosion at CIFg - backhoe housing	4.00E-04	5.64E-05	2.26E-08
22	High wind at the eaV/ILTVe	1.00E-03	2.00E-05	2.00E-08
23	High wind at the eaV/LAWVd	1.00E-03	1.50E-05	1.50E-08
24	Explosion at CIFg - tank farm tank	3.40E-07	5.36E-03	1.82E-09

a. The dose given is for the offsite maximally exposed individual (MEI) using 99.5 percentile meteorology.

b. E-Area Vaults/Intermediate-Level Nontritium Vault.

c. E-Area Vaults/Long-Lived Waste Storage Buildings.

d. E-Area Vaults/Low-Activity Waste Vault.

e. E-Area Vaults/Intermediate-Level Tritium Vault.

f. Engineered low-level trenches.

g. Consolidated Incineration Facility.

F.5.2.2 Accident Analysis for the Low-Level Waste No-Action Alternative

This section addresses the effects of postulated Accidents associated with the no-action alternative for low-level waste. The postulated accidents provide a baseline for comparison of the effects of the postulated accidents associated with the other alternatives.

Impacts from Postulated Radiological Accidents

From the list of potential radiological Accidents presented in Table F-9, the representative bounding accident scenarios were identified for the no-action alternative through the binning process described in Section F.4.1. Figure F-3 identifies the highest-risk accident scenarios for the four frequency ranges. As shown in Figure F-3, most of the accidents were in the anticipated frequency range. This distribution of accidents is due to the levels of radioactivity associated with low-level waste. At the lower accident frequency ranges, the risks become quite small compared with those in the anticipated accident frequency range. Consequently, for the no-action alternative, it was not necessary to analyze an accident scenario beyond the extremely unlikely accident frequency range. Table F-10 lists the low-level waste representative bounding accidents, accident consequences, and latent fatal cancers for exposed workers and the public.

The low-level waste representative bounding Accidents and their impacts, as identified in Table F-10, are described below:

Accident Scenario 1 -Container breach at the intermediate-level nontritium vault (two containers, noncombustible waste): The intermediate-level nontritium vault would contain both combustible waste (paper, plastics, cloth, etc.) and noncombustible waste (scrap hardware) contaminated with mixed fission products. Accidents involving this scrap could result in the airborne release of this contamination. The major contributor to the dose would be the waste material, which becomes airborne as a result of the accident. In order to estimate the consequences of this accident, the following conservative assumptions were made:

- Two waste containers were breached. This assumption is based on the hypothetical situation in which one waste container was being placed (by crane) into the intermediate-level nontritium vault cell and was inadvertently dropped (through either human error or crane malfunction) on a second waste container already within the intermediate-level nontritium vault cell, resulting in a breach of both containers.

Figure F-3.

- Analysis has shown that the radionuclide release due to rupture of a waste container in the intermediate-level nontritium vault that contains a noncombustible waste form would conservatively bound the release of an intermediate-level nontritium vault container that contains a combustible waste form. Therefore, it is conservatively assumed for this analysis that the two damaged waste containers have noncombustible waste as their contents.

- Radiological container inventory for the intermediate-level nontritium vault is based on 120 percent of the maximum estimated value.

Accident Scenario 13 -High wind at the intermediate-level nontritium vault (one container): In a moderate hazard facility, DOE (LLNL 1990) specifies a maximum wind speed of 175 kilometers
(109 miles) per hour and a wind-driven missile in the form of a two-by-four plank weighing 6.8 kilograms (15 pounds) and traveling with a horizontal speed of 80 kilometers (50 miles) per hour at a maximum height of 9 meters (30 feet). The accident analyzed for this highwind event is the breach of one container as the result of a wind-driven missile entering the open top of the intermediate-level nontritium vault and striking a waste container. It is assumed that 0.1 percent of the waste material becomes airborne. Analysis has shown that the radionuclide release would be the same as that for the container breach accident described above. Therefore, it is conservatively assumed that the high-wind-driven missile strikes containers that contain noncombustible waste.

Accident Scenario 15 -Tornado (220 kilometers per hour) at the intermediate-level nontritium vault (two containers): The accident analyzed for the 220-kilometer (137-mile) per hour tornado is the breach of two containers as the result of two tornado-driven missiles entering the open top of the intermediate-level nontritium vault and each striking one waste container, for a total of two failed containers. Analysis has shown that the radionuclide release would be the same as that for the container breach accident described above. Therefore, it is conservatively assumed that the tornado-driven missiles strike containers that contain noncombustible waste.

F.5.2.3 Accident Analysis for the Low-Level Waste Under Alternative B

This section addresses the impacts of postulated Accidents for low-level waste associated with alternative B.

F.5.2.3.1 Impacts from Postulated Radiological Accidents

This section presents the potential effects of postulated radiological Accidents at facilities identified in Table F-8 for the low-level waste management described in alternative B. Figure F-4 shows the highest-risk accident scenarios for the four frequency ranges. As shown in Figure F-4, most of the accidents analyzed were in the anticipated accident frequency range. The distribution of accidents analyzed is indicative of the levels of radioactivity associated with low-level waste. At the lower accident frequency ranges, the risks become quite small compared to those in the anticipated accident frequency range. Accidents associated with the Consolidated Incineration Facility occur in the less frequent accident ranges. Table F-11 lists the representative bounding accidents, accident consequences, and latent fatal cancers for exposed workers and the public. DOE assumes that conclusions regarding representative bounding accident scenarios could change as a result of the minimum, maximum, or expected waste forecasts. The accident analysis for each accident scenario is based on a conservative assumption of peak utilization of facilities. That is, the minimum, maximum, and expected waste forecasts would only affect how long the facilities would operate. Therefore, while the consequence or frequency of postulated accidents do not change, the expected duration of risk from a facility-specific accident scenario could be longer or shorter, depending on the case. The number of new facilities needed to meet the low-level waste management requirements could be affected by the minimum, maximum, and expected waste forecasts. Thus, the consequence or frequency of specific accident scenarios could be increased or decreased, depending on the case. Impacts for these cases will be addressed in the representative bounding accident descriptions.

Accident Scenario 1 -Container breach at the intermediate-level nontritium vault (two containers, noncombustible waste): This accident scenario is detailed in Section F.5.1.2. This accident scenario is considered the representative bounding accident for the anticipated accident range. Under the expected waste forecast, four additional intermediate-level waste vaults are expected to be required. For the minimum waste forecast with two additional intermediate-level waste vaults, it could be assumed that the frequency of this accident would be less than for the expected waste forecast. For the maximum waste forecast with nine additional intermediate-level waste vaults, it could be assumed that the frequency would be greater than for the expected waste forecast (i.e., more containers are at risk of a breach).

Accident Scenario 12 -Large fire at the Consolidated Incineration Facility: Most fires at the Consolidated Incineration Facility would be caused by welding, electrical shorts, friction, materials in contact with hot process equipment, and smoking. Other causes would include lightning and explosions. The consequences of such fires would be monetary losses, injuries and death to personnel, and

Figure F-4.

This accident scenario is considered the representative bounding accident for the unlikely accident range.

For alternative B -minimum, maximum, and expected waste forecasts, the Consolidated Incineration Facility would operate from 1996 to 2024 and the highest-risk accident in this frequency range would be Accident Scenario 13: High wind at the intermediate-level nontritium vault.

Accident Scenario 15 -Tornado [220 kilometers (137 miles) per hour] at the intermediate-level nontritium vault: This accident scenario is detailed in Section F.5.2.2 and is considered the representative bounding accident for the extremely unlikely accident range.

Accident Scenario 24 -Explosion of tanks associated with the Consolidated Incineration Facility: Tanks located in the vicinity of the Consolidated Incineration Facility include two liquid waste blend tanks. These 16-cubic-meter (4,200-gallon) tanks receive wastes from various sources and blend them to a proper viscosity and heating value prior to feeding into the rotary kiln. Each tank is fitted with an agitator that continually mixes the waste and a heater that maintains the temperature. Fuel in the form of liquid waste is always present in the tanks. Potential ignition sources include a malfunction of the agitator or heater. Such a malfunction would have to include disintegration of an agitator impeller or an electrical short in the heater that overrode thermostatic control. A transfer error could also be an ignition source if highly incompatible materials were introduced into a tank. Lightning could be an ignition source if the tank was not properly grounded. Simultaneously, a nitrogen blanketing system would have to fail and oxygen would have to be introduced into the tank head space for an explosion to occur. Failure of the nitrogen blanketing system initiates visual and audible alarms and stops all tank-feed and transfer operations. Once the blanketing system failed, there would be a period of time before enough oxygen could diffuse into the tank head space to cause an explosion. This accident scenario is considered the representative bounding accident for the beyond-extremely-unlikely accident range.

For alternative B -minimum, maximum, and expected waste forecasts, the Consolidated Incineration Facility is expected to operate from 1996 to 2024. Technical reports identified no accidents from 1994 to 1996.

F.5.2.3.2 Impacts from New or Proposed Facilities

Table F-8 identifies two proposed facilities under alternative B for which no quantitative accident analyses exist. These facilities are listed and briefly described below. Because these facilities are proposed and their designs are not necessarily complete, quantitative analyses at this time would provide non-meaningful risk information (because the designs could be changed) that could be compared to the risk information available for existing facilities. However, DOE will perform quantitative analyses throughout the design, construction, and operation phases of the soil sort facility in accordance with requirements, and DOE will ensure that the risks associated with operating these facilities are within established regulatory guidelines.

The soil sort facilitywould sort and segregate clean and contaminated soils. This facility would provide standard sand-and-gravel-handling equipment with instrumentation for monitoring radiation. Radiation detectors would divert contaminated material traveling along a conveyer system in a different direction from the clean soil. By locating small particles of radioactive material dispersed throughout the soil, contaminants could be isolated and removed. It is assumed that the Accidents at the soil sort facility would be bounded by the accidents selected for alternative B.

Offsite smelter -DOE is currently studying the use of an offsite smelter to determine the economic feasibility of recycling low-level contaminated stainless-steel scrap obtained during the decommissioning of retired SRS facilities. The intended end products of the stainless-steel recycling process are containers [2.83-cubic meter (100-cubic foot) boxes and 55-gallon drums] for the disposal or storage of radioactive waste originating within the DOE complex. Since no decisions on siting, configuration of equipment, or even whether the project would be completed have been made at this time, DOE assumes that Accidents involving an offsite smelter would be bounded by the accidents selected for alternative B.

Offsite low-level waste volume reduction ñ DOE plans to use an offsite vendor to supercompact, repackage, or incinerate low-level waste. None of the potential Accidents involving low-level waste identified in Table F-9 occurred at the compactor facilities. Accidents identified for low-level waste at the Consolidated Incineration Facility were not representative bounding accidents. Therefore, DOE assumes that accidents involving an offsite volume-reduction facility would be bounded by the accidents selected for alternative B.

F.5.2.4 Accident Analysis for Low-Level Waste Under Alternative A

Alternative A emphasizes a limited treatment configuration. Its accident analysis is the same as that for the no-action alternative. The facilities under alternative A are identical to the facilities identified to support the noaction alternative. The impacts from the postulated radiological accident scenarios are the same as described in Section F.5.2.2 (Figure F3).

F.5.2.5 Accident Analysis for Low-Level Waste Under Alternative C

Alternative C emphasizes an extensive treatment configuration. The facilities listed in Table F-8 for alternative C are similar to those that support alternative B for low-level waste, except that alternative C includes a proposed non-alpha vitrification facility. Since this facility does not present a representative bounding accident, the effects from the postulated radiological accident scenarios for alternative C are identical to those for alternative B, as described in Section F.5.2.3 (Figure F-4). A qualitative evaluation of the impacts associated with the non-alpha vitrification facility is as follows:

Non-alpha vitrification facility -The non-alpha vitrification facility would prepare waste for vitrification, vitrify it, and treat the secondary waste gases and liquids generated by the vitrification process. The waste would fall in the following treatability groups: soils, job-control waste, and equipment. The facility would consist of a thermal pretreatment unit, a melter, and an offgas treatment unit. The afterburner would enhance destruction of any remaining hazardous organic compounds prior to treatment in the offgas system. It can be assumed that the accident initiators for the non-alpha vitrification facility would be similar to those for the Defense Waste Processing Facility vitrification facility. However, the releases would be minor in comparison. It is also assumed that the offgas treatment unit Accidents would be similar to those for the F/H-Area Effluent Treatment Facility.

F.5.2.6 Impacts to Involved Workers from Accidents Involving Low-Level Waste

The representative bounding accident scenarios for low-level waste involve the intermediate level nontritium waste vaults, the long-lived waste storage buildings, and the Consolidated Incineration Facility. For the intermediate level nontritium vaults, scenarios involve a container rupture, a tornado, and a high wind accident scenario. For the container-rupture scenario, dose contribution from direct radiation exposure is not considered major because operations are carried out remotely. The following features are provided to control exposure and limit injuries to workers due to container rupture:

- The crane operator is shielded from waste containers.

- The crane operator has dosimetry with an audible alarm that sounds when a preset dose is reached.

- The waste container lifting-fixtures are remotely controlled from the crane control cab.

- Cell covers are installed over partially filled cells to provide radiation shielding.

- The cell cover lifting-fixture is remotely controlled from the crane control cab and the shielding plugs are remotely engaged and disengaged.

Because high winds and tornadoes can usually be predicted and proper precautions taken before major damage occurs, radiological and/or chemical effects to the facility workers due to high winds or tornadoes are considered to be minor. Procedures exist to discontinue operation and place waste containers in safe temporary storage areas in cases of inclement weather.

For the long-lived waste storage buildings accident scenario, a fire involving a dropped deionizer vessel was identified as the representative bounding accident. Although workers would only be expected to be in the immediate vicinity of the long-lived waste storage buildings during waste handling operations, they would be exposed to occupational and industrial types of injuries associated with a fire and could possibly receive a dose due to exposure to radioactive materials.

The accident scenarios for the Consolidated Incineration Facility involve a fire or explosion. The consequences to facility workers from either a fire or explosion in the immediate area include occupational and industrial types of injuries (possibly including death) as well as doses resulting from contact with radioactive materials.

While some exposure to involved workers could occur due to an accidental release of radioactive materials in all scenarios, DOE assumes no fatalities to workers would be likely from radiological consequences.

F.5.2.7 Impacts from Low-Level Waste Chemical Accidents

No chemical hazards assessment was performed for the low-level radioactive waste facilities. The chemical inventories for each facility that has hazard assessment documentation were compared to the reportable quantities as listed in 40 CFR Part 302.4. None of the facilities has sufficient quantities of hazardous chemicals to warrant a complete chemical analysis.

F.5.3 HAZARDOUS WASTE

<u>Identification of Hazardous Waste Facilities</u>

The accident analyses considered facilities and processes that support the management of hazardous waste. The facilities were identified from the hazardous waste information provided in Chapter 2.
Table F-12 lists the facilities associated with each of the alternatives. Descriptions of these facilities are provided in Appendix B.

Although Table F-12 identifies several nuclear facilities (e.g., Consolidated Incineration Facility), there are no radiological Accidents associated with hazardous waste. Radiological material with a hazardous waste component was identified as mixed waste and is addressed in Section F.5.4.

Since mixed waste facilities contain radioactive materials with a hazardous chemical component, and in some cases, results of the accident scenarios for mixed waste bound the chemical hazards at hazardous waste facilities, impacts from chemical hazards for hazardous waste are addressed in Section F.5.4.7 for mixed waste.

Table F-10. Representative bounding radiological accidents for low-level waste under the no-action alternative.

			Accident consequences				Point estimate of increased risk per yeara (increased risk of fatal cancers per occurrence)b Latent fatal cancers			
No.	Accident description	Frequency per year (accident range)	Uninvolved worker at 100 meters (rem)	Uninvolved worker at 640 meters (rem)	Offsite maximally exposed individual (rem)	Population within 80 kilometersc (person-rem)	Uninvolved worker at 100 meters	Uninvolved worker at 640 meters	Offsite maximally exposed individual	Population within 80 kilometers
1	Container breach at the ILNTVd	2.00E-02 (anticipated)	6.47E+01	2.30E+00	3.31E-02	1.68E+03	1.04E-03 (5.18E-02)	1.84E-05 (9.20E-04)	3.31E-07 (1.66E-05)	1.68E-02 (8.40E-01)
13	High wind at the ILNTVd	1.00E-03 (unlikely)	1.01E-03	6.08E-04	3.04E-04	2.11E+01	4.04E-10 (4.04E-07)	2.43E-10 (2.43E-07)	1.52E-10 (1.52E-07)	1.06E-05 (1.06E-02)
15	Tornado at the ILNTVd	2.00E-05 (extremely unlikely)	4.07E-04	7.73E-02	1.18E-02	1.18E+01	3.26E-12 (1.63E-07)	6.18E-10 (3.09E-05)	1.18E-10 (5.90E-06)	1.18E-07 (5.90E-03)

a. Point estimate of increased risk per year is calculated by multiplying the consequence (dose) ¥ latent cancer conversion factor ¥ annual frequency.

b. Increased risk of fatal cancers per occurrence is calculated by multiplying the consequence (dose) ¥ latent cancer conversion factor.

c. A conservative assumption of 99.5 percentile meteorology was assumed for determining accident consequences for the exposed population within 80 kilometers. A less conservative meteorology (50 percentile) was used to determine the accident consequences for exposed individuals.

d. Intermediate-Level Non-Tritium Vault.

Table F-11. Representative bounding radiological accidents for low-level waste under alternative B.

No.	Accident description	Frequency per year (accident range)	Accident consequences: Uninvolved worker at 100 meters (rem)	Uninvolved worker at 640 meters (rem)	Offsite maximally exposed individual (rem)	Population within 80 kilometersc (person-rem)	Point estimate of increased risk per yeara (increased risk of fatal cancers per occurrence)b — Latent fatal cancers: Uninvolved worker at 100 meters	Uninvolved worker at 640 meters	Offsite maximally exposed individual	Population within 80 kilometers
1	Container breach at the ILNTVd	2.00E-02 (anticipated)	6.47E+01	2.30E+00	3.31E-02	1.68E+03	1.04E-03 (5.18E-02)	1.84E-05 (9.20E-04)	3.31E-07 (1.66E-05)	1.68E-02 (8.40E-01)
12	Large fire at CIFe	2.34E-04 (unlikely)	2.55E+00	8.15E-02	1.40E-03	9.58E+01	2.39E-07 (1.02E-03)	7.63E-09 (3.26E-05)	1.64E-10 (7.00E-07)	1.12E-05 (4.79E-02)
15	Tornado at the ILNTVd	2.00E-05 (extremely unlikely)	4.07E-04	7.73E-02	1.18E-02	1.18E+01	3.26E-12 (1.63E-07)	6.18E-10 (3.09E-05)	1.18E-10 (5.90E-06)	1.18E-07 (5.90E-03)
24	Explosion at CIFe - tank farm	3.40E-07 (beyond-extremely-unlikely)	1.28E+00	4.07E-02	7.01E-04	4.79E+01	1.74E-10 (5.12E-04)	5.54E-12 (1.63E-05)	1.19E-13 (3.51E-07)	8.14E-09 (2.40E-02)

a. Point estimate of increased risk per year is calculated by multiplying the consequence (dose) ¥ latent cancer conversion factor ¥ annual frequency.

b. Increased risk of fatal cancers per occurrence is calculated by multiplying the consequence (dose) ¥ latent cancer conversion factor.

c. A conservative assumption of 99.5 percentile meteorology was assumed for determining accident consequences for the exposed population within 80 kilometers. A less conservative meteorology (50 percentile) was used to determine the accident consequences for exposed individuals.

d. Intermediate-Level Non-Tritium Vault.

e. Consolidated Incineration Facility.

Table F-12. Hazardous waste facilities identified by alternative.

List of facilities	No-action alternative	Alternative A (limited treatment configuration)	Alternative C (extensive treatment configuration)	Alternative B (moderate treatment configuration)
Hazardous wasteHazardous waste storage facilities	X	X	X	X

M-Area Air Stripper	X	X	X	X
Recycle units[a]	X	X	X	X
Containment building[b,c]			X	
Non-alpha vitrification facility[b]			X	
Consolidated Incineration Facility		X	X[d]	X

a. Recycle units include silver recovery, refrigerant recycle, lead melter, and solvent distillation. These units do not have quantitative or qualitative accident analyses available. Accidents for recycle units are assumed to be bounded by the accident scenarios selected for this alternative.

b. Proposed facility.

c. Accidents for the containment building are assumed to be the same as those identified for the Hazardous Waste/Mixed Waste Treatment Building identified in the technical report presenting accident analyses for solid wastes (WSRC 1994c).

d. Facility operates until proposed facility comes on line.

F.5.4 MIXED WASTE

The following evaluation addresses the impacts of postulated Accidents associated with the alternatives considered in this eis for the management of mixed waste.

F.5.4.1 Facilities and Accidents: Mixed Waste

The accident analyses considered facilities and processes that support the management of mixed waste. The facilities were identified from the mixed waste information provided in Chapter 2. Table F-13 lists the facilities associated with each of the alternatives. Descriptions of these facilities are provided in Appendix B. For each facility, a list of postulated-accident scenarios was developed to support the accident analysis for each mixed waste alternative. Accidents for RCRA disposal are assumed to be the same as those identified for the Hazardous Waste/Mixed Waste Disposal Facility vaults. The design of these vaults (concrete vaults with temporary steel covers) and their operations (waste containers are transferred from trucks to the vaults via overhead crane) are similar to that of the intermediate-level waste vaults. The postulated-accident scenarios for the intermediate-level nontritium vaults are assumed to bound the impacts of postulated Accidents for RCRA disposal.

Table F-14 lists potential Accidents . This information was extracted from the technical reports supporting this eis (WSRC 1994b, c, and e). While all the accidents listed in Table F-14 are supported by quantitative analyses, they are not listed in this table because accident impacts for proposed facilities are mainly qualitative.

Table F-13. Mixed-waste facilities identified by alternative.

List of facilities area[a]	No-action alternative	Alternative A (limited treatment configuration)	Alternative C (extensive treatment configuration)	Alternative B (moderate treatment configuration)
Organic waste storage tank	X	X	X	X
F/H-Area Effluent Treatment Facility	X	X	X	X
Mixed waste storage facilities	X	X	X	X
Solvent storage tanks S29-S30 and S33-S36	X	X	X	X
Aqueous and Organic waste storage tanks	X			
SRTC mixed waste storage tanks exchange	X	X	X	X
M-Area Vendor Treatment Facility	X	X	X	X
RCRA disposal[a]	X	X	X	X
Process Waste Interim Treatment Facility (Bldg. 3411M)		X	X	X
Containment building[b,c]		X	X	X
Non-alpha vitrification facility[b]			X	X
Soil sort facility[b]		X		
Consolidated Incineration Facility		X	X[d]	X
Dilute Effluent Treatment Facility (Bldg. 341-M)		X	X	X

a. Accidents for Resource Conservation and Recovery Act (RCRA) disposal are assumed to be the same as those identified for the Hazardous Waste/Mixed Waste Disposal Facility vaults identified in the technical report (WSRC 1994c).

b. Proposed facility.

c. Accidents for the containment building are assumed to be the same as those identified for the Hazardous Waste/Mixed Waste Treatment Building identified in the technical report presenting accident analyses for solid wastes (WSRC 1994c).

d. Facility operates until proposed facility comes on line.

F.5.4.2 Accident Analysis for the Mixed Waste No-Action Alternative

This section addresses the impacts of postulated accidents associated with the noaction alternative for treating mixed waste. The postulated accidents provide a baseline for comparison of the effects of the postulated accident associated with the action alternatives.

Table F-14. List of potential Accidents associated with the management of mixed waste.

No.	Accident description	Annual frequency	Dosea (rem)	RiskRisk (rem/yr)
1	Container breach at the eaV/ILNTVb	2.00E-02	2.63E-01	5.26E-03
2	Fire at the eaV/ILNTVb	8.30E-02	8.60E-03	7.14E-04
3	Excessive open containers at the containment building	1.00E-02	5.68E-02	5.68E-04
4	Release due to multiple open containers at the containment building	3.00E-03	6.81E-02	2.04E-04
5	Excessive inventory at the containment building	5.00E-03	3.20E-02	1.60E-04
6	Earthquake at the containment building	1.50E-03	6.20E-02	9.30E-05
7	Drum spill and tritiumtritium release at the containment building	5.00E-03	1.60E-02	8.00E-05
8	Tornado at the containment building	2.00E-02	3.05E-03	6.10E-05
9	Release due to one open container at the containment building	7.74E-03	6.20E-03	4.80E-05
10	Evaporation/dispersal of two to ten containers at the containment building	2.00E-04	6.00E-02	1.20E-05
11	Earthquake at the SRTCc storage tanks	2.00E-04	5.84E-02	1.17E-05
12	F2 tornado at Building 316-M	1.12E-04	5.67E-02	6.35E-06
13	Earthquake (0.04g) at Building 316-M	2.00E-03	1.65E-03	3.30E-06
14	F3 tornado at Building 316-M	2.80E-05	1.18E-01	3.30E-06
15	High wind at the containment building	2.00E-02	1.53E-04	3.06E-06
16	Large fire for entire CIFd	2.34E-04	1.07E-02	2.50E-06
17	F4 tornado at Building 316-M	3.50E-06	4.72E-01	1.65E-06
18	Drop/Spill/Leak at the SRTCc storage tanks	1.50E-02	6.52E-05	9.77E-07
19	High wind at the eaV/ILNTVb	1.00E-03	3.40E-04	3.40E-07
20	Earthquake at CIFd	1.00E-03	2.65E-04	2.65E-07
21	Explosion at CIFd - rotary kiln	1.50E-04	1.57E-03	2.36E-07
22	Tornado at the eaV/ILNTVb	2.00E-05	1.18E-02	2.36E-07
23	High velocity straight winds at CIFd	2.00E-02	5.23E-06	1.05E-07
24	Explosion at the containment building containment buildingreleasing 50 percent of tritiumtritium inventory	1.00E-06	5.58E-02	5.58E-08
25	Fire at the containment building containment buildingreleasing 50 percent of tritiumtritium inventory	1.00E-06	5.58E-02	5.58E-08
26	Release at Building 341-1M Building due to earthquake	2.00E-04	1.54E-04	3.08E-08
27	Explosion at CIFd - backhoe housing	4.00E-04	5.64E-05	2.26E-08
28	Normal processing with tritiumtritium ETFe airborne release due to straight wind	1.20E-03	1.47E-05	1.76E-08
29	Normal processing other than tritiumtritium ETFe airborne release due to straight wind	1.20E-03	1.46E-05	1.75E-08

30	Rainwater flooding at the containment building	1.00E-06	1.60E-02	1.60E-08
31	Normal processing with tritiumtritium ETFh liquid release due to straight wind	1.20E-03	9.40E-06	1.13E-08
32	Aircraft crash into the containment building	1.60E-07	6.78E-02	1.08E-08
33	Normal processing other than tritiumtritium ETFe liquid release due to straight wind	1.20E-03	7.70E-06	9.24E-09
34	Normal processing with tritiumtritium ETFe airborne release due to tornado	4.50E-05	2.04E-04	9.18E-09
35	Normal processing other than tritiumtritium ETFe airborne release due to tornado	4.50E-05	2.03E-04	9.14E-09
36	Normal processing with tritiumtritium ETFe airborne release due to earthquake	2.00E-04	2.77E-05	5.54E-09

Table F-14. (continued).

No.	Accident description	Annual frequency	Dosea (rem)	RiskRisk (rem/yr)
37	Normal processing with tritiumtritium ETFe liquid release due to earthquake	2.00E-04	9.40E-06	1.88E-09
38	Explosion at CIFd - tank farm tank	3.40E-07	5.36E-03	1.82E-09
39	Normal processing other than tritiumtritium ETFe liquid release due to earthquake	2.00E-04	7.70E-06	1.54E-09
40	Explosion at CIFd - tank farm sump and diked area	1.90E-07	6.85E-03	1.30E-09
41	Normal processing other than tritiumtritium ETFe airborne release due to earthquake	2.00E-04	2.50E-06	5.00E-10
42	Design basis ETFe liquid release due to straight wind	9.84E-06	4.70E-05	4.62E-10
43	Normal processing with tritiumtritium ETFe liquid release due to tornado	4.50E-05	9.40E-06	4.23E-10
44	Normal processing other than tritiumtritium ETFe liquid release due to tornado	4.50E-05	7.70E-06	3.47E-10
45	Design basis ETFe airborne release due to straight wind	9.84E-06	1.12E-05	1.10E-10
46	Design basis ETFe airborne release due to tornado	3.69E-07	2.83E-04	1.04E-10
47	Normal processing with tritiumtritium ETFe airborne release due to transfer error	1.80E-02	4.46E-09	8.03E-11
48	Design basis ETFe liquid release due to earthquake	1.64E-06	4.70E-05	7.71E-11
49	Normal processing with tritiumtritium ETFe airborne release due to corrosion damage	8.80E-02	8.75E-10	7.70E-11
50	Normal processing other than tritiumtritium ETFe airborne release due to transfer error	1.80E-02	1.72E-09	3.10E-11
51	Normal processing other than tritiumtritium ETFe airborne release due to corrosion damage	8.80E-02	3.38E-10	2.97E-11
52	Design basis ETFe airborne release due to leaks	2.13E-02	1.35E-09	2.88E-11
53	Release at DETFf due to earthquake	2.00E-03	1.17E-08	2.34E-11

54	Design basis ETFe airborne release due to overflow	1.48E-03	1.44E-08	2.13E-11
55	Design basis ETFe liquid release due to tornado	3.69E-07	4.70E-05	1.73E-11
56	Design basis ETFe airborne release due to earthquake	1.64E-06	8.40E-06	1.38E-11
57	Normal processing with tritiumtritium ETFe airborne release due to a siphoning incident	2.60E-03	1.12E-09	2.91E-12
58	Design basis ETFe airborne release due to spill	1.48E-03	1.88E-09	2.78E-12
59	Normal processing other than tritiumtritium ETFe airborne release due to siphoning incident	2.60E-03	4.34E-10	1.13E-12
60	Design basis ETFe airborne release due to transfer error	1.48E-04	6.86E-09	1.02E-12
61	Design basis ETFe airborne release due to corrosion damage	7.22E-04	1.35E-09	9.75E-13
62	Design basis ETFe airborne release due to a siphoning incident	2.13E-05	1.73E-09	3.68E-14

a. The dose given is for the offsite maximally exposed individual using 99.5 percentile meteorology.

b. Intermediate-level nontritium vault.

c. Savannah River Technology Center.

d. Consolidated Incineration Facility.

e. F/H-Area Effluent Treatment Facility.

f. Dilute Effluent Treatment Facility (Bldg. 341-M).

Table F-15. Representative bounding radiological accidents for the no-action alternative for mixed wastes.

			Accident consequences				Point estimate of increased risk per yeara (increased risk of fatal cancers per occurrence)[b] Latent fatal cancers			
No.	Accident description	Frequency per year (accident range)	Uninvolved worker at 100 meters (rem)	Uninvolved worker at 640 meters (rem)	Offsite maximally exposed individual (rem)	Population within 80 kilometersc (person-rem)	Uninvolved worker at 100 meters	Uninvolved worker at 640 meters	Offsite maximally exposed individual	Population within 80 kilometers
1	Container breach at the ILNTV[d]	2.00E-02 (anticipated)	6.47E+01	2.30E+00	3.31E-02	1.68E+03	1.04E-03 (5.18E-02)	1.84E-05 (9.20E-04)	3.31E-07 (1.66E-05)	1.68E-02 (8.40E-01)
11	Earthquake at the SRTC[e] Storage Tanks	2.00E-04 (unlikely)	6.00E+00	1.92E-01	8.06E-03	3.60E+01	4.80E-07 (2.40E-03)	1.54E-08 (7.68E-05)	8.06E-10 (4.03E-06)	3.60E-06 (1.80E-02)

14	F3 tornadof at Building 316-M	2.80E-05 (extremely unlikely)	4.78E-04	1.15E-01	1.18E-01	7.98E-02	5.35E-12 (1.91E-07)	1.29E-09 (4.60E-05)	1.65E-09 (5.90E-05)	1.12E-09 (3.99E-05)
46	Design basis ETF[g] airborne release due to tornado	3.69E-07 (beyond-extremely-unlikely)	2.17E-03	6.91E-05	3.90E-05	3.44E-04	3.20E-13 (8.68E-07)	1.02E-14 (2.76E-08)	7.20E-15 (1.95E-08)	6.35E-14 (1.72E-07)

a. Point estimate of increased risk per year is calculated by multiplying the consequence (dose) ¥ latent cancer conversion factor ¥ annual frequency.

b. Increased risk of fatal cancers per occurrence is calculated by multiplying the consequence (dose) ¥ latent cancer conversion factor.

c. A conservative assumption of 99.5 percentile meteorology was assumed for determining accident consequences for the exposed population within 80 kilometers. A less conservative meteorology (50 percentile) was used to determine the accident consequences for exposed individuals.

d. Intermediate-Level Non-Tritium Vault.

e. Savannah River Technology Center.

f. F3 tornadoes have rotational wind speeds of 254 to 331 kilometers (158 to 206 miles) per hour.

g Effluent Treatment Facility.

Table F-16. Representative bounding radiological accidents for mixed wastes under alternative B.

			Accident consequences				Point estimate of increased risk per yeara (increased risk of fatal cancers per occurrence)b Latent fatal cancers			
No.	Accident description	Frequency per year (accident range)	Uninvolved worker at 100 meters (rem)	Uninvolved worker at 640 meters (rem)	Offsite maximally exposed individual (rem)	Population within 80 kilometersc (person-rem)	Uninvolved worker at 100 meters	Uninvolved worker at 640 meters	Offsite maximally exposed individual	Population within 80 kilometers
1	Container breach at the ILNTVd	2.00E-02 (anticipated)	6.47E+01	2.30E+00	3.31E-02	1.68E+03	1.04E-03 (5.18E-02)	1.85E-05 (9.20E-04)	3.31E-07 (1.66E-05)	1.68E-02 (8.40E-01)
4	Release due to multiple open containers at the containment building	3.00E-03 (unlikely)	3.91E-01	5.76E-01	8.13E-03	3.80E+02	4.69E-07 (1.56E-04)	6.91E-07 (2.30E-04)	1.22E-08 (4.07E-06)	5.70E-04 (1.90E-01)
14	F3 tornadoe at Building 316-M	2.80E-05 (extremely unlikely)	4.78E-04	1.15E-01	1.18E-01	7.98E-02	5.35E-12 (1.91E-07)	1.29E-09 (4.60E-05)	1.65E-09 (5.90E-05)	1.12E-09 (3.99E-05)

32	Aircraft crash at the containment building	1.60E-07 (beyond-extremely-unlikely)	1.52E+01	5.41E-01	8.32E-03	3.99E+02	9.73E-10 (6.08E-03)	3.46E-11 (2.16E-04)	6.66E-13 (4.16E-06)	3.19E-08 (2.00E-01)

a. Point estimate of increased risk per year is calculated by multiplying the consequence (dose) ¥ latent cancer conversion factor ¥ annual frequency.

b. Increased risk of fatal cancers per occurrence is calculated by multiplying the consequence (dose) ¥ latent cancer conversion factor.

c. A conservative assumption of 99.5 percentile meteorology was assumed for determining accident consequences for the exposed population within 80 kilometers. A less conservative meteorology (50 percentile) was used to determine the accident consequences for exposed individuals.

d. Intermediate-Level Non-Tritium Vault.

e. F3 tornadoes have rotational wind speeds of 254 to 331 kilometers (158 to 206 miles) per hour.

F.5.4.2.1 Impacts from Postulated Radiological Accidents

From the list of potential radiological Accidents presented in Table F-14, the representative bounding accident scenarios were identified for the noaction alternative using the binning process described in Section F.4.1. Figure F-5 shows the highest-risk accident scenarios for the various frequency ranges for the no-action alternative. As shown in Figure F-5, the accidents associated with mixed waste are analyzed over a broad spectrum of consequences and frequencies. The accident scenarios postulated for the F/H-Area Effluent Treatment Facility generally present lower consequences, while accident scenarios postulated for vault disposal facilities generally present higher consequences. Table F15 lists the representative bounding accidents, accident consequences, and latent fatal cancers for exposed workers and the public.

Accident Scenario 1 -Container breach at the intermediate-level nontritium vault (two containers, noncombustible waste): This accident scenario is detailed in Section F.5.2.2 and is assumed to be representative of a mixed waste accident for vault disposal.

Accident Scenario 11 -Earthquake at the Savannah River Technology Center storage tanks: The earthquake (greater than 0.2g) is assumed to impose reaction loads on the above-grade confinement structure and damage the structure. The below-grade structures, including the tank cells, are expected to respond with the ground motion, so major damage is considered unlikely. Similarly, because of their wall thickness [1.27 centimeters (0.5 inch) stainless steel], short height [3.35 to 3.96 meters (11 to 13 feet)], and small diameter [3 to 3.66 meters (10 to 12 feet)], it is unlikely that the tanks would rupture. However, in this scenario, the tank and cell exhaust filtration is assumed to be disrupted. This disruption is accounted for by assuming that the inventory of two 13.6-cubic-meter (3,600gallon) high-activity waste tanks is available for airborne release. It is estimated that 0.1 percent of the radionuclides contained in the tank becomes airborne.

Accident Scenario 14 -F3 tornado at Building 316-M: Building 316-M (mixed waste storage building) is an outdoor storage area on a concrete base, with a roof and no sidewalls. Waste is stored in approved containers, generally 55-gallon drums and large steel boxes. Based on a similar analysis for the Burial Ground, an F3 tornado [a tornado with rotational windspeeds of 254 to 331 kilometers (158 to 206 miles) per hour] is assumed to rupture 25 percent of the drums. It is assumed that 100 percent of the drum contents could be scattered.

Accident Scenario 46 -Design basis F/H-Area Effluent Treatment Facility airborne release due to tornado: This accident scenario is detailed in Section F.5.1.2.1.

Figure F-5.

F.5.4.2.2 Impacts from New or Proposed Facilities

Table F-13 identifies no new or proposed facilities for the hazardous and mixed waste no-action alternative.

F.5.4.3 Accident Analysis for the Mixed Waste Under Alternative B

This section addresses the impacts of postulated Accidents associated with alternative B for mixed wastes.

F.5.4.3.1 Impacts from Postulated Radiological Accidents

This section presents potential effects from postulated radiological Accidents at facilities identified in Table F-13 for the management of mixed waste under alternative B. Figure F6 shows the highest-risk accident scenarios for the various frequency ranges. As shown in Figure F-6, the accidents associated with mixed waste are analyzed over a broad spectrum of consequences and frequencies. The accident scenarios postulated for the F/H-Area Effluent Treatment Facility generally present lower consequences, while accident scenarios postulated for vault disposal facilities generally present higher consequences. Table F16 lists the representative bounding accidents, accident consequences, and latent fatal cancers for exposed workers and the public for alternative B. DOE assumes that conclusions regarding representative bounding accident scenarios could change based on the minimum, maximum, and expected waste forecasts. The accident analyses for the accident scenarios are based on a conservative assumption of peak utilization of facilities [i.e., the minimum, maximum, and expected waste forecasts would only affect how long the facilities (e.g., the Consolidated Incineration Facility)] would operate. Therefore, while the consequence or frequency for postulated accidents do not change, the expected duration of risk from a facility-specific accident scenario could be longer or shorter, depending on the case. The number of new facilities needed to meet the mixed waste management requirements could be affected by the minimum, maximum, and expected waste forecasts. Thus, the consequence or frequency for specific accident scenarios could be increased or decreased, depending on the case. Impacts for the three cases are addressed in the representative bounding accident descriptions.

Figure F-6.

The representative bounding Accidents and their impacts under the alternative B are briefly described below:

Accident Scenario 1 -Container breach at the intermediate-level nontritium vault (two containers, noncombustible waste): This accident scenario is described in Section F.5.2.2 and is considered to be the representative bounding accident for the anticipated accident range.

Accident Scenario 4 -Release due to multiple (2 to 10) open containers at the containment building: The consequences of this accident scenario are bounded by the worst unmitigated accident scenario where the ventilation and scrubber systems of the containment building are assumed to fail. This accident scenario is considered the representative bounding accident for the unlikely accident range. Under the minimum, maximum, and expected waste forecasts, the containment building is expected to operate from 2006 to 2024. From 1994 to 2006 -- when the containment building is not operational -- the highest-risk accident in this frequency range would be Accident Scenario 18: Earthquake at the Savannah River Technology Center Storage Tanks.

Accident Scenario 14 -F3 tornado at Building 316-M: This accident scenario is detailed in Section F.5.4.2.1 and is considered the representative bounding accident for the extremely unlikely accident range. Utilization of this facility is expected to be the same under the minimum, maximum, and expected waste forecasts.

Accident Scenario 32 -Aircraft crash at the containment building: An aircraft could breach only that part of the containment building into which it crashes. DOE assumes that the consequences associated with this event are the same as for the worst unmitigated accident event for the entire containment building. Thus, whether one or all segments in the containment building are breached due to an aircraft crash, the consequences listed for this scenario are considered to be bounding. This accident scenario is considered the representative bounding accident for the beyond-extremely-unlikely-accident range. Under the minimum, maximum, and expected waste forecasts, the containment building is expected to operate from 2006 to 2024. From 1994 to 2006, the next highest risk accident in this frequency range would be Accident Scenario 50: Explosion at the Consolidated Incineration Facility tank farm sump and diked area.

F.5.4.3.2 Impacts from New or Proposed Facilities

Table F-13 identifies three proposed facilities under alternative B for which no quantitative accident analyses exist. Accidents associated with the soil sort facilityare described in Section F.5.2.3.2 and with the non-alpha vitrification facility in Section F.5.2.5.

F.5.4.4 Accident Analysis for Mixed Waste Under Alternative A

The facilities listed in Table F-13 for alternative A are identical to those that support alternative B, except that alternative A does not include the non-alpha vitrification facility. Since this facility was not involved in the representative bounding accident, the effects from the postulated radiological accident scenarios for alternative A are identical to those described in Section F.5.4.3.

F.5.4.5 Accident Analysis for Mixed Waste Under Alternative C

The facilities listed in Table F-13 for alternative C are similar to those that support alternative B for mixed waste, except that the Consolidated Incineration Facility does not operate for the entire 30-year period under alternative C. Since this facility was not involved in the representative bounding accident, the effects from the postulated radiological accident scenarios for alternative C are identical to those described in Section F.5.4.3.

F.5.4.6 Impacts to Involved Workers from Accidents Involving Mixed Waste

The mixed waste Accidents that have the highest risks involve the containment building. The accident initiators (aircraft crash, explosion, or tornado) are considered to be more dangerous to the worker than the resulting release of contaminants. The other accident scenarios (transfer errors or container damage) are not expected to cause serious injury to workers, because the operators will be equipped with a breathing supply via an air compressor airflow. An emergency supply of breathing air is provided for each worker from high pressure breathing air cylinders permanently connected to the breathing air systems.

F.5.4.7 Impacts from Mixed Waste Chemical Accidents

Because the mixed waste facilities contain radioactive materials with a hazardous chemical component, the results of the mixed waste accident scenarios bound the chemical hazards at hazardous waste facilities. This section discusses the chemical hazards for mixed wastes, as well as those for hazardous wastes.

A chemical hazards analysis was performed for the Consolidated Incineration Facility as part of a safety analysis report. The basis for this analysis was that the chemical inventory would be such that an unmitigated release of all the material in one section of the facility would result in concentrations of chemicals at 100 meters (328 feet) less than one-half the concentration that is immediately dangerous to life and health (IDLH). The Consolidated Incineration Facility is considered a low hazard facility. The criteria for being a low hazard facility include the requirement that the nonradiological consequences associated with the highest accident frequencies are no greater than the specified IDLH value at 100 meters and 10 percent of the specified IDLH value at the SRS boundary. As reported in the technical report (WSRC 1994c), if releases are maintained below the IDLH onsite criterion, the releases are automatically below the IDLH offsite criterion. Since chemical inventories are controlled such that the worst-case nonradiological consequences can be no greater than 50 percent of the specified IDLH value at 100 meters (328 feet), both criteria are satisfied for the Consolidated Incineration Facility. As a result, further analysis is not necessary.

Preliminary chemical hazards analyses were performed for the E-Area mixed waste storage building, the NArea mixed waste and hazardous waste storage buildings, and the B-Area hazardous waste storage building to determine the hazard categorization for each facility. The NArea mixed waste and hazardous waste storage buildings have an inventory that bounds the EArea mixed waste storage building and the BArea hazardous waste storage building. The N-Area chemicals requiring further analysis to determine the potential consequences of their accidental release are listed in Table F-17. This table provides the maximum onsite and offsite airborne concentrations resulting from a postulated release of chemical inventory.

The Organic Waste Storage Tank associated with the Defense Waste Processing Facility would be the primary facility for the storage of benzene mixed waste. Benzene that has been separated from a precipitate slurry by distillation in the Defense Waste Processing Facility would be transferred approximately 112.7 meters (370 feet) to the Organic Waste Storage Tank in an above-ground pipe. Consequently, an explosion could occur in either the inner or outer tank or as a result of a benzene leak during a transfer. An explosion in either tank would occur if the oxygen concentration in the tank vapor space reaches the minimum required for combustion and the benzene vapor is ignited. A benzene release from the transfer line would form a pool on the ground, which would evaporate and form a vapor cloud. If ignited, the explosion of the vapor cloud could cause the Organic Waste Storage Tank to explode.

In a tornado scenario, the Organic Waste Storage Tank is assumed to catastrophically fail as the result of a tornado-generated missile. As the benzene leaves the tank, "splashing" occurs, causing a fraction of the benzene to become an aerosol. The released benzene forms a pool [122 meters by 122 meters (400 feet by 400 feet)] bounded by the drainage ditch that surrounds the organic waste storage tank site. The tornado is assumed to remain in the vicinity of the pool for one minute. The evaporation rate from the pool during this minute is based on a tornado wind speed of 177 kilometers (110 miles) per hour.

Following the tornado, evaporation from the pool continues over the next 4 minutes under normal wind conditions of 10 miles per hour. It is assumed that after 5 minutes from the initial failure of the Organic Waste Storage Tank, the released benzene has completely drained to the drainage ditch. It is also assumed that normal wind conditions continue for the remainder of the event. Table F18 presents the results for the two postulated Organic Waste Storage Tank chemical accident scenarios.

Safety documentation does not analyze potential events involving hazardous materials at MArea facilities. Using the methodology described in Section F.4.2 for M-Area facilities, it was determined that the inventory of sulfuric acid located in the Dilute Effluent Treatment Facility (341M) would be the only chemical present in sufficient quantities to warrant further evaluation. This accident scenario assumed an unmitigated liquid spill of the entire inventory of sulfuric acid at 341-M, with a resulting pool covering 77 square meters (829 square feet) at a depth of 1 centimeter (0.39 inch). The evaporation rate for this liquid spill was estimated to be 2.01E-05 grams per second at standard pressure and temperature. The results of this chemical analysis are presented in Table F-19.

Table F-17. Mixed/hazardous waste chemical hazards analysis results.

Chemical	Quantity (kg)[b]	Onsite concentration 100 meters (328 feet) (mg/m3)[c]	Offsite Concentration (mg/m3)[c]	ERPG-1[d] (mg/m3)[c]	ERPG-2[d] (mg/m3)[c]	ERPG-3[d] (mg/m3)[c]
Arsenic	1.03E+03	4.5E-01	2.8E-04	6.00E-01	1.00E+00	1.00E+02
Benzene	3.0E+03	6.7E+02	4.2E-01	1.60E+01	1.60E+02	9.58E+03

Beryllium	1.0E+01	4.4E-03	2.8E-06	5.00E-03	1.00E-02	1.00E+01
Cadmium	6.0E+03	2.7E+00	1.7E-03	1.50E-01	2.50E-01	5.00E+02
Chromium	6.1E+03	2.7E+00	1.7E-03	1.50E+00	2.50+00	(e)
Lead	3.6E+05	1.6E+02	1.0E-01	1.50E-01	2.50E-01	7.00E+02
Mercury	3.4E+04	1.5E+01	9.4E-03	1.50E-01	2.00E-01	2.80E+01
Methyl chloride	6.5E+02	2.9E+02	1.8E-01	2.07E+02	4.13E+02	2.07E+04
Methylethylketone	8.0E+03	1.8E+03	1.1E+00	8.85E+02	2.95E+03	8.85E+03
Nickel	2.8E+01	4.4E-02	2.8E-05	3.00E+00	5.00E+00	(e)
Silver	1.1E+03	4.7E-01	3.0E-04	3.00E-01	5.00E-01	(e)
Trichloroethane	7.8E+04	3.5E+02	2.2E-01	1.91E+03	5.46E+03	1.64E+04
Xylene	3.3E+03	1.6E+01	9.9E-03	4.34E+02	8.69E+02	4.34E+03

a. The chemicals presented in this table are those for which concentration guidelines were available.

b. Kilograms. To convert to pounds, multiply by 2.2046.

c. Milligrams per cubic meter of air.

d. Emergency Response Planning Guideline. See Table F-3.

e. No equivalent value found.

Table F-18. Chemical hazards Accidents analysis results for the Organic Waste Storage Tank.

Accident description	Annual frequency	100-meter concentration (mg/m3)a	640-meter concentration (mg/m3)	Offsite concentration (mg/m3)	ERPG-1b (mg/m3)	ERPG-2 (mg/m3)	ERPG-3 (mg/m3)
Explosion at the OWSTc	2.70E-04	1.40E+04	6.10E+02	5.70E+00	1.60E+01	1.60E+02	9.60E+03
Tornado at the OWST	1.00E-04	1.02E+04	1.21E+03	1.54E+01	1.60E+01	1.60E+02	9.60E+03

a. Milligrams per cubic meter of air.

b. Emergency Response Planning Guideline. See Table F-3.

c. Organic Waste Storage Tank.

Table F-19. Chemical hazards analysis results for the 341-M facility.

Chemical	Inventory (kilograms)a	100-meter concentration (mg/ m)b	640-meter concentration (mg/ m)b	Offsite concentration (mg/ m)b	ERPG-1c (mg/ m)b	ERPG-2c (mg/ m)b	ERPG-3c (mg/ m)b
Sulfuric acid	1.52E+04	9.10E-06	7.70E-07	2.70E-07	2.00E+00	1.00E+01	3.00E+01

a. To convert to pounds, multiply by 2.2046.

b. Milligrams per cubic meter of air.

c. Emergency Response Planning Guideline. See Table F-3.

F.5.5 TRANSURANIC AND ALPHA WASTE

The following sections address the impacts of postulated Accidents associated with the alternatives considered in this eis for the management of transuranic and alpha waste.

F.5.5.1 Facilities and Accidents: Transuranic and Alpha Waste

The accident analyses considered all facilities and processes involved in the management of transuranic and alpha waste. The facilities were identified from the transuranic waste information provided in Chapter 2. Table F-20 lists the facilities associated with each of the alternatives. Descriptions of these facilities are provided in Appendix B. For each facility, a list of postulated accident scenarios was developed to support the accident analysis for transuranic waste for each alternative.

Table F-21 lists potential accidents. This information was extracted from the technical reports supporting this eis (WSRC 1994b, c, and e). While all the accidents listed in Table F-21 are supported by quantitative analyses, accident impacts for proposed facilities are not listed in the table because they are mainly qualitative.

Table F-20. Transuranic and alpha waste facilities identified by alternative.

a. Accidents for Resource Conservation and Recovery Act (RCRA) disposal are assumed to be bounded by the accident scenarios associated with the transuranic waste storage pads.

b. Proposed facility.

c. Accidents for the transuranic waste characterization/certification facility are assumed to be the same as the accident scenarios described in the Transuranic Waste Facility Preliminary Safety Analysis Report identified in the WSRC technical report presenting accident analyses for solid wastes (WSRC 1994c).

Table F-21. List of potential accidents associated with the management of transuranic waste.

List of facilities area	No-action alternative	Alternative A (limited treatment configuration)	Alternative C (extensive treatment configuration)	Alternative B (moderate treatment configuration)
Low-activity waste vaults	X	X	X	X
Transuranic and alpha waste storage pads	X	X	X	X
Experimental Transuranic Waste Assay Facility/ Waste Certification Facility	X			
RCRA disposal[a]		X	X	X
Alpha vitrification facility[b]			X	X
Consolidated Incineration Facility			X	
Transuranic waste characterization/certification facility[b,c]		X	X	X

No.	Accident description	Annual frequency	Dose[a] (rem)	RiskRisk (rem/yr)
1	Deflagration in culvert during TRU[b] retrieval activities	1.00E-02	4.56E-01	4.56E-03
2	Fire at the ea V/LAWV[c]	8.30E-02	3.55E-02	2.95E-03
3	Fire in culvert - TRU[b] storage pads	8.10E-04	1.94E+00	1.57E-03
4	Drum breach due to culvert overturn during TRU retrieval activities	4.00E-02	2.28E-02	9.12E-04
5	Container breach at the ea V/LAWV[c]	2.00E-02	4.00E-02	8.00E-04
6	Fire from all causes - TRU[b] storage pads	2.60E-03	7.52E-02	1.96E-04
7	Vehicular crash - TRU[b] storage pads	2.60E-03	6.84E-02	1.78E-04
8	Drum rupture on the TRU[b] storage pads (internally induced)	2.10E-02	5.70E-03	1.20E-04
9	Drum breach/fall of unlined drums during TRU[b] retrieval activities	7.20E-02	1.10E-01	7.92E-05
10	Fire in the TRU[b] waste characterization/certification facility w/o HEPA[d] bypass	6.00E-03	9.50E-03	5.70E-05
11	Drum breach/fall during TRU[b] retrieval activities	4.00E-02	1.10E-03	4.40E-05
12	Multiple drum deflagration during TRU[b] retrieval activities	1.50E-04	2.30E-02	3.45E-06
13	Vehicle crash/fire on the TRU[b] storage pads	6.50E-05	3.51E-01	2.28E-05
14	Explosion with fire in the TRU[b] waste characterization/ certification facility	4.20E-03	9.10E-04	3.82E-06
15	Large fire for entire CIF[e]	2.34E-04	1.07E-02	2.50E-06
16	Vehicle crash during TRU[b] retrieval activities	2.00E-04	4.60E-03	9.20E-07
17	Earthquake at CIF[e]	1.00E-03	2.65E-04	2.65E-07
18	Explosion at CIF[e] - rotary kiln	1.50E-04	1.57E-03	2.36E-07
19	High winds - TRU[b] storage pads	3.80E-03	5.50E-05	2.10E-07
20	Drum fire due to vehicle crash during TRU[b] retrieval activities	5.00E-06	2.30E-02	1.15E-07

21	High velocity straight winds at CIFe	2.00E-02	5.23E-06	1.05E-07
22	Tornado at the eaV/LAWVc	2.00E-05	4.90E-03	9.80E-08
23	Earthquake - TRUb storage pads	2.00E-04	2.28E-04	4.56E-08
24	F2 tornado on TRUb storage pads	4.50E-05	7.00E-04	3.20E-08
25	Explosion at CIFe - backhoe housing	4.00E-04	5.64E-05	2.26E-08
26	Earthquake at the TRUb waste characterization/certification facility	2.00E-04	8.10E-05	1.62E-08
27	High wind at the eaV/LAWVc	1.00E-03	1.50E-05	1.50E-08
28	F3 tornado on TRUb storage pads	8.00E-06	1.50E-03	1.20E-08
29	Fire in the TRUb waste characterization/certification facility w/ HEPAd bypass	6.00E-06	6.52E-04	3.91E-09
30	High winds on the TRUb storage pads	4.00E-05	7.20E-05	2.90E-09
31	Explosion at CIFe - tank farm tank	3.40E-07	5.36E-03	1.82E-09
32	Explosion at CIFe - tank farm sump and dike area	1.90E-07	6.85E-03	1.30E-09
33	Criticality in the TRUb waste characterization/certification facility	1.00E-06	1.29E-03	1.29E-09
34	HEPAd filter bypass in the TRUb waste characterization/certification facility	2.00E-03	1.00E-09	2.00E-12

a. The dose given is for the offsite maximally exposed individual using 99.5 percentile meteorology.

b. Transuranic.

c. E-Area Vaults low-activity waste vault.

d. High efficiency particulate air.

e. Consolidated Incineration Facility.

Table F-22. Representative bounding radiological accidents for transuranic waste under the no-action alternative.

			Accident consequences				Point estimate of increased risk per yeara (increased risk of fatal cancers per occurrence)b			
							Latent fatal cancers			
No.	Accident description	Frequency (per year)	Uninvolved worker at 100 meters (rem)	Uninvolved worker at 640 meters (rem)	Offsite maximally exposed individual (rem)	Population within 80 kilometersc (person-rem)	Uninvolved worker at 100 meters	Uninvolved worker at 640 meters	Offsite maximally exposed individual	Population within 80 kilometers
1	Deflagration in culvert during TRUd drum retrieval activities	1.00E-02 (anticipated)	1.12E+02	3.97E+00	5.72E-02	2.90E+03	8.96E-04 (8.96E-02)	1.59E-05 (1.59E-03)	2.86E-07 (2.86E-05)	1.45E-02 (1.45E+00)

3	Fire in culvert at the TRUd waste storage pads (one TRU drum in culvert)	8.10E-04 (unlikely)	4.74E+02	1.69E+01	2.43E-01	1.23E+04	3.07E-04 (3.79E-01)	5.48E-06 (6.76E-03)	9.84E-08 (1.22E-04)	4.98E-03 (6.15E+00)
13	Vehicle crash with resulting fire at the TRUd waste storage pads	6.50E-05 (extremely unlikely)	8.59E+01	3.06E+00	4.40E-02	2.23E+03	4.47E-06 (6.87E-02)	7.96E-08 (1.22E-03)	1.43E-09 (2.20E-05)	7.25E-05 (1.12E+00)

a. Point estimate of increased risk per year is calculated by multiplying the consequence (dose) ¥ latent cancer conversion factor ¥ annual frequency.

b. Increased risk of fatal cancers per occurrence is calculated by multiplying the consequence (dose) ¥ latent cancer conversion factor.

c. A conservative assumption of 99.5 percentile meteorology was assumed for determining accident consequences for the exposed population within 80 kilometers. A less conservative meteorology (50 percentile) was used to determine the accident consequences for exposed individuals.

d. Transuranic.

Table F-23. Representative bounding radiological accidents for transuranic waste under alternative B.

			Accident consequences				Point estimate of increased risk per yeara (increased risk of fatal cancers per occurrence)b Latent fatal cancers			
No.	Accident description	Frequency (per year)	Uninvolved worker at 100 meters (rem)	Uninvolved worker at 640 meters (rem)	Offsite maximally exposed individual (rem)	Population within 80 kilometersc (person-rem)	Uninvolved worker at 100 meters	Uninvolved worker at 640 meters	Offsite maximally exposed individual	Population within 80 kilometers
1	Deflagration in culvert during TRUd drum retrieval activities	1.00E-02 (anticipated)	1.12E+02	3.97E+00	5.72E-02	2.90E+03	8.96E-04 (8.96E-02)	1.59E-05 (1.59E-03)	2.86E-07 (2.86E-05)	1.45E-02 (1.45E+00)
3	Fire in culvert at the TRUd waste storage pads (one TRU drum in culvert)	8.10E-04 (unlikely)	4.74E+02	1.69E+01	2.43E-01	1.23E+04	3.07E-04 (3.79E-01)	5.48E-06 (6.76E-03)	9.84E-08 (1.22E-04)	4.98E-03 (6.15E+00)
13	Vehicle crash with resulting fire at the TRUd waste storage pads	6.50E-05 (extremely unlikely)	8.59E+01	3.06E+00	4.40E-02	2.23E+03	4.47E-06 (6.87E-02)	7.96E-08 (1.22E-03)	1.43E-09 (2.20E-05)	7.25E-05 (1.12E+00)

a. Point estimate of increased risk per year is calculated by multiplying the consequence (dose) ¥ latent cancer conversion factor ¥ annual frequency.

b. Increased risk of fatal cancers per occurrence is calculated by multiplying the consequence (dose) ¥ latent cancer conversion factor.

c. A conservative assumption of 99.5 percentile meteorology was assumed for determining accident consequences for the exposed population within 80 kilometers. A less conservative meteorology (50 percentile) was used to determine the accident consequences for exposed individuals.

d. Transuranic.

Table F-24. Representative bounding radiological accidents for transuranic waste under alternative C.

			Accident consequences				Point estimate of increased risk per yeara (increased risk of fatal cancers per occurrence)b Latent fatal cancers			
No.	Accident description	Frequency per year (accident range)	Uninvolved worker at 100 meters (rem)	Uninvolved worker at 640 meters (rem)	Offsite maximally exposed individual (rem)	Population within 80 kilometersc (person-rem)	Uninvolved worker at 100 meters	Uninvolved worker at 640 meters	Offsite maximally exposed individual	Population within 80 kilometers
1	Deflagration in culvert during TRUd drum retrieval activities	1.00E-02 (anticipated)	1.12E+02	3.97E+00	5.72E-02	2.90E+03	8.96E-04 (8.96E-02)	1.59E-05 (1.59E-03)	2.86E-07 (2.86E-05)	1.45E-02 (1.45E+00)
3	Fire in culvert at the TRUd waste storage pads (one TRU drum in culvert)	8.10E-04 (unlikely)	4.74E+02	1.69E+01	2.43E-01	1.23E+04	3.07E-04 (3.79E-01)	5.48E-06 (6.76E-03)	9.84E-08 (1.22E-04)	4.98E-03 (6.15E+00)
12	Vehicle crash with resulting fire at the TRUd waste storage pads	6.50E-05 (extremely unlikely)	8.59E+01	3.06E+00	4.40E-02	2.23E+03	4.47E-06 (6.87E-02)	7.96E-08 (1.22E-03)	1.43E-09 (2.20E-05)	7.25E-05 (1.12E+00)
	Explosion at CIFe - tank farm	3.40E-07 (beyond-extremely-unlikely)	1.28E+00	4.07E-02	7.01E-04	4.79E+01	1.74E-10 (5.12E-04)	5.54E-12 (1.63E-05)	1.19E-13 (3.51E-07)	8.14E-09 (2.40E-02)

a. Point estimate of increased risk per year is calculated by multiplying the consequence (dose) ¥ latent cancer conversion factor ¥ annual frequency.

b. Increased risk of fatal cancers per occurrence is calculated by multiplying the consequence (dose) ¥ latent cancer conversion factor.

c. A conservative assumption of 99.5 percentile meteorology was assumed for determining accident consequences for the exposed population within 80 kilometers. A less conservative meteorology (50 percentile) was used to determine the accident consequences for exposed individuals.

d. Transuranic.

e. Consolidated Incineration Facility.

F.5.5.2 Accident Analysis for Transuranic and Alpha Waste No-Action Alternative

This section addresses the effects of postulated Accidents associated with the no-action alternative considered for transuranic wastes. The postulated accidents provide a baseline for comparison of the effects of the postulated accidents associated with the other alternatives.

F.5.5.2.1 Impacts from Postulated Radiological Accidents

From the list of potential radiological Accidents presented in Table F-21, the representative bounding accident scenarios were identified for the no-action alternative. Figure F-7 shows the highest-risk accident scenarios for the four frequency ranges. As shown in Figure F-7, the accidents associated with the transuranic waste storage pads and the low-activity waste vaults are scattered over the three highest accident frequency ranges. However, there are no accidents identified in the technical reports for the beyond-extremely-unlikely accident range. Table F-22 lists the representative bounding accidents, accident consequences, and latent fatal cancers for exposed workers and the public.

Accident Scenario 1 -Deflagration in culvert during transuranic drum handling activities: The culverts are concrete containers used to store up to 14 transuranic waste drums. Transuranic waste drum handling activities would require the movement of some culverts and other waste containers to gain access to the waste drums. Because the drums inside a culvert are not vented, a flammable mixture of hydrogen and air could exist (due to the radiolysis of the polyethylene wrappings inside the drum). Ignition of this flammable gas mixture would most likely occur due to a shift in the material while moving the culverts. Although the curie content of the drums inside the culverts is much higher than that in drums stored directly on transuranic waste storage pads, it is assumed that the amount of curies released to the atmosphere due to a drum deflagration inside a culvert would be mitigated somewhat by the culvert. This accident scenario is considered the representative bounding accident for the anticipated accident range.

Accident Scenario 3 -Fire in a culvert at the transuranic and alpha waste storage pads (one drum): Culverts are concrete containers used to store up to 14 transuranic 55-gallon drums. Transuranic drums stored in concrete culverts potentially generate hydrogen gas through radiolytic decomposition of organics that could be in the drums. As a consequence, a fire hazard is associated with the storage of transuranic and alpha waste in drums. A postulated fire in a concrete culvert is assumed to involve only one drum, since other drums are sealed with gaskets and the lids are secured with metal ring clamps.

Figure F-7. Accidents that were analyzed for the no-action alternative for transuranic waste facilities.

Accident Scenario 12 -Vehicle crash with resulting fire at the transuranic waste storage pads: The frequency of a vehicle crash into a transuranic pad impacting waste containers is estimated as
2.60E-03 event per year. Approximately 2.5 percent of vehicle crashes result in fires. Therefore, the frequency of a vehicle crashing into a transuranic pad and causing a fire is estimated to be 6.50E-05 event per year. It is estimated that a vehicle crash into a transuranic pad followed by a fire would affect 7 pallets (28 drums) of transuranic waste.

F.5.5.2.2 Impacts from New or Proposed Facilities

Table F-20 identifies no new or proposed facilities under the no-action alternative for transuranic waste.

F.5.5.3 Accident Analysis for the Transuranic and Alpha Waste Under Alternative B

This section addresses the impacts of postulated Accidents associated with alternative B considered for the transuranic waste stream.

F.5.5.3.1 Impacts from Postulated Radiological Accidents

This section presents potential effects from postulated radiological Accidents at facilities identified in Table F-20 for alternative B. Figure F-8 shows the highest-risk accident scenarios for the four frequency ranges. As shown in Figure F-8, this alternative consists of many more accident scenarios than the no-action alternative. There are no accidents listed in the technical reports for the beyond-extremely-unlikely accident range. Table F-23 lists the representative bounding accidents, accident consequences, and latent fatal cancers for exposed workers and the public. Although alternative B has additional facilities associated with it, the representative bounding radiological accident scenarios are the same as those for the no-action alternative (Table F-23). However, DOE assumes that the conclusions regarding the representative bounding accident scenarios could be affected by alternative B minimum, maximum, and expected waste forecasts. The accident analyses for the accident scenarios are based on a conservative assumption of peak utilization of facilities, [i.e., the minimum, maximum, and expected waste forecasts would only affect how long the facilities (e.g., the Experimental Transuranic Waste Assay Facility/Waste Certification Facility), would operate]. Therefore, while consequences or frequencies for postulated accidents do not change, the expected duration of risk from a facility-specific accident scenario could be longer or shorter, depending on the case. However, the number of new facilities needed to meet the transuranic waste management requirements could be affected by the minimum, maximum, and expected waste forecasts. Thus, the consequences or frequencies for specific accident scenarios could be increased or decreased, depending on the case. Impacts for these cases are addressed in the representative bounding accident descriptions in Section F.5.5.2.1.

Figure F-8.

Under the expected waste forecast, 14 additional transuranic and alpha waste storage pads would be required. However, for the minimum waste forecast (6 additional transuranic and alpha waste storage pads), it could be assumed that the frequency of this accident scenario occurring would be less than the expected waste forecast, because fewer containers are at risk due to a deflagration. For the maximum waste forecast (1,173 additional transuranic and alpha waste storage pads), it could be assumed that the frequency of this accident scenario occurring would be much greater than the expected waste forecast, because a great many more containers are at risk due to a deflagration.

Accident Scenario 3 -Fire in transuranic culvert at the transuranic and alpha waste storage pads (one transuranic drum): This accident scenario is detailed in Section F.5.5.2.1 and is considered the representative bounding accident for the unlikely accident range.

Accident Scenario 12 -Vehicle crash with resulting fire at the transuranic and alpha waste storage pads: This accident scenario is detailed in Section F.5.5.2.1 and is considered the representative bounding accident for the extremely unlikely accident range. Impacts regarding the alternative B minimum, maximum, and expected waste forecasts would be similar in terms of decreasing and increasing risk, as discussed in the preceding representative bounding accident description.

F.5.5.3.2 Impacts from New or Proposed Facilities

Table F-20 identifies one proposed facility for which quantitative or qualitative accident analyses do not exist. This facility is described below. Because the facility is proposed and its design is not complete, quantitative analyses at this point would provide non-meaningful risk information (because the design could be changed) that could be compared to the risk information available for existing facilities. However, DOE will perform quantitative analyses throughout the design, construction, and operation phases of proposed facilities in accordance with requirements, and DOE will ensure that the risks associated with operating these facilities are within established regulatory guidelines.

Alpha vitrification facility -The alpha vitrification facility would prepare waste for vitrification, vitrify it, and treat the secondary waste gases and liquids generated by the vitrification process. The waste would include newly generated alpha-contaminated waste and mixed waste, alpha-contaminated waste and mixed waste in storage, and some mixed waste soils. This waste would fall in the following treatability groups: 10 to 100 nanocuries per gram nonmixed; 10 to 100 nanocuries per gram mixed; and greater than 100 nanocuries per gram transuranic waste. All waste would enter this facility in drums transported from the transuranic waste characterization/certification facility. The final vitrified and low-temperature stabilized waste forms would be sent back through the transuranic waste characterization/ certification facility for final certification. The vitrification facility would consist of a thermal pretreatment unit, a melter, an afterburner, and an offgas treatment unit. The afterburner would enhance destruction of any remaining hazardous organic compounds prior to treatment in the offgas system. The offgas system would scrub the gases and minimize the release of any hazardous materials or particulates to the atmosphere. It can be assumed that the Accidents initiated by the alpha vitrification facility would be similar to those for the Defense Waste Processing Facility vitrification facility. However, the releases would be minor in comparison. It is also assumed that the offgas treatment unit accidents would be similar to those for the F/H-Area Effluent Treatment Facility.

F.5.5.4 Accident Analysis for Transuranic and Alpha Waste Under Alternative A

The facilities under alternative A are identical to the facilities identified to support alternative B, except that alternative A does not include the alpha vitrification facility. Because the alpha vitrification facility is a proposed facility and as such did not contribute to the representative bounding Accidents , it is assumed that the impacts from the postulated radiological scenarios for alternative A are the same as described in Section F.5.5.3.

F.5.5.5 Accident Analysis for Transuranic and Alpha Waste Under Alternative C

This section addresses the impacts of the postulated Accidents associated with alternative C considered for the transuranic waste stream.

This section presents potential effects from postulated radiological Accidents at facilities identified in Table F-20 for alternative C. Figure F-9 shows the highest risk accident scenarios for the four frequency ranges. As shown in Figure F-9, this alternative consists of many more accident scenarios than the no-action alternative, with a substantial addition of accidents in the unlikely and beyond-extremely-unlikely accident frequency ranges. Table F-24 lists the representative bounding accidents, accident consequences, and latent fatal cancers for exposed workers and the public. DOE assumes that the conclusions regarding the representative bounding accident scenarios could be affected by alternative C minimum, maximum, and expected waste forecasts. The accident analyses for the accident scenarios are based on the conservative assumption of peak utilization of facilities [i.e., the minimum, maximum, and expected waste forecasts would only affect how long the facilities (e.g., Experimental Transuranic Waste

Figure F-9.

Assay Facility/Waste Certification Facility) would operate]. Therefore, while consequences or frequencies for postulated Accidents do not change, the expected duration of risk from a facility-specific accident scenario could be longer or shorter, depending on the case. However, the number of new facilities needed to meet the transuranic waste management requirements could be affected by the minimum, maximum, and expected waste forecasts. Impacts for these cases are addressed in the representative bounding accident descriptions.

Accident Scenario 1 -Deflagration in culvert during drum handling activities. This accident scenario is detailed in Section F.5.5.3.1 and is considered the representative bounding accident for the anticipated accident range.

Accident Scenario 3 -Fire in transuranic culvert at the transuranic and alpha waste storage pads (one transuranic drum): This accident scenario is detailed in Section F.5.5.2.1 and is considered the representative bounding accident for the unlikely accident range.

Accident Scenario 12 -Vehicle crash with resulting fire at the transuranic and alpha waste storage pads: This accident scenario is detailed in Section F.5.5.2.1 and is considered the representative bounding accident for the extremely unlikely accident range. Impacts regarding alternative B minimum, maximum, and expected waste forecasts would be similar in terms of decreasing and increasing risk, as discussed in the preceding representative bounding accident description.

Accident Scenario 31 -Explosion of tanks associated with the Consolidated Incineration Facility: This accident scenario is detailed in Section F.5.2.3.1 and is considered the representative bounding accident for the beyond extremely unlikely accident range.

F.5.5.6 Impacts to Involved Workers from Accidents Involving Transuranic and Alpha Waste

While it is not a representative bounding accident in this analysis, a criticality in the transuranic waste characterization/certification facility could be the most dangerous accident scenario for the involved worker. Direct radiation could affect personnel in the facility, depending on their proximity to the accident location and the degree of shielding in place. Potentially lethal radiation doses (approximately 400 rem) could be received by a person about 7 meters (23 feet) from an unshielded event producing 2.0E+17 fissions. Because 2.0E+18 fissions are assumed for a criticality in the transuranic waste characterization/certification facility, it is estimated that the dose at 7 meters (23 feet) would be approximately 4,000 rad. The 12-inch-thick concrete walls of the waste preparation cell would reduce the radiation dose by a factor of approximately 10, although cell windows would probably provide less protection. Personnel adjacent to the walls of the waste preparation cell could receive fatal doses.

If the high efficiency particulate air filters were bypassed, as assumed in the transuranic waste characterization/certification facility fire scenario, the combustion products would be exhausted to the atmosphere via the sand filter. Thus, DOE assumes no fatalities to workers from radiological consequences. Additionally, operators in the waste preparation cell of the transuranic waste characterization/certification facility would be equipped with respiratory protection and would follow facility-specific and SRS safety procedures.

Accident scenarios involving transuranic waste drum retrieval operations are not expected to result in serious injury or fatalities to involved workers due to radiological consequences. There would be a containment structure for the vent and purge station to protect workers from injury due to a deflagration in a waste drum. Portable air monitors would be required for this operation, in addition to a contamination control hut with a carbon high efficiency particulate air filter exhaust, which would prevent serious injury to adjacent workers due to exposure. Workers inside the contamination hut would be required to wear protective equipment, including respirators, when there is a potential for an airborne contamination.

F.5.5.7 Impacts from Transuranic and Alpha Waste Chemical Accidents

A chemical hazards analysis was performed for the transuranic and alpha waste storage pads. For a discussion of the hazard analysis methodology, refer to Section F.4.2. In the hazards assessment document prepared for the transuranic waste storage pads, specific Accidents were not analyzed. Instead, the entire quantity of chemicals in each segment was assumed to be released. Table F-25 lists the results of this chemical assessment. Because the concentrations do not exceed the ERPG-1 limits, no further analyses were performed. The preliminary chemical hazards analysis performed in conjunction with the initial hazard categorization of the transuranic and alpha waste storage pads provides a bounding chemical analysis for the transuranic and alpha waste. The transuranic waste storage pads are representative of the entire transuranic and alpha waste inventory contained in E-Area. Other facilities such as the transuranic waste characterization/certification facility, alpha vitrification facility, and transuranic waste retrieval activities involve the manipulation of the transuranic and alpha waste inventory, including chemicals contained on the transuranic and alpha waste storage pads.

While the chemical analysis did not address frequencies associated with chemical releases, some qualitative statements concerning the frequency of chemical releases can be made. Because the chemical inventory contained on the transuranic and alpha waste storage pads is widely dispersed, it is difficult to identify a credible accident scenario that could liberate the entire or even a large portion of the chemical inventory. More probable are the accident scenarios identified in Section F.5.3, which would release small amounts of hazardous chemicals along with radionuclides.

A chemical hazards analysis was performed for the Consolidated Incineration Facility. The results of this analysis are described in Section F.5.4.7.

Table F-25. Transuranic and alpha waste storage pads chemical hazards analysis results.

Chemical	Quantity (kg)b	Onsite concentration 100 meters (328 feet) (mg/m3)c	Offsite concentration (mg/m3)c	ERPG-1d (mg/m3)c	ERPG-2d (mg/m3)c	ERPG-3d (mg/m3)c
Beryllium	3.74E+04	1.67E+01	8.23E-03	5.00E-03	1.00E-02	1.00E+01
Cadmium	7.50E+05	3.33E+02	1.65E-01	1.50E-01	2.50E-01	5.00E+01
Chloroform	3.75E+04	8.33E+03	4.11E+00	1.47E+02	4.88E+02	4.88E+03
Chromium	3.75E+04	1.67E+01	8.23E-03	1.50E-01	2.50E+00	(e)
Copper	1.50E+05	6.67E+01	3.29E-02	3.00E+00	5.00E+00	(e)
Lead	1.50E+06	6.67E+02	3.29E-01	1.50E-01	2.50E-01	7.00E+02
Lead nitrate	3.75E+04	1.67E+01	8.23E-03	1.50E-01	2.50E-01	7.00E+02
Mercuric nitrate	3.75E+04	1.67E+01	8.23E-03	1.50E-01	2.00E-01	2.80E+01
MercuryMercury	3.75E+04	1.67E+01	8.23E-03	1.50E-01	2.00E-01	2.80E+01
Methyl isobutyl ketone	3.75E+04	1.67E+02	8.23E-02	3.07E+02	1.02E+03	1.23E+04
Nickel nitrate	3.75E+04	1.67E+01	8.23E-03	3.00E+00	5.00E+00	(e)
Silver nitrate	3.75E+04	1.67E+01	8.23E-03	3.00E-01	5.00E-01	(e)
Sodium chromate	3.75E+04	1.67E+01	8.23E-03	1.50E-01	2.50E-01	3.00E+01
Toluene	3.75E+04	8.33E+03	4.11E+00	3.77E+02	7.54E+02	7.54E+03
Trichlorotrifluoro-ethane	3.75E+04	1.67E+01	8.23E-03	9.58E+03	1.15E+04	3.45E+04
Uranyl nitrate	3.75E+04	1.67E+01	8.23E-03	1.50E-01	2.50E-01	3.00E+01
Xylene	3.75E+04	1.67E+02	8.23E-02	4.34E+02	8.69E+02	4.34E+03
Zinc	3.75E+04	1.67E+01	8.23E-03	3.00E+01	5.00E+01	(e)
Zinc nitrate	3.75E+04	1.67E+01	8.23E-03	3.00E+01	5.00E+01	(e)

a. The chemicals presented in this table are those for which concentration guidelines were available.

b. Kilograms. To convert to pounds, multiply by 2.2046.

c. Milligrams per cubic meter of air.

d. Emergency Response Planning Guideline. See Table F-3.

e. No equivalent value found.

Table F-26. Conservative estimate of risk from seismic accidents.

	High-level waste[a]		Hazardous and mixed waste[b]		Low-level waste[c]		Transuranic waste[d]	
	Accident number	Risk (rem/yr)	Accident number	Risk (rem/yr)	Accident number	Risk (rem/yr)	Accident number	Risk (rem/yr)
	3	1.63 E-05	6	9.30E-05	14	2.65E-07	17	2.65E-07
	13	6.82E-07	11	1.17E-05			23	4.56E-08
	27	6.76E-09	13	3.30E-06			26	1.62E-08
	28	5.54E-09	20	2.65E-07				
	33	1.88E-09	26	3.08E-08				
	34	1.54E-09	36	5.54E-09				
	40	5.00E-10	37	1.88E-09				
	56	7.71E-11	39	1.54E-09				
	66	1.38E-11	41	5.00E-10				
			48	7.71E-11				
			53	2.34E-11				
			56	1.38E-11				
Total seismic risk		1.70E-05		1.08E-04		2.65E-07		3.27E-07
Highest risk accident		1.91E-04		5.26E-03		5.20E-03		4.56E-03

a. See Table F-4.

b. See Table F-14.

c. See Table F-9.

d. See Table F-21.

F.6 Cumulative Impacts from Postulated Accidents*

A severe seismic event was identified as the only reasonably foreseeable accident that has the potential to initiate simultaneous releases of radioactive or toxic materials from multiple facilities at SRS. A design-basis earthquake, which has an estimated ground acceleration of 0.2 times the acceleration of gravity (0.2*g*) potentially could impact multiple facilities. An earthquake of this magnitude is estimated to have a 2.0 × 10-4 annual probability of occurrence (1 in 5,000 years). Analyses estimating the cumulative impacts from multiple facility releases caused by a severe earthquake at SRS have not been included in the list of potential Accidents (Tables F-4, F-9, F-14, and F-21). Such analyses would be based on the assumption that the earthquake breaches all of the buildings and their materials are released. Even accounting for release fractions and taking credit for existing facility design parameters, this type of analysis is considered too conservative because it is not expected that an earthquake of 0.2*g* would cause equivalent amounts of damage at multiple locations. Trying to realistically estimate impacts from multiple facilities at different locations would inherently include a margin of error of sufficient magnitude to compromise the confidence in the resulting estimate.

The illustration below is based on the unlikely assumption that an earthquake would cause each postulated accident scenario initiated by an earthquake to occur simultaneously. However, the analysis shows that the cumulative risk of these simultaneous Accidents would be less than the highest-risk accident (Table F-26). Table F-26 lists the risk of each earthquake-initiated accident and the sum of those risks. The highest-risk event is more than 10 times the cumulative seismic-event risk for each corresponding waste type.

The synergistic effects of chemical hazards from simultaneous releases from a common accident initiator were not evaluated due to the scarcity of information about the effects of concurrent exposure to various chemical combinations. DOE is not aware of synergistic effects resulting from simultaneous exposures to radiation and a carcinogenic chemical, such as benzene, each of which is known to result in an increased incidence of cancer. Indeed, synergistic effects of radiation and other agents have been identified in only a few instances, most notably the combined effects of radiation exposure and smoking causing lung cancer among uranium miners. Radioactivity released simultaneously with hazardous chemicals could affect the clean-up or mitigation of the resulting hazard that could have a greater impact than if the releases were separate.

F.7 Secondary Impacts from Postulated Accidents

The primary focus of accident analyses performed to support the operation of a facility is to determine the magnitude of the consequences of postulated-accident scenarios on public and worker health and safety. DOE recognizes that Accidents involving releases of materials can also adversely affect the surrounding environment. To determine the greatest impact that could occur to the environment from the postulated accidents, DOE evaluated each radiological accident scenario to determine potential secondary impacts.

F.7.1 BIOTIC RESOURCES

The consequences of a postulated accident on biotic resources have not been studied. DOE believes that the area of contamination from the postulated-accident scenarios would be localized. Terrestrial biota in or near the contaminated area could be exposed to small quantities of radioactive materials and ionizing radiation until the affected areas could be decontaminated. Effects on aquatic biota would be minor, since no waste management facilities are near any major bodies of water.

F.7.2 WATER RESOURCES

No adverse impacts on water quality from the postulated-accident scenarios are considered likely. Contamination of the groundwater or surface water due to the postulated releases would be minor. Contamination would migrate slowly to the groundwater, so the clean-up efforts that would follow a release incident would capture the contaminants before they reached groundwater.

F.7.3 ECONOMIC IMPACTS

With the exception of the economic effects generated by severe-accident scenarios, such as those initiated by severe earthquakes, limited economic effects would occur as a result of accident scenarios postulated in this appendix. Clean-up of contamination would be localized at the facility where the accident occurred, and DOE expects that the current workforce could perform the clean-up activities. In addition, DOE expects that offsite contamination would be limited or nonexistent.

F.7.4 NATIONAL DEFENSE

The postulated-accident scenarios considered for SRS waste management facilities would not affect national defense.

F.7.5 ENVIRONMENTAL CONTAMINATION

Contamination of the environment from the postulated Accidents for SRS waste management facilities would be limited to the immediate area surrounding the facility where the accident occurred. It is unlikely that the postulated accidents would result in offsite contamination.

F.7.6 THReaTENED AND ENDANGERED SPECIES

Habitats of Federally listed threatened or endangered species have not been identified in the immediate vicinity of the SRS waste management facilities. Because the accident scenarios postulated in this appendix would result only in localized contamination, DOE does not expect these Accidents to affect threatened or endangered species.

F.7.7 LAND USE

Because the Accidents postulated in this appendix would result in only localized contamination around the facility where an accident occurred, and no measurable offsite contamination is likely, DOE expects no impacts on land use.

F.7.8 TReaTY RIGHTS

The environmental impacts of Accidents postulated in this appendix would be within the SRS boundaries. Because there are no Native American lands within SRS boundaries, treaty rights would not be affected.

F.8 Accident Mitigation

An important part of the accident analysis process is to identify actions that can mitigate consequences from Accidents if they occur. This section summarizes the SRS emergency plan, which governs responses to accident situations that affect SRS employees or the offsite population.

The *Savannah River Site Emergency Plan* defines appropriate response measures for the management of site emergencies (e.g., radiological or hazardous material Accidents). It incorporates into one document a description of the entire process designed to respond to and mitigate the consequences of an accident. For example, protective actions guidelines are established for accidents involving chemical releases to keep onsite and offsite exposures as low as possible. Exposure is minimized or prevented by limiting the time spent in the vicinity of the hazard or the release plume, keeping personnel as far from the hazard or plume as possible (e.g., physical barricades and evacuation), and taking advantage of available shelter. Emergencies that could cause activation of this plan or part of it include the following:

- Events (operational, transportation, etc.) with the potential to cause releases above allowable limits of radiological or hazardous materials.

- Events such as fires, explosions, tornadoes, hurricanes, earthquakes, dam failures, etc., that affect or could affect safety systems designed to protect SRS and offsite populations and the environment.

- Events such as bomb threats, hostage situations, etc., that threaten the security of SRS.

- Events created by proximity to other facilities, such as the Vogtle Electric Generating Plant (a commercial nuclear power plant across the Savannah River from SRS) or nearby commercial chemical facilities.

Depending on the types of Accidents and the potential impacts, emergencies are classified into one of several categories in accordance with requirements defined in the DOE 5500 series of orders. Incidents classified as "alerts" are expected to be confined within the affected facility boundary. Measurable impacts to workers outside the facility boundary or members of the public would be expected from incidents classified as alerts. Incidents classified as "Site Area Emergencies" represent events that are in progress or have occurred and involve actual or likely major failures of facility safety or safeguards systems needed for the protection of onsite personnel, the public, the environment, or national security. Because Site Area Emergencies have the potential to impact workers at nearby facilities or members of the public in the vicinity of SRS, these emergency situations require notification of and coordination of responses with the appropriate local authorities. Incidents classified as "General Emergencies" are events expected to produce consequences that require protective actions to minimize impacts to both workers and the public. Under General Emergencies, full mobilization of available onsite and offsite resources is usually required to deal with the event and its consequences.

In accordance with the *Savannah River Site Emergency Plan*, drills and exercises are conducted frequently at SRS to develop, maintain, and test response capabilities and validate the adequacy of emergency facilities, equipment, communications, procedures, and training. For example, drills for the following accident scenarios are conducted periodically in the facilities or facility areas: facility/area evacuations; shelter protection; toxic gas releases; nuclear incident monitor alarms (which activate following an inadvertent nuclear criticality); fire alarms; medical emergencies; and personnel accountability (to ensure that all personnel have safely evacuated a facility or area following an emergency). Periodic drills are also conducted with the following organizations or groups and independently evaluated by the operating contractor and DOE to ensure that they continue to maintain (from both a personnel and equipment standpoint) the capability to adequately respond to emergency situations: first aid teams; rescue teams; fire wardens and fire-fighting teams; SRS medical and health protection personnel, as well as personnel from the nearby Eisenhower Army Medical Center; SRS and local communications personnel and systems; SRS security forces; and SRS health protection agencies.

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PAGE TOC FIGURES TABLES PAGE

Appendix G

G.1 Introduction

This appendix provides a list of Resource Conservation and Recovery Act (RCRA) facilities, units, and sites referred to in the eis. Section G.1 lists the RCRA/ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) units identified in Appendix C "RCRA/CERCLA Units List" of the Savannah River Site (SRS) Federal Facility Agreement (EPA 1993). Section G.2 lists the RCRA-regulated units identified in Appendix H "RCRA-Regulated Units List" of the SRS Federal Facility Agreement. Section G.3 lists the Site Evaluation units identified in Appendix G "Site Evaluation List" of the SRS Federal Facility Agreement. DOE is required to conduct RCRA Facility Investigation/Remedial Investigations for the units listed in Section G.1 and remedial or removal evaluations for the sites listed in Section G.3. Section G.4 lists references. The eis waste forecasts were developed based on the May 11, 1992, version of the SRS Federal Facility Agreement's Appendixes.

This section lists the RCRA/CERCLA units identified in Appendix C, "RCRA/CERCLA Units List," of the SRS Federal Facility Agreement.

108-4R Overflow Basin

211-FB Pu-239 Release

716-A Motor Shop Seepage Basin

A-Area Burning/Rubble Pits

A-Area Coal Pile Runoff Basin

A-Area Miscellaneous Rubble Pile

A-Area Rubble Pit

Burial Ground Complex

Burma Road Rubble Pit

C-Area Burning/Rubble Pit

C-Area Coal Pile Runoff Basin

C-Area Reactor Seepage Basins

Central Shops Burning/Rubble Pit (631-6G)

Central Shops Burning/Rubble Pit (631-5G)

Central Shops Burning/Rubble Pit (631-1G, 3G)

Central Shops Sludge Lagoon

CMP Pits

D-Area Ash Basin

D-Area Burning/Rubble Pits

D-Area Coal Pile Runoff Basin

D-Area Oil Seepage Basin

D-Area Waste Oil Facility

F-Area Burning/Rubble Pits

F-Area Coal Pile Runoff Basin

F-Area Inactive Process Sewer Lines from Building to the Security Fence

F-Area Retention Basin

Fire Department Hose Training Facility

Ford Building Seepage Basin

Ford Building Waste Site

G-Area Oil Seepage Basin

Gas Cylinder Disposal Facility

Grace Road Site

Gunsite 113 Access Road

Gunsite 218 Rubble Pile

Gunsite 720 Rubble Pit

H-Area Coal Pile Runoff Basin

H-Area Inactive Process Sewer Lines from Building to the Security Fence

H-Area Retention Basin

Hydrofluoric Acid Spill

K-Area Bingham Pump Outage Pits

K-Area Burning/Rubble Pit

K-Area Coal Pile Runoff Basin

K-Area Reactor Seepage Basin

K-Area Rubble Pile

K-Area Sludge Land Application Site

L-Area Bingham Pump Outage Pits

L-Area Burning/Rubble Pit

L-Area Hot Shop

L-Area Oil/Chemical Basin and L-Area Acid/Caustic Basin

L-Area Rubble Pit (131-1L)

L-Area Rubble Pit (131-3L)

M-Area Settling Basin Inactive Process Sewers to Manhole 1

M-Area West

Miscellaneous Chemical Basin/Metals Burning Pits

New TNX Seepage Basin

Old F-Area Seepage Basin

Old TNX Seepage Basin

P-Area Bingham Pump Outage Pits

P-Area Burning/Rubble Pit

P-Area Coal Pile Runoff Basin

Par Pond

Par Pond Sludge Land Application Site

R-Area Acid/Caustic Basin

R-Area Bingham Pump Outage Pits

R-Area Burning/Rubble Pits

R-Area Reactor Seepage Basins

Road A Chemical Basin

Silverton Road Waste Site

SRL 904-A Process Trench

SRL Oil Test Site

SRL Seepage Basins

Tank 16

Tank 37 CTS Line Leak

TNX Burying Ground

TNX Groundwater

Warner's Pond

West of SREL "Georgia Fields" Site

G.2

This section lists the RCRA-regulated units identified in Appendix H, "RCRA-Regulated Units List," of the SRS Federal Facility Agreement.

Met Lab Basin/Carolina Bay

Acid/Caustic Basins, F-, H-, K-, and P-Areas (4 units)

Burial Ground Solvent Tanks (S23 - S30) (8 units)

DWPF Organic Storage Tank

F-Area Hazardous Waste Management Facility (3 units)

H-Area Hazardous Waste Management Facility (4 units)

Hazardous Waste Storage Buildings (including Solid Waste Storage Pads) (4 units)

Low Level Radioactive Waste Disposal Facility (RCRA regulated portions)

M-Area Hazardous Waste Management Facility (2 units)

M-Area Interim Treatment/Storage Facility

Mixed Waste Management Facility

Mixed Waste Storage Building (643-29E)

Mixed Waste Storage Building (643-43E)

Mixed Waste Storage Tank (S-32)

New TNX Seepage Basin

Sanitary Landfill

SRL Mixed Waste Storage Tanks

SRL Seepage Basins (4 units)

TRU Waste Storage Pads 1 through 6 (6 units)

TRU Waste Storage Pads 7 through 17 (11 units)

G.3

This section lists the Site Evaluation units identified in Appendix G, "Site Evaluation List," of the SRS Federal Facility Agreement.

R-Area Asbestos Pit

D-Area Asbestos Pit

C-Area Asbestos Pit (080-21G)

C-Area Asbestos Pit (080-22G)

H-Area Erosion Control Site

L-Area Erosion Control Site

Substation 51 Erosion Control Site

F-Area Erosion Control Site

Gunsite 051 Rubble Pile

Gunsite 102 Rubble Pile

Gunsite 072 Rubble Pile

C-Area Disassembly Basin

K-Area Disassembly Basin

L-Area Disassembly Basin

P-Area Disassembly Basin

R-Area Disassembly Basin

Cooling Water Effluent Sump

Purge Water Storage Basin

C-Area Erosion Control Site

P-Area Erosion Control Site

Gas Cylinder Disposal Facility

R-Area Rubble Pit

L-Area Rubble Pit

Concrete Lake (R-Area)

C-Area Reactor Cooling Water System

K-Area Reactor Cooling Water System

L-Area Reactor Cooling Water System

P-Area Reactor Cooling Water System

C-Area Ash Pile

K-Area Ash Basin

L-Area Ash Basin

P-Area Ash Basin

R-Area Ash Basin

C-Area Ash Pile (188-1C)

C-Area Ash Pile (188-2C)

F-Area Separations Facilities and Associated Spills

H-Area Separations Facilities and Associated Spills

F-Area Scrap Lumber Pile

F-Area Tank Farm

H-Area Tank Farm (except Tank 16)

RBOF (Receiving Basin for Offsite Fuels)

H-Area Retention Basin (281-1H)

H-Area Retention Basin (281-2H)

F-Area Retention Basin

H-Area Retention Basin (281-8H)

F-Area Ash Basin (288-0F)

H-Area Ash Basin

F-Area Ash Basin (288-1F)

Underground Sump 321-M #001

Underground Sump 321-M #002

D-Area Rubble Pit

D-Area Waste Oil Facility

D-Area Ash Basin (488-1D)

D-Area Ash Basin (488-2D)

Rubble Pile - Cemetery Road

Rubble Pile - Bragg Bay Road and Cemetery Road

Rubble Pile - Road 781.1

Rubble Pile - Bragg Bay Road

Gunsite 113 Rubble Pile

Risher Road Open Metal Pit

Scrap Metal Pile

R-Area Rubble Pile

L-Area Rubble Pile

Central Shops Scrap Lumber Pile

Miscellaneous Rubble Pile

3G Pumphouse Erosion Control Site

SRFS Rubble Pile

Neutralization Sump

L-Area Hot Shop

Salvage Yard

New Salvage Yard

40-Acre Hardwood Site

Lower Kato Road Site

Orangeburg Site

Lucy Site

Kato Road Site

Road F Site

Second Par Pond Site

SREL Rubble Pile

Spill on 4/24/91 of 0.11 Ci of Pu-239

Low Level Radioactive Drain Lines

A-Area Ash Pile (788-0A)

A-Area Ash Pile (788-2A)

P-Area Reactor Seepage Basin (904-061G)

P-Area Reactor Seepage Basin (904-062G)

P-Area Reactor Seepage Basin (904-063G)

L-Area Reactor Seepage Basin

C-Area Reactor Seepage Basin (904-066G)

C-Area Reactor Seepage Basin (904-067G)

C-Area Reactor Seepage Basin (904-068G)

K-Area Containment Basin

Fire Department Hose Training Facility

313-M and 320-M Inactive Clay Process Sewers to Tims Branch

Advanced Tactical Training Area (ATTA) Firing Ranges

Arsenic Treated Wood Storage Area

B-Area Sanitary Treatment Plant Rubble Pile

B-Area Tower Foundation

Beaver Dam Creek

Central Shops Area of Concern

D-F Steamline Erosion Control Site

Ditch to Outfall H-12 (Tributary to Four Mile Creek)

Diversion Box - Radioactivity from 907-1H

DWPF Concrete Batch Plant

F-Area Railroad Crosstie Pile

F-Area Sanitary Sludge Land Application Site

Fire Training Pit at 709-1F

Four Mile Branch

Groundwater, F-, H-, K-, P-Area Acid/Caustic Basin

Groundwater, R-Area

Gun Emplacement 407A and 407B Rubble Pile

Gunsite 012 Rubble Pile

H-Area Burning Pit

H-Area Sanitary Sludge Land Application Site

IMHOFF Tank Rubble Pile

Indian Grave Branch

K-Area Area of Concern

L-Area Scrap Metal and Wood

L-Lake

Lower Three Runs Creek

Meyers Mill Siding Rubble Pile

Miscellaneous Rubble at Dunbarton

Miscellaneous Trash at Snapp

Old Ellenton Rubble Pile

Old R-Area Discharge Canal

Parking Lot Type Lights on Wilson Road

Patterson Mill Road Rubble Pile

Pen Branch

Pile of Telephone/Light Poles

Pond B Dam Rubble Pile

Potential Release of Caustic/HNO3 from 312-M

Potential Release of Diesel Fuel and Benzene from 730-M

Potential Release of NaOH/H2SO4 from 183-2L

Potential Release of NaOH/H2SO4 from 183-2R

Potential Release of NaOH/H2SO4 from 280-1F

Potential Release of TCT, TET CE, HNO3, U, Heavy Metals from 321-M Abandoned Sewer Line

Process and Sewer Lines as Abandoned

Reactor Areas Cask Car Railroad Tracks as Abandoned

Recreation Area #002 Rubble Pile

Risher Road Rubble Pile

Risher Road Rubble Pile #2

Road 3 Foundation Rubble Pile

Road 9 at Gate 23 Rubble Pile

Road 9 Rubble Pile

Robbins Station Road Rubble Pile

Rubble Pile Across from Gunsite 012

Rubble Pile Near Junction U.S. 278 and GE Road 103

Rubble Pile North of SRL

S-Area Erosion Control Site

Sandblast Areas

Savannah River

Savannah River Swamp

Silverton Road Waste Tank Plugs

Small Arms Training Area (SATA)

Stadia Lights with Poles

Steed Pond

Steel Creek

Steel Creek Swamp

Stormwater Outfall A-002

Stormwater Outfall A-024

Stormwater Outfall H-013

Stormwater Outfall K-011

Stormwater Outfall L-012

Stormwater Outfall P-010

TCU Rubble Pile

Tims Branch

TNX Rubble Pile

Unnamed Tributary of Four Mile Branch South of C-Area

Unnumbered Gun Emplacement Rubble Pile

Upper Three Runs Creek

Warners Pond (Spill on 9/24/56 of Beta-Gamma)

Combined Spills from 105-C, 106-C, and 109-C

Combined Spills from 105-K, 106-K, and 109-K

Combined Spills from 105-P, 106-P, and 109-P

Combined Spills from 105-R, 106-R, and 109-R

Combined Spills from 183-2

Combined Spills from 183-2K

Combined Spills from 183-2P

Combined Spills from 211-H

Combined Spills from 241-84H

Combined Spills from 241-H (H-Area Tank Farm)

Combined Spills from 242-F

Combined Spills from 242-H

Combined Spills from 483-D and Associated Areas

Combined Spills from 643-G

Combined Spills from 672-T

Combined Spills from 674-T (Boneyard)

Combined Spills from 679-T

Combined Spills from 701-1T

Spill of Mercury Adjacent to Building 780-2A

Spill of Mercury in Building 232-H

Spill of Uranyl Nitrate (1/2 Ton)

Spill of Pu-239 from 221-FB

Spill of Retention Basin Pipe Leak

Spill of Beta-Gamma (<1 Ci)

Spill of Beta-Gamma (<1 Ci)

Spill of Seepage Basin Pipe Leak from 904-44G

Spill of Rad Liquid from Solvent Trailer

Spill of Seepage Basin Pipe Leak Between 904-42G and 904-43G

Spill of Segregated Solvent from 211-F

Spill of Flush Water - Rad (500 square feet)

Spill of Waste Tank Spill

Spill of Seepage Basin Pipe Leak

Spill of Flush Water - Rad (100 square feet)

Spill of Rad Water from 773-A

Spill of Waste Water - Rad (50 gallons)

Spill of Waste Water - Rad (3 gallons)

Spill of Rad Contaminated Soil

Spill of PCE

Spill of 50% Nitric Acid (200 gallons)

Spill of 50% Sodium Hydroxide (600 pounds)

Spill of 50% Sodium Hydroxide (50 gallons)

Spill of H-Area Process Sewer Line Cave-In

Spill of Seepage Basin Pipe Leak in H-Area Seepage Basin

Spill of Sump Overflow

Spill of Diversion Box Overflow from 281-1H

Spill of Contaminated Water

Spill of Contaminated Liquid

Spill of Acid in D-Area

Spill of 50% Nitric Acid (5,600 pounds)

Spill of Waste Water - Rad (less than 5 gallons)

Spill of Chromated Water from H-Area Pump House

Spill of Nitric Acid (3 gallons)

Spill of Chromated Water from Valve House 3

Spill of 34% Aluminum Nitrate

Spill of Uranyl Nitrate (100 pounds)

Spill of Contaminated Flush Water

Spill of Hydrogen Sulfide

Spill of Chromated Water

Spill of Low Level Waste from Trailer

Spill of Chromated Water from 243-H

Spill of Hydrogen Sulfide

Spill of Acid Solution

Spill of 31.5% Hydrochloric Acid from 183-P

Spill of Radioactive Spill

Spill of Oil - Rad

Spill of Fine-Organic #101 from 8307Z

Spill of Low Level Water Near 105-C

Spill of Tritiated Water in C-Area

Spill of Sodium Hydroxide

Spill of Simulated Salt Solution, Pizzolith 122R in 643-7G

Spill of Chromated Water from 221-F

Spill of Chilled Water

Spill of Process Solution

Spill of Water - Rad (200 gallons)

Spill of 6% Potassium Permanganate

Spill of Aluminum Nitrate

Spill of Caustic (50 gallons)

Spill of Acid Mixture from S-Area Trailer S-16

Spill of Water Vapor - Rad

Spill of 64% Nitric Acid from 221-F

Spill of Sulfuric Acid (25 milliliters)

Spill of Alcohol from 779-A

Spill of Cooling Water from Tank Farm

Spill of Process Water from 106-P

Spill of Mercury Near 284-F

Spill of Hydrochloric Acid From S-Area

Spill of Uranyl Nitrate (500 gm)

Spill of Mercury from 748-A

Spill of Nitric Acid (1 1/2 gallons)

Spill of Nitric Acid at Barricade 10

Spill of Aropol from 690-G

Spill of Chromated Water from Between 702-A and 708-A

Spill of Phosphoric Acid

Spill of 50% Sodium Hydroxide (2 gal)

Spill of Plating Solution

Spill of Water - Rad from 106-1C

Spill of 50% NaOH from 341-M

Spill of Acid (10 gallons)

Spill of Caustic (6 gallons)

Spill of Nitric Acid (10 gallons)

Spill of Water - Rad (1/2 pint)

Spill of Water - Rad (less than 1 gallon)

Spill of 50% Sodium Hydroxide (2 gal)

Spill of Nitric Acid (2 gallons)

Spill of Neutralization System Water

Spill of Tritiated Waste Oil from 110-P

Spill of Water - Rad (20 gallons)

Spill of Water - Rad (1 gallon)

Spill of 50% Sodium Hydroxide (5 gal) 01/01/87

Spill of Potassium Permanganate

Spill of Caustic (20 gallons)

Spill of Mercury North of 211-H

Spill of Sulfuric Acid Between 704-8F and 703-F Parking Lot

Caustic (1 gallon)

Chromated Water from 241-24H

Acidic Water (15 gallons)

Cr III Ligno - Sulfonate

Chromated Water from 772-F

Water - Rad (15 gallons)

Water from 300-M

Caustic from 295-H

50% Sodium Hydroxide

Water - Rad (~1 gallon)

Bromocide Solution from 607-14D

Water - Rad

Bromocide Solution from 607-22P

KOH, SMBS, NaPO4 from 784-A

64% Nitric Acid at Barricade 1

Sulfuric Acid (less than 1 gallon)

Acidic Water (15 gallons)

Ethylene Glycol-Rad from 772-F

64% Nitric Acid in F-Area

Cs-137 from 254-8H

G.4 Reference

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.

PAGE TOC FIGURES TABLES PAGE

PAGE TOC FIGURES TABLES PAGE

Appendix H. Alternative Approaches to Low-Level Waste Regulation

The U.S. Department of Energy (DOE) received comments during the scoping process requesting several analyses and comparisons of potential alternative regulatory regimes for low-level radioactive wastes. Among these was the suggestion that DOE consider the regulation of its low-level radioactive waste disposal activities by an independent organization, presumably the Nuclear Regulatory Commission, which regulates disposal of low-level radioactive wastes from their licensees. Comparison of current DOE low-level radioactive waste vault designs with a vault designed to meet the U.S. Environmental Protection Agency's (EPA) Resource Conservation and Recovery Act (RCRA) requirement and the Nuclear Regulatory Commission's commercial low-level radioactive waste disposal standards, and comparison of DOE's current low-level radioactive waste vault design with its current methods for shallow land disposal were also requested. DOE is bound by existing law (Atomic Energy Act) to regulate its low-level radioactive waste disposal activities. A change in regulatory authority for these activities would constitute a major change in approach, including changes in legislation. Such considerations are well beyond the scope of this eis and are not discussed further. This appendix focuses instead on the comparison of alternative regulatory regimes as requested by the commentor.

The first analysis identifies the similarities and differences in the requirements established by DOE and the Nuclear Regulatory Commission for the disposal of low-level radioactive waste. This comparison permits an assessment of the potential for substantive differences in the impacts of such disposal operations. This section also presents a description of the RCRA hazardous waste landfill design requirements (40 CFR 264.301) to which Savannah River Site (SRS) vault designs can be compared. Comparisons of the performance of existing shallow land disposal at SRS with alternative engineered disposal systems were presented in an earlier eis [*Waste Management Activities for Groundwater Protection, Savannah River Plant* (DOE 1987)] and are not repeated here.

H.1 DOE and Nuclear Regulatory Commission Technical Regulatory Requirements for LowLevel Radioactive Waste

The basic DOE requirements for low-level radioactive waste management are established in DOE Order 5820.2A (9/26/88), and those of the Nuclear Regulatory Commission in 10 CFR 61 (12/27/82). Several basic factors shape the nature and extent of the respective sets of requirements:

DOE is a major generator of low-level radioactive waste at a number of its operating facilities and has substantial technical and research and development resources and expertise in its staff and those of its operating contractor/waste generator organizations. DOE's requirements extend to the waste generator as well as to the operator of disposal facilities which, for its major sites, are staffed by the same contractor organization and are under DOE's direction.

DOE's requirements implicitly recognize that its major waste-generating sites tend to be diverse in the scope of their activities, materials handled, and wastes produced. DOE's requirements also recognize that these sites tend to be large in size and relatively isolated in location (compared to typical commercial, industrial, or academic licensees of the Nuclear Regulatory Commission). As a result, DOE's policy explicitly requires that low-level radioactive waste be disposed of at its site of origin to the extent possible.

Nuclear Regulatory Commission regulations are more detailed, prescriptive, and process-oriented than those of DOE, consistent with the legal role of the agency as a purely regulatory organization, and the adversarial nature of its licensing and hearing processes. The regulations are also supported by such other documents as Regulatory Guides, Standard Review Plans, and Technical Positions that further expand the direction of and guidance to applicants and licensees.

Nuclear Regulatory Commission regulations recognize the responsibility of the States for disposal of low-level radioactive waste under the Low Level Radioactive Waste Policy Act, their likely role as site owners and landlords of the operating licensees, and eventual responsibility for institutional control. Thus, the Nuclear Regulatory Commission regulations provide a role for the host and affected States in the licensing process.

A side-by-side comparison of the requirements of DOE Order 5820.2A and the corresponding requirements of the Nuclear Regulatory Commission in Part 61 is presented in Table H-1. Selecting this basis for comparison has eliminated from the table the substantial portions of Part 61 that deal with

the licensing process requirements (e.g., the contents of the license application, financial responsibility, etc.) that are judged not to affect the substantive requirements that determine waste disposal impacts. The two sets of requirements were divided for comparison into eight major categories: performance objectives; performance assessment; waste characterization and acceptance criteria; disposal site selection; facility and site design; disposal facility operation; disposal site closure/post-closure; and environmental monitoring.

Table H-1. Low-level radioactive waste regulations: DOE and Nuclear Regulatory Commission requirements.

Doe citation	Doe requirement	Nrc citation	Nrc requirement
Order 5820.2A (9/26/88)	Establishes policies, guidelines, and minimum requirements for management of radioactive wastes, including low-level radioactive wastes	10 CFR 61 12/27/82	Licensing requirements for land disposal of radioactive wastes; procedures, criteria, and terms and conditions for licensing of disposal of wastes received from others. Does not apply to (1) high-level waste, (2) uranium or thorium tailings, or (3) disposal of licensed material by licensees under Part 20
Attachment 2 Definitions:	Low-Level Waste. Radioactive waste not classified as high-level waste, transuranic waste, or spent nuclear fuel, or uranium or thorium tailings and waste Transuranic Waste. Waste contaminated with alpha-emitting nuclides with atomic number greater than 92, half-life greater than 20 years, and concentrations greater than 100 nanocuries per gram	§ 61.2 Definitions	"Low-level radioactive wastes containing source, special nuclear, or byproduct material that are acceptable for disposal in a land disposal facility...not classified as high-level waste, transuranic waste, spent nuclear fuel, or...uranium or thorium tailings and waste."
III. Management of low-level waste: 3. Requirements a. Performance objectives	(1) Protect public health and safety in accordance with other Environment, Safety and Health and DOE Orders	Subpart C-Performance objectives § 61.40 General Requirement	Land disposal facilities to be sited, designed, operated, closed, and controlled after closure to provide reasonable assurance that human exposures are within the limits established in the performance objectives.
	(2) Limit effective dose equivalent resulting from external exposure to the waste and concentrations in water, soil, plants, and animals resulting from releases to less than or equal to 25 millirem per year; atmospheric releases to meet 40 CFR 61 requirements; reasonable effort to maintain releases as low as reasonably achievable	§ 61.41 Protection of the general population from releases of radioactivity	Concentrations of radioactive material which may be released...in...water, air, soil, plants or animals...less than or equal to 25 millirem per year to whole body, less than or equal to 75 millirem per year to thyroid, and less than or equal to 25 millirem per year to any other organ. Reasonable effort to maintain releases as low as reasonably achievable to the environment in general.
			"Design, operation, and closure of the land disposal facility must ensure protection of any individual inadvertently intruding into...the site or contacting the waste at any time after institutional controls...are

	(3) Committed effective dose equivalent to inadvertent intruders after loss of institutional control (100 years) of less than or equal to 100 millirem per year (continuous exposure) or less than or equal to 500 millirem (single acute exposure)	§ 61.42 Protection of individuals from inadvertent intrusion § 61.7(4) Concepts § 61.7(5)	removed." Institutional control of access to the site is required for up to 100 years; permits disposal of Class A and Class B waste without special provisions for intruder protection. "Waste that will not decay to levels which present an acceptable hazard to an intruder within 100 years is designated as Class C waste." Disposed of at greater depth or with intruder barriers with an effective life of 500 years. Maximum concentrations of radionuclides are specified (§ 61.55) to ensure no unacceptable intruder hazard after 500 years.

Table H-1. (continued).

Doe citation	Doe requirement	Nrc citation	Nrc requirement
a. Performance objectives (cont.)	(4) Protect groundwater resources, consistent with Federal, State and local requirements.		No specific parallel in Part 61
b. Performance assessment	(1) ...Prepare and maintain a site-specific radiological performance assessment for disposal of waste to demonstrate compliance with 3.a.	§ 61.13 Technical Analyses	...Analyses to demonstrate performance objectives of Subpart C will be met, including: (a) pathways to general population must include air, soil, ground- and surface water, plant uptake, and exhumation by burrowing animals, identifying differentiated roles played by natural site characteristics and design features; (b) protection of intruders afforded by meeting segregation requirements and barriers; (c) protection of individuals during operations, including likely accidents; and (d) analyses of long-term site stability
	(2) ...For each DOE reservation, prepare and maintain an overall waste management systems performance assessment supporting combination of waste management practices used in generation reduction, segregation, treatment, packaging, storage and disposal.		No specific parallel - not applicable
	(3) ...Where practical, make monitoring measurements to evaluate actual and prospective performance within and outside each facility and disposal site.	§ 61.53 Environmental Monitoring	...Requires an environmental monitoring program to evaluate potential health and environmental impacts during construction, operation and after closure, and capable of providing early warning, if migration is indicated, before it leaves the site
c. Waste generation	(1) ...Controls shall be directed to reducing the gross volume of waste generated and/or the amount of radioactivity requiring disposal.		No specific parallel - not applicable
	(2) Generation Reduction...low-level waste generators shall establish auditable programs to assure minimization of the amount of low-level waste generated and/or shipped for disposal.		No specific parallel - not applicable
	(3) Segregation...low-level waste generators shall separate uncontaminated waste from low-level waste.		No specific parallel - not applicable
	(4) Minimization...new process or process change designs shall incorporate principles to minimize generation of lowlevel waste.		No specific parallel - not applicable

Table H-1. (continued).

Doe citation	Doe requirement	Nrc citation	Nrc requirement
d. Waste characterization	(1) Low-level waste shall be characterized...to permit proper segregation, treatment, storage and disposal...characterization shall ensure that actual physical and chemical characteristics and major radionuclide content are recorded and known during the entire waste management process.	§ 61.55(a) Waste Classification	(1) *Considerations.* Wastes are to be classified for near-surface disposal to permit consideration of, first, limiting concentrations of long-lived radionuclides with hazards persisting after institutional controls, improved waste form, and deeper disposal are no longer effective; and, second, concentrations of shorter-lived radionuclides for which those protective measures are effective. (2) *Classes of waste.* Defines Class A, Class B and Class C wastes in terms of nuclide concentrations and stability requirements
	(2) Waste characterization data to be recorded on a waste manifest include (a) physical and chemical characteristics; (b) volume; (c) weight; (d) major radionuclides and concentrations; (e) packaging date, weight, volume.	Appendix F to §20.1001-20.2401 Requirements for Low-Level-Waste Transfer for Disposal at Land Disposal Facilities and Manifests	*I. Manifest*...requires physical description of waste, volume, radionuclide identity and quantity, total radioactivity, and principal chemical form; solidification agent to be specified; waste with greater than or equal to 0.1 percent chelating agents by weight to be identified and the agent estimated
	(3) Radionuclide concentration determined by direct or correlatable indirect methods (i.e., scaling factors)		No specific parallel - not applicable
e. Waste acceptance criteria	(1) Waste shipped to a site for treatment, storage or disposal shall meet the requirements of the receiving site.		No specific parallel - not applicable
	(2) Waste acceptance criteria shall be established for each low-level waste treatment, storage, and disposal facility.		No specific parallel - not applicable
	(3) Generators shall implement low-level waste certification program to ensure waste acceptance criteria are met; generators and receiving facilities jointly responsible for compliance with waste acceptance criteria	Appendix F to §20.1001-20.2401	*II. Certification*...requires generator to include with shipment, certification of proper waste classification and packaging.
	(4) Generator low-level waste certification programs shall be audited periodically.		No specific parallel - not applicable

Table H-1. (continued).

Doe citation	Doe requirement	Nrc citation	Nrc requirement
e. Waste acceptance criteria (cont.)	(5) Waste acceptance criteria for storage, treatment, or disposal facilities shall address: (a) allowable quantities/concentrations of specific radionuclides to be handled; (b) criticality safety requirements; (c) restrictions for classified low-level waste; (d) external radiation and internal heat generation; (e) restrictions on generation of harmful gases, vapors or liquids in waste; (f) chemical and structural stability of waste packages, radiation effects, microbial activity, chemical reactions, and moisture; (g) restrictions for chelating and complexing agents; and (h) quantity of free liquids.	§ 61.56 Waste Characteristics	(a) Establishes minimum requirements for all waste classes, including (1) no cardboard or fiberboard box packaging for disposal; (2) liquid waste to be solidified, or packaged with adequate absorbent material; (3) restrictions on free liquid to less than 1 percent of volume; (4) not readily capable of detonation or explosive reactions at normal temperature and pressure; (5) restrictions on generation of toxic gases, vapors, or fumes harmful to personnel; (6) not pyrophoric; (7) gaseous waste to be packaged at less than 1.5 atmospheres at normal temperature and pressure and total less than 100 curies per container; and (8) waste containing chemically or biologically hazardous material to be treated to reduce hazard to the extent practical. (b) Requires structural stability of waste by (1) a stable waste form and/or container; (2) limiting free-standing and corrosive liquids to less than 1 percent of waste volume in a stable container, or 0.5 percent of volume for waste processed to a stable form; and (3) minimize void spaces within the waste and its package

f. Waste treatment	(1) Waste shall be treated by appropriate methods to enable disposal site to meet performance objectives.		No specific parallel - not applicable
	(2) ...Methods such as incineration, shredding, and compaction to reduce volume and increase form stability shall be implemented as necessary to meet performance criteria. Use to increase life of disposal facility and improve performance to the extent it is cost effective.		No specific parallel - not applicable
	(3) Large scale waste treatment facility development requires support by National Environmental Policy Act documentation plus (a) site waste stream analysis and treatment process evaluation; (b) construction design report; and (c) a Safety Analysis Report.		No specific parallel - not applicable
	(4) Operation of treatment facilities requires support by (a) operations and management procedures; (b) personnel training and qualification procedures; (c) monitoring and emergency response plans; and (d) records of each low-level waste package entering and leaving the facility.		No specific parallel - not applicable
g. Shipment	Offsite shipment of low-level waste shall comply with DOE 1540.1.	10 CFR 71 and DOT 49 CFR 173	Define transport requirements for radioactive materials

Table H-1. (continued).

Doe citation	Doe requirement	Nrc citation	Nrc requirement
h. Long-term storage	(1) Shall be stored by appropriate methods to achieve performance objectives of 3.a.		No specific parallel - not applicable
	(2) Records shall be maintained for all low-level waste that enters and leaves the facility.		No specific parallel - not applicable
	(3) Documentation requirements include (a) needs analysis; (b) construction design report; (c) Safety Analysis Report and NEPA documentation; and (d) operational procedures and plans.		No specific parallel - not applicable
	(4) Storage to allow decay and to await disposal by approved methods are acceptable	§ 20.2001(a)(2)	A licensee shall dispose of licensed material...by any one of four methods including decay in storage.
i. Disposal	(1) Low-level waste shall be disposed of to meet the performance objectives of 3.a., consistent with the site radiological performance assessment in 3.b.	Part 61	...Establishes requirements to assure compliance with Subpart C Performance Objectives
	(2) "Engineered modifications (stabilization, packaging, burial depth, barriers) for specific waste types and for specific waste compositions (fission products; induced radioactivity; uranium, thorium, radium) for each disposal site shall be developed through the performance assessment model." ...in the process, site specific waste classification limits may also be developed if operationally useful for specific wastes.	§ 61.51 Disposal site design for land disposal	(1) Site design features for near-surface disposal to focus on long-term isolation and avoidance of need for continuing maintenance; (2) design to be compatible with closure and stabilization plan; (3) design to complement and improve natural site features; (4) covers designed to minimize water infiltration, diverting percolation and surface water from waste and resist degradation; (5) diverted water not to produce erosion requiring maintenance; and (6) minimize contact between water and waste during storage, disposal or post-disposal
	(3) Establishes an Oversight and Peer Review Panel of DOE, contractor and other specialists in performance assessment to ensure consistency and quality		No specific parallel - not applicable
	(4) Disposition of waste designated as greater-than-class C (10 CFR 61.55) must be handled as special case, including special performance assessment through the NEPA process.	§ 61.55(2)(iv) Waste classification § 61.7(b)(5) Concepts	Waste for which form and disposal methods must be more stringent than those specified for Class C waste are not generally acceptable for near-surface disposal. There may be some instances where waste with concentrations greater than permitted for Class C would be acceptable for nearsurface disposal with special processing or design. These would be evaluated on a case-by-case basis.

Table H-1. (continued).

Doe citation	Doe requirement	Nrc citation	Nrc requirement
i. Disposal (cont.)	(5) Additional disposal requirements include: (a) no cardboard or fiberboard boxes not meeting Department of Transportation requirements with stabilized waste and minimum voids; (b) no liquid exceeding 1 percent of waste volume in disposal container, or 0.5 percent of waste processed to stable form; (c) waste not readily capable of detonation or explosive decomposition or reaction at normal temperature and pressure, or explosive reaction with water; (d) waste not contain or generate quantities of toxic gases, vapors, or fumes harmful to workers; (e) gaseous waste packaged at pressure less than or equal to 1.5 atmospheres at 20°C; and (f) no pyrophoric waste.	§ 61.56 Waste characteristics	See previous entry for this Section (page H-6)
	(6) Wastes containing amounts of radionuclides below regulatory concern, as defined by Federal regulations, can be disposed without regard to radioactivity.	§ 20.2005 Disposal of specific wastes	Identifies specific licensed material that may be disposed of "as if it were not radioactive"
	(7) Disposal Site Selection shall (a) have criteria developed for new low-level waste disposal sites, based on planned confinement technology; (b) be based on evaluation of site and confinement technology in accordance with NEPA process; (c) provide a site with hydrogeologic characteristics which, with confinement technology, will protect groundwater resource; (d) consider natural hazards; and (e) have criteria which address impacts on populations, land use, resource development plans and public facilities, transport and utility accessibility, and location of waste generation.	§ 61.50 Disposal site suitability for near-surface disposal	(1) ...Specifies minimum acceptable site characteristics with primary emphasis on isolation of wastes; (2) capable of being characterized, modeled, analyzed and monitored; (3) consider projected population growth relative to performance objectives; (4) avoid natural resource areas whose exploitation might compromise achievement of performance objectives; (5) avoid flooding and poorly drained areas; (6) minimize upstream drainage area; (7) provide sufficient depth to water table; (8) hydrogeologic disposal unit shall not discharge groundwater to the surface within the site; (9) avoid areas with sufficient tectonic activity to challenge the performance objectives; (10) avoid areas where surface geologic processes may adversely affect performance or modeling and prediction; and (11) avoid areas where nearby activities could impact performance objective achievement or mask the ability to monitor that performance.
		§ 61.7(a)(2) Concepts	...Site characteristics should be considered in terms of the indefinite future and evaluated for at least a 500 year time frame.
	(8) Disposal Facility and Site Design (a) require design criteria based on analyses of physiographic, environmental and hydrogeological data, as well as assessments of projected waste volumes and characteristics to assure Order policy and requirements can be met; and (b) disposal units shall be designed in accordance with criteria and NEPA process	§ 61.51 Disposal site design for land disposal	See previous entry for this Section (page H-7)

Table H-1. (continued).

Doe citation	Doe requirement	Nrc citation	Nrc requirement
i. Disposal (cont.)	(9) Disposal Facility Operations (a) requires operating procedures that protect the environment, health and safety of the public and facility personnel; ensure facility security; minimize need for long-term control; and meet closure/post-closure plan requirements; (b) emplacement of permanent markers; (c) training requirements, emergency plans and the unusual occurrence reporting system; (d) minimize voids in disposal units between waste containers; and (e) conduct operations such that active disposal operations will not adversely affect filled disposal units	§ 61.52 Land disposal facility operation and disposal site closure	(a)(1) requires segregation of Class A wastes; (2) requires disposal of Class C wastes greater than or equal to 5 meters below top surface of cover or with intruder barriers designed to resist inadvertent intrusion for greater than or equal to 500 years; (3)-(11) provides specific requirements on maintenance of package integrity, void minimization, cover placement to minimize surface radiation dose rate, marking of boundaries of disposal units, maintenance of buffer zone, closure and stabilization of units as they are filled, prevent adverse effects of active disposal operations on closed units, and no disposal of non-radioactive materials

j. Disposal site closure/post- closure	(1) Requires development of site-specific closure plans for new and existing sites addressing closure within a 5-year period after filling, and conformance with NEPA process. Performance objectives for existing disposal sites developed on a case-by-case basis as part of NEPA process.	§ 61.12(g) Specific technical information (license application)	Requires a description of the disposal site closure plan, including design features intended to facilitate disposal site closure and to eliminate the need for ongoing maintenance
	(2) During closure/post closure, residual radioactivity levels for surface soils shall comply with existing DOE decommissioning guidelines.		No specific parallel - not applicable
	(3) Corrective measures shall be applied to new sites or individual units if conditions occur or are forecast that jeopardize attainment of performance objectives.	§ 61.12(l) Specific technical information (license application)	Requires a description of the plan for taking corrective measures if migration of radionuclides is indicated by monitoring program
	(4) Manage inactive sites in conformance with Resource Conservation and Recovery Act, Comprehensive Environmental Response, Compensation, and Liability Act and Superfund Amendment and Reauthorization Act; or if mixed waste, may be included in permit applications for operation of contiguous disposal facilities.		No specific parallel - not applicable
	(5) Closure plans to be reviewed and approved by appropriate field organization		No specific parallel - not applicable
	(6) Termination of monitoring and maintenance activities to be based on analysis of site performance at end of institutional control period	§ 61.29 Post-closure observation and maintenance	Responsibility for the disposal site, including observing, monitoring and necessary maintenance and repairs, shall be maintained for five years; a shorter or longer period for post-closure observation and maintenance may be established.

Table H-1. (continued).

Doe citation	Doe requirement	Nrc citation	Nrc requirement
k. Environmental monitoring	(1) Each low-level waste treatment, storage and disposal facility (operational or not) to be monitored by a program conforming with DOE 5484.1 and k(2) and k(3)	§ 61.53(c) Environmental monitoring	See previous entry for this Section (Page 4)
	(2) Program shall measure (a) operational effluent releases; (b) migration of radionuclides; (c) disposal unit subsidence; and (d) changes in facility and site parameters that may affect long-term site performance		See previous entry
	(3) Based on facility characteristics, program may include surface soil, air, surface water, and subsurface soil and water both in the saturated and unsaturated zones		See previous entry
	(4) Program shall be capable of detecting trends in performance far enough in advance to permit any needed corrective action, and able to ascertain compliance with Environment, Safety and Health Orders		See previous entry
l. Quality assurance	Consistent with DOE 5700.6C, conduct in accordance with American National Standards Institute/American Society of Mechanical Engineers Nuclear Quality Assurance-1 and other appropriate consensus standards	§ 61.12(j) Specific technical information	Requires a description of the quality assurance program during site qualification, design, construction, operation and closure of the facility
m. Records and Reports	(1) Defines record-keeping requirements for field organizations based on waste manifest data	§ 61.80 Maintenance of records, reports and transfers	Establishes requirements for maintenance of records and their transfer to State and local governmental agencies, and other agencies as designated by the Commission at license termination
	(2) Waste Manifest records shall contain data specified in 3.d.(2) and be kept as permanent records.		See previous entry

H.2 DOE - Nuclear Regulatory Commission Requirement Comparisons

H.2.1 PERFORMANCE OBJECTIVES

The basic performance objectives for the protection of the general public in DOE and Nuclear Regulatory Commission regulations are essentially identical: requiring maintenance of releases as low as reasonably achievable, and setting a limit of 25 millirem/year to any individual from all exposure pathways as a consequence of releases from the disposal site. In addition, the DOE Order limits atmospheric releases of radioactivity from a site to no more than 10 millirem/year as stipulated in the EPA National Emission Standards for Hazardous Air Pollutants regulation, 40 CFR 61.

An apparent difference exists in the approaches specified for protection of a hypothetical future inadvertent intruder by each of the agencies. Nuclear Regulatory Commission requirements for intruder protection are to be met by a combination of defined concentration limits on those wastes that will not decay to acceptable levels within 100 years (Class C wastes) and emplacement at depths greater than 5 meters or with 500year-effective intruder barriers. DOE requires assurance that the specified dose limits will not be exceeded after the 100-year institutional control period and requires the specification of the quantities/concentrations of wastes in waste acceptance criteria for each treatment, storage and disposal facility.

The Nuclear Regulatory Commission initially proposed a rule that included both a 500-millirem intruder dose limit and concentration limits conservatively calculated to achieve that dose. In the final rule, the Nuclear Regulatory Commission removed the dose limit as a requirement for future performance because a licensee could not demonstrate compliance or monitor that future performance; however, that dose value was used as the basis for calculating the concentration limits for Class C wastes. Thus, the apparent difference between the requirements is only superficial and more a consequence of the formal nature of the Nuclear Regulatory Commission regulatory process than a substantive difference in protection afforded the hypothetical future inadvertent intruder, since both agencies use the same dose as a basis for protection features.

H.2.2 PERFORMANCE ASSESSMENT

Both agencies require a radiological performance assessment to demonstrate the compliance of proposed disposal activities with the performance objectives. DOE also requires a performance assessment for the overall waste management system at each site covering activities from the reduction of wastes generated through treatment to their disposal. In keeping with their nature as licensing requirements, Nuclear Regulatory Commission regulations are more explicit in the details of the performance assessment to be provided. Both DOE and the Nuclear Regulatory Commission require monitoring to assess actual and prospective performance.

H.2.3 WASTE CHARACTERIZATION AND ACCEPTANCE CRITERIA

Nuclear Regulatory Commission waste characterization and classifications apply only to the wastes delivered to the disposal site, whereas DOE characterization applies to all aspects of waste management, from its initial segregation at the waste generator, through treatment and interim storage, to its final disposal. The transfer documents, or manifests, specified by each agency (by the Nuclear Regulatory Commission in Appendix F to Part 20) require essentially the same information.

Characteristics of waste packages acceptable for disposal are essentially the same for the two agencies, although the requirements set by the Nuclear Regulatory Commission in 10 CFR 61 Part 56 are specified by DOE in two parts of DOE 5820.2A [3.e.(5) Waste Characterization and 3.i.(5) Disposal]. Because of the nature of the materials handled by DOE in the course of its diverse missions, DOE also requires waste acceptance criteria for criticality safety and for (security) classified low-level radioactive waste not applicable to Nuclear Regulatory Commission licensees.

H.2.4 DISPOSAL SITE SELECTION

For new disposal sites, DOE requires the development of selection criteria that recognize the intended confinement technology, and the selection of a site considering both site and confinement technology characteristics. DOE requirements include consideration of natural hazards and of environmental impacts as well as protection of groundwater resources. Nuclear Regulatory Commission site-selection requirements focus exclusively on site characteristics and require their evaluation for at least a 500-year time frame, reflecting the greater reliance for protection placed by the Nuclear Regulatory Commission on site (as opposed to facility design) features.

H.2.5 FACILITY AND SITE DESIGN

DOE requires facility and site design criteria, the specifications for which (including such factors as stabilization, packaging, burial depth, and barriers) are left for definition by each disposal site [3.i.(2)]; design criteria are to be based on site features as well as expected waste volumes and characteristics [3.i.(8)]. Nuclear Regulatory Commission site design requirements are general with respect to their objectives, except for the specification of the effective life of intruder barriers as 500 years where
Class C wastes cannot be buried at depths greater than 5 meters. In addition to the fundamental site specifications common to both DOE and Nuclear Regulatory Commission requirements, the latter also identifies as requirements the ability of a site to be characterized, modeled, analyzed, and monitored, and the avoidance of areas where nearby activities could adversely impact achievement of performance objectives or substantially mask the monitoring program.

H.2.6 DISPOSAL FACILITY OPERATION

DOE requirements under this title are similar to but less specific than those of the Nuclear Regulatory Commission, particularly with respect to the segregation of Class A wastes (determined by concentration of short- and long-lived radionuclides) and the Nuclear Regulatory Commission requirement for deeper disposal of Class C wastes or the use of a 500-year effective intruder barrier. Both are intended to limit worker and public exposures to those specified in the performance objectives (identical for both agencies) and to promote long-term site stability.

H.2.7 DISPOSAL SITE CLOSURE/POST-CLOSURE

DOE and the Nuclear Regulatory Commission requirements for closure and post/closure activities are similar. Both require site-specific closure plans; the Nuclear Regulatory Commission requires plans for corrective measures, while the DOE requirement is for their application if the attainment of performance objectives is threatened or occurs.

H.2.8 ENVIRONMENTAL MONITORING

DOE and the Nuclear Regulatory Commission requirements for environmental monitoring are quite similar in substance and objectives; both require programs that will demonstrate compliance with public health and safety standards and provide early warning of migration of radioactivity from the disposal sites.

H.3 Nuclear Regulatory Commission - DOE Comparison Summary

Apart from the licensing procedural elements of the Nuclear Regulatory Commission regulations, the most substantial distinctions between the requirements of the Nuclear Regulatory Commission and DOE affecting the disposal of low-level radioactive waste are in the specificity of the Nuclear Regulatory Commission regulations in 10 CFR 61, which are not reflected in DOE Order 5820.2A. To a considerable extent that is the result of the formal regulatory process prescribed for the Nuclear Regulatory Commission and its licensees. Additionally, the more general nature of the DOE Order reflects the greater flexibility required to manage the diversity of waste materials and forms which are produced by the wide variety of missions and activities carried out by and for DOE, as well as the broad range of existing DOE site characteristics that are not reflected at likely licensed disposal sites.

Despite these distinctions, the performance objectives specified for the protection of the public and workers from the operation of low-level radioactive waste disposal facilities are essentially identical, and the means specified for demonstrating compliance (i.e., performance assessments) are also essentially identical in approach. Accordingly, there are no substantive differences in the degree of protection afforded public health and safety inherent in the different agency regulations.

H.4 EPA Hazardous Waste Landfill Requirements

As indicated in the previous discussion, Nuclear Regulatory Commission and DOE design requirements for low-level radioactive waste disposal facilities are prescribed in terms of their performance requirements (i.e., basically their ability to limit radiological dose to meet the respective regulations). In contrast, the EPA regulations governing landfill facilities for hazardous wastes under RCRA (40 CFR 264.301), although not applicable to low-level radioactive waste disposal, prescribe facility design features themselves. These include, for example:

Each new landfill must have two or more liners and a leachate collection and removal system between the liners. The liners must be designed and constructed to prevent migration of wastes out of the landfill to the adjacent subsurface soil or groundwater or surface water during the active period of the landfill (including the closure period).

The liners must be constructed of materials that have appropriate chemical properties and sufficient strength and thickness to prevent failure, be placed upon a foundation or base capable of providing support to the liner and resistance to pressure gradients, and must be installed to cover surrounding earth likely to be in contact with the waste or leachate.

The liner system must include a top and bottom liner. The bottom liner must include two components, the lower of which must be constructed of at least 90 cm (3 feet) of compacted soil material with a hydraulic conductivity of no more than 1 ∞ 10-7 cm/sec (2 ∞ 10-7 ft/min).

The leachate collection and removal system immediately above the top liner must be designed, constructed, operated, and maintained to collect and remove leachate from the landfill during the active life and post-closure care period to ensure the leachate depth over the liner does not exceed 30 cm (1 foot).

The leachate collection and removal system between the liners is also a leak detection system. The requirements for a leak detection system include: constructed of granular drainage materials with a hydraulic conductivity of 1 ∞ 10-2 cm/sec (2 ∞ 10-2 ft/min) or more and a thickness of 30 cm (1 foot) or constructed of synthetic or geonet drainage materials with a transmissivity of 3 ∞ 10-5 m2/sec (2 ∞ 10-2 ft2/min); constructed of materials that are chemically resistant to the waste and leachate and of expected strength and thickness to prevent collapse; and designed and operated to minimize clogging; constructed with sumps and liquid removal methods.

A run-on control system capable of preventing flow into the active portion of the landfill during peak discharge from at least a 25-year storm, and a runoff management system to collect and control at least the water volume resulting from a 24-hour, 25-year storm must be in place.

Thus, the EPA requirements for a hazardous waste landfill do not specify or require "vaults" as such, nor do they specify performance requirements (e.g., environmental exposure or concentration limits), or appear to contemplate that such landfills would consist of more than a trench excavated in the earth with relatively sophisticated engineered systems for leachate collection and infiltration protection. The vaults proposed for disposal of low-level radioactive waste at SRS, as described in Appendix B, greatly surpass the EPA hazardous waste landfill requirements described above.

H.5 Reference

DOE (U.S. Department of Energy), 1987, *Waste Management Activities for Groundwater Protection, Savannah River Plant*, DOE/eis-0120, Savannah River Operations Office, Aiken, South Carolina, December.

PAGE TOC FIGURES TABLES PAGE

PAGE TOC FIGURES TABLES PAGE

Appendix I

I.1 Introduction

DOE completed the draft Environmental Impact Statement (eis) for Waste Management at the Savannah River Site (SRS) in January 1995, and on January 27, 1995, the U.S. Environmental Protection Agency (EPA) published a Notice of Availability for the document in the Federal Register (60 FR 5386). EPA's notice started the public comment period on the draft eis and announced an ending date of March 13, 1995. At a request from the public, DOE extended the comment period through March 31, 1995. This appendix presents the comments received from government agencies and the public during the comment period and DOE's responses to those comments.

Comments by letter, telephone (voice mail), facsimile, and in formal statements made at public hearings were accepted. The hearings, which included the opportunity for informal discussions with SRS personnel involved with waste management, were held in Barnwell, South Carolina on February 21, 1995; Columbia, South Carolina on February 22, 1995; North Augusta, South Carolina on February 23, 1995; Savannah, Georgia on February 28, 1995; Beaufort, South Carolina on March 1, 1995; and Hilton Head, South Carolina on March 2, 1995. DOE received comments from a total of 15 individuals, government agencies, or other organizations including five written or oral statements at the hearing sessions. Ten letters were received. No one submitted comments by facsimile or voice mail. The statements made at the hearings were documented in official transcripts. Each of these comments were assigned unique number codes as follows for reference in this Final eis:

Hearings HH001 through HH002 (Statements made at the Hilton Head meeting)

NA001 (Statement made at the North Augusta meeting)

S001 through S002 (Statements made at one of the Savannah meetings)

Letters L001 through L010

Specific comments by each commentor were numbered sequentially (i.e., 001, 002, etc.) to provide unique identifiers. The individuals, government agencies, and other organizations that submitted comments and their unique identifiers are provided in Table I-1.

The comments DOE received reflect a broad range of concerns and opinions about topics addressed in this eis. The topics most frequently raised by commentors were concerns about specific facilities, including the Consolidated Incineration Facility; the various waste types this eis addresses; public participation; and potential impacts on human health. Comments received from government agencies consisted primarily of statements of no conflict or requests for clarification. The EPA endorsed the proposed action in their response and gave the Draft eis a rating of EC2. This rating indicated that the agency has environmental concerns about the project and that EPA needs more information to fully assess the impacts.

DOE also received numerous comments that raised issues outside the scope of this eis; many of them involved proposed actions that are being evaluated in other National Environmental Policy Act (NEPA) reviews. DOE considered those comments it received during the comment period that were within the scope of this eis in the preparation of the final eis. Individual comments received and DOE's responses, identified by the numbering system described above, are provided in Parts 1, 2, and 3 of this appendix. Where appropriate, DOE revised the eis in response to these comments. In such cases, the revision is indicated in the margin of the page with a change bar and the number of the comment that prompted the revision.

Table I-1. Public Comments on the Draft Environmental Impact Statement.

Statements Made at the Public Hearings

Comment Source No.	Commentor	Response To Comment
NA	**North Augusta, SC, February 23, 1995**	
NA001	Bob Overman	Response To Comment

S	**Savannah, GA, February 28, 1995**	
S001	Jean O. Brown	Response To Comment
S002	Fred Nadelman Coastal Citizens for a Cleaner Environment	Response To Comment
HH	**Hilton Head, SC, March 2, 1995**	
HH001	George Minot	Response To Comment
HH002	Charlotte Marsala	Response To Comment

Correspondence Received from Government Agencies and the Public

Comment Source No.	Commentor	Response
L001	James E. Bolen	Response To Comment
L002	W. F. Lawless Citizens Advisory Board	Response To Comment
L003	Andreas Mager, Jr. National Marine Fisheries Service	Response To Comment
L004	Kenneth W. Holt Dept. Of Health and Human Services	Response To Comment
L005	Shirley Dennis	Response To Comment
L006	Robert H. Wilcox	Response To Comment
L007	Debra K. Hasan Citizens for Environmental Justice	Response To Comment
L008	Heinz J. Mueller U.S. Environmental Protection Agency, Region IV	Response To Comment
L009	Mary T. Kelly League of Women Voters	Response To Comment
L010	W. F. Lawless Citizens Advisory Board	Response To Comment

I.2 Statements Made at the Public Hearings

Response to Comment NA001-1

The comment suggests that DOE should address the hazards of the decomposition of organic materials present in low-level wastes previously sent to shallow land disposal at SRS by excavating these wastes and treating them to destroy the organic fraction by incineration. Additionally, the commentor recommended that the incinerator ash be vitrified, and that buried contaminated metals be retrieved and processed by smelting before sale or reburial. These techniques are generally consistent with the extensive treatment configuration described in alternative C. However, the Waste Management eis does not establish what type of environmental restoration activities should be implemented for the various waste sites at SRS. The SRS low-level waste disposal facilities are being investigated in accordance with the SRS Federal Facility Agreement. A formal risk assessment and remedial investigation will be performed for the Burial Ground Complex under Resource Conservation and Recovery Act (RCRA) Section 3004(u)/Comprehensive Environmental Response, Compensation, and Liability Act
Section 120(e) to determine the facility's closure and postclosure performance objectives and requirements. These analyses will consider the hazards presented by the wastes, including the potential for gas formation as a result of the decomposition of organic materials and the potential for migration of contaminants on buried organic and metal wastes, to establish appropriate remediation requirements. These hazards will be weighed against the risks posed by the remediation alternatives, including worker exposure during excavation of the wastes and the emissions associated with any treatment performed on the excavated materials.

Response to Comment S001-01

DOE believes that the charts and other technical information that were presented at the public hearings on the SRS Waste Management Draft eis accurately describe the waste management alternatives and their impacts. Because the alternatives in the eis include new facilities that have not been operated at SRS, DOE studied similar existing facilities and used validated analytical techniques and models to estimate impacts. In their review of the eis, federal and state agencies examined the results of DOE analyses and provided their comments as presented in this Appendix and Appendix J. The eis has also been subject to independent peer review, as discussed in the response to comment L002-02. The analytical procedures and models used to determine the impacts presented on the charts are discussed in the eis. For example, refer to Section 4.1.3 for groundwater resources, Section 4.1.5 for air resources, Section 4.1.12 for health effects, and Section 4.1.13 and Appendix F for further detail on accidents.Letter S002.

Response to Comment S002-01

Plutonium storage is out of the scope of this eis. The response to comment L007-07 provides additional information on the storage of transuranic waste, which may contain plutonium. DOE addresses plutonium storage and storage of other weapons materials in other National Environmental Policy Act documentation including the *Stockpile Stewardship and Management Programs 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 *FCanyon Plutonium Solutions eis* (DOE/eis0219), the *Interim Management of Nuclear Materials eis* (DOE/eis-0220), the *Long-Term Storage and Disposition of Weapons - Useable Fissile Materials Programmatic eis* (DOE/eis-0229), the *Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components eis* (DOE/eis-0225), and the *Environmental Assessment for Operation of the HB-Line Facility and Frame Waste Recovery Process for the Production of Pu-238 Oxide at the SRS* (DOE/eis-0948).

Response to Comment S002-02

The Department of Energy Savannah River Operations Office is committed to the safe storage and disposal of all nuclear and other hazardous materials for which it is responsible. Standards for the storage and disposal of radioactive material are set forth in the Atomic Energy Act of 1954 (42 USC §201 *et seq.*) and implemented through DOE Orders. The DOE Orders establish an extensive system of standards and requirements that protect human health and minimize dangers to life or property from radioactive material management activities under DOE's jurisdiction. DOE Order 5820.2A, "Radioactive Waste Management," establishes performance criteria for the storage of high-level and transuranic wastes and for the storage and disposal of low-level wastes. The performance criteria for low-level waste disposal facilities require that a radiological performance assessment be developed that projects the migration of radionuclides from the disposed waste to the environment and estimates the resulting dose to people. The performance assessment is used to establish the combination of waste inventory and proposed disposal method that provides reasonable assurance that the performance objectives will be met. Engineered structures, such as the low-level waste disposal vaults, and enhanced waste forms, such as the stabilized waste forms to be achieved by the Consolidated Incineration Facility or the proposed vitrification facilities, evaluated in this eis are designed to provide containment of the radioactive materials in accordance with applicable requirements.

Further, the Atomic Energy Act, as amended, and other related statutes give EPA responsibility and authority for developing generally applicable standards for protection of the environment from radioactive material. EPA has promulgated several regulations under this authority including the "Environmental Radiation Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Wastes" (40 CFR 191). DOE must manage its radioactive wastes in accordance with applicable EPA regulations. In addition, the management of radioactive waste that also contains hazardous waste components, known as mixed waste, is also subject to regulation under RCRA, which is coadministered by the state of South Carolina.

Response to Comment S002-03

DOE analyzes accident scenarios associated with existing and proposed waste processing, storage, and disposal facilities in Appendix F, "Accident Analysis," of this eis. Accident analysis methodology included natural phenomena initiators such as floods, tornadoes, and earthquakes. DOE considers the potential for flood damage in the design of SRS facilities.

Both above-grade and below-grade storage and disposal facilities would be located in E-Area, which is centered over the drainage divide between Upper Three Runs and Fourmile Branch and is approximately 30 meters (100 feet) above their floodplains (as shown in Figure 3-7 of the eis). Sites of new construction would be graded to direct stormwater away from the storage and disposal facilities. In addition, facility design would include sumps to remove water that entered underground disposal areas. Therefore, flooding would not damage above- or below-grade storage and disposal facilities.

As shown in Figure 3-4 of the eis, no earthquake fault underlies E-Area, where SRS waste management activities are carried out. A design-basis earthquake, which has an estimated ground acceleration of
0.2 times the acceleration of gravity (0.2*g*), is (as stated in Section 3.2.3 of the eis) estimated to have a 2.0 ∞ 10-4 annual probability of occurrence (1 in 5,000 years) at SRS. Appendix F analyzed 24 potential accidents that would be initiated by earthquakes. The analysis shows that the risk of these accidents (probability ∞ consequences), both individually and cumulatively, is not the highest risk event for any waste type. The highest risk accident to a storage or disposal facility initiated by an earthquake would increase the likelihood of a fatal cancer to the offsite maximally exposed individual by 4 chances in
1 million which would not be detectable, given the individual likelihood of fatal cancer from all causes of about 1 in 4. As stated in Section F.7, Secondary Impacts from Postulated Accidents, no adverse impacts on water quality from postulated accidents are considered likely. Contamination would migrate slowly to the groundwater, so clean-up efforts that would follow a release incident would capture the contaminants before they reach the groundwater, and it is unlikely that the postulated accidents would result in offsite contamination.Comment HH-001.

Response to Comment HH001-01

Although specific alternatives for environmental restoration (i.e., cleaning up contaminants released into the environment in the past) would be subject to separate NEPA review, if appropriate, DOE has included in this eis the waste volumes that could be generated from environmental restoration activities. As the discussions at the hearing indicated, DOE-Savannah River Operations Office is evaluating the feasibility of in-place vitrification of contaminated soil as well as other in-place treatments. In-place vitrification is addressed in Appendix D, Section D.7.15 of the eis as an emerging treatment technology which may well be employed for the treatment of some or much of the contaminated soil at SRS. Sections 2.1.3, 2.1.4, and 2.1.5 of the eis show that the expected, minimum, and maximum waste volumes resulting from environmental restoration activities depend on whether inplace treatment is viable (as assumed for most of the units in the minimum waste forecast) or the waste must be removed for treatment (as assumed for most of the units in the maximum waste forecast).

As indicated in Section 2.1, the environmental restoration program is regulated by the *Federal Facility Agreement for SRS*, an agreement between EPA, the South Carolina Department of Health and Environmental Control (SCDHEC), and DOE. Characterization of the environmental restoration units (identified in Appendix G) is in its early stages. Therefore, DOE believes it would be premature to consider site-specific environmental restoration alternatives in this eis. DOE-Savannah River Operations Office has established a land use planning group to develop a comprehensive land use plan and land use options for the SRS.

Response to Comment HH002-01

Subsidizing or providing additional scintillation monitors for Savannah River water users is outside the scope of the Waste Management eis. However, this suggestion was forwarded to the DOE Savannah River Environmental Compliance Division for review.

After detailed review of DOE's and the state's monitoring program, DOE believes that additional monitoring is not necessary because of the following reasons:

- DOE presently monitors the tritium concentrations at a number of locations upstream of Savannah, GA including Highway 301, and the Beaufort Jasper and the Port Wentworth water treatment plant intakes. DOE presents the results of its monitoring program for public review in the *SRS Annual Environmental Monitoring Reports*. The 1994 annual dose to an individual who drank two liters of water per day from either of the Savannah River water intakes (0.06 millirem) is well below a level that would cause concern. DOE encourages public participation in its environmental monitoring program through review of the *SRS Annual Environmental Monitoring Reports*.

- River water at Highway 301 is routinely sampled by SCDHEC to independently verify that there are no health concerns presented by the Savannah River due to contaminants released from SRS.

We also wish to note that the SRS reactors, which in the past presented the greatest risk of an unplanned release, are presently shutdown. Only the K-Reactor is being maintained for possible future missions. Before K-Reactor was shutdown, the component that caused the release in December 1991 was replaced and successfully tested. That component has been drained and deactivated for over 2 years.

Response to Comment HH002-02

Lawrence Livermore Laboratories is currently bench-scale testing a less energy-intensive water desalination technology. The technology works on the principle of deionization. Deionization is simply the stabilization of the electrical charge on an atom, group of atoms, or molecule by maintaining or restoring its electrical configuration. The deionization unit would contain charged ion plates (i.e., positive and negative) that would be used to attract the salt molecules from saltwater. To purge the system the charge on the plates would be reversed and a concentrated brine (i.e., salt) solution would be removed. The plates would then be reversed again and the system would be ready to treat more saltwater. There is no application of this technology for desalination purposes at SRS, however, in theory the technology could be applied to the treatment of wastewater with inorganic contaminants.

Since this technology is being developed by DOE through the Office of Technology Development (OTD), its applications to SRS would be evaluated and applied through the DOE complex-wide focus areas which include: plumes (i.e., groundwater plumes), landfills, stabilization (i.e., materials and waste), high level waste, and mixed waste. OTD communicates the potential application of emerging and developing technologies to SRS.

In response to the comment about layoffs, in this eis DOE evaluated the manpower needed to construct and operate the treatment, storage and disposal facilities. This includes retraining personnel to perform waste management activities.

I.3 Correspondence Received from Government Agencies and the Public

Response to Comment L001-01

EPA has established regulations under the Toxic Substances Control Act that specify standards for the incineration of polychlorinated biphenyl materials (PCBs). As noted in the comment, these standards are generally more restrictive than those imposed on the incineration of hazardous wastes under RCRA. For example, a destruction and removal efficiency of 99.9999 percent is specified for the incineration of PCBs as opposed to the efficiency of 99.99 percent generally required by RCRA regulations. Certification of an incinerator under the Toxic Substances Control Act requires extensive testing in addition to that required for RCRA permitting. Furthermore, the EPA regulations under the Toxic Substances Control Act prohibit generators of PCB materials from avoiding, by dilution, requirements applicable to materials contaminated in excess of specified PCB concentrations. It would not be cost-effective to obtain permits under the Toxic Substances Control Act for the small amount of PCB wastes that could be treated at the Consolidated Incineration Facility, and it would not be legal to circumvent the Toxic Substances Control Act regulations by diluting PCB wastes.

Response to Comment L001-02

Implementation of steam or electrical power generation by recovering waste energy from the Consolidated Incineration Facility was considered at the time the process was being designed. Energy recovery was not adopted because the economic benefits were marginal. The small thermal capacity of the Consolidated Incineration Facility design limits the amount of recoverable energy. Additionally, energy recovery would increase the complexity of operations and maintenance and require that the combustion offgas be held at a temperature range known to promote the formation of undesired combustion products such as dioxins and furans. The costs to enhance the air pollution control system to counter this increased pollutant generation and maintain emissions at safe levels would offset any cost benefits of energy recovery. Retrofitting an energy recovery system into the Consolidated Incineration Facility at this time would significantly impact design of the downstream air pollution control system. Substantial costs would also be incurred to modify various environmental permits and to repeat emissions tests such as the trial burn required by RCRA.

Response to Comment L002-01

On March 3, 1995, the Manager, DOE-SR, extended the public comment period through March 31, 1995, to allow the Citizens Advisory Board time to consider and present comments. On March 13, 1995, DOE issued a press release announcing the extension of the public comment period; the announcement was published in local newspapers.

Response to Comment L002-02

DOE retained nationally recognized experts in waste management to provide independent review before issuing the Draft eis. Four individuals participated, three of whom also provided independent review of the *SRS Proposed Site Treatment Plan* prepared in response to the Federal Facility Compliance Act of 1992. The reviewers were required to sign a "no conflict of interest" statement stating that they have no financial, contractual, personal, or organizational interests in decisions reached through the eis that could affect their ability to render impartial advice. Their reviews included reading the documents, extensive discussion meetings at SRS, and submittal of written review comments. Their recommendations were incorporated into the draft eis.

Response to Comment L003-01

As described in the respective sections on surface water impacts in Chapter 4, no substantive changes in the physical, chemical, or biological characteristics of the surface waters feeding the Savannah River are expected to result from implementing any of the alternatives evaluated in the eis. This is due to the essential similarity of the very low concentrations in the projected discharges to those currently being released in accordance with the conditions of the current National Pollutant Discharge Elimination System Permit, and the very small volumetric addition of a few percent, relative to the natural stream flows, at the maximum.

Discharges from SRS treatment systems and outfalls are monitored for the constituents included on the National Pollutant Discharge Elimination System permit on a schedule prescribed by the permit. If a discharge is found to exceed the permit limits, DOE determines the cause of the exceedance and corrects the problem. Most of the treatment systems can be shut down and the wastewater stored until the problem is corrected. Both the M-Area Dilute Effluent Treatment Facility and the F/HArea Effluent Treatment Facility can be operated in a batch treatment mode. The M-Area Air Stripper can be shut down (the wells supplying the groundwater would cease pumping) until any problem could be corrected. Also, SRS has an ongoing stream monitoring program (not part of the National Pollutant Discharge Elimination System program) for the collection and analysis of samples. Thus, any changes in constituent concentrations would be noted and steps taken to locate the source of the changes. It should be noted that tables in Section 1.0 of Appendix E indicate that the radionuclides in the aqueous discharges will be very low as was explained in Section 4.1.4 of the eis.

As discussed in Section 4.1.4, measures would be taken to control the impact of stormwater runoff during both construction and operation activities. SRS must meet criteria of National Pollutant Discharge Elimination System permits issued by SCDHEC for both activities. Pollution prevention plans have been prepared which detail the steps to be taken to control suspended solids, debris, and oil/grease that may be in the runoff and impact the streams (WSRC 1994). Facilities or measures taken to control these impacts would be regularly inspected. Additionally, immediately following major rain events, the facilities would be inspected. If problems are found during these inspections, DOE would take corrective actions to mitigate the problems.

Response to Comment L003-02

A protected species survey of the uncleared part of E-Area has been completed and submitted to U.S. Fish and Wildlife Service and the National Marine Fisheries Service. This survey, dated February 3, 1995, initiated informal consultation as required by Section 7 of the Endangered Species Act of 1973. The survey concluded that activities proposed for E-Area north of F-Area and south of the M-Line Railroad will not affect any Federally protected animal or plant species. The revised survey of April 1995 is included in this eis as Appendix J.

The survey does not address impacts to threatened and endangered species on additional land outside the boundary of E-Area that would be needed if SRS is required to manage the maximum waste forecast. If land outside E-Area is needed, additional surveys for threatened and endangered species would be required and another Section 7 consultation would be initiated with U.S. Fish and Wildlife Service. Until decisions are made on the facilities that are needed and the amount of waste that would be handled at SRS, the selection of additional land would be premature.

Response to Comment L004-01

The downstream population which uses the Savannah River as the source of its drinking water is not considered part of the population within 80 kilometers (50 miles) of SRS. The text in Section 3.8.5 has been modified to clarify this point. In addition, a map locating all the communities within the 80-kilometer (50-mile) radius has been added to that section.

Response to Comment L004-02

All tables and figures in the document have been numbered.

Response to Comment L004-03

The term "collective dose" has been added to the glossary. Figures and tables were searched and other words have been included in the glossary.

Response to Comment L004-04

Because this probability of contracting a latent fatal cancer is not related to the waste management alternatives considered in the eis, DOE believes that it is inappropriate to include a discussion of health impacts in Chapter 3, which only describes the affected environment. The sentence discussing the probability of contracting a fatal cancer has been deleted to make the discussion in question consistent with others in this chapter.

Response to Comment L004-05

N-Area data was inadvertently omitted from the discussion of gamma radiation levels. The data are now included in the table in Section 3.12.1.3. In addition, the level for N-Area given in the text of Section 3.12.1.2 was incorrect. The correct value is 460 millirem per year. The text has been corrected.

Response to Comment L004-06

DOE agrees with the comment. All citations dealing with risk conversion factors have been changed to reflect the original reference found in ICRP (1991).

Response to Comment L004-07

Table 4-8 (originally Table 4.1.11-4) has been revised and no longer presents low consequence accidents.

Response to Comment L004-08

DOE has revised the paragraph to clarify that the number of cancer deaths expected is not specific to the population in the vicinity of SRS but to any population of comparable size.

Response to Comment L004-09

The entry in the figure has been corrected.

Response to Comment L004-10

The entry in Table 4-31 (formerly Table 4.2.11-9) has been corrected to 4.110-11.

Response to Comment L004-11

The table reference has been corrected.

Response to Comment L004-12

The word "additional" has been added to the sentence to make the statement correct.

Response to Comment L004-13

Contributions of various isotopes to the offsite maximally exposed individual and population doses were determined by developing isotope-specific emission factors for each facility. These factors, when coupled with facility throughput data based on the alternative and the waste forecast, yielded total quantities of each isotope released from each facility. The release values were then used with facilityspecific unit-activity isotopic dose conversion factors to determine the isotope-specific doses. Calculated isotopic-specific doses are reported in Section E.4 (Appendix E). A detailed description of the calculations can be found in Chesney (1995). The text of the eis has been revised to refer the reader to Appendix E and to Chesney (1995) for additional information.

In addition, the text in the no-action alternative section has been changed. In the no-action alternative (Section 4.1.5.2.2) the F-Area tank farm and the M-Area Vendor Treatment Facility have been added to the list of facilities that contribute to offsite doses.

Response to Comment L004-14

Reference to the footnote in the table has been corrected and the footnote has been modified to explain how the value is calculated.

Response to Comment L004-15

The table reference has been corrected.Letter L005.

Response to Comment L005-01

DOE intends to pursue funding to support the initiatives developed on the basis of this eis and the obligations imposed under the Federal Facilities Compliance Act. DOE-Savannah River prioritizes and requests funding for various projects through DOE-Headquarters (HQ). DOE-HQ requests funding from the U.S. Congress, which either approves or disapproves the request.

Response to Comment L005-02

DOE is investigating two sites for the permanent disposal of transuranic and high-level wastes. If approved, permanent repositories for transuranic waste in Carlsbad, New Mexico, and for highlevel waste in Yucca Mountain, Nevada, would dispose of these wastes. However, as described in this eis, SRS would contain permanent disposal sites for certain low-level and mixed/hazardous wastes. Letter L006.

Response to Comment L006-01

NEPA requires agencies to prepare a detailed statement (i.e., an eis) on proposals for major Federal actions significantly affecting the quality of the human environment. DOE determined that the actions proposed in this eis are major and may significantly affect the environment. Simply stated, DOE supports NEPA and its goal to ensure that environmental amenities and values are considered in decisionmaking along with economic and technical considerations.

Response to Comment L006-02

DOE is required and fully intends to comply with current, applicable regulations. This eis considers three reasonable alternatives (alternatives A, B, and C) that would comply with applicable waste management requirements. However, the suggested "fresh look" at environmental requirements is not only outside the scope of this eis, but is also beyond the authority of DOE to implement.

Response to Comment L006-03

The NEPA process includes the formulation of reasonable alternatives that are feasible from a common sense, technical, and economic standpoint. As paraphrased from the Summary and Chapter 2, the factors used to identify the most desirable technologies include process efficiency and effectiveness, engineering feasibility, costs, and environmental attributes. Because the environmental impacts of the candidate technologies are very small, the values of the other criteria are expected to weigh heavily in the decisionmaking process.

Response to Comment L006-04

DOE agrees that the impacts resulting from any of the operating scenarios for the Consolidated Incineration Facility evaluated in this eis are very small. DOE evaluated a wide range of alternative operating scenarios for this facility to aid in establishing the appropriate role of incineration in an integrated waste management system for SRS. Different waste types (including hazardous, mixed, and low-level wastes) and volumes were proposed for treatment at the Consolidated Incineration Facility. The operating scenarios considered ranged from modifying the facility to include solid waste feed and ash handling systems capable of accommodating large volumes of soils and sludges to operating the incinerator for only a limited time until a non-alpha vitrification facility could be designed and constructed. The emissions and exposures associated with the operation of the Consolidated Incineration Facility vary with the waste volumes proposed for treatment under each alternative; however, under all alternatives, the impacts would be very small. DOE will consider the environmental consequences evaluated in this environmental impact statement along with costs, schedule, and regulatory requirements in reaching a decision regarding the operation of the Consolidated Incineration Facility. DOE will document its decision in the Record of Decision for this eis.

Response to Comment L006-05

DOE believes that the responses to comments L006-01 and -03 address this concern. Part of the process is to identify the real and potential issues and to implement the actions required to establish a safe and cost-effective mix of treatment, storage, and disposal facilities.

Response to Comment L007-01

The three action alternatives (alternatives A, B, and C) examined in the Waste Management eis represent treatment, storage, and disposal configurations that would provide the capability to manage all SRS wastes in accordance with applicable regulatory requirements. The alternatives represent different strategies (limited, moderate, and extensive treatment) for meeting regulatory objectives. The extensive treatment scenario of alternative C is not prescribed by regulation.

Some of the regulations applicable to SRS waste management prescribe the technology to be used to manage a particular type of waste, whereas other regulations establish a level of performance that the management technology must achieve. For wastes for which regulations prescribe a particular technology, the prescribed technology is included in all three action alternatives. For example, EPA regulations under RCRA specify that all mixed high-level radioactive wastes be treated by vitrification, and DOE would use vitrification to treat its mixed high-level waste under any of the three action alternatives. Where the regulations establish performance criteria but do not prescribe a method of treatment, DOE considered a range of management technologies in this eis. This analysis allowed DOE to compare the benefits afforded by each technology (e.g., volume reduction, migration resistance of the final waste form) and the corresponding impacts of implementation (e.g., worker and public health, cost, safety) as part of the basis for selecting a waste management configuration.

Public involvement in the NEPA process does not establish or alter regulatory policy. Agencies responsible for establishing regulations provide the regulations for public review during their development. For example, EPA provides for public involvement in the development of new RCRA regulations. The text of the proposed regulation is published in the *Federal Register* and supporting information used by EPA to develop the proposal is available for public review in the RCRA docket. EPA considers any comments received on the proposed regulation in developing the final regulation.

Response to Comment L007-02

This comment refers to the category of low-level waste known as "class C" waste. This waste classification is defined in 10 CFR 61.55 (U.S. Nuclear Regulatory Commission) as waste that must meet rigorous requirements on its waste form to ensure stability; it also requires additional measures at the disposal facility to protect against inadvertent intrusion. This classification is generally reserved for waste containing high concentrations of long-lived radioisotopes such as carbon-14 and iodine-129 (halflives of 5,730 and 17,000,000 years respectively). Waste containing concentrations of long-lived radionuclides in excess of the class C criterion is referred to as "greater-than-class C" waste and is generally not acceptable for near-surface disposal. These wastes would normally be disposed of in a geologic repository as defined in 10 CFR 60.

DOE classifies waste differently from the 10 CFR 61 waste classification system; however, DOE discusses the disposition of greater-than-class C waste in DOE Order 5820.2A, "Radioactive Waste Management." The Order requires that disposal systems for such waste be justified by specific performance assessments through the NEPA process.

Though not specifically discussed in the WMeis, small quantities of waste meeting the greaterthanclass C criteria of 10 CFR 61.55 have been identified at SRS. This waste, consisting primarily of spent-deionizer resins from reactor moderator purification systems, has been included in the long-lived low-level waste category. Section 2.2.3.3 of the WMeis states that DOE plans to store this long-lived waste in the long-lived waste storage buildings in E-Area. The Waste Management Programmatic eis evaluates a regionalization alternative under which a very small amount (less than 1 cubic meter) of greater-than-class C waste would be transferred to SRS. Receipt of this very small amount of additional low-level waste would not affect the alternatives considered or the environmental consequences evaluated in the eis; DOE would manage this waste as long-lived low-level waste.

Response to Comment L007-03

In the absence of a site-specific radiological performance assessment, the existing disposal units in the Low-Level Radioactive Waste Disposal Facility cannot demonstrate conformance with the performance objectives and assessment requirements of DOE Order 5820.2A. DOE determined that disposal of lowlevel wastes that have not been certified as conforming to the DOE Order 5820.2A requirements should cease as of March 31, 1995. Shallow land disposal of uncertified wastes at the Low-Level Radioactive Waste Disposal Facility concluded March 31, 1995 with limited exceptions (such as the continued use of suspect soils to backfill the existing disposal units). DOE will continue to dispose of wastes that have been certified to comply with waste acceptance criteria based on radiological performance assessments. Such disposal will occur at the E-Area vaults (for most low-level waste) and shallow land disposal (for suspect soils only) in the area adjacent to the Low-Level Radioactive Waste Disposal Facility for which a radiological performance assessment has been completed. DOE assumes that radiological performance assessments to be developed in the future will support shallow land disposal of additional lowlevel wastes such as the stabilized ash and blowdown wastes from the Consolidated Incineration Facility.

Response to Comment L007-04

Although the technology exists, SRS does not have a facility to completely characterize radiological properties of transuranic waste (waste contaminated with greater than 100 nanocuries per gram). SRS conservatively manages alpha waste (material in the activity range from 10 to 100 nanocuries per gram) as transuranic waste. SRS plans to ship its transuranic waste to the DOE Waste Isolation Pilot Plant when that facility becomes operational. Once the Waste Isolation Pilot Plant Waste Acceptance Criteria are finalized, SRS plans to develop the transuranic waste characterization/certification facility to characterize and repackage its transuranic waste for shipment to the Waste Isolation Pilot Plant. The alpha waste would be certified as mixed low-level waste or low-level waste for disposal at SRS. The characterization of hazardous constituents would continue to be based on the process knowledge of the generator and the waste would be packaged to meet the Waste Isolation Pilot Plant No-Migration Petition requirements once approved.

Response to Comment L007-05

As stated in Section 3.12.2.2 the current SRS radiological control program implements the Radiation Protection Guidance to the Federal Agencies for Occupational Exposure approved by President Reagan on January 20, 1987, and issued to all Federal agencies. This guidance has been 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.*

The safety of the public and the well-being of the environment is ensured by conduct of the effluent monitoring and environmental surveillance programs at SRS; the programs are based on current scientific understanding of radiation effects, which is reflected in DOE orders. DOE Order 5400.1, "General Environmental Protection Program," requires the submission of an environmental report that documents the impact of facility operations on the environment and on public health. These annual reports demonstrate compliance with requirements of DOE Order 5400.5, "Radiation Protection of the Public and the Environment."

DOE is firmly committed to operating a Radiological Control Program of the highest quality. This commitment applies to all DOE activities that manage radiation and radioactive materials and that may potentially result in radiation exposure to workers, the public, and the environment. Performance excellence has been demonstrated by maintaining radiation exposures to SRS workers and the public, at values which are well below regulatory limits.

Response to Comment L007-06

The disposition of spent nuclear fuel at SRS and other sites in the nuclear weapons complex is not within the scope of this eis. DOE exercises strict control over all fissionable material for which it is responsible because of the potential risks associated with these materials. DOE is preparing other eiss which address these issues; please refer to Table 1-1 in this eis.

Response to Comment L007-07

SRS performs storage of its transuranic waste in accordance with its RCRA Part A Permit and DOE orders. SRS utilizes containers and storage pads in accordance with detailed procedures to protect human health and the environment. Depending on the size of the waste material, transuranic waste is packaged in 55-gallon drums or carbon steel boxes. For drums with greater than 0.5 curies of alpha activity, up to 14 drums are placed inside a concrete culvert which is sealed to protect against potential radiological exposure.

As indicated in Section 2.2.6 and Section B.30 of Appendix B, the SRS procedures for transuranic waste address requirements for packaging and segregating waste, labeling and assaying containers, recordkeeping of container contents, onsite transportation, storage of containers and inspection of storage facilities. The storage facility consists of 19 reinforced concrete pads roughly 80 ft. by 150 ft. in size known as "TRU pads." The transuranic waste pads are all located in an area with controlled access in the central portion of SRS. TRU Pads 1-17 operate under RCRA interim status which requires a contingency plan for emergencies and maintenance of inspection records and facility personnel training records. TRU Pads 1-6 are full of containers and in accordance with past interim storage practices are covered with soil until their retrieval. This interim storage practice provides added radiological protection to humans and the environment from the transuranic waste and protection of the containers from the weather. TRU Pads 7-13 are uncovered pads that store primary carbon steel boxes and concrete culverts. TRU Pads 14-17, where 55-gallon drums are stored, are covered with plastic enclosures, and resemble greenhouses. TRU Pads 18-19 operate under DOE orders since they store only nonhazardous transuranic waste. These two uncovered pads contain only carbon steel boxes. Through years of study and management of transuranic waste, SRS has utilized the above mentioned interim storage practices to protect humans and the environment and provide safe retrievable storage of transuranic waste.

The SRS RCRA Part A Permit for TRU Pads 1-17 allows a maximum of 84,200 55-gallon drums, although this number will not be reached due to the other storage containers on the pads and packing of higher activity drums inside concrete culverts. Based on the current volume estimate for transuranic waste in storage of 10,053 cubic meters (2,656,000 gallons), it has been conservatively estimated that no more than 48,000 55gallon drums are presently in storage at the transuranic waste facility.

Response to Comment L007-08

Remedial decisionmaking is regulated by the *Federal Facility Agreement for SRS*, an agreement between the U.S. Environmental Protection Agency, the South Carolina Department of Health and Environmental Control, and DOE. Characterization of the environmental restoration units (identified in Appendix G) is in its early stages. DOE believes it would be premature to consider site-specific environmental restoration alternatives in this eis, and therefore does not include site cleanup in the scope of this eis.

Response to Comment L007-09

The placement of all wastes in the most stable form possible is consistent with the extensive treatment configuration alternative (alternative C). The waste that would be transported to geologic repositories (high-level and transuranic waste) requires permanent isolation from the environment. DOE is investigating two sites for the permanent disposal of transuranic and high-level wastes. If approved, permanent repositories in Carlsbad, New Mexico, and Yucca Mountain, Nevada, would dispose of these wastes. The design and operation of these sites is not in the scope of this eis. SRS high-level waste would be processed in the Defense Waste Processing Facility and the vitrified product would be enclosed in stainless steel canisters and transferred to the Yucca Mountain repository for permanent disposal. DOE recently issued a Supplemental eis on this facility (DOE 1994) and a Record of Decision (DOE 1995).

Response to Comment L007-10

Pollution prevention, including minimizing the spread of waste, is an integral part of SRS's pollution prevention program under the *Department of Energy, Savannah River Site Waste Minimization and Pollution Prevention Awareness Plan, FY 1995*. The waste minimization program has identified source reduction, through administrative controls and good housekeeping practices, as an essential element to achieve waste volume reduction. The source reduction program includes administrative controls that reduce the likelihood of spills and minimize the spread of contamination. Section 2.2.1.3 presents the 1994 waste minimization goals. These goals are reviewed at least annually and progress reports, which are prepared quarterly, show substantial and continuing achievement of its goals.

Response to Comment L007-11

DOE agrees. DOE-SR has established a Citizens Advisory Board to help achieve this objective. Public and state government involvement is a significant component of the Federal Facility Compliance Act, which involves selection of the technology for the management of mixed waste.

Response to Comment L007-12

DOE agrees that certain waste in storage requires characterization and separation; this eis analyzes a proposal to construct and operate the transuranic waste-transuranic waste--> characterization/certification facility and a soil sort facility for these purposes. All of the action alternatives considered in the eis have the objective of isolating wastes from the environment. Among these alternatives, alternative C would achieve the most stabilization, while alternative A could be implemented most quickly.

The comment regarding onsite management versus transport of waste is a DOE complex-wide issue. The final eis includes an offsite low-level waste volume reduction initiative that has several advantages over the supercompactor described in the draft eis (Section 2.6.3). The analysis indicates that transportation impacts are very small.

In general, strategies for the management of DOE nuclear weapons complex waste are beyond the scope of this eis but are being addressed in the Waste Management Programmatic eis. The minimization of waste transport by onsite treatment, storage, and disposal is consistent with the decentralization alternative that is under consideration in the programmatic eis.

Response to Comment L007-13

DOE has attempted in this eis, and in other documents over the years, to inform the public about the risks associated with the wastes which result from its operations. It is difficult to convey this important information in a manner which is accurate and understandable, and yet does not raise undue and unfounded fears among members of the public. DOE welcomes any suggestions for means to share this information with the public.

Response to Comment L007-14

DOE agrees that prolonged storage is not an acceptable substitute for proper treatment and disposal. The alternatives considered by DOE include waste storage only until the required treatment and disposal technologies can be developed and implemented. When prolonged storage may be required pending a disposal determination, DOE proposes that treatment be provided that will minimize hazards associated with such storage.

Response to Comment L007-15

The eis has identified in Chapter 4, as well as in Appendices E and F, the magnitudes of the chemical and radioactive risks from both normal operations and accidents for each of the waste types to be managed at SRS.

Response to Comment L007-16

See the response to Comment L007-13. DOE continually informs the public and provides opportunities for their involvement. After announcing its intent to prepare this eis, DOE held three workshops and three scoping meetings in combination with two other related eiss. After issuing the draft eis, DOE conducted hearings at six locations to inform the public of its plans and receive comments.

Response to Comment L007-17

The encapsulation of waste in glass by vitrification is a technology that will be used extensively at SRS. Two facilities, the Defense Waste Processing Facility and the M-Area Vendor Treatment Facility, will vitrify high-level and certain mixed low-level wastes, respectively. Vitrified high-level waste would be sent to a geologic repository for permanent disposal when such a facility is available (see response to Comment L007-09). In addition, this eis analyzes the impacts of constructing and operating two vitrification facilities, one for nonalpha waste (mixed low-level and possibly low-level and hazardous waste) and one for transuranic and other alpha-emitting waste. Alternative C relies heavily on vitrification to create a highly migration-resistant waste form.

Response to Comment L007-18

Agencies, organizations, and individuals who participated in the preparation of this eis are identified in the List of Preparers. DOE has attempted to use graphics where it believes they are useful and appropriate, and has examined other possible applications for graphics in the Final eis.

Response to Comment L007-19

Generally speaking, the eis shows that offsite effects, if any, to individuals or communities due to the waste management actions discussed in the eis would be very small. These effects would be the result of radiation exposure, which is calculated to result from the various alternatives analyzed in the eis. The estimated dose received by the population in any specific region or community, as well as the dose to an average individual in that region or community can be determined for each of the alternatives discussed in the eis. The harm to a community or individual would be the risk of contracting cancer. The following paragraphs describe the process for determining that risk or harm.

Figure 4-6 identifies annular sectors around the SRS within which communities of interest to the reader can be located. For each of these sectors, Table E.5-1 provides two sets of fractional values: the first is the fraction of the total population dose resulting from a particular alternative which is received by the population in that sector, and the second, is the fraction of the total population dose which is received by the average person in that annular sector. Offsite (i.e., public) population doses, expressed as "person-rem" over the 30-year period, are presented for each of the alternatives in their respective sections of Chapter 4, and are summarized in Table 2-38 of the eis.

Thus, a community can be located within a specific annular sector on the map in Figure 46, and the dose fraction for that sector determined from Table E.5-1 for either population dose or for the average individual dose. If the community comprises most or all of that annular sector, multiplying the particular population dose in the appropriate section of Chapter 4 (or from Summary Table 2-38) by the population dose fraction will give an approximate value of the community population dose. If the community is a smaller part of the annular sector, multiplying the particular alternative's population dose by the average individual dose fraction will provide the dose to the average individual in that community, and multiplying again by the community's population will give an estimate of the population dose for that community.

Multiplying the population dose to the community of interest by the cancer risk factor of 0.0005 per person-rem provides an estimated number of fatal cancers that would be expected to occur in that community due to the radiation dose received over the thirty-year period analyzed in this eis.

Response to Comment L007-20

The effects on members of the public from managing these wastes would result from very small amounts of radioactive materials and perhaps hazardous chemicals that might escape during the handling, treatment, and disposal of these wastes. The most likely effect of exposure to these radioactive materials and chemicals is an increase in the risk of contracting cancer, which is small but which increases as the exposure increases. Therefore, impacts to offsite populations have been evaluated and determined to be very small. Impacts to offsite populations have been presented as an incremental increase in the risk of developing a fatal cancer and the number of additional cancer deaths for individuals and populations, respectively. These impacts have been included in the Summary Section and Chapter 4 of the eis.

Response to Comment L007-21

Please see the responses to comments L007-19 and L007-20. Also, DOE endeavors to keep the public informed of activities and provides opportunities for public involvement. See the response to Comment L007-16.

Response to Comment L007-22

DOE appreciates the efforts of the Citizens for Environmental Justice and their presentation of the workshop on February 25, 1995. It was a valuable precursor to the hearings that DOE presented in Savannah on February 28.

Response to Comment L008-01

Since DOE is experienced with decontamination and decommissioning is limited to date, DOE relies on commercial experience. This includes using private companies with previous decontamination and decommissioning experience and using the same methodologies for waste treatment and minimization developed by and for private industry. The lessons learned from previous DOE and commercial activities have been compiled into the *Decommissioning Handbook*, (DOE/EM-0142P, March 1994) which serves as a reference when determining the means for achieving the appropriate level of cleanup of SRS facilities.

Response to Comment L008-02

DOE agrees that long-term storage of spent deionizers is not desirable; however, treatments for these waste streams are not completely developed at this time. DOE is aggressively pursuing several emerging technologies described in Appendix D of this eis that may prove suitable for treating these wastes. The primary technologies being considered are quantum catalytic extraction, polyethylene encapsulation, and vinyl ester styrene solidification, which stabilizes and encapsulates spent deionizers. These technologies are rapidly approaching commercial availability and, if they prove feasible, will be used to reduce or eliminate the storage of these wastes.

Response to Comment L008-03

DOE is utilizing available treatment for radioactive oils and mercury-contaminated tritiated oils where the radioactivity level is low and does not pose an environmental risk. The wastes in question, however, are small in volume but have very high concentrations of tritium. Treatment by conventional means would release this tritium into the environment. DOE is investigating emerging technologies which may be suitable for disposal of these wastes. One such technology is a packed bed reactor (described in Appendix D, Section D.7.10) which would have the ability to capture the tritium and mercury in the offgas system, preventing release to the environment.

Response to Comment L008-04

Should the maximum waste forecast become reality, DOE would employ a site selection process similar to the one employed for the area adjacent to F- and EAreas to identify sites for additional waste management facilities. In response to consultation requirements under NEPA, DOE described this selection process in the Protected Species Survey, dated April 1995 and completed pursuant to Section 7 of the Endangered Species Act. The initial effort to site new facilities near existing waste management facilities resulted in the selection of land near F- and E-Areas. In order to minimize impacts to biodiversity, wetlands, threatened and endangered species, and cultural resources, every effort was made to site facilities in existing cleared areas. Under the alternatives and forecasts for this eis, varying number of facilities could not be accommodated in these cleared areas and undeveloped land was required. Every effort was made to site potential facilities that could not be accommodated in existing cleared areas on level, upland pine forest that had been previously farmed. This avoided wetlands, threatened and endangered species habitat, areas of high diversity, and archaeological sites. Undeveloped wetlands and steep upland areas that had never been farmed were considered only when their use could not be avoided due to their proximity to preferred sites (e.g., some upland hardwood sites would be required for sediment ponds). The values of these areas to wildlife and the biodiversity of the region was a consideration in the final selection. It is anticipated that any construction needed to accommodate the amount of waste anticipated by the maximum waste forecast would employ a similar site selection process documented through correspondence and site visits, if necessary, with U.S. Fish and Wildlife Service and National Marine Fisheries Service, the U.S. Army Corps of Engineers, and the State Historic Preservation Officer.

Response to Comment L009-01

The eis presents, in Section 2.1 and Appendix A, DOE's range of forecasts of the waste it may manage at SRS, including the relatively small volumes from other sites. As indicated in that material, the major determinant of waste volume is the extent of onsite restoration activities, rather than the receipt of offsite waste.

DOE will issue a programmatic eis on waste management that will provide the basis for decisions on alternative treatment and disposal options for the entire DOE complex. The programmatic eis will detail the types and quantities of waste that might be managed at SRS and at other DOE facilities. The public will have a chance to comment on the proposals during the public comment period. There are a number of equity issues that will have to be worked out between states concerning how much and what types of waste each will allow to be managed within its borders to ensure no state is overburdened.

Response to Comment L009-02

DOE completed a detailed supplemental eis for the Defense Waste Processing Facility in November 1994 to assist in determining how to proceed with the Defense Waste Processing Facility. On April 12, 1995, DOE published its Record of Decision for the Defense Waste Processing Facility in the *Federal Register* (60 FR 18589). The Record of Decision documents DOE's decision to continue construction and to operate the Defense Waste Processing Facility as currently designed using the In-Tank Precipitation process. DOE has also decided to implement additional safety modifications to the Defense Waste Processing Facility prior to operating the facility with radioactive waste. As noted in the Record of Decision, DOE currently proposes to vitrify only the high-level radioactive waste currently in tanks at SRS, plus any small increments produced as a result of ongoing SRS activities. DOE would undertake additional NEPA reviews if other wastes are proposed for treatment at the Defense Waste Processing Facility.

The Defense Waste Processing Facility is presently being tested with simulated waste. As of mid-April1995, 24 canisters of vitrified simulated waste had been produced. DOE is presently on schedule for radioactive testing to begin in December 1995. Processing of SRS high-level radioactive waste is scheduled to begin in mid-February 1996. DOE believes that the existing and future inventories of high-level waste can be processed by 2018.

Response to Comment L010-01

DOE agrees, in principal, that the treatment of high activity transuranic waste should be pursued with a sense of urgency. However, the categorization of any waste as an urgent problem would require, at the outset, evidence of an imminent threat to the health and safety of the public or the work force. The accident analysis for high activity transuranic wastes indicates that, in a fire, the offsite population dose can be high but that the expected frequency of such an event is low, making its occurrence unlikely and its risk very low. While this situation does not pose an imminent threat that warrants classification as an urgent problem, the likelihood of a serious accident increases the longer these wastes remain untreated in storage. For this reason, DOE agrees that long-term storage of untreated waste is not desirable and has assigned a high priority to addressing transuranic waste treatment.

Response to Comment L010-02

DOE agrees with the recommendation to expedite the treatment selection for high activity transuranic wastes. DOE has conducted and continues extensive research and development on organic destruction treatment options for transuranic wastes. The Office of Technology Development has identified waste focus areas for research including transuranic wastes, and is funding ongoing activities at various DOE sites. The goal of this research is to have a selected technology completely developed and available for site implementation by November 1997. As part of the Office of Technology Development technology selection process, the DOE National Environmental Science and Technology Council performs independent technical reviews and evaluations of priorities. The DOE National Environmental Science and Technology Council is comprised of scientists and engineers with national and international reputations in their fields of expertise. DOE will make every effort to select a technology for treatment of transuranic waste by year's end and will present a status report at the November 1995 Citizens Advisory Board meeting.

Response to Comment L010-03

As a result of SRS developing the proposed site treatment plan as required by the Federal Facility Compliance Act, preferred technologies have been identified to allow treatment of SRS mixed waste streams including transuranic waste. To support this effort, funding has been targeted in fiscal year 1997 specifically for the Federal Facilities Compliance Act related activities. In the case of transuranic waste treatment, funding has been targeted for two specific activities. The first activity is to begin development of a transuranic waste treatment facility. In fiscal year 1997 it is envisioned that pre-engineering activities would be performed to support development of a capital line-item to treat transuranic wastes. A second activity that would be performed in fiscal year 1997 would be to initiate a direct support contract for transuranic waste characterization and certification. At present, these funds are targeted to support transuranic waste treatment; however, actual funds are not guaranteed at this time. It should be noted that arc melter studies and hybrid plasma induction activities are currently being performed in the research and development arena to address transuranic waste treatment.

Response to Comment L010-04

The retrieval activities planned for transuranic waste stored on TRU Pads 2 to 5 include "overpacking" and not "repackaging." With overpacking, an existing 55-gallon drum will be placed inside an 83-gallon overpack drum for continued safe storage. It should be understood that waste will not be removed from the existing 55-gallon drum and repackaged into a new drum. The primary objective of the retrieval project is the safety of continued transuranic waste storage. These drums were first placed in storage in the mid 1970s; they have a minimum design life of 20 years. Since the drums are under earthen cover, monitoring their condition is not possible. The storage and retrieval hazards of the covered drums will increase with time from corrosion, and are enhanced because the drums cannot be routinely monitored. The covered drums to be retrieved are the lowest risk containers on these pads based on curie loading, but if these drums are left stored under earthen cover until significant deterioration occurs, the hazards associated with handling the drums during retrieval can increase by 300 percent. With regard to worker safety, an environmental assessment performed in 1988 (DOE 1988) showed that routine transuranic waste retrieval operations would result in insignificant amounts of radiation exposure to operating personnel. It also showed that retrieval and subsequent overpacking of these drums reduces the immediate environmental hazards.

The buried drums on TRU Pads 2 to 5 must be retrieved for disposal at the Waste Isolation Pilot Plant. The plan is to retrieve the drums without further delay, vent and purge them of any accumulated flammable gases, and overpack them with a new, vented 83-gallon drum. The overpacked and vented drums will then be re-stored on a weather-protected storage pad in a safe condition. The waste would not be repackaged until a suitable facility is constructed in the future.

Response to Comment L010-05

DOE proposes to incinerate combustible low-level waste and to use supercompaction to treat noncombustible low-level waste. As indicated in Appendix B, Section B.5 the Consolidated Incineration Facility was originally intended for the processing of solid and liquid hazardous and mixed wastes for which incineration is the preferred treatment. However, Appendix B.5 confirms that Consolidated Incineration Facility capacity is expected to be adequate for the incineration of combustible low-level wastes as well.

Response to Comment L010-06

DOE has completed the evaluation of stabilization alternatives for the Consolidated Incineration Facility residue and blowdown (Burns et al. 1993). Several studies on ash stabilization and blowdown have been completed. DOE is continuing to evaluate treatment technologies. The selected means of stabilization is cementation since it represents the most cost-effective alternative, is compatible with ash and blowdown chemistry, and will minimize groundwater impacts. DOE welcomes review of the data and will convene an independent scientific peer review team to evaluate the data. DOE will attempt to arrange this review promptly so that the results can be presented at the July 1995 Citizens Advisory Board meeting.

Response to Comment L010-07

DOE agrees that uncertainties exist in the nature of the final cleanup standards, as well as in the completed definition of areas to be decontaminated and restored. The range of waste forecasts presented in the eis is intended to bound the effects of those uncertainties on the resulting waste volumes.

The non-alpha vitrification facility is an appropriate and flexible technology for treating soils. However, DOE will continue to evaluate alternative treatment activities based on further soil characterization and on new technologies. If waste volumes meet or exceed the expected (best estimate) waste forecasts, the non-alpha vitrification facility would be required to treat liquid, soil, and sludge wastes generally resulting from environmental restoration and/or decontamination and decommissioning activities.

Response to Comment L010-08

DOE agrees that research and development on the treatment of contaminated soils warrants (and is receiving) a high priority to ensure that areas containing such soils can be processed both effectively and economically. It should be noted, however, that there is no statutory or regulatory requirement that DOE relinquish control over all or parts of SRS in 100 years. It is possible that areas not economically or technically feasible to decontaminate or restore to acceptable levels may remain under the control of DOE or another government agency for an indefinite period.

Response to Comment L010-09

At the request of the Citizens Advisory Board, DOE will work with them to develop an appropriate plan for determining how to safely categorize and manage contaminated and suspect soils.

I.4 References

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PAGE TOC FIGURES TABLES PAGE

Appendix J

INTRODUCTION

This report documents the results of a protected species survey conducted in support of the proposed U.S. Department of Energy (DOE) plan to construct and operate additional waste management treatment, storage, and disposal facilities within the uncleared portion of E-Area at the Savannah River Savannah RiverSite (SRS) located near Aiken, South Carolina (Figure 1).

Approximately 600 acres of undeveloped woodland adjacent to E-Area were investigated as potential sites for the proposed waste management treatment, storage, and disposal facilities. Approximately 61 acres of currently graded, fenced, and partially developed land and 115 acres of undeveloped land would be required to develop the additional facilities.

Plant and animal surveys conducted by the Savannah River Savannah RiverForest Station (SRFS) during 1992, 1993, and 1994 located no protected species within or adjacent to areas that would be affected (LeMaster 1994a, b, and c).

The term "protected species" as used in the context of this report encompasses both plant and animal species that have been designated by the Federal government as endangered or threatened as defined in the Endangered Species Act and identified in the U.S. Fish and Wildlife Service (USFWS) list of endangered and threatened wildlife and plants (50 CFR Parts 17.11 and 17.12).

DESCRIPTION OF PROPOSED PROJECT

This protected species survey evaluated approximately 600 acres of undeveloped woodland adjacent to approximately 100 acres of previously cleared, fenced, and partially developed land within E-Area (Figures 2 and 3). Dominant cover types are shown in Figure 2. The proposed project is to treat, store and dispose of radioactive, mixed, and hazardous wastes generated during 40 years of operations at the SRS. DOE proposes to construct the following treatment, storage, and disposal facilities:

24 long-lived waste storage buildings (size 50' x 50')

18 Resource Conservation and Recovery Act (RCRA)-permitted disposal vaults (size 200' x 50')

4 low-activity waste vaults (size 650' x 150')

4 intermediate-level waste vaults (size 250' x 50')

56 shallow land disposal shallow land disposaltrenches (size 100' x 20')

14 transuranic waste transuranic wastestorage pads (size 150' x 50')

80 mixed waste mixed wastestorage buildings (size 160' x 60')

1 supercompactor

1 alpha vitrification facility

1 non-alpha vitrification facility

1 containment building

1 transuranic waste characterization/certification facility

Figure 1. General location of the proposed waste management expansion area of E-Area at the Savannah River Savannah RiverSite, South Carolina.

Note: Refer to Figure 2 for details on the proposed project area indicated by the outlined box on the above map.

Construction of the treatment facilities that are proposed to be located northwest of F-Area will require approximately 10 years. Until the treatment facilities are available, all waste will be stored within the developed portion of E-Area, a loblolly pine (*Pinus taeda*) plantation planted in 1987 (3 acres), and a recently harvested mixed pine hardwood stand (4 acres) (Figure 2). When treatment of the waste begins in 2008, waste stored in the developed portion of E-Area will be treated, consolidated, and disposed in RCRA vaults to be constructed in a 9acre loblolly pine plantation established in 1987 (Figure 3).

Efforts will be implemented to avoid problems before performing activities that would disturb surface soils soilsand cause potential impacts. Erosion control will be established in accordance with the SRS Project Storm Water Management and Sedimentation Reduction Plan (WSRC 1993) as required by law. Management practices such as silt fences, hay bales, and rip-rap will be installed during construction to prevent erosion and avoid impacts to the wetlands located downgradient from the proposed project. Marketable timber would be harvested from the proposed project area.

To minimize impacts to the biodiversity, wetlands, and archaeological resources of SRS and to protect threatened and endangered species, the proposed facilities would be located adjacent to existing cleared and developed land in E-Area. All disposal facilities except the RCRA disposal vaults would be located in a 100-acre cleared, graded, and currently developed portion of E-Area. Additional land requirements for the treatment facilities would encompass approximately 34 acres of loblolly pine established in 1987; 57 acres of longleaf pine (*P. palustris*) established in 1922, 1931, and 1936; and 20 acres of white oak (*Quercus alba*), red oak (*Q. rubra*), and hickory (*Carya sp.*) established in 1922.

Three waste management alternatives have been analyzed in a draft environmental impact statement published in March 1995. If SRS were required to treat the maximum amount of waste it could handle, new facility construction could affect as much as 184 acres of undeveloped land north of E-Area. An additional 789 acres outside the surveyed area would also be required under the maximum waste forecast. Should SRS have to treat the maximum amount of waste, additional threatened and endangered species threatened and endangered speciessurveys, wetlands assessments, and archaeological resource surveys would be required. The amount of waste SRS would be required to treat has not been determined so no siting studies to identify any additional land have been initiated.

DESCRIPTION OF PROJECT AND SURROUNDING ARea

The proposed waste management area is located north of the developed portion of E-Area and south of Upper Three Runs Upper Three Runsand M-Line railroad. The majority of the site is a relatively level upland area dominated by Ailey sand (2-6 percent slopes), Lakeland sand (0-6 percent slopes), Troup sand (0-6 percent slopes), and Blanton sand (0-6 percent slopes). These level upland areas end abruptly along distinct bluffs overlooking the floodplain of Upper Three Runs and several small unnamed tributaries. These steep slopes are composed of Troup and Lucy sands

Figure 2. Map depicting the major plant communities/habitat types in and around the proposed waste management expansion area of E-Area and proposed facilities through 2008. Source: SRFS (1994).

Figure 3. Map depicting the major plant communities/habitat types in and around the proposed waste management expansion area of E-Area and proposed facilities through 2024.

(25-40 percent slopes and 15-25 percent slopes). The wetland floodplain of Upper Three Runs Upper Three Runsis composed of Ogeechee sandy loam ponded, fluvaquents, frequently flooded, and Pickney sand, frequently flooded (Rogers 1990). Contour elevations range from 130 feet above sea level along Upper Three Runs to 300 feet on the hilltops.

The sandy upland portions of the survey area are composed of approximately 11 acres of slash pine (*P. elliottii*) planted in 1959; 79 acres of loblolly pine planted in 1987; 88 acres of loblolly pine planted in 1946; 49 acres of longleaf pine planted in 1988; 158 acres of longleaf pine established in 1922, 1931, or 1936; and 30 acres of recently harvested mixed pine hardwood. The slopes are dominated by 180 acres of an upland hardwood community established in 1922. These steep slopes contain a closed canopy of mature white oak, red oak, and hickory. The wetlands wetlandsadjacent to Upper Three Runs are dominated by tulip poplar (*Liriodendron tulipifera*) and sweet gum (*Liquidambar styraciflua*) (SRFS 1994).

PROTECTED SPECIES REVIEWED

Based on the protected species accounts provided in 50 Code of Federal Regulations 17.11 and 17.12 and the lists provided in Hyatt (1994), a list of protected species potentially occurring in the proposed project area was compiled (Table 1). Table 1 also provides a brief description of the preferred habitat for each of these species.

SURVEY RESULTS

Surveys of the proposed project area were conducted during 1992, 1993, and 1994 by SRFS for evidence of any of the protected species listed in Table 1.

IMPACT IDENTIFICATION

Based on the results of the aforementioned surveys, potential impacts which were identified are listed below:

Bald Eagle (*Haliaeetus leucocephalus*) - Records of the presence of this species on the SRS date back to the late 1950s (Mayer et al. 1985, 1986). Two bald eagle nesting territories have been established on SRS (Mayer et al. 1988; Wike et al. 1994). The nearest of these nest sites to the proposed project area is located approximately 7 miles to the south. There have been no documented records of bald eagles using the proposed project area (Mayer et al. 1985, 1986). In addition, the proposed project area has no preferable forage or nesting habitat available. The project area provides only marginal roosting habitat. Based on SRS records, use of the project site by bald eagles would be incidental at best. No evidence indicating the presence of this species was encountered during the surveys. The proposed project should have little to no impact on this endangered species. However, there is the potential that suitable habitat could become inhabited during the 30-year life of the project. As new facilities are planned, additional surveys will be initiated as needed and consultation with the USFWS will continue.

Table 1. Plant and Animal Species that potentially occur on SRS and are protected under the ESA of 1973

Wood Stork (*Mycteria americana*) - The breeding colony of wood storks from Birdsville, Georgia, continues to sporadically use wetland areas of the SRS for foraging (Wike et al. 1994). Documented wood stork use of SRS dates back to the late 1950s (Norris 1963). However, the proposed project area provides neither forage nor nesting habitat for this endangered species. In addition, there are no documented records of any previous use of the project site by wood storks (Coulter 1993). No evidence of this species was found during the surveys. The proposed project should not have any impact on this endangered species. However, as new facilities are planned, surveys will be initiated as needed and consultation with the USFWS will continue.

Red-Cockaded Woodpecker (*Picoides borealis*) - Seventy-seven red-cockaded woodpeckers lived on SRS at the end of 1994 (LeMaster 1994b). Red-cockaded woodpeckers prefer to nest in pines more than 60 years old and forage in pine forests more than 40 years old. Although the proposed project site is within the interior portion of SRS that is not intensively managed for the birds, the age of several stands of pines on the site make them appropriate for nesting and foraging. Due to the suitability of the habitat and the proximity of active colonies (7 miles to the north) and managed recruitment stands (1.5 miles to the north), an intensive survey was conducted in 1993. One hundred and fifty eight acres of longleaf pine established in 1922, 1931, or 1936 were surveyed. No evidence of red-cockaded woodpeckers was found during the survey (LeMaster 1994c). While the proposed project should have no impact on this endangered species, there is the potential that suitable habitat could become inhabited during the 30year life of the project. No land clearing or facility construction is currently planned until at least after the year 2000. As new facilities are planned, additional surveys will be initiated as needed and consultation with USFWS will continue.

American Alligator (*Alligator mississippiensis*) - The SRS supports a population populationof approximately 200 to 250 American alligators (Gibbons and Semlitsch, 1991). The proposed project area does not provide any suitable habitat for this protected species. In addition, there are no documented records of any previous use of the project site by alligators. The closest known areas used by alligators are the wetlands present in the Upper Three Runs drainage corridor, located adjacent to the project site. No evidence of this species was found during the surveys. The proposed project should not have any impact on the threatened species. However, as new facilities are planned, surveys will be initiated as needed and consultation with the USFWS will continue.

Shortnose Sturgeon (*Acipenser brevirostrum*) - The proposed project has been designed utilizing Best Management Practices to eliminate or minimize impacts from any discharges that could impact tributaries to the Savannah River. In addition, the proposed project site is an upland area, and the project boundary is over 1,000 feet from the nearest stream (Upper Three Runs), which at that point is 15 kilometers from the river. The shortnose sturgeon occurs in the river along the southwestern boundary of SRS (Wike et al. 1994). The proposed project area does not provide any suitable habitat for this species. Furthermore, no evidence of this species was found during the surveys. Therefore, the proposed project should not have any impact on this endangered species. As new facilities are planned, additional surveys will be initiated and consultation with the National Marine Fisheries Service (NMFS) will continue.

Smooth Purple Coneflower (*Echinacea laevigata*) - Two populations of this species are known to occur on the SRS (Knox and Sharitz 1990; Hyatt 1994). The first, a small dwindling population populationlocated adjacent to Burma Road, includes approximately 200 individuals (SRFS 1992). This population is approximately 4.5 miles southwest of the proposed project area. The second population, composed of approximately 500 individuals, is located 7.2 miles southeast of the project area (LeMaster 1994b). The proposed project area could provide habitat for the smooth purple coneflower. However, no evidence of this species was found during the 1992 and 1994 botanical surveys. The proposed project should not have any impact on this endangered species. While the proposed project should have no impact on this endangered species, there is the potential that suitable habitat could become inhabited during the 30year life of the project. As new facilities are planned, additional surveys will be initiated as needed and consultation with USFWS will continue.

MITIGATION PLANS

No mitigation plans are necessary to minimize or prevent potential impacts to any of the protected species listed in Table 1.

SUMMARY

The proposed project should not affect any Federally protected animal or plant species. DOE will continue to consult informally with the USFWS and the NMFS as new facilities are planned and National Environmental Policy Act reviews continue over the 30-year life of the project.

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RESPONSIBLE AGENCY: U.S. Department of Energy (DOE)

TITLE: FinalDraft Environmental Impact Statement, Waste Management, Savannah River Site, Aiken, South Carolina (DOE/eis-0217-D).

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ABSTRACT: The purpose of this environmental impact statementeis is to helpassist DOE in decideing 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 (including management of wastes received from offsite activities (including management of wastes received from offsite) 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 adversee impacts. Evaluations of impacts on water quality, air quality, ecological systems, land use, geologicc resources, cultural resources, socio-economics, and the health and safety of onsite workers and the public are included in the assessment.

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). One set of comments was received after the format comment period closed. Responses to those comments and resulting addenda to this eis re included as an enclosure with the document. One set of comments was received after the formal comment period closed. Responses to those comments and resulting addenda to this eis are included as an enclosure with the document.

FOREWORD

This environmental impact statement (eis) evaluates addresses alternative approaches to and environmental impacts of managing wastes at the Savannah RiverSavannah River Site (SRS). The U.S. Department of Energy's (DOE's) primary mission at SRS from the 1950s until the recent end of the Cold War was tothe producetion and processing of nuclear materials to support defense programs. These activities resulted in the generatedion of five types of waste: liquid high-level radioactive, low-level radioactive, hazardous, mixed (radioactive and hazardous combined), and transuranic wasteTransuranic wastes. These wastes are still being continue to be generated by ongoing operations, environmental restorationEnvironmental restoration, and decontamination and decommissioningdecontamination and decommissioning of surplus facilities. This eis evaluates alternatives for managing the five types of waste during the next decade and establishes a baseline for analyzing facilities that DOE might build and other actions that DOE might take after 2005assessing options for waste management beyond that time. Because waste management alternatives would be implemented over several years, DOE maycould issue more than one Record of Decision based on this eis.

Four waste management alternatives are evaluatedanalyzed in this eis. In addition to the no-action alternative, which consists ofincludes continuing current management practicesactivities, 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. TheAll 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. In addition, tThis eis evaluates siting, constructionngion, and start-up or operatioon ofng of specific waste managementtreatment, storage, and disposal facilities at SRS over the next 10 years, as well as operational impacts for the 30-year forecast horizon. TenÊyears was sellected because that is approximately the time required to get a project approved, designed, and constructed. In addition, because of ongoing advances in technology, 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 *WasteEnvironmental Management Programmatic eis* (DOE/eis-0200), the *TritiumTritium Supply and RecyclingRecycling 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; draft issued June 1994), the *Proposed Nuclear Weapons Nonproliferation Policy for the Acceptance of United States Origin 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 SRSSavannah River Site eis* (DOE/eis-0220D), the *F-Canyon PlutoniumPlutonium Solutions at SRS eis* (DOE/eis-0219; final issued December 1994), the *Defense Waste Processing FacilityDefense Waste Processing Facility Supplemental eis* (DOE/eis-0082S; final issued November 1994), the *Environmental Assessment for Operations of the HB-Line Facility and Frame Waste Recovery Process for Production of Pu-238 Oxide at the SRS* (DOE/ea-0948; draft issued September 1994), the *Continued Operation of the Pantex PlantPlant and Associated Storage of Nuclear Weapon Components eis* (DOE/eis-0225), and the *SRS ProposedDraft Site Treatment Plan* for mixed wasteMixed waste.

DOE published a Notice of Intent to prepare this eis in the *Federal Register* on AprilÊ6, 1994 (59ÊFRÊ16494). 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 thatto defined the scope and approach of this eis. The implementation plan was issued by DOE in June 1994. Publication of the draft eis provideds a second opportunity for public comment.

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, 2ndÊFloor, University Parkway, Aiken, South Carolina [(803) 648-6851], and the Freedom of Information Reading Room, Room IE-190, Forrestal Building, 1000ÊIndependence 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.

DOE has considered comments it received during the public comment period in the preparation of 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.

ChangesRevisions from the draft eis are indicated in this final eis by vertical change bars in the margin. The change 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.

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, regulations of the Council on Environmental Quality regulations (40 CFR 1500-1508), and the 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:

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

Chapter 2 describes the alternatives, identifies the preferred alternative, and provides a summary comparison of the environmental impacts of each alternative.
Chapter 3 describes the affected environment at SRS potentially affected by as it relates to the alternatives addressed.
Chapter 4 provides a detailed assessment of the potential environmental impactsconsequences of the alternatives. ItThe chapter also assesses unavoidable adverse impactsUnavoidable adverse impacts and irreversible or irretrievable commitments of resources, and cumulative impactsCumulative 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 containsfurnishes copies of letters, and hearing transcripts frommade during the public comment period, and DOE's responses from DOE to those comments.
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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