Enclosure 2

Change Pages for Mixed Oxide Fuel Fabrication Facility Environmental Report

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Mixed Oxide Fuel Fabrication Facility Environmental Report, Revision 5

Docket Number 070-03098

Prepared by
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Under
U. S. Department of Energy
Contract DE-AC02-99-CH10888

Nuclear Q/A Yes ☐ No ☒
UCNI Yes ☐ No ☒
Proprietary Yes ☐ No ☒

	REVISION DESCRIPTION SHEET
REVISION NUMBER	**PAGES REVISED AND DESCRIPTION**
0	Original Issue, transmitted to NRC 19 December 2000 (DCS-NRC-000031)
1	Update to include responses to NRC Requests for Additional Information, transmitted to NRC 12 July 2001(DCS-NRC-000053); minor editorial corrections.
2	Supplement to include information on alternate feedstock and solidification of liquid high alpha waste. Incorporates changes resulting from amended ROD for SPD FEIS and S&D PEIS. Incorporated any design changes since December 2000. Transmitted to NRC 11 July 2002 (DCS-NRC-000102).
3	Pg 3-10, Update to include responses to NRC Requests for Additional Information, transmitted to NRC 29 October 2002 (DCS-NRC-000116).
	Pg 3-11, Update to include responses to NRC Requests for Additional Information, transmitted to NRC 29 October 2002 (DCS-NRC-000116).
	Pg 3-52, Update to include responses to NRC Requests for Additional Information, transmitted to NRC 29 October 2002 (DCS-NRC-000116).
	Pg 3-53, Updated to clarify waste volumes.
	Pg 4-5, 4-5a, Update to include responses to NRC Requests for Additional Information, transmitted to NRC 29 October 2002 (DCS-NRC-000116).
	Pg 4-37, 4-37a, Update to include responses to NRC Requests for Additional Information, transmitted to NRC 29 October 2002 (DCS-NRC-000116).
	Pg 5-1, Update to include responses to NRC Requests for Additional Information, transmitted to NRC 29 October 2002 (DCS-NRC-000116).
	Pg 5-4, Update to include responses to NRC Requests for Additional Information, transmitted to NRC 29 October 2002 (DCS-NRC-000116).
	Pg 5-13, Update to include responses to NRC Requests for Additional Information, transmitted to NRC 29 October 2002 (DCS-NRC-000116).
	Pg 5-14, Update to include responses to NRC Requests for Additional Information, transmitted to NRC 29 October 2002 (DCS-NRC-000116).
	Pg 5-19, Update to include corrections associated with changes to meteorological data provided verbally to NRC EIS Staff.
	Pg 5-21, Update to include corrections associated with changes to meteorological data provided verbally to NRC EIS Staff.
	Pg 5-23, Update to include responses to NRC Requests for Additional Information, transmitted to NRC 29 October 2002 (DCS-NRC-000116).

	REVISION DESCRIPTION SHEET
REVISION NUMBER	**PAGES REVISED AND DESCRIPTION**
	Pg 5-41, Update to include corrections transmitted to NRC 10 December 2002 (DCS-NRC-000121).
	Pg 5-43, Update to include corrections transmitted to NRC 10 December 2002 (DCS-NRC-000121).
	Pg 5-44, Update to include corrections transmitted to NRC 10 December 2002 (DCS-NRC-000121).
	Pg 5-75, Update to include responses to NRC Requests for Additional Information, transmitted to NRC 29 October 2002 (DCS-NRC-000116).
	Pg 5-76, Update to include responses to NRC Requests for Additional Information, transmitted to NRC 29 October 2002 (DCS-NRC-000116).
	Pg 5-82, Update to include responses to NRC Requests for Additional Information, transmitted to NRC 29 October 2002 (DCS-NRC-000116).
	Pg 5-85, Update to include corrections associated with changes to meteorological data provided verbally to NRC EIS Staff.
	Pg 5-88, Update to include corrections transmitted to NRC 10 December 2002 (DCS-NRC-000121).
	Pg 5-89, Update to include corrections transmitted to NRC 10 December 2002 (DCS-NRC-000121).
	Pg 5-91, Update to include responses to NRC Requests for Additional Information, transmitted to NRC 29 October 2002 (DCS-NRC-000116); design changes to Waste Solidification Building.
	Pg 5-92, Update to include corrections associated with changes to meteorological data provided verbally to NRC EIS Staff.
	Pg 5-93, Update to include responses to NRC Requests for Additional Information, transmitted to NRC 29 October 2002 (DCS-NRC-000116).
	Pg 5-102, Update to include corrections transmitted to NRC 15 January 2003 (DCS-NRC-000125).
	Pg 6-2, Update to include corrections associated with changes to meteorological data provided verbally to NRC EIS Staff.
	Pg 6-10, Update to include corrections associated with changes to meteorological data provided verbally to NRC EIS Staff.
	Pg A-6, Update to include supplemental information transmitted to NRC 12 December 2002 (DCS-NRC-000122).

	REVISION DESCRIPTION SHEET
REVISION NUMBER	**PAGES REVISED AND DESCRIPTION**
	Pg A-30, Update to include letter from SCDHEC on 401 Water Quality Certification.
	Pg D-9, Update to include corrections associated with changes to meteorological data provided verbally to NRC EIS Staff.
	Pg D-10, Update to include corrections associated with changes to meteorological data provided verbally to NRC EIS Staff).
	Pg D-25, Update to include corrections associated with changes to meteorological data provided verbally to NRC EIS Staff.
	Pg F-6, Update to include corrections transmitted to NRC 10 December 2002 (DCS-NRC-000121).
	Pg F-7, Update to include corrections transmitted to NRC 10 December 2002 (DCS-NRC-000121).
	Pg F-8, Update to include corrections transmitted to NRC 10 December 2002 (DCS-NRC-000121).
	Pg F-9, Update to include corrections transmitted to NRC 10 December 2002 (DCS-NRC-000121).
	Pg G-1 through G-52, Update to include responses to NRC Requests for Additional Information, transmitted to NRC 29 October 2002 (DCS-NRC-000116); design changes to Waste Solidification Building.
4	Pg 5-24, Update to reflect revised Waste Solidification Building low-level radioactive waste volume.
	Pg 5-93, Table 5-15c updated to reflect revised Waste Solidification Building low-level radioactive waste volume.
	Pg G1 through G-56, Updated to reflect design improvements to the Waste Solidification Building and revised accident analyses.
5	Pg ix, Revised Figure 4-2 Title.
	Pg xxv through Pg xxx Updated list of effective pages.
	Pg 1-10 and 1-11, Updated schedule.
	Pg 3-3, Correct Reagents Processing Building description.
	Pg 3-4, Update VOC projection to reflect new fuel tank size.
	Pg 3-5, Update diesel fuel tank size.

	REVISION DESCRIPTION SHEET
REVISION NUMBER	**PAGES REVISED AND DESCRIPTION**
	Pg 3-17, Removed reference to silver recovery. Removed reference to ETF.
	Pg 3-18 and Pg 3-19, Removed references to ETF.
	Pg 3-33, Revised figure to remove silver recovery.
	Pg 3-35, Revised figure to remove silver recovery.
	Pg 3-45, Remove references to ETF.
	Pg 3-52, Add depleted uranyl nitrate to the list of chemicals consumed at MFFF.
	Pg 3-53, Update waste volumes to reflect decrease in high alpha waste volumes.
	Pg 3-54, Update waste volumes to reflect increase in waste filters.
	Pg 4-1, Remove reference to controlled area boundary.
	Pg 4-11, Correct transcription error on CPT hole depths.
	Pg 4-49, Remove reference to controlled area boundary.
	Pg 4-114, Correct transcription error on total worker dose.
	Pg 5-13, Remove reference to ETF.
	Pg 5-15, Correct stack height to agree with Section 5.1.7 and previous changes.
	Pg 5-22 – 5-24, Update waste volumes.
	Pg 5-19, Refine definition of site worker to reflect changes for controlled area boundary.
	Pg 5-21, Refine definition of facility workers to reflect changes for controlled area boundary.
	Pg 5-40 – 5-41, Editorial change and revision to increase operation flexibility.
	Pg 5-47, Editorial change.
	Pg 5-60, Correct Reagents Processing Building description.
	Pg 5-63, Editorial change.
	Pg 5-81 through 5-83, Update air quality tables to reflect design changes.
	Pg 5-87, Update waste volumes. Remove reference to ETF

	REVISION DESCRIPTION SHEET
REVISION NUMBER	**PAGES REVISED AND DESCRIPTION**
	Pg 5-88, Correct calculation rounding error.
	Pg 5-89, Revision to increase operation flexibility.
	Pg 5-91, Update air quality tables to reflect design changes.
	Pg 5-93, Update waste volumes.
	Pg 5-101, Update to cross reference Table 3-2 for chemical consumptions.
	Pg 6-10, Update air quality and waste impacts.
	Pg 7-2, Update to reflect recent permitting activities. Added NNSA as owner.
	Pg 7-4 through 7-8, Update to reflect recent permitting activities.
	Pg 7-14, Update to reflect recent permitting activities.
	Pg 8-4, Add new reference from Appendix G revision.
	Pg F-2 – F3a, Revised to reflect changes associated with controlled area boundary.
	Pg F-7 and F-8, Revised to increase operation flexibility.
	Pg F-9 and F-10, Revised to reflect changes associated with controlled area boundary.
	Pg F-14 and F-16, Revised to reflect changes associated with controlled area boundary.
	Pg G-1 through G-58, Revised to reflect latest design modifications.

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LIST OF FIGURES

LIST OF EFFECTIVE PAGES

Page **Effective Revision**

oxide. The best reported gallium removal (Kolman et al. 2000) results in impurities still two orders of magnitude higher than that required in the fuelplutonium oxide. Furthermore, the TIGR process remains an experimental process requiring further testing to scale the process to production while ensuring uniform plutonium oxide powder physical characteristics, such as particle size, surface area, chemical reactivity. Additionally, DOE is no longer providing funding for continued work on the TIGR process.

The aqueous polishing process, however, is a proven technology that is known to remove impurities that might have adverse impacts on fuel fabrication or performance. In addition to removing gallium and impurities, the aqueous polishing process produces uniform plutonium oxide powder with the appropriate physical characteristics. The aqueous polishing process also removes the existing americium from the plutonium to permit fuel fabrication and at-reactor fuel handling to proceed with much lower operational radiation exposures. The TIGR process would not reduce radiation exposures at mission reactors.

1.5 ALTERNATIVES CONSIDERED IN THIS ENVIRONMENTAL REPORT

Taking into consideration the above framework of determinations previously made by DOE and the nature of the proposed action before the NRC (see Section 1.1 above), DCS has developed the following range of alternatives for consideration in this ER.

This ER includes a No Action Alternative that is relevant to the proposed action. The No Action Alternative for this ER is a decision by the NRC to not grant a license to DCS to possess and use SNM at the MFFF. Because of previous DOE decisions, the consequences of the No Action Alternative are the same as those discussed in the SPD EIS (DOE 1999c); all weapons-usable fissile materials would remain in storage using proven nuclear material safeguards and security procedures. The No Action Alternative consequences, evaluated and discussed in the SPD EIS, are summarized in Section 5.7.1 of this ER but were not reanalyzed in this ER. The consequences of the No Action Alternative are discussed in more detail in the SPD EIS.

Within F Area at SRS, DCS considered various locations for the MFFF. This evaluation is discussed in Section 5.7.2 of this ER. Design alternatives that may impact the environment are addressed in Section 5.7.3 of this ER.

1.6 PROJECT SCHEDULE

The following timetable represents the anticipated schedule for licensing, construction, and operation of the MFFF.

Submit Application for Construction Authorization	28 February 2001
Submit License Application	2005
Initiate Facility Construction	2005
[Text deleted]	

Commence Production of MOX Fuel	2007

Any significant delay in the schedule of the MFFF could adversely affect the overall MFFF plutonium disposition mission.

- Grinding area
- Fuel rod fabrication area
- Fuel bundle assembly area
- Storage areas for feed material, pellets, rods, and fuel assemblies
- A laboratory area
- Space for use by the International Atomic Energy Agency.

Support equipment (e.g., heating, ventilation, and air conditioning [HVAC] components; high-efficiency particulate air [HEPA] filter plenums; inverters; switchgear; pumps) is also present within the building complex. There are no convenience toilets, lockers, or break rooms for normal staff use within the radiation control areas of the MOX Fuel Fabrication Building. Adequate space for waste packaging and its temporary storage is provided. The MFFF processes (i.e., plutonium polishing, powder processing, pellet processing, rod processing, building and glovebox ventilation systems, and offgas treatment) are described in Section 3.2.

The MOX Fuel Fabrication Building contains the SNM processing areas. This building complex is the source of any anticipated radiological releases to the environment. The MOX Fuel Fabrication Building produces solid and liquid wastes and airborne effluents. Solid wastes and liquid waste streams are transferred to the appropriate SRS waste management facilities in accordance with the applicable SRS Waste Acceptance Criteria (WAC) (WSRC 2000b). Anticipated airborne effluents are treated, as described in Sections 3.2 and 3.3, and monitored before being released to the environment. The management of the MFFF waste streams is described in Section 3.3.

3.1.2 Reagents Processing Building

The Reagents Processing Building, located inside the protected area adjacent to the aqueous polishing area of the MOX Fuel Fabrication Building, provides space for storage and mixing of the chemical reagents used in the aqueous polishing process. The Reagents Processing Building consists of a number of separate rooms/areas for the various chemicals. Liquid chemical containers are located inside curbed areas for containment of accidental spills. Safety showers and eyewash stations are located in each of the chemical rooms/areas. One end of the Reagents Processing Building has a loading dock for transfer of chemical drums in and out of the building. The Reagents Processing Building floor level is slightly above grade with a below-grade collection tank room that receives waste chemicals from [Text Deleted] the Reagents Processing Building. The Reagents Processing Building contains shower, restroom, and locker facilities. Chemicals are transferred to the aqueous polishing area from the Reagents Processing Building via piping located in a concrete trench/tunnel between the two buildings.

Table 3-2 summarizes the chemicals used at the MFFF site, many of which are stored in the Reagents Processing Building. The Reagents Processing Building has roof vents to allow for venting in emergency situations. No measurable gaseous emissions are expected from activities within this building.

The Liquid Solvent Area is located on the northwest side of the Reagents Processing Building. This area provides Resource Conservation and Recovery Act 90-day staging area for collection and transfer of liquid waste solvent. The area consists of a loading dock, monorail, two carboy tanks, and curbed areas for containment of spills.

3.1.3 Emergency Generator Building

The Emergency Generator Building, located inside the protected area adjacent to the MOX Fuel Fabrication Building, contains the diesel generators that provide the emergency power for items relied on for safety (IROFS) in the MFFF. The building is a single-story, slab-on-grade, reinforced-concrete building. The design of the building structure is of sufficient strength and thickness to protect against the effects of extreme natural phenomena (e.g., severe wind and tornado) and associated generated missiles, as well as to resist the design basis earthquake. Natural disasters considered in the design of the Emergency Generator Building are the same as those considered for the MOX Fuel Fabrication Building.

The emergency onsite power is provided by seismically-mounted diesel generators that are approximately 2,000 kW [1]. Located adjacent to the diesel generator rooms, but separated from them by firewalls, are the switchgear, motor control centers, and uninterruptible power supplies (UPSs). The UPS equipment uses sealed, maintenance-free batteries. Transformers are provided with containment pits for potential leaks.

The Emergency Fuel Storage Vault is located inside the protected area adjacent to the Emergency Generator Building. The Emergency Diesel Fuel Storage Vault is a single story, in-ground, buried, reinforced concrete building that provides support and protection for the two 25,000 gallon fuel storage tanks. Each of the tanks and associated equipment is located within a missile resistant structure with roof and walls of sufficient strength and thickness to resist the design basis earthquake.

The diesel generator rooms contain a day tank that stores a maximum of 660 gal (2,498 L) of fuel oil. Each day tank is enclosed with a dike that can accommodate the full contents of the associated tank. These diesel generators also emit criteria pollutants during operation, and the diesel fuel tank emits a very small amount of volatile organic compounds (VOCs) due to evaporative losses. Unless there is a leak associated with the diesel fuel storage tanks, these tanks only provide fugitive emissions due to a very small evaporation (i.e., approximately 1.8 lb/yr [0.82 kg/yr]) of VOCs.

3.1.4 Standby Generator Building

The Standby Generator Building is located inside the protected area and contains the normal operation electrical generators that provide the onsite power source for the major loads in the

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[1] Further design refinement may reduce the size of the diesel generators. These are bounding values for NEPA purposes.

event of a loss of offsite power. The building is a single-story, slab-on-grade structure with pre-engineered steel framing and insulated metal siding and roof.

The building contains four 2,000-kW standby diesel generators[2]. The normal switchgear, load centers, motor control centers, power panels, and dry type transformers are located adjacent to the diesel generator rooms and are separated from them by firewalls.

Fuel for the standby generators is provided by a 10,000-gal (37.854-L), double-walled tank buried adjacent to the building. This double-walled tank meets the design requirements of 40 CFR Part 280 for underground storage tanks. The diesel generator rooms contain a day tank that stores a maximum of 660 gal (2,498 L) of fuel oil. Each day tank is enclosed with a dike that can accommodate the full contents of the associated tank. These diesel generators also emit criteria pollutants during operation, and the diesel fuel tank emits a very small amount of VOCs due to evaporative losses.

3.1.5 Secured Warehouse Building

The Secured Warehouse Building is a single-story, slab-on-grade, pre-engineered, metal building located inside the protected area. The exterior walls and roof consist of insulated metal panels. The Secured Warehouse Building is comprised of several distinct areas: the General Storage Area; the MOX Fresh Fuel Package (MFFP) Storage and Maintenance Area; the Depleted Uranium Storage Area; the Small Parts Washing Facility; Offices; Electrical Equipment Room; and the Small Parts Storage Area. The walls are of reinforced concrete or reinforced masonry. Access to the General and Small Parts Storage Areas is provided by two receiving bays with roll-up doors and two secured entrance doors. The office area is constructed of light-gauge steel framing. The Depleted Uranium Storage Area has walls of reinforced concrete block or reinforced concrete and a concrete roof slab on metal decking. Access to this storage area is provided by one receiving bay with roll-up door and two secured entrance doors. Access to the MFFP Storage Area is provided by one receiving bay with a roll-up door and two secured doors.

The Secured Warehouse Building supports the MFFF operations by receiving and storing materials, equipment, and supplies inside the protected area near the MOX Fuel Fabrication Building, making them readily available when needed. Depleted uranium dioxide (UO_2), a MOX feedstock, is stored in drums in the Depleted Uranium Storage Area.

The Secured Warehouse Building also provides storage locations for 16 new-fuel shipping packages, components, and equipment for incidental periodic maintenance of these shipping packages in the MFFP Storage and Maintenance Area.

The two-story Parts Washing Facility is [Text Deleted] located in the Secured Warehouse Building. The Parts Washing Facility is where new fuel rod assembly parts are cleaned prior to use in the MOX Fuel Fabrication Building. This facility has a separate ventilation/exhaust

[2] Further design refinement may reduce the size of the diesel generators. These are bounding values for NEPA purposes.

buffer storage tanks, sampled and analyzed to verify their compatibility with SRS site requirements. They will be then directed to the Waste Solidification Building.

3.3.2.2 Liquid Americium Stream

The regenerated concentrates stream [Text Deleted] contains unwanted impurities, trace amounts of silver, plutonium and uranium, and possibly some excess acid. This stream is a liquid high alpha activity waste[4]. The stream is collected in a storage tank, and the contents of the tank are sampled and analyzed.

Liquid high alpha activity waste (i.e., americium) will be transferred through a dedicated pipeline to the Waste Solidification Building.

3.3.2.3 Excess Acid Stream

The acid recovery process produces a condensate stream and excess acid or evaporator bottoms. The acid recovery distillates stream also will be collected in buffer storage tanks and subsequently sampled and analyzed. Depending on the process requirements, the distillate stream may be either recycled into the process through rinsing and scrubbing of the columns or discharged to the SRS process sewer. The evaporator bottoms are expected to contain significant levels of alpha-emitting isotopes and will be managed with the liquid high alpha activity waste. The waste will be transferred to the Waste Solidification Building.

3.3.2.4 Excess Low-Level Radioactive Solvent Waste

The alkaline treatment process generates a small excess solvent stream and an alkaline waste stream. After these washings, the alkaline liquid waste stream is transferred to the liquid high alpha activity waste storage tanks and managed with the liquid alpha waste stream. The tanks are sampled and analyzed before transfer to the Waste Solidification Building.

The slightly contaminated excess solvent is a LLW. It is collected and, when a sufficient quantity of solvent has been accumulated, packaged in a container. The container of spent solvent is transferred by truck to an appropriate SRS for disposal at an approved facility.

3.3.2.5 Stripped Uranium Stream

After the uranium stripping process, the uranium is isotopically diluted (uranium-235 < 1%) for criticality considerations and is collected in a storage vessel. The uranium stream will be transferred to the Waste Solidification Building for management by SRS as LLW.

[4] Liquid high alpha activity waste contains alpha-emitting isotopes in excess of the low-level radioactive waste (LLW) limit (>100 nCi/g). Classification of the waste is deferred until further processing by SRS.

3.3.2.6 Rinsing Water

Potentially contaminated wastewater is collected in the controlled area. This wastewater consists of laboratory rinse water (slightly acidic), mop water from washing, and condensate from room air conditioners. The rinse water stream is transferred to the Waste Solidification Building. The final processing system, identified as the Clean Water Treatment System (CWTS), will be designed using standard wastewater treatment technologies to meet EPA, SCDHEC and DOE discharge limits for the Savannah River Site.

3.3.2.7 Contaminated Drains

The MFFF building contaminated drains system consists of drains, piping, and necessary tanks, which collect all contaminated and potentially contaminated fluids from within the process areas and other potentially contaminated areas. There are not any personnel sinks or toilets in potentially contaminated areas. Janitor sinks and floor drains in potentially contaminated areas drain to the contaminated drain system. All drains lead to central collection tanks in the MFFF building radioactive waste area for monitoring and discharge to the appropriate SRS facility for processing. Drains from rooms that contain criticality-safe equipment and collection tanks must have a critically-safe geometry aligned to criticality-safe tanks. Drains in rooms that contain conventional equipment will be aligned to conventional tanks.

The design of the contaminated drains system considers the collection system guidelines in Regulatory Guide 3.10 (NRC 1973).

Additional liquid containment features include the following engineered systems:

- Tanks containing contaminated liquids are located in diked rooms/areas that are of sufficient size to contain the contents of a single tank.
- Concrete vaults and dikes are used for spill protection of diesel fuel oil storage tanks.
- Stainless steel-lined floors and portions of walls creating containment basins in tank rooms of the aqueous polishing building are used.
- Double-walled pipes are used for transport of contaminated liquids between or outside of the buildings.
- Stormwater collection and monitoring basins and oil separators are employed.

3.3.2.8 Nonhazardous Liquid Waste

Nonhazardous liquid waste includes uncontaminated HVAC condensate, boiler blowdown, and the sanitary waste from sinks, showers, urinals, and water closets from outside the radiological control area. The Radiation Protection Contamination Monitoring and Control Program ensures that showers and sinks outside of the restricted radiation zones will not be contaminated. This program requires personnel and equipment leaving contaminated areas to be monitored to ensure that they are not contaminated. The uncontaminated HVAC condensate is discharged to the stormwater system in accordance with SCDHEC standard stormwater permit conditions. The remaining nonhazardous wastewater is discharged to the SRS F-Area sanitary sewer system that connects to the CSWTF.

3.3.2.9 Processing of Liquid High Alpha Activity Waste at the Waste Solidification Building

The Waste Solidification Building will receive waste from the MFFF and PDCF. Appendix G provides a characterization of these waste streams. As noted in Table 3-3, three of the MFFF liquid waste streams (liquid americium, excess acid, and solvent regeneration alkaline wash) are combined into the high alpha waste. The stripped uranium waste stream is transferred as a separate waste to the Waste Solidification Building. The two wastes are batch transferred through separate double-walled stainless steel lines to the Waste Solidification Building. [Text deleted] Waste from the PDCF is also transferred [Text deleted] to the Waste Solidification Building.

The wastes are collected in the waste receipt area of the WSB. The waste receipt area is equipped with separate collection tanks for each waste type. Each collection tank is sized to hold six weeks worth of waste.

The waste is transferred by pump from the waste receipt tanks to the pretreatment tanks on the ground level. Following receipt, provisions have been made to volume reduce the high alpha waste stream (but not required). The high alpha waste volume is reduced by evaporation and the still bottoms neutralized with sodium hydroxide. The distillate is treated and discharged as LLW. The neutralized bottoms are blended with cement to produce a solid TRU waste matrix suitable for disposal at the Waste Isolation Pilot Plant (WIPP).

The volume of stripped uranium waste will be reduced using evaporation with the distillate treated and discharged as LLW and the uranium blended with cement to produce a solid LLW matrix suitable for disposal at SRS or an approved outside facility.

3.3.3 Facility Solid Waste Management

The management of solid waste for the MFFF is discussed in the SPD EIS, Appendix H, Section H.4.2.3.2 (DOE 1999c). No HLW will be generated by the facility. Solid waste includes transuranic (TRU) waste, mixed TRU waste, LLW, mixed LLW, hazardous waste, and nonhazardous solid waste. Waste that is potentially contaminated with plutonium is collected, drummed, and then analyzed to determine the waste category. The drums are then separated by waste category and stored as TRU waste, mixed TRU waste, LLW, and mixed LLW. All solid waste will comply with SRS WAC and certification requirements. The methods and materials used in the management of these various waste streams are often similar and are noted in the following discussion.

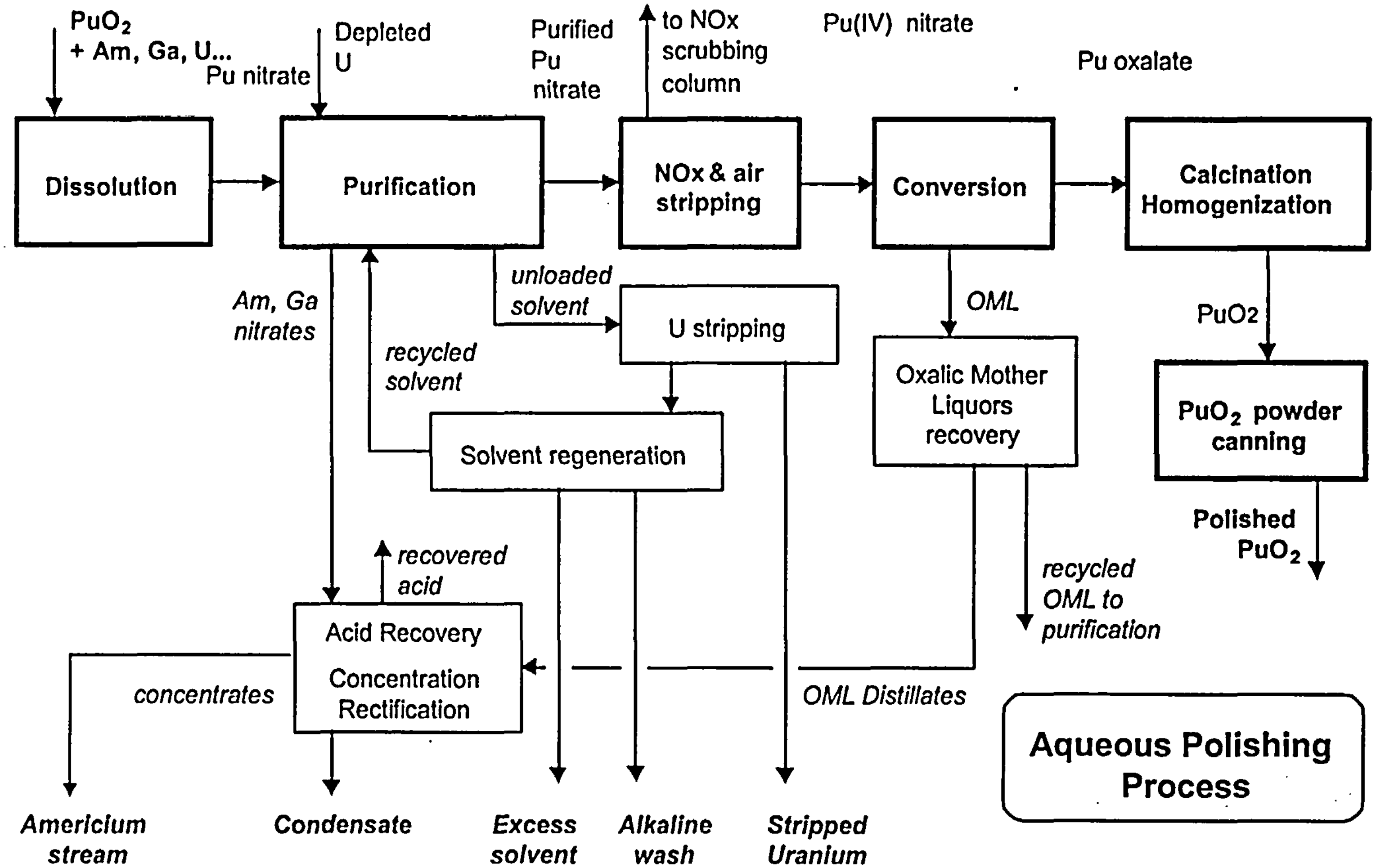

Figure 3-5. Plutonium Polishing Block Diagram (revised)

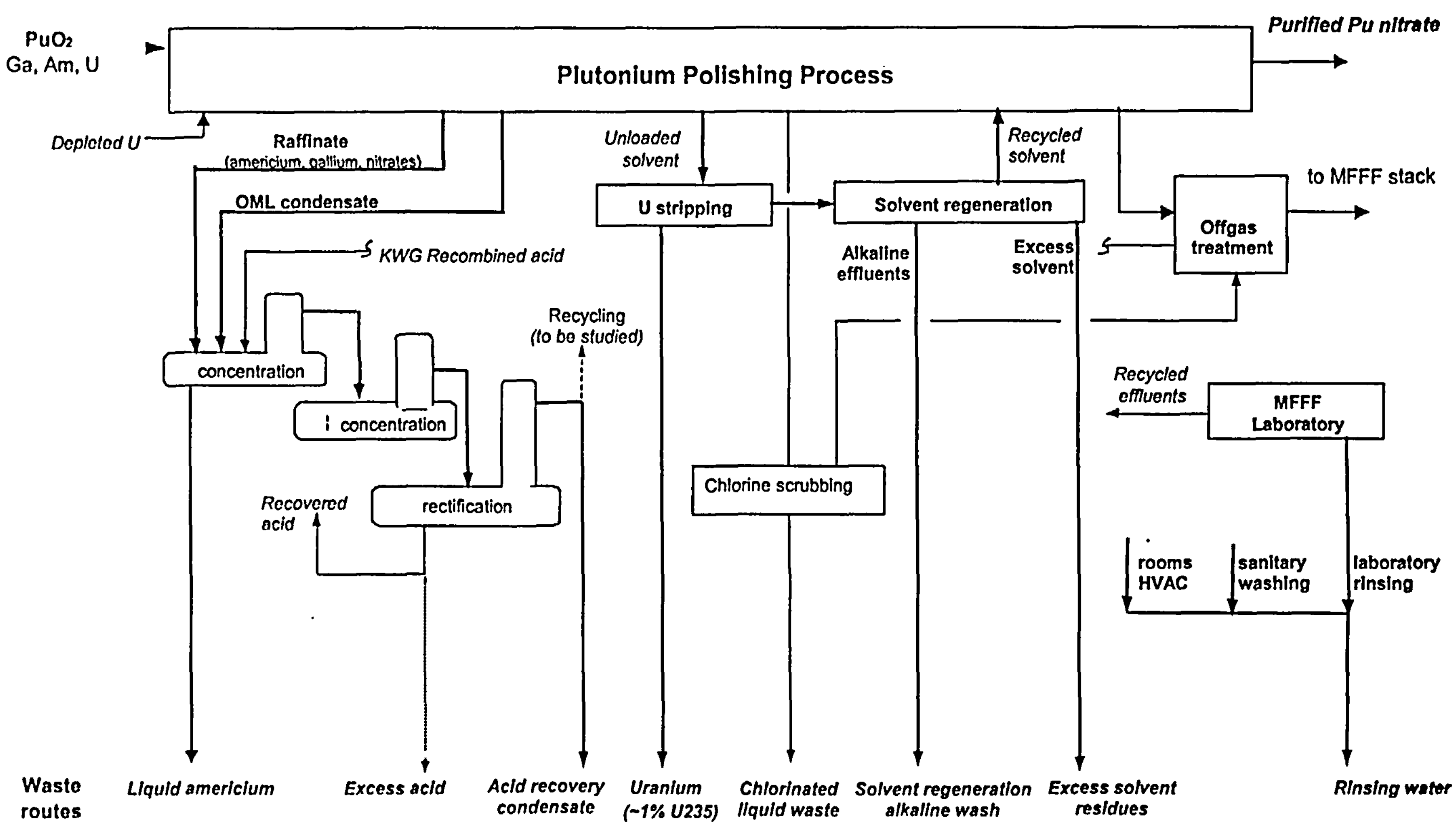

Figure 3-6. Aqueous Polishing Waste Streams (revised)

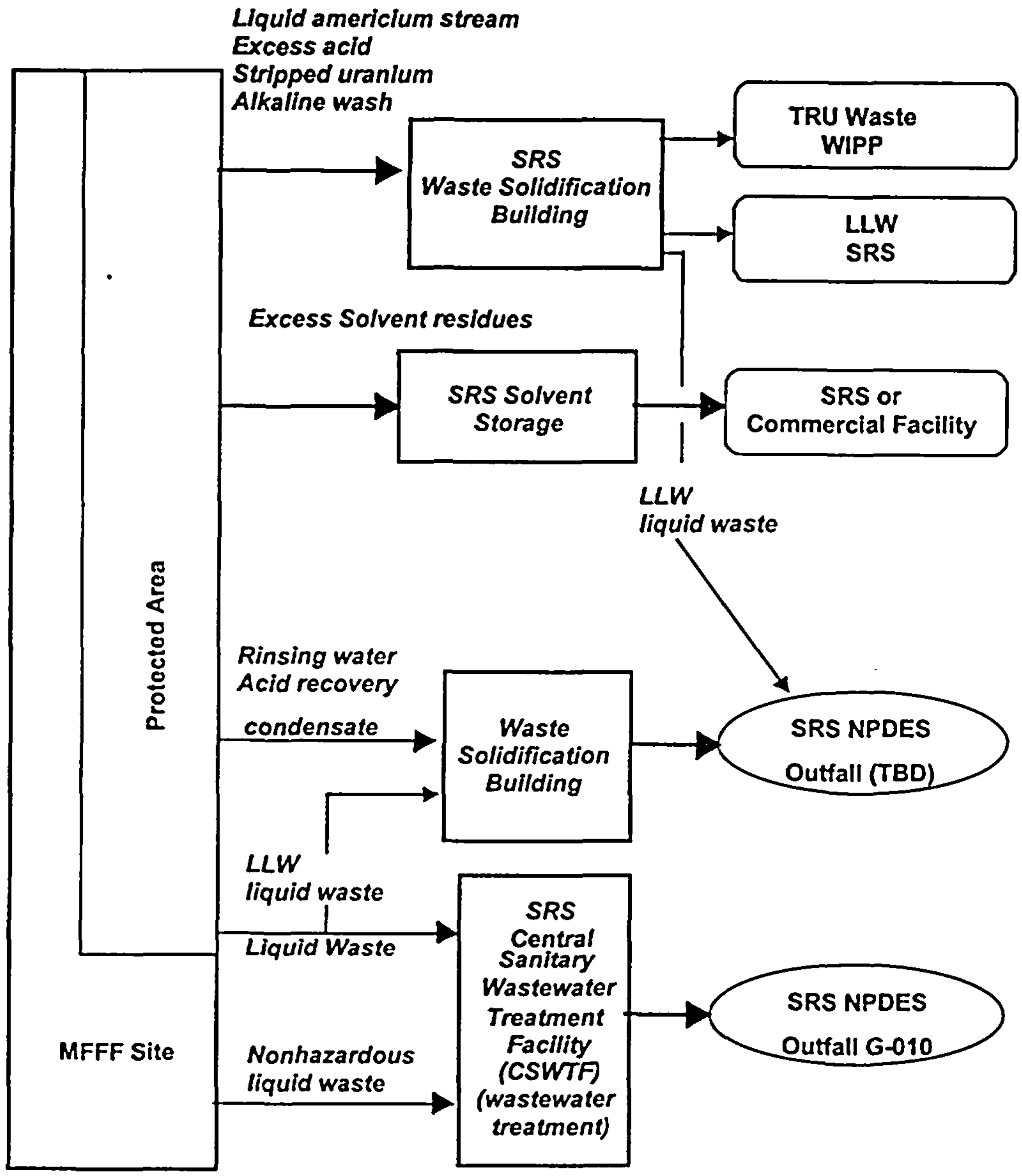

Figure 3-11. MFFF Liquid Waste Management Flow Diagram

Table 3-2. Chemical Consumption and Onsite Inventory

Chemical	Annual Consumption	Anticipated Onsite Inventory
Argon	13,836,000 scf	6,000 gal (Liquid)
Aluminum Nitrate (2 M)	3.5 gal	0.5 gal
95 % Argon-5 % Hydrogen	---- (24 hour back-up)	56,000 scf
90 %Argon-10 % Methane	392,000 scf	45,000 scf
Dodecane	1,800 gal	180 gal
Helium	367,000 scf	280,000 scf
Hydrazine (35%)	530 gal	126 gal
Hydrogen	400,000 scf	43,000 scf
Hydrogen peroxide (35%)	520 gal	60 gal
Hydroxylamine nitrate (1.9 M)	6100 gal	180 gal
Manganese nitrate (1M)	7 gal	1 gal
Nitric acid (13.6N)	1,300 gal	925 gal
Nitrogen	160,000,000 scf	500,000 lbs (liquid)
Nitrogen Tetroxide	147,000 scf	4,000 lbs (liquid)
Oxalic acid	12,640 lb	1,200 lb
Oxygen	30,500 scf	12,500 scf
Porogen (MP only)	310 lbs	440 lbs
Silver nitrate (10M)	75 gal	7 gal
Sodium carbonate	430 lb	40 lb
Sodium hydroxide (10M)	800 gal	150 gal
Sodium Sulfite (anhydrate)	740 lb	100 lb
Tributyl phosphate	700 gal	126 gal
Uranyl nitrate (depleted)	3660 gal	200 gal
Zinc Stearate (MP only)	460 lbs	660 lbs

Table 3-3. Aqueous Polishing Waste Streams

Waste Stream	Maximum Annual Volume (gal)[a]	Main Chemical or Isotope Concentration or Annual Quantity	Disposition (gal)
Liquid americium stream Concentrated stream from acid recovery.	3,000 (PDCF) 4,400 (AFS)	Am-241: < 24.5 kg/yr (84,000 Ci) Pu: < 150 g/yr Hydrogen ions: 9.4 N $[H^+]$ Nitrate salts: 2,200 kg/yr+ nitrates from silver Silver: < 300 kg/yr Trace quantities of thallium, lead and mercury	**High Alpha Waste to WSB** 10,300 (PDCF) 8,421 (AFS)
Excess acid stream	1,321 (AFS) 4,100 (PDCF)	Am: < 90 mg/yr (rectification step after two evaporation steps) Hydrogen ions: 13.6 N	
Alkaline stream	3,200 (PDCF) 2,700 (AFS)	Pu: < 16 g/yr U: < 13 g/yr Na: < 110 kg/yr	
Stripped uranium stream	44,000 (PDCF) 40,000 (AFS))	Plutonium: < 0.1 mg/L Stripped U quantity: < 3,100 kg/yr [~1% U-235] Hydrogen ions: 0.14 N $[H^+]$	**Stripped Uranium to WSB** 44,000 (PDCF) 40,000 (AFS)
Excess low-level radioactive solvent wastes	2,800 (PDCF) 2,600 (AFS)	Solvent: 30% tributyl phosphate in dodecane Pu: < 17.2 mg/yr	**SRS Solvent Recovery** 2,800 (PDCF) 2,600 (AFS)
Distillate waste[b]	102,000 (PDCF) 70,000 (AFS)	Am-241: < 0.85 mg/yr Activity 2.39 x 10^8 Bq/yr Hydrogen ions: 0.02 N $[H^+]$	**Liquid LLW** 285,000 (PDCF) 273,000 (AFS)
Chloride removal waste	20,000 (AFS)	This waste is produced only when alternate feedstock with chlorides is used. < 5 g/L chloride [b]	
Rinsing water[b]	158,000 (PDCF) 158,000 (AFS)	Alpha activity: < 4 Bq α/L Hydrogen ions[c]: 0 – 0.6N $[H^+]$	
Internal HVAC condensate	25,000	Trace contamination	

[a] Reported volumes represent maximum anticipated for rinses and changeovers. PDCF indicates feed from PDCF; AFS indicated Alternative Feedstock.

[b] DCS may use distillate and rinse water to dilute the chloride waste to lower chloride concentrations.

[c] Some systems use slightly acidic water for rinsing.

Table 3-4. Solid Waste Generated by MFFF Fuel Fabrication Processes

Waste Stream	Annual Volume (Mass)[a]	Contamination[b] (mg Pu/kg)	Disposition[c]
Uncontaminated, nonhazardous solid waste	575 yd^3 1,150 yd^3 (max)		**Solid Nonhazardous Waste** 877 yd^3 1,754 yd^3 (max)
Potentially contaminated solid waste[c]	302 yd^3 604 yd^3 (max)	Under detection limit Free of contamination waste collected in controlled area	
UO_2 area LLW	9 yd^3 18 yd^3 (max)	Uranium contamination	**Solid LLW** 218 yd^3 230 yd^3 (max)
Zirconium swarfs and samples	2 yd^3 4 yd^3 (max)	< 0.2	
Stainless Steel Inner and Outer Cans	16 yd^3	< 0.2	
Building and U area ventilation filters	190 yd^3	< 0.3	
Miscellaneous LLW	< 1 yd^3 2 yd^3 (max)	< 0.2	
Cladding area TRU	9 yd^3 11 yd^3 (max)	< 2.8	**Solid TRU Waste** 205 yd^3 306 yd^3 (max)
Low contamination TRU waste	60 yd^3 72 yd^3 (max)	< 10	
High contamination TRU waste	83 yd^3 100 yd^3 (max)	approximately 250	
PuO_2 convenience cans	7.9 yd^3	approximately 1670	
Filters	43.3 yd^3 92 yd^3 (max)	approximately 715 (PDCF) approximately 1000 (AFS)	
Miscellaneous TRU waste	1.6 yd^3 23 yd^3 (max)	approximately 600	

[a] Values are approximate based on preliminary design

[b] Estimates for plutonium mass collected in solid waste is about 7 kg.

[c] Potentially contaminated waste will be surveyed and released as nonradioactive if determined to be below release limits.

(max) Represents maximum expected annual volume due to unplanned change-overs.

4. DESCRIPTION OF THE AFFECTED ENVIRONMENT

The SPD EIS (DOE 1999c) provided an extensive discussion of the affected environment for SRS, including F Area. That discussion is included in this chapter with appropriate updated information. SRS developed the *Generic Safety Analysis Report* (GSAR) (WSRC 1999a) for all facilities located at SRS. The GSAR provides key site information including (but not limited to) geology, hydrology, meteorology, land use, and demographics for SRS. The GSAR is updated on a periodic basis. The GSAR is used in this ER to supplement the information provided in the SPD EIS. This ER also uses the SRS Environmental Reports for 1998 and 1999 (Arnett and Mamatey 1999, 2000a) to update information provided in the SPD EIS. Where more recent information is not available, the data provided in the SPD EIS were used. In some instances, more recent data were investigated, and it was determined that data presented in the SPD EIS provided a more conservative basis for projecting impacts on the affected environment.

4.1 SITE LOCATION AND LAYOUT

The site location is summarized in Section 4.1.1, and the site layout is described in Section 4.1.2.

4.1.1 Site Location

The MFFF is located in the Separations Area (F Area) of SRS in South Carolina (Figure 4-1). SRS, which is owned by the U.S. Government, was set aside in 1950 for the production of nuclear materials for national defense. SRS, as shown in Figure 4-1, is an approximately circular tract of land occupying 310 mi^2 (803 km^2) or 198,400 ac (80,292 ha) within Aiken, Barnwell, and Allendale Counties in southwestern South Carolina. Public access to the SRS area is limited by DOE security regulations to the DOE site boundary (Figure 4-2). F Area and the MFFF are located in Aiken County near the center of SRS, east of SRS Road C and north of SRS Road E. F Area comprises approximately 395 ac (160 ha) of SRS. The nearest site boundary to F Area is approximately 5.8 mi (9.3 km) to the west. The center of F Area is approximately 25 mi (40 km) southeast of the city limits of Augusta, Georgia; 100 mi (161 km) from the Atlantic Coast; 6 mi (9.7 km) east of the Georgia border; and about 110 mi (177 km) south-southwest of the North Carolina border. The MFFF site is located adjacent to the north-northwest corner of F Area (Figure 4-3).

The location of SRS and F Area relative to towns, cities, and other political subdivisions within a 50-mi (80-km) radius is shown in Figure 4-4. The largest nearby population centers are Aiken, South Carolina, and Augusta, Georgia. The only towns within 15 mi (24 km) of the center of F Area are New Ellenton, Jackson, Barnwell, Snelling, and Williston, South Carolina.

Prominent geographical features within 50 mi (80 km) of SRS are Thurmond Lake (formerly called Clarks Hill Reservoir) and the Savannah River. Thurmond Lake is an impoundment of the Savannah River approximately 40 mi (64 km) northwest of the center of SRS. The Savannah River bounds 17 mi (27 km) of the southwest border of SRS.

4.3.2 MFFF Site-Specific Geology

Soils in F Area are predominantly of the Fuquay-Blanton-Dothan association, consisting of nearly level to sloping, well-drained soils. Other soils include the Troup-Pickney-Lucy association, consisting of nearly level soils formed along, and parallel to, the floodplains of streams.

In 2000, 13 exploration borings and 63 cone penetration test (CPT) holes were used to define subsurface conditions at the MFFF site. Additional site geotechnical programs previously performed by others adjacent to and on this site were also used to evaluate site subsurface geologic and groundwater conditions. Actual conditions encountered at the MFFF site were evaluated with known geologic and groundwater hydrology conditions (described in Section 4.4.3), and no unusual conditions were encountered.

The CPT holes extended from approximately 85 ft (26 m) to 166 ft (50 m) below existing site grade. Each CPT hole provided a continuous profile of the soil conditions encountered at each test location. Seismic, resistivity, and piezometric measurements were obtained in many of the CPT holes. Some soft soil zones related to past solution and deposition activity were identified at depth on the MFFF site. The soft zones encountered were typical of those that have been described in previous F-Area investigations. The CPT holes were used to define limits of the soft zones. The planned locations of heavily loaded structures, such as the MOX Building and Diesel Generator Building, were adjusted on the MFFF site to minimize the potential impact of the underlying soft zones. This adjustment was necessitated by the potential of the soil to liquefy under certain conditions, forcing foundations to fail. The soil exploration borings extended from approximately 115 ft (35 m) to 181 ft (55.2 m) below existing site grade. The exploration borings were used to correlate with the CPT holes and to obtain soil samples for laboratory testing. Three cased holes for the exploration program were used for downhole seismic testing.

A comprehensive laboratory testing program was conducted to establish both static and dynamic design parameters for use in analysis. Laboratory results indicate that conditions at the MFFF site are consistent with those encountered in previous investigations in F Area and other studies in the same geologic units described at SRS.

The upper geologic units at the MFFF site are composed of the Barnwell Group described in Section 4.3.1.2. The exploration borings also extended through the Tinker/Santee Formation, Warley Hill Formation, and into the Congaree Formation of the Orangeburg Group.

The unconfined water table is within the Upper Three Runs aquifer, as described in Section 4.4.3.1. Based on the results of pore water pressure dissipation testing, the groundwater level at the MFFF site was generally encountered at a depth of 60 ft (18.3 m) or more below grade, at the time of site exploration. As indicated in WSRC (2002), the Upper Three Runs aquifer water table is generally at 210 ft (63.6 m) (msl). In the past ten years, during wetter seasons, it has reached 220 ft (67 m) (msl), well below the deepest MFFF construction excavation level of 242 ft (73.8 m) (msl). The water table and gradient at the MFFF site are consistent with Figure 4-9.

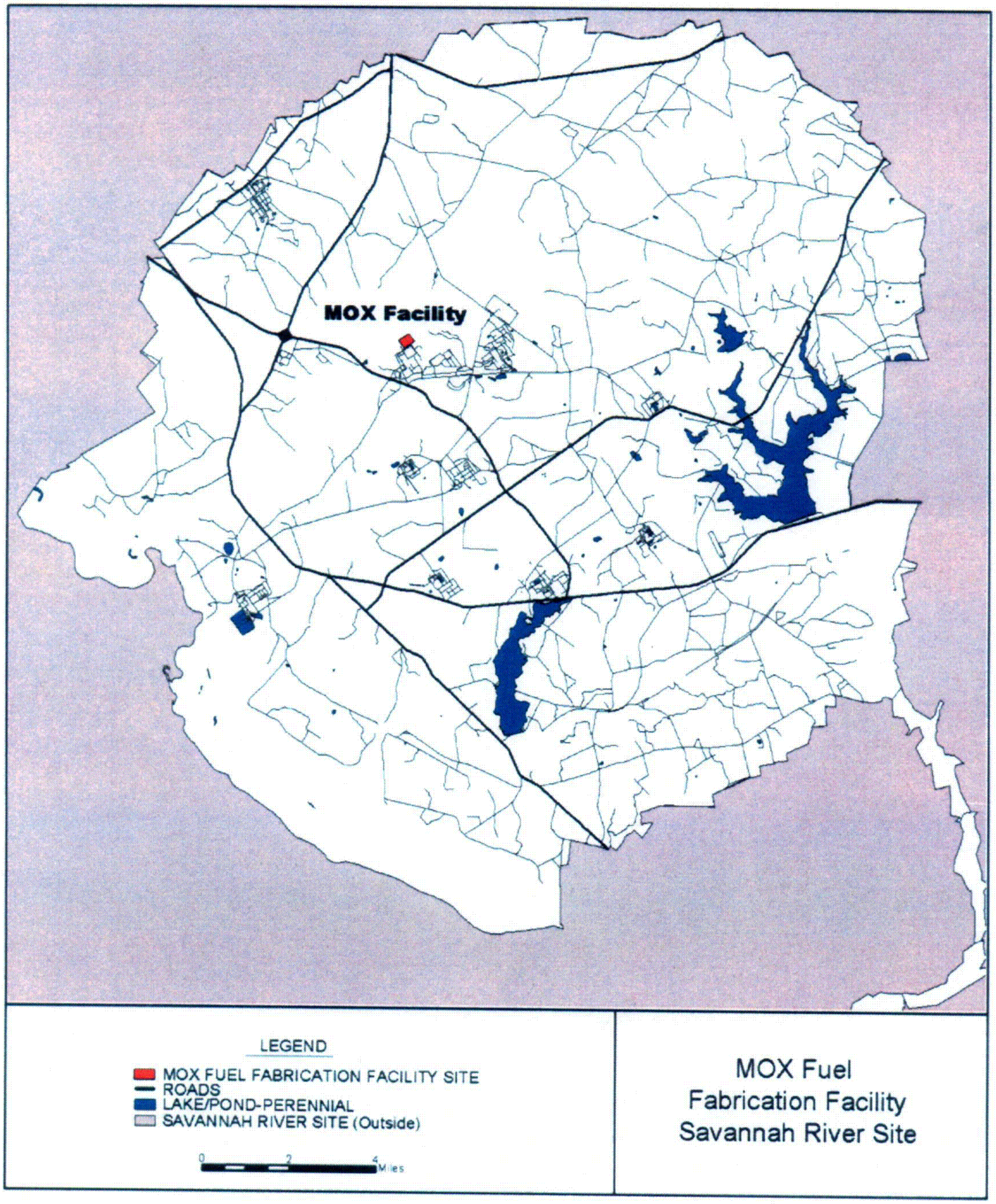

Figure 4-2. Location of MFFF within the Savannah River Site

C01

Table 4-25. Radiation Doses to Workers from Normal SRS Operations (Total Effective Dose Equivalent)

	Onsite Releases and Direct Radiation	
Occupational Personnel	**Standard** [a]	**Actual**
Average radiation worker (mrem/yr)	5,000	46[b]
Total workers (person-rem/yr)	NA	136.5[c]

[a] The radiological limit for an individual worker is 5,000 mrem/yr (10 CFR Part 835). However, DOE's goal is to maintain radiological exposure as low as reasonably achievable. It has therefore established an administrative control level of 2,000 mrem/yr (DOE 1994b); DOE must make reasonable attempts to maintain worker doses below this level.

[b] Source: DOE, 1999e. DOE/EH-629, *DOE Occupational Radiation Exposure 1999 Report*, Table 1B-c.

[c] Source: DOE, 1999e. DOE/EH-629, *DOE Occupational Radiation Exposure 1999 Report*, Exhibit 3-17.

5.2.2 Impacts on Surface Water Use and Quality

The MFFF does not discharge any process liquid directly to the environment. Noncontact HVAC condensate and stormwater will discharge through an approved NPDES outfall. All liquid wastes are transferred to SRS for treatment, storage, and ultimate disposal. A description of these wastes is provided in Section 3.3.

Liquid LLW will be transferred to the Waste Solidification Building. [Text deleted] Liquid LLW from MFFF will be discharged to Upper Three Runs after treatment. The discharge represents less than 0.01% of the Upper Three Runs 7-day 10-year low flow and is therefore, a negligible volume impact to Upper Three Runs. Because the liquid LLW will be treated to meet SRS NPDES permit limitations, negligible impacts on surface water quality are expected.

5.2.3 Impacts on Groundwater Quality

MFFF operations will withdraw approximately 1 gal/min (3.8 L/min) from the SRS groundwater system for process water. During start-up and process transitions, the groundwater withdrawals may increase to 30 gal/min (114 L/min). F area process water system capacity is 2,100 gpm with an average demand of 350 gpm (800 gpm peak). MFFF operations will withdraw approximately 3.7 gal/min (14 L/min) from the SRS groundwater system for domestic water. The domestic water capacity from deep wells supplying the A-area loop, which includes F Area, is 3,000 gpm and that the average domestic water consumption from the A-area domestic water loop in 2000 was 754 gpm (about 1,200 gpm peak). MFFF groundwater withdrawals are not anticipated to have any impact on SRS or local groundwater supplies.

The MFFF does not employ settling or holding basins as part of the wastewater treatment system. There will be no direct discharge of wastewater to the groundwater. Therefore, no impacts on groundwater quality are expected.

5.2.4 Impacts on Ambient Air Quality

There are four sources of air emissions from the MFFF operations:

- NO_X and chlorine emissions from the MFFF stack derived from the aqueous polishing process
- Criteria pollutant emissions from routine testing of the emergency and standby diesel generators
- Fugitive emissions from chemical and fuel storage tanks
- Emissions from employee and site vehicles.

Impacts of the chemical air emissions from the MFFF are presented in Section 4.4.2.1 and Appendix G, Section G.4.2.4.2 of the SPD EIS (DOE 1999c), and are updated in the following discussion.

It is also unlikely that any federally listed threatened or endangered species would be affected, although South Carolina state-classified special-status species (American alligator) could be affected by noise or human activity during operations, as discussed for construction (Section 5.1.5.2).

5.2.6 Impacts from Facility Noise

The location of the MFFF relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during operations would include new or existing sources (e.g., cooling systems, vents, motors, material-handling equipment, emergency and standby diesel generators), employee vehicles, and truck traffic. Given the distance to the site boundary (about 5.4 mi [8.7 km]), noise emissions from equipment would not be expected to annoy the public.

Some noise sources could have onsite impacts, such as the disturbance of wildlife. However, noise would be unlikely to affect federally listed threatened or endangered species or their critical habitats because none are known to occur in F Area. Traffic noise associated with operation of the MFFF would occur on the site and along offsite local and regional transportation routes used to bring materials and workers to the site. Noise from traffic associated with operation of the MFFF would likely produce less than a 1-dB increase in traffic noise levels along roads used to access the site, and thus would not result in any increased annoyance of the public.

Operations workers could be exposed to noise levels higher than the acceptable limits specified by OSHA in its noise regulation (29 CFR §1926.52). However, DCS will implement appropriate hearing protection programs to minimize noise impacts on workers. These programs include the use of administrative controls, engineering controls, and personal hearing protection equipment.

5.2.7 Impacts on Historic, Scenic, and Cultural Resources

Once the construction impacts to the archaeological site have been mitigated, operation of the MFFF is not projected to have any impact on site or regional historic or cultural resources.

The MFFF buildings will have a minimal effect on the scenic character of the surrounding area and is consistent with the VRM Class IV designation for the area. The buildings are low-rise structures of varying heights less than 100 ft (30 m). This height is consistent with, and does not exceed, the other building heights in the area, which range from 10 to 100 ft (3 to 30 m). The tallest new structure is an exhaust stack, which is located on top of the MFFF building. The stack is less than 120 ft (37 m) above the existing grade, and its distance from sensitive receptors and screening by trees will minimize its impact as a visual intrusion to the scenic character of the area.

The appearance of MFFF facilities in and adjacent to F Area would remain consistent with the area's industrialized landscape character. In height and size, the proposed facilities will be similar to existing buildings in F Area. Facilities generally are not visible offsite because views less than those used for this calculation. [Text deleted] Because the MFFF does not discharge any liquid directly to the environment, the liquid/aquatic pathway was not considered in the dose calculations.

Table 5-11 summarizes the potential radiological impacts on three individual receptor groups: the population living within 50 mi (80 km) of SRS, the maximally exposed member of the public, and the average exposed member of the public. This table also shows a comparison of the calculated potential doses due to normal operations to the all-pathway standard given in 10 CFR Part 20, Subpart D and the doses from natural background radiation.

Given incident-free operation of the MFFF, the total population dose would be 0.28 person-rem/yr. The annual dose to the maximally exposed member of the public from operation of the MFFF would be 3.3E-03 mrem/yr. The dose to the average individual in the population would be 2.7E-04 mrem/yr. Details regarding calculation of the radiological impact of normal operations of the MFFF on the general public are presented in Appendix D.

5.2.10.2 Radiation Doses to Site Workers

Site workers are defined as those that work within the SRS boundaries (including both MFFF workers and SRS workers) but are not directly involved in process activities at the MFFF. The doses to site workers presented here were determined using the GENII system (Pacific Northwest Laboratory 1988a, 1988b). The calculated dose is the 50-year committed effective dose equivalent due to internal exposure and the effective dose equivalent due to external exposure resulting from one year of release and one year of uptake. Details related to the dose calculations for site workers can be found in Appendix D.

The current spatial distribution of site workers within the SRS boundary is not readily available. Therefore, a population dose for site workers could not be directly determined. Rather, a dose to a site worker located on the MFFF boundary (328 ft [100 m] from the release point) and a dose to a site worker located on the SRS boundary (5 mi [8 km] from the release point) were calculated. Those doses were then multiplied by the total number of site workers to obtain a maximum population dose at the boundary of the MFFF and at the boundary of SRS. These two values provide the maximum and minimum, respectively, estimated population dose for the site workers. Actual dose to SRS site workers is projected to be between these two extremes.

Calculation of the dose due to normal operations of the MFFF for the MEI representing site workers assumed the following:

- Chronic atmospheric releases.

Operation of the MFFF is not expected to significantly impact SRS infrastructure other than the impacts to the SRS waste management systems discussed in the next section.

The MFFF will require 130,000 MWh/yr of electricity during operations. SRS has 482,700 MWh of unused capacity. MFFF electrical needs are not anticipated to impact electricity availability for SRS.

The water usage for all mechanical fluid systems during MFFF operation is anticipated to be approximately 322,700 – 485,500 gal/yr (1.8 million L/yr). F area process water system capacity is 2100 gpm with an average demand of 350 gpm (800 gpm peak). The MFFF sanitary water usage is anticipated to be approximately 1.95 million gal/yr (7.4 million L/yr). The domestic water capacity from deep wells supplying the A area loop which includes F Area, is 3,000 gpm and that the average domestic water consumption from the A area domestic water loop in 2000 was 754 gpm (about 1,200 gpm peak). Therefore, no impacts on water availability would be expected.

5.2.12 Waste Management Impacts

MFFF operational impacts on SRS waste management activities are discussed in Section 4.4.2.2 of the SPD EIS (DOE 1999c).

The waste management facilities within the MFFF will transfer all wastes generated to SRS waste management facilities. Table 5-12 compares the expected waste generation rates from operating the MFFF with the existing site waste generation rates.

As described in Section 3.3, the MFFF will not generate any HLW. The aqueous polishing process produces a liquid high alpha activity waste and a stripped uranium waste that will be transferred through two separate double-walled pipes to the WSB.

The waste streams that comprise the liquid high alpha liquid waste stream and are to be transferred to SRS for management include the americium stream, the alkaline wash stream, and the excess acid stream. The total volume of the combined high alpha waste streams is estimated to be just over 10,000 gallons (40 m^3) annually. The composite stream contains approximately 84,000 Curies of americium-241.

The stripped uranium stream will average 44,000 gallons (167 m^3) annually during normal operations and 40,000 gallons (151 m^3) annually during alternate feedstock processing. The stripped uranium stream is 1% as uranium-235 to avoid criticality issues.

As described in Section 3.3.2.8, both of these waste streams will be converted to a solid waste suitable for disposal as TRU waste or LLW as appropriate. In addition to the MFFF waste, the WSB will convert approximately 11,000 gallons (41.6 m^3) per year of liquid waste from the PDCF to solid waste.

The MFFF is expected to generate about 285,000 gal (1,080 m^3) per year of low-level liquid waste. The MFFF will include collection tanks with sampling capability for the LLW stream. The waste stream will be verified to meet the waste acceptance criteria. After confirming waste acceptability, it will be transferred to the Waste Solidification Building.

The WSB will generate a maximum of 235,000 gallons (890 m^3) of liquid LLW annually from the processing of the MFFF and PDCF high radioactivity waste streams.

The liquid LLW generated by the MFFF and WSB will be treated at the WSB before release to Upper Three Run. The volume of these wastes [less than 1,000,000 gal/yr (3,785 m^3/yr)] would be [Text deleted] less than 1 % of the 7-day, 10-year low flow for Upper Three Run.

[Text deleted]

Excess dodecane solvent, contaminated with plutonium, will be transferred to SRS waste management for treatment and disposal as a contaminated solvent waste. This is a very small waste stream of 2,800 gal/yr.

The solid low level and TRU wastes resulting from the MFFF will be processed along with other SRS wastes of the same type in an existing waste infrastructure. This infrastructure is described and the environmental impacts evaluated in the *SRS Waste Management Final Environmental*

Impact Statement (DOE 1995b) over a wide range of waste volumes, which could result from SRS and external operations. The MFFF solid TRU waste is estimated to be 306 yd^3 (234 m^3) per year. The WSB would produce an additional 190 yd^3 (147 m^3) of TRU waste per year. Over its lifetime, the MFFF and WSB would expect to generate 5,560 yd^3 (4,250 m^3) of TRU waste. The forecast for SRS TRU waste generation over the next 30 years ranges from a minimum estimate of 7,578 yd^3 (5,794 m^3) to 710,648 yd^3 (543,329 m^3), with an expected forecast of 16,433 yd^3 (12,564 m^3) (DOE 1995b, Table A-1). The estimated MFFF lifetime TRU solid waste quantity is about 35 % the expected SRS TRU waste forecast but only a small fraction (<1%) of the maximum SRS estimate.

The environmental impacts resulting from the disposal of TRU waste at the Waste Isolation Pilot Plant (WIPP) are discussed in *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* (DOE 1997e). The impacts projected in DOE 1997e (Table 2-2 in DOE 1997e) were based on disposal of 170,000 m^3 TRU waste. The additional 4,300 m^3 TRU waste from the WSB represents an increase of 3% in the projected waste disposed. Any increase in impacts resulting from disposing WSB solid TRU waste at WIPP should be within the error associated with any projected impacts of WIPP operation. Furthermore, the *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* projected that, "No LCFs would be expected in the population around WIPP from radiation exposure (3 E-4 LCFs). ... no cancer incidence (2 x 10^{-5} cancers) would be expected in the population from hazardous chemical exposure." (DOE 1997e, pg 5-29) The addition of 4,300 m^3 TRU waste from the MFFF and WSB would not be expected to change this conclusion.

The MFFF solid low level waste (LLW) is estimated to be 230 yd^3 (176 m^3) per year and liquid LLW is estimated as 285,000 gallons (1,080 m^3) per year. The WSB would produce an additional 413 yd^3 (316 m^3) of solid LLW per year from the solidification of MFFF stripped uranium. Over its lifetime, the MFFF would expect to generate 21,800 yd^3 (16,668 m^3) of LLW. The forecast for SRS LLW generation over the next 30 years ranges from a minimum estimate of 480,310 yd^3 (367,223 m^3) to 1,837,068 yd^3 (1,404,539 m^3), with an expected forecast of 620,533 yd^3 (474,431 m^3) (DOE 1995b, Table A-1). The estimated MFFF LLW quantity is only a small fraction of any of the SRS estimates. Consequently, the waste volumes generated from MOX are small in comparison to the annual SRS volumes and impacts to SRS waste management are well within the bounds evaluated in the *SRS Waste Management Final Environmental Impact Statement* (DOE 1995b).

All TRU wastes and LLW transferred to SRS waste management facilities would meet the requirements of the applicable Waste Acceptance Criteria (WAC).

Table 5-12 illustrates that the MFFF waste generation rates are generally less than 5% of the SRS generation rates, except for solid TRU waste, which is projected to be about 500% of the SRS annual generation rate. Although the annual MFFF TRU waste generation exceeds the current annual SRS TRU waste generation, the MFFF cumulative TRU waste volumes are well below the maximum projected SRS TRU waste volumes.

The loss or damage of the primary confinement barrier may result in either the dispersion of radioactive materials and hazardous chemicals or a loss of subcritical conditions. Criticality events and the effects of hazardous chemicals are discussed in Sections 5.5.2.7 and 5.5.2.9, respectively. The loss at each level of confinement is necessary for a non-negligible release from the MFFF site to occur.

Damage to or failure of the confinement barriers can be caused by human error or equipment failure resulting in the following:

- Failure of negative pressure or a flow perturbation causing flow reversals between some confinement zones
- Breaches of container or rod confinement boundaries due to crushing, shearing, grinding, cutting, and handling errors
- Backflow into lines that penetrate primary and secondary confinement boundaries
- Corrosion-induced confinement failures
- Pipe or vessel breaks or leaks
- Clogging of filters
- Failure of filters
- Glove or seal failures during normal or maintenance operations
- Thermal excursions leading to failure of gloves, seals, and/or cladding.

[Text deleted] Loss-of-confinement events are postulated to occur and are evaluated for each primary confinement within the MFFF without regard to the probability of the initiating event. Postulated loss-of-confinement events include the following:

- Loss of confinement from a glovebox containing powders, pellets, solutions, or fuel rods
- Loss of confinement from aqueous polishing process equipment containing plutonium or americium in solution form
- Loss of confinement from canisters, fuel rods, fuel assemblies, HEPA filters, or waste drums
- Loss of confinement from transportation packages or UO_2 drums.

The loss-of-confinement event postulated to produce the largest radiological consequences (See Appendix F for a definition of bounding events) is an event caused by a load handling accident of the Jars Storage and Handling Unit. See Section 5.5.2.5 for a description of this event. The bounding radiological consequences associated with this event are provided in Table 5-13. Appendix F provides assumptions associated with this event. The frequency associated with this event is estimated to be unlikely or lower since multiple failures are required for this event to occur.

The bounding low consequence event consequence is a fire involving waste drums located in the truck bay. Consequences are presented in Table 5-13b. The frequency of this event is estimated to be not unlikely or lower.

The MFFF utilizes many features to reduce the likelihood and consequences of these events as well as other loss-of-confinement events. Key features include reliable and redundant confinement systems; process temperature, pressure, and flow controls; radiation monitoring systems; redundant control systems; emergency procedures; and worker training.

As shown in Tables 5-13a and 5-13b, the radiological consequences at the SRS site boundary are low. Such impacts would not be sufficient to warrant evacuation of the public or interdiction or decontamination of land or food supplies. Tables 5-13a and 5-13b also show that the radiological consequences to the nearest site worker are low. Appendix F provides assumptions associated with this event.

Given the low consequences and or low likelihood of this type of accident, the radiological risk from the loss-of-confinement events is low.

5.5.2.3 Internal Fire

A fire hazard arises from the simultaneous presence of combustible materials, an oxygen source, and a sufficient ignition source. A fire can spread from one point to another by conduction, convection, or radiation. The immediate consequence of a fire is the destruction, by combustion or by thermal damage, of elements in contact with the fire. A fire can lead to either the dispersion of radioactive materials and hazardous chemicals or a loss of subcritical conditions. Criticality events and the effects of hazardous chemicals are discussed in Sections 5.5.2.7 and 5.5.2.9, respectively.

Fires can be caused by human error, electrical equipment failures, equipment that operates at high temperatures, uncontrolled chemical reactions, or static electricity.

Fires are postulated to occur and are evaluated for each fire area within the MFFF without regard to the probability of the fire occurring. Fire areas and the associated fire boundary limit the size of the fire and contain the fire within the fire area. MFFF fire areas often correspond, but are not limited, to existing room boundaries. Thus, a facility-wide fire or a fire involving two or more fire areas simultaneously is a remote and speculative event. Postulated fires include the following:

[8 km] from the MFFF). The chemical consequence modeling for site worker impacts (i.e., at a distance of 100 meters from the MFFF stack) used ALOHA code along with the ARCON96 code (NRC 1997) to calculate maximum chemical concentrations. Calculated concentrations were compared to Emergency Response Planning Guidelines (ERPGs) or to Temporary Emergency Exposure Limits (TEELs). TEELs describe temporary or equivalent exposure limits for chemicals for which official ERPGs have not yet been developed.

An evaporation model extracted from the ALOHA code was used to calculate a release from a spilled or leaked chemical, which is assumed to form a puddle one-centimeter deep. A spill or leak from the largest tank or container holding the chemical was modeled.

Consideration for spill size, location, container integrity, and chemical concentration was included in the evaluation.

Based on the results, DCS concludes that the concentration of all chemicals at the SRS boundary following a release from the MFFF is low. The results also indicate that the maximum chemical concentrations for the site workers are low. The frequency of significant chemical releases at the MFFF is conservatively estimated to be unlikely. Appendix F provides additional information related to the chemical evaluation.

MFFF features to reduce the frequency and magnitude of a chemical release include the following: reagent preparation controls, separation and segregation of incompatible reagents, process temperature controls, ventilation controls, vessel level indications, drip trays, leak detection, sumps, drains, operating procedures, emergency procedures, operator training, hazardous material control, toxic gas exhaust systems, and an emergency control room.

Given the low consequences and/or low likelihood of this type of accident, the risk from chemical releases is low.

5.5.3 Evaluation of Facility Workers

The risk to workers is qualitatively evaluated for all MFFF events. Sufficient engineering design features and administrative controls have been incorporated into the MFFF design to ensure that any unacceptable consequence is highly unlikely.

Key design features include shielding, confinement systems, criticality and explosion prevention structures, systems, and components (SSCs), radiation monitoring systems, and fire protection systems. Key administrative controls include operator training, criticality safety, radiation protection, fire safety, and industrial hygiene programs. In addition, workers are trained and qualified and perform their work in accordance with approved procedures.

Given the low consequences and/or low likelihood of events, the overall radiological risk to the MFFF worker is low.

5.7.3.1 Reagent Process Building

DCS considered two options for locating the aqueous polishing reagent process. One option was to locate the preparation of reagents within the same area as the aqueous polishing area. The second option was to locate the reagent process in a separate building and pump mixed reagents to the aqueous polishing area.

The reagent preparation process involves an exothermic reaction that presents a potential explosion hazard. DCS decided to separate the preparation of material presenting the potential chemical explosion hazard from the SNM. The reagent preparation process was moved to a separate building adjacent to the aqueous polishing area. The mixed reagents will be pumped to the aqueous polishing area on an as-needed basis. The relocation of these processes reduces the potential of a chemical accident resulting in a release of radioactivity to the environment.

In the design of the Reagent Process Building, DCS considered the use of underground storage tanks to contain any overflows and spills from the reagent storage and mixing tanks. Because of the environmental risk associated with underground waste storage tanks, DCS decided to eliminate the underground tanks. Any overflows and spills from the reagent storage and mixing tanks will be contained in a curbed area and gravity flow to collection tanks in below grade rooms in the Reagent Processing Building. The collection tanks will be manually pumped to drums and removed from the Reagent Process Building for disposition.

5.7.3.2 Recycling of Acid Recovery Distillates in the Aqueous Polishing Process

DCS selected a design alternative for the acid recovery process that consists of adding an evaporation step to lower the activity of these distillates and to recycle half of the volume of the distillates in place of fresh demineralized water. The reduced volume of evaporator concentrates is transferred to SRS as a liquid high alpha activity waste. The addition of this evaporator reduces the volume of liquid for processing at SRS and reduces the volume of demineralized water required for the process.

5.7.3.3 Reduction in TRU Waste Volume Due to Lower Glovebox Cooling Flow Rates

Glovebox internal cooling flow rates at MELOX are dependent on the heat release of reactor-grade plutonium. The heat release of weapons-grade plutonium is significantly lower than that of reactor-grade plutonium. Because of the lower heat release, the glovebox internals can be cooled by natural convective cooling, which results in a reduced airflow, filter size, and TRU solid waste volume during periodic filter replacement.

5.7.3.4 Recycling of Laboratory Effluents Using Aqueous Polishing Capability

Aqueous laboratory wastes at MELOX are precipitated and solidified, resulting in TRU wastes. In the MFFF, the plutonium is removed from the laboratory waste and recycled into the aqueous polishing process. The resulting laboratory wastes are LLW.

Service, periodic habitat loss would normally occur. Although some destruction would occur during and after construction, losses will be minimized by careful siting of facilities and incorporation of mitigation measures into all construction activities. In addition, consultation and coordination with state and federal natural resource and wildlife agencies prior to any site disturbances will ensure that all potential sensitive species, candidate or listed, are protected to the maximum extent possible.

There are no other activities that would affect long-term productivity of environmental resources.

5.9 RESOURCES COMMITTED

Site preparation, construction, and operation of the MFFF commit both onsite and offsite resources, some of which are irreversibly committed and irretrievably lost. Irreversible and irretrievable commitments of resources include those resources consumed during facility operation and those that are not expected to revert to a natural state if the structures are removed at the end of the station life. Section 5.9.1 discusses the commitment of resources during construction, while Section 5.9.2 discusses the commitment of resources during operation.

5.9.1 Resources Committed During Construction

Construction of the MFFF will disturb 106 ac (42 ha), most of which will be returned to original use once construction is complete. Once constructed, the MFFF will occupy 41 ac (16.6 ha) of land as shown in Table 5-20. Approximately 28 ac (11.3 ha) of this land is currently managed as a timber crop by the U.S. Forest Service that could be harvested independent of the MFFF's construction. Although removal of this timber represents a resource loss, as part of a managed forest, the resource is normally considered replaceable. Part of the land is also currently used as a spoils area for soil excavated for the APSF. This soil will be used as fill or relocated to an SRS landfill [Text Deleted]. Because the area is utilized by DOE as an industrial site, continued industrial use after completion of the MFFF mission is possible.

Water used during construction will be treated in the SRS waste treatment system and returned to the environment. Waste disposal capacity will be provided by the current SRS infrastructure.

During construction, the heavy equipment onsite will consume diesel fuel and electricity. Major materials required during facility construction include concrete aggregate and cement, reinforcing steel, aluminum, lumber, piping materials, and electric wire and cable.

Concrete and steel constitute the bulk of construction materials; however, there are numerous other minor resources incorporated into the physical plant. Some materials (e.g., copper wire and cable and aluminum) are valuable enough to be recycled, whereas the value of others does not encourage recycling.

Table 5-7. Emissions (kg/yr) from MFFF Operation

(update of Table G-67 of the SPD EIS, p. G-41)

Pollutant	Emergency/Standby Generators	Process	Vehicles
Carbon monoxide	2,345	0	32,658
Nitrogen dioxide	24,442	4,484[a]	9,472
PM_{10}	230[b]	0	33,422[b]
Sulfur dioxide	1,422	0	0
Volatile organic compounds	1,050	1.03[c]	4,372
Total suspended particulates	230	0	33,422
Chlorine	0	15[d]	0

[a]Process NO_x emissions are from the MFFF stack due to the aqueous polishing process.
[b]PM_{10} emissions were assumed to be the same as total suspended particulate emissions for this analysis resulting in some overestimate of PM_{10} concentrations.
[c]Process VOC emissions are from the emergency and standby diesel generator fuel oil storage tanks.
[d]Process chlorine emissions are from the MFFF stack due to the chloride content of the Pu feedstock.

Table 5-8. Increments to Ambient Concentrations (μg/m³) from MFFF Operation [a]

(update of Table G-68 of the SPD EIS, p. G-41)

Pollutant	Averaging Period	Most Stringent Standard or Guideline[b]	SRS Maximum Concentration[c]	MFFF Contribution	Total
Carbon monoxide	8 hours	10,000	66	22.7	88.7
	1 hour	40,000	254	78.8	332.8
Nitrogen dioxide	Annual	100	17.2	0.053	17.3
PM_{10}	Annual	50	7	0.0004	7
	24 hours	150	97	0.78	97
Sulfur dioxide	Annual	80	24	0.003	24
	24 hours	365	337	4.8	342
	3 hours	1,300	1,171	22.4	1,193
Total suspended particulates	Annual	75	46	0.0004	46
Chlorine	24 hours	75	0	0. 04	0.04

[a] Concentrations are the maximum occurring at or beyond the SRS boundary or a public access road.
[b] The more stringent of the federal and state standards is presented if both exists for the averaging period.
[c] Hunter (2001), Represents maximum SRS emissions impact at SRS boundary.

Table 5-9. Comparison of MFFF Impacts to PSD Class II Limits

Pollutant	Averaging Period	Increase in Concentration ($\mu g/m^3$)	PSD Class II Area Allowable Increment ($\mu g/m^3$)	Percent of Increment
Nitrogen dioxide	Annual	0.053	25	0.21
PM_{10}	Annual	0.0004	17	0.003
	24 hours	0.78	30	2.6
Sulfur dioxide	Annual	0.003	20	0.014
	24 hours	4.8	91	5.3
	3 hours	22.4	512	4.4

Table 5-12. Potential Waste Management Impacts from MFFF Operation

Waste Type	Maximum Estimated MFFF Waste Generation		Annual Site Waste Generation [c] (yd³/yr)	Percent of Annual Site Waste Generation
	Liquids[a] (gal/yr)	Solid [b] (yd^3/yr)		
Liquid LLW	285,000 (MFFF)	Disposed as Liquid LLW at WSB	Not available	Not available
Solid LLW		230	10,615	6
Stripped Uranium (solidified and added to LLW)	44,000	413		
Liquid High Alpha Activity Waste (solidified and added to TRU waste)	10,300	190[d]	93	533[e]
Solid TRU Waste		306		
Excess Low-Level Radioactive Solvent Waste	2,800	Disposed as Mixed LLW	NA	NA
Liquid Nonhazardous Waste	8,800,000	Disposed Through Approved NPDES Facilities	90,867,868	10
Solid Nonhazardous Waste		1,754	40,000	4

[a] From Tables 3-3

[b] From Table 3-4. Values for Stripped Uranium and High Alpha Waste represent conversion to solid as discussed in Appendix G.

[c] From Table 4-27.

[d] Assumes a 3-fold volume reduction during solidification at WSB.

[e] Annual MFFF TRU waste generation exceeds current annual SRS generation but the MFFF cumulative volume is well below the maximum projected SRS cumulative volume.

Table 5-13b. Summary of Bounding Low Consequence MFFF Events

Bounding Accident	Meteorology[a]	Maximum Impact to Site Worker (mrem)	Maximum Impact to Site Worker (probability of cancer deaths)	Maximum Impact to Person at SRS Boundary (mrem)	Maximum Impact at SRS Boundary (probability of cancer deaths)	Impact on Population within 80 km (person-rem)	Impact on Population within 80 km (LCFs)
Loss of Confinement	bounding – 95% percentile	<900	<6E-4	<8	<3E-6	<2E+1	<1E-2
Internal Fire	bounding – 95% percentile	<900	<6E-4	<8	<3E-6	<2E+1	<1E-2
Load Handling	bounding – 95% percentile	<500	<3E-4	<4	<2E-6	<1E+1	<5E-3
Hypothetical Explosion Event	bounding – 95% percentile	N/A	N/A	N/A	N/A	N/A	N/A
Hypothetical Criticality Event	bounding – 95% percentile	N/A	N/A	N/A	N/A	N/A	N/A

[a] Values calculated for 50th percentile indicate that median meteorology is at least three times lower than the bounding values

Table 5-15a. Estimated Maximum Cumulative Ground-level Concentrations of Nonradiological Pollutants (micrograms per cubic meter) at SRS Boundary

Pollutant	Averaging Time	SCDHEC Ambient Standard ($\mu g/m^3$)	SRS Maximum Concentration ($\mu g/m^3$)[a]	MFFF ($\mu g/m^3$)[b]	PDCF and WSB[c]	SNF[d]	Tank Closure ($\mu g/m^3$)[e]	Salt Processing Alternative[f]	Other Foreseeable Planned SRS Activities ($\mu g/m^3$)[d]
Carbon monoxide	1 hour 8 hours	40,000 10,000	254 66	78.8 22.7	0.0942 0.373	9.760 1.31	3.4 0.8	18.0 2.3	36.63 5.15
Oxides of Nitrogen	Annual	100	17.2	0.053	0.0287	3.36	0.07	0.03	4.38
Sulfur dioxide	3 hours 24 hours Annual	1,300 365 80	1,171 337 24	22.4 4.8 0.003	1.46 0.56 0.041	0.98 0.13 0.02	0.6 0.12 0.006	0.4 0.05 5.0×10^{-4}	8.71 2.48 0.17
Ozone	1 hour	235	NA	NA	NA	0.80	2.0	2	0.71
Lead	Max.quarter	1.5	0.0003	NA	NA	NA	4.1×10^{-6}	4.0×10^{-7}	0.00
Particulate matter (≤10 microns aerodynamic diameter)	24 hours Annual	150 50	97 7	0.78 0.0004	0.026 0.0018	0.13 0.02	0.06 0.03	0.07 1.0×10^{-3}	3.24 0.13
Total suspended particulates ($\mu g/m^3$)	Annual	75	46	0.0004	0.0018	0.02	0.005	1.0×10^{-3}	0.06

[a] Hunter, 2001, *Memorandum from C.H. Hunter to D.C. Carroll, Clean Air Act Title V Dispersion Modeling for SRS (Revision 2)*, SRT-NTS-980189, March 15

[b] MFFF ER, Table 5-8

[c] MFFF ER, Appendix G; DOE 1999, *Surplus Plutonium Disposition Final Environmental Impact Statement*, DOE/EIS-0283, Table G-60

[d] DOE 2000, *Savannah River Site Spent Nuclear Fuel Management Final Environmental Impact Statement*, DOE/EIS-0279

[e] DOE 2000, *High-Level Waste Tank Closure Draft Environmental Impact Statement*, DOE/EIS-0303D

[f] DOE 2001, *Savannah River Site Salt Processing Alternatives Draft Supplemental Environmental Impact Statement*, DOE/EIS-0082-S2D

Table 5-15c. Estimated Cumulative Waste Generation from SRS Concurrent Activities (cubic meters)

Waste Type	SRS Operations [a,b]	MFFF [c]	PDCF and WSB [d]	SNF Management [e]	Tank Closure [f]	Salt Processing [g]	Environmental Restoration/ D&D [d]	Other Waste Volume [d]
High-level	14,129	0	0	11,000	97,000	45,000	0	69,552
Low-level	118,669	16,668 [h]	10,000	140,000	19,260	920	61,630	110,102
Hazardous/mixed	3,856	120	10	270	470	56	6,178	4,441
Transuranic	6,012	4,300 [h]	180	3,700	0	0	0	8,820
Nonhazardous Liquid	416,000	333,000	269,000	Not Reported	Not Reported	Not Reported	Not Reported	Not Reported
Nonhazardous Solid	6,670	13,000	28,000	Not Reported	Not Reported	Not Reported	Not Reported	Not Reported

NOTE: LLW and TRU waste are liquid plus solid

[a] DOE 2000, *Savannah River Site Spent Nuclear Fuel Management Final Environmental Impact Statement*, DOE/EIS-0279

[b] Based on total 30-year expected waste forecast, which includes previously generated waste

[c] MFFF ER, Tables 3-3, 3-4, and 5-12

[d] MFFF ER, Appendix G; DOE 1999, *Surplus Plutonium Disposition Final Environmental Impact Statement*, DOE/EIS-0283; Table H-34

[e] DOE 2000, *Savannah River Site Spent Nuclear Fuel Management Final Environmental Impact Statement*, DOE/EIS-0279

[f] DOE 2000, *High-Level Waste Tank Closure Draft Environmental Impact Statement*, DOE/EIS-0303D

[g] DOE 2001, *Savannah River Sit Salt Processing Alternatives Draft Supplemental Environmental Impact Statement*, DOE/EIS-0082-S2D

[h] Includes MFFF produced solid radioactive waste, MFFF produced liquid radioactive waste solidified at WSB for disposal as solid radioactive waste, and MFFF liquid LLW treated at WSB.

Table 5-21. Irreversible and Irretrievable Commitments of Operations Resources for the MOX Fuel Fabrication Facility

Resource	Annual Resource Commitment	Comments
Electricity	130,000 MWh	
Water	2,438,410 gal (max)	Water will be treated and returned to the environment
Fuel Oil	111,000 gal	Used for emergency and standby diesels
Plutonium	3.5 metric tons (Pu)	
Depleted Uranium	66.5 metric tons (U)	
Argon	See Table 3-2	
Argon-Methane	See Table 3-2	
Dodecane	See Table 3-2	
Helium	See Table 3-2	
Hydrazine (35%)	See Table 3-2	
Hydrogen	See Table 3-2	
Hydrogen Peroxide (35%)	See Table 3-2	
Hydroxylamine Nitrate	See Table 3-2	
Manganese Nitrate	See Table 3-2	
Nitric Acid	See Table 3-2	95% of acid is recovered and recycled
Nitrogen	See Table 3-2	
Nitrogen Tetroxide	See Table 3-2	
Oxalic Acid Dehydrate	See Table 3-2	
Oxygen	See Table 3-2	
Porogen	See Table 3-2	
Silver Nitrate	See Table 3-2	
Sodium Carbonate	See Table 3-2	
Sodium Hydroxide (10M)	See Table 3-2	
Tri-Butyl Phosphate	See Table 3-2	
Uranyl nitrate (depleted)	See Table 3-2	
Zinc Stearate	See Table 3-2	

Table 6-2. Comparison of Environmental Impacts for the Proposed Action and the No Action Alternative

Environmental Impact	Proposed Action[a]	No Action Alternative[b]
Land Use (acres)	106 (Disturbed in Construction) 41 (Occupied during Operation)	0
Surface Water Quality	No Impact	No Impact
Groundwater Quality	No Impact	No Impact
Ambient Carbon Monoxide Increment ($\mu g/m^3$) 8-hour average	22.7	34.1 – 3000
Ambient Nitrogen Dioxide Increment ($\mu g/m^3$) Annual average	0.053	0.25 – 24
Ambient Particulate Matter – PM_{10} Increment ($\mu g/m^3$) 24-hour average	0.78	0.77 – 89
Ambient Sulfur Dioxide Increment ($\mu g/m^3$) 24-hour average	4.8	2.0E-05 – 171
Public Population Dose – 50 mi (80 km) in 2030 (person-rem)	0.28	6.3E-06 – 2.9E-04
Maximally Exposed Public Individual (mrem)	3.3E-03	6.8E-06 – 6.5
Bounding Accident Public Population Dose Within 50 mi (80 km) (person-rem)	< 6	723 – 2,590
Wetlands Affected (acres)	None	None
Critical Habitat Lost (acres)	None	None
Cultural Resources Disturbed	Excavation of archaeological site[c]	None
Liquid LLW (gal/yr)	285,000	No change
Solid LLW (yd^3/yr)	643	No change
Solid TRU Waste (yd^3/yr)	496	No change
Excess Low-Level Radioactive Solvent Waste (gal/yr)	2,800	No change
Liquid Nonhazardous Waste (gal/yr)[d]	8,800,000	No change
Solid Nonhazardous Waste (yd^3/yr)	1,754	No change
Cost ($ Billion)	3.8[e]	4.6

7.1.3 U.S. Army Corps of Engineers (COE)

An Individual or General 404 Permit is not required from the COE since there are no plans to dredge and fill jurisdictional wetlands during the construction of the MFFF.

A Floodplain Assessment (WSRC 1999a) that addresses the flood history of the Savannah River and Upper Three Runs, and the effects of local intense precipitation at F Area, indicates that the MFFF site is situated well above the design basis flood level. The MFFF site is not located in a floodplain, nor are there any wetlands present within the MFFF site.

7.1.4 U.S. Department of Energy (DOE)/National Nuclear Security Administration (NNSA)

The MFFF will be an NNSA-owned, NRC-licensed facility located at SRS. The NNSA is the owner, while DOE-SR is providing the host site. Accordingly, environmental and site utility permits and plans are needed from DOE-SR for MFFF construction and operation. In addition, SRS site-wide permits may serve as a platform for some of the MFFF environmental permits.

7.1.5 U.S. Department of Transportation (DOT)

Transport of the MFFF fuel to the mission reactors requires compliance with the following DOT enabling regulations:

- 49 CFR Part 107, "Hazardous Materials Program Procedures," Subpart G: Registration and fee to DOT as a person who offers or transports hazardous materials
- 49 CFR Part 171, "General Information, Regulations, and Definitions"
- 49 CFR Part 173, "Shippers – General Requirements for Shipments and Packages," Subpart I: Radioactive materials
- 49 CFR Part 177, "Carriage by Public Highway"
- 49 CFR Part 178, "Specification for Packagings."

All provisions of these enabling regulations will be met prior to the transport of MFFF fuel assemblies from the MFFF to the mission reactors.

7.1.6 U.S. Department of Interior (DOI)

The U.S. Fish and Wildlife Services (USFWS) bureau of DOI is responsible for the protection of threatened and endangered species. Since there are no threatened or endangered species on the MFFF site, a negative declaration on endangered species has been received from the USFWS.

to be emitted during MFFF operations is not of sufficient magnitude to trigger any CAA Title V (40 CFR Part 71) permitting requirements. The MFFF sintering furnace, aqueous polishing screw calciner, and package boiler are all electrically fired and therefore will not generate any criteria pollutant emissions.

Although NRC-licensed facilities are exempted from National Emissions Standards for Hazardous Air Pollutants (NESHAP) requirements governing radiological releases, DOE-owned facilities are not exempted under 40 CFR 61 Subpart H. EPA Region IV and SCDHEC approved an alternate calculation methodology, which exempted MFFF from preparing a NESHAP Construction Permit. Compliance with applicable enabling regulations and other guidance on radiological releases is addressed in the *Construction Authorization Request* and *License Application*.

Emissions of hazardous air pollutants from the Reagent Process Building will be under the triggers of 10 tons (9.1 metric tons) per year for a single hazardous air pollutant and 25 tons (22.7 metric tons) per year for all hazardous air pollutants. Refrigerants used for air conditioning at the MFFF will consist of Class II refrigerants (i.e., non-ozone-depleting substances). Therefore, permitting for CAA Title VI, "Stratospheric Ozone Protection" (40 CFR Part 82), relative to the usage and storage of refrigerants, will not be required.

Although the criteria and hazardous air pollutant emissions during MFFF operation are minimal, SCDHEC does require the development of Bureau of Air Quality permit forms (i.e., Permit Forms I IIA, IIB, IIF and IIG) to obtain exemptions. The MFFF may (1) qualify as a General Conditional Major Operating Permit or (2) permit forms for emissions from the MFFF stack, diesel generators, and diesel fuel storage vault may need to be submitted to augment the SRS Title V Operating Permit. A decision on which type of air operating permit is appropriate for MFFF will be made prior to operations.

7.2.1.2 Surface Water Protection

To protect jurisdictional waters from pollutants that could be conveyed in construction-related stormwater runoff, EPA enabling regulations require construction projects disturbing 5 ac (2 ha) or more of soil to secure coverage under an NPDES permit authorizing the construction-related stormwater discharges. Since a concrete batch plant is employed as part of the construction activities, its runoff would also need to be addressed within this permitting structure (i.e., filing an NPDES Permit for a no discharge basin). EPA regulates the proper disposition of stormwater from these larger construction sites through an NPDES permit program (i.e., 40 CFR §122.26(b)(14)) pursuant to Section 402 of the CWA. With respect to MFFF construction activities at SRS, a Construction NPDES General Permit (i.e., SCR000000) is available to cover construction projects disturbing 5 ac (2 ha) or more of soil.

Coverage under the General Permit will be secured by filing an application form with SCDHEC (i.e., Notice Of Intent [NOI]) [Text deleted] prior to initiating any construction activities. The scope of construction will need to comply with applicable terms and conditions identified in the Storm Water General Permit.

Soil-disturbing activities associated with construction of the MFFF include the following:

- Site grading, clearing, and grubbing;
- Berms that will function as diversion ditches;
- Storm water detention basin;
- Construction of the site access road; and,
- Construction laydown area.

Once the NOI is filed with SCDHEC, coverage under the General Permit is received [Text deleted]. However, prior to filing an NOI, the preparation and approval of a Storm Water Pollution Prevention Plan (SWPPP) is required.

The NOI will provide general information about the site, such as name, location, dates, and other general information relevant to the nature of the construction activities. Within the SWPPP, there will be provisions outlining erosion and sediment controls, soil stabilization practices, structural controls, and other Best Management Practices (BMPs) that will be employed during construction to protect offsite waters from adverse impacts from construction-related stormwater runoff. The SWPPP will also outline maintenance and inspection requirements and identify BMPs for the effective management of stormwater runoff from a concrete batch plant, if one is employed. If a detention basin is required, it will be appropriately sized to meet the applicable criteria in the General Permit. BMPs include schedules of activities, prohibition of practices, maintenance procedures, and other management practices designed to prevent or reduce the pollution of waters of the United States from erosion and sedimentation. BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

The SWPPP will be maintained onsite throughout the construction process and will be updated as appropriate. The SWPPP will also be made available for review, upon request, by SCDHEC.

Grading Permits, which are required by SRS, will be developed and filed, as appropriate.

Once construction has been completed, the existing SRS Industrial NPDES General Permit for stormwater that is exposed to pollutants in an industrial activity will be modified to accommodate the MFFF. The existing SRS (i.e., SC0000175) NPDES Permit for process water discharges will not require modification since there are no expected MFFF process water discharges. The MFFF will likely acquire a Utility Water Permit from SCDHEC, which is appropriate for facilities with zero process water discharge.

Prior to operations, a Spill Prevention Control and Countermeasures (SPCC) Plan will be developed because more than 42,000 gallons of fuel will be stored underground.

Sanitary wastewater from MFFF construction and operations activities will be disposed of through a tie-in with the CSWTF. Prior to MFFF construction a SCDHEC Sanitary Wastewater Construction Permit will be obtained. Prior to operations, a SCDHEC Sanitary Wastewater Operating Permit will be obtained following the same protocol.

All radioactive wastewater generated during operations will be dispositioned in the Waste Solidification Building (WSB).

7.2.1.3 Drinking Water and Groundwater Protection

Drinking water requirements for construction and operation of the MFFF will be satisfied by a tie-in to the available drinking water from the SRS domestic water system. This system complies with applicable SDWA enabling regulations associated with the delivery of safe and reliable drinking water for SRS employees. A Domestic Water Distribution Construction Permit will be obtained prior to construction. Approval from the SRS Water Services Department and Environmental Site Services (ESS) will be sought by providing static and residual pressure at the tie-in and design calculations of head loss, interior flows, and fire fighting flow requirements. SCDHEC has delegated permitting authority for domestic water permits to ESS. Prior to operations, a Domestic Water Distribution Operating Permit will be obtained following the same protocol.

[Text Deleted]

7.2.1.4 Pollution Prevention, Waste Minimization and Waste Management

The MFFF project is committed to pollution prevention and waste minimization practices and will incorporate RCRA pollution prevention goals, as identified in 40 CFR Part 261. A Pollution Prevention and Waste Minimization Plan will be developed to meet the waste minimization criteria of both NRC and EPA regulations. The Pollution Prevention and Waste Minimization Plan will describe how the MFFF design procedures for operation will minimize (to the extent practicable) contamination of the facility and the environment and minimize (to the extent practicable) the generation of radioactive, mixed, hazardous, and nonhazardous solid waste.

Nonhazardous RCRA wastes from construction activities will be appropriately disposed at an offsite permitted landfill.

Throughout operations, the small quantities of waste generated will be appropriately handled and disposed. The small quantities of hazardous wastes that would be generated are expected to be much less than 100 kg/month. Thus, the MFFF should qualify as a Small Quantity Hazardous Waste Generator. The MFFF-generated wastes will be transported to a satellite accumulation area and later relocated to a staging area or existing SRS-permitted RCRA storage area. Since there will be no treatment or long-term storage of MFFF RCRA wastes in MFFF facilities, there will be no need for an MFFF RCRA Part B Permit.

The MFFF design includes the storage of diesel fuel for the standby diesel generators in a double-walled tank and the storage of diesel fuel for emergency diesel generators in a tank within a vault. Only the double-walled tanks have to meet the design requirements of 40 CFR Part 280 and SCDHEC Regulation 61-92 Part 280 for underground storage tanks (USTs). The tank within a vault is exempted from UST regulations. Therefore, prior to construction, a UST Construction Permit will be obtained, and prior to operations, a UST Operating Permit will be obtained for the double-walled tanks and associated piping.

MFFF-generated wastes will be treated, stored, and disposed through the existing SRS waste management infrastructure.

7.2.2 South Carolina Department of History and Archives

Construction activities that take place at SRS require compliance with applicable federal historic preservation requirements administered through the state of South Carolina.

The SPD EIS (DOE 1999c) documented that there are no cultural resources located on the MFFF site. However, there is an archaeological resource area on the MFFF. Discussions have been initiated with the state historic preservation officer and mitigation measures have been identified. These mitigation measures will precede any construction activities and are part of the SRS Infrastructure Project.

7.2.3 South Carolina Department of Natural Resources (SCDNR)

SCDNR is responsible for the protection of threatened and endangered species listed by the State of South Carolina. Since there are no threatened or endangered species on the MFFF site, a negative declaration on endangered species has been requested of the SCDNR.

7.3 AIKEN COUNTY

Aiken County does not have any applicable environmental permitting requirements.

As part of the notification requirements associated with 40 CFR Part 355 (implementing regulation for the Emergency Planning and Community Right-to-Know Act), any necessary notifications will be established with the Local Emergency Planning Committee, at the appropriate time, to identify hazardous materials that will be used once the MFFF is operational.

7.4 PERMIT AND APPROVAL STATUS AND CONSULTATIONS

7.4.1 Permit and Approval Status

Several permits and plans associated with construction activities have been prepared and will be formally filed with the appropriate agency prior to the commencement of construction. Construction and operational permit applications will be prepared and filed, and regulator approval and/or permits will be received prior to applicable construction or facility operation. [Text Deleted]

Table 7-1 provides the status of compliance with federal and state environmental laws.

7.4.2 Agency Consultations

Several consultations have been made with the cognizant agencies:

- The MFFF Environmental Permitting Plan was presented to SCDHEC in June 2001;
- A NESHAP Alternate Calculation technique was presented to EPA Region IV and SCDHEC in December 2001; and,
- A NESHAP Alternate Calculation approval was provided by EPA Region IV and SCDHEC in April 2002;

More specific discussions will continue to be held, as appropriate, as the project progresses.

Table 7-1. Status of Compliance with Federal and State Environmental Laws (continued)

Requirement	Status	Comments
Construction Environmental Plans and Permits (continued)		
Underground Storage Tank (UST) Installation Permit 40 CFR 112 40 CFR 280 South Carolina Regulation 61-92	Included in MFFF Environmental Permit Plan Initiated	Consultation with SCDHEC initiated. Installation of Fuel Tanks, Fuel Oil Lines, and Fuel Unloading Station. Standby diesel tank is classified as a UST since it is not in a vault.
Pollution Prevention and Waste Minimization Plan 40 CFR 261 40 CFR 262 40 CFR 264 40 CFR 268 South Carolina Regulation 61-66 South Carolina Regulation 61-79 South Carolina Regulation 61-99 South Carolina Regulation 61-104	Included in MFFF Environmental Permit Plan Initiated	Consultation with SCDHEC initiated. Best Management Practices for Construction Waste Management.
Operational Environmental Plans and Permits		
Bureau of Air Quality Air Operating Permit 40 CFR 71 South Carolina Regulation 61.62-70	Included in MFFF Environmental Permit Plan	Consultation with SCDHEC initiated. All MFFF Air emissions will be contained in permit.
Risk Management Plan 40 CFR 68.130 Tables 1 & 3 South Carolina Regulation 61.62-68	Included in MFFF Environmental Permit Plan Not required	Consultation with SCDHEC initiated. MFFF will impose administrative limits on 40 CFR 68.130 and South Carolina Regulation 61.62-68 extremely hazardous chemicals, which will preclude the need for a Risk Management Plan.
Bureau of Water Quality Utility Water Permit 40 CFR 122 South Carolina Regulation 61-9 South Carolina Regulation 61-67	Included in MFFF Environmental Permit Plan	Consultation with SCDHEC initiated. Condensate and stormwater discharges will be addressed in a Utility Water Permit, which is appropriate for zero process water release facilities.
Sanitary Wastewater Operating Permit 40 CFR 122 South Carolina Regulation 61-9 South Carolina Regulation 61-67	Included in MFFF Environmental Permit Plan	Consultation with SCDHEC initiated. Tie-in to SRS Central Sanitary Wastewater Treatment Facility (CSWTF) for ultimate treatment and disposal of sanitary waste.

DOE, 1997b. *Shutdown of the River Water System at the Savannah River Site Final Environmental Impact Statement*, DOE/EIS-0268, Savannah River Operations Office, Aiken, SC, May

DOE, 1997c. *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement Record of Decision*, 62 FR 3014, January 21

DOE, 1997d. *Surplus Plutonium Disposition Environmental Impact Statement – Notice of Intent*, 62 FR 28009, May 22

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DOE, 1998b. *Savannah River Site Spent Nuclear Fuel Management Draft Environmental Impact Statement*, DOE/EIS-0279D, Savannah River Operations Office, Aiken, SC, December

DOE, 1998c. *Record of Decision for the Department of Energy's Waste Management Program Treatment of Nonhazardous Wastewater Hazardous Waste*, 63 FR 41810, August 5

DOE, 1998d. *Record of Decision for the Department of Energy's Waste Isolation Pilot Plant Disposal Phase; Notice Record of Decision for the Department of Energy's Waste Management Program: Treatment and Storage of Transuranic Waste; Notice*, 63 FR 3624, January 23

DOE, 1998e. *Final Environmental Impact Statement on Management of Certain Plutonium Residues and Scrub Alloy at the Rocky Flats Environmental Technology Site*, DOE/EIS-0277F, Office of Fissile Materials Disposition, Washington, DC

DOE, 1999a. *Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada*, DOE-EIS-0250D, Office of Civilian Radioactive Waste Management, Las Vegas, NV

DOE, 1999c. *Surplus Plutonium Disposition Final Environmental Impact Statement*, DOE/EIS-0283, November

DOE, 1999d. *Deactivation Implementation Guide*, DOE G 430.1-3, Office of Field Integration, Washington, DC

DOE, 1999e. *DOE Occupational Radiation Exposure 1999 Report*, DOE/EH-629.

The material at risk (MAR) is the amount of radioactive material (in grams) available to be acted on by a given physical stress associated with the accident. For facilities, processes, and activities, the MAR is a value representing some maximum quantity of radionuclide present or reasonably anticipated for the process or structure being analyzed. Different MARs may be assigned for different accidents since it is only necessary to define the material in those discrete physical locations that are exposed to a given stress.

The damage ratio (DR) is the fraction of the MAR actually impacted by the accident-generated conditions. The DR is estimated based upon engineering analysis of the response of structural materials for containment to the type and level of stress or force generated by the event. Conservative engineering approximations are typically used. These approximations often include a degree of conservatism due to simplification of phenomena to obtain a usable model, but the purpose of the approximation is to obtain, to the degree possible, a realistic understanding of potential effects.

The airborne release fraction (ARF) is the coefficient used to estimate the amount of a radioactive material suspended in air as an aerosol and thus available for transport due to physical stresses from a specific accident. For discrete events, the ARF is a fraction of the material affected. An entrainment event is treated in the same manner, with the exception that its release mechanism is a function of time. Thus, to use the five-factor formula, the airborne release rate (ARR) of an entrainment event must be multiplied by the duration of the entrainment and then equated to the ARF (i.e., ARF = ARR x duration). Entrainment is not considered for materials in the form of a pellet or for materials contained in rods or filters.

The respirable fraction (RF) is the fraction of airborne radionuclides as particles that can be transported through air and inhaled into the human respiratory system.

Values for the RF and ARF are based on bounding values from the NRC (NRC 1998d).

The leak path factor (LPF) is the fraction of the radionuclides in the aerosol transported through some confinement deposition or filtration mechanism. There can be many LPFs for some hazard events, and their cumulative effect is often expressed as one value that is the product of all leak-path multiples. Inclusion of these multiples in a single LPF is done to clearly differentiate between calculations of doses without controls (where the LPF is assumed equal to 1) and calculations of doses with controls (where the LPF reflects the dose credit provided to the controls). In this manner, the LPF represents the credit taken for the control features at the MFFF.

Specific values for these parameters used in the bounding analysis are provided in Section F.6.

F.1.3 Potential Receptors

For each potential accident, information is provided on accident consequences and frequencies to three types of receptors: (1) a site worker, (2) the maximally exposed member of the public, and (3) the offsite population. The first receptor, a site worker (which includes MFFF site workers and SRS site workers), is a hypothetical individual working on the site but not within the MFFF. The site worker is conservatively evaluated downwind at a point 328 ft (100 m) from the accident. The second receptor, a maximally exposed member of the public, is a hypothetical individual assumed to be downwind at the SRS boundary. The SRS boundary is conservatively evaluated at a distance of 5 mi (8 km). Exposures received by this individual are intended to represent the highest doses to a member of the offsite public. The third receptor, the offsite population, is all members of the public within 50 mi (80 km) of the accident location.

F.1.4 Dispersion Modeling

The MACCS2 (MELCOR Accident Consequence Code System for the Calculation of the Health and Economic Consequences of Accidental Atmospheric Radiological Releases) computer code was used to compute the downwind relative air concentrations (χ/Q) for a groundlevel release from the MFFF (NRC 1998a). The relative concentration (atmospheric dispersion factors) (χ/Q) is the dilution provided relative to site meteorology and distance to the receptor(s). MACCS2 simulates the impact of accidental atmospheric releases of radiological materials on the surrounding environment. MACCS2 was developed as a general-purpose application to diverse reactor and nonreactor facilities licensed by the NRC or operated by DOE or the Department of Defense.

The receptor of interest includes the maximally exposed individual (MEI) member of the public at the SRS boundary [5 mi (8 km)]. This input is conservative with respect to the nearest site boundary and the nearest public road barricade (5.4 and 5.2 mi [8.7 and 8.4 km], respectively). The input into the MACCS2 code included a meteorological data file, which contains one year of hourly meteorological conditions for SRS. No credit is taken for building wake effects. The SRS meteorological data files are composed of hourly data for each calendar year from 1987 through 1996. Test runs demonstrated that 1987 and 1988 yield the most conservative site boundary χ/Q values; therefore, calculations were performed using the 1987 and 1988 meteorological data files. The dose incurred by the MEI is reported at the 95th percentile level, without regard to sector, from a ground release. The associated atmospheric dispersion factor (χ/Q) is 3.69E-06 sec/m^3. New meteorological data was used in the calculation of χ/Q with no effect on the resultant value.

The ARCON96 computer code was used to compute the downwind relative air concentrations (χ/Q) for the onsite receptor located within 328 ft (100 m) of a groundlevel release from the MFFF to account for low wind meander and building wake effects (NRC 1997). ARCON96 implements a straight-line Gaussian dispersion model with dispersion coefficients that are modified to account for low wind meander and building wake effects. A constant release rate is assumed for the entire period of release. Building wake effects are considered in the evaluation of relative concentration from groundlevel releases. ARCON96 calculates relative concentration using hourly meteorological data. The SRS meteorological data files are composed of hourly data taken at a height of 200 ft (61 m) for each calendar year from 1987 through 1996. It then combines the hourly averages to estimate concentrations for periods ranging in duration from 2 hours to 30 days. Wind direction is considered as the averages are formed. As a result, the averages account for persistence in both diffusion conditions and wind direction. Cumulative frequency

The bounding low consequence event is a fire involving waste drums located in the truck bay. (See Section F.6.2 for a description of this event.) Consequences are presented in Table 5-13b.

The MFFF utilizes many features to reduce the likelihood and consequences of these events, as well as other loss-of-confinement events. Key features include reliable and redundant confinement systems; process temperature, pressure, and flow controls; radiation monitoring systems; redundant control systems; emergency procedures; and worker training.

F.6.2 Internal Fire

[*Text removed under 10 CFR 2.390.] This unit contains polished plutonium powder for the purpose of down blending the mixed oxide powder to the desired blend for fuel rod fabrication. [*Text removed under 10 CFR 2.390.] Fire areas with a larger material at risk have a lower damage ratio for this event resulting in a lower overall source term.

The evaluation conservatively assumes that a fire occurs in this fire area and impacts the powder stored in this area, resulting in a release of radioactive material. [*Text removed under 10 CFR 2.390.] Due to the low combustible loading in this fire area, just a small fraction of this material would be expected to be involved in the fire. However, the evaluation conservatively uses the entire fire area inventory in the consequence analysis. The damage ratio is assumed to be 1.0, the bounding respirable release fraction is 6E-04, and the bounding leak path factor is 1E-04. The bounding radiological consequences associated with this event are provided in Table 5-13a.

The MFFF utilizes many features to reduce the likelihood and consequences of this event as well as other fire-related events. Key features include fire barriers, minimization of combustibles and ignition sources, ventilation systems with fire dampers and HEPA filters, qualified canisters and containers, fire suppression and detection systems, emergency procedures, worker training, and local fire brigades.

The frequency associated with this event is estimated to be Unlikely or lower because multiple failures are required for this event to occur.

The bounding low consequence fire event is due to a fire in a waste drum located in the truck bay. Although most waste drums contain only small amounts of plutonium, the evaluation conservatively assumes that 240 grams of unpolished plutonium is involved in the fire. The ARF is 5E-4, the RF is 1.0, the LPF is 1.0, and the DR is 1.0. The results are presented in Table 5-13b.

F.6.3 Load Handling

[*Text removed under 10 CFR 2.390.]

Gloveboxes that contain a larger material at risk have a lower damage ratio for this event resulting in a lower overall source term.

The glovebox is postulated to be impacted during maintenance operations by either a lifting device or a lifted load outside of the glovebox, damaging a portion of the glovebox causing some of its contents to drop to the floor, resulting in a release of radioactive material. [*Text removed under 10 CFR 2.390.] Due to the large glovebox size, it is expected that just a small fraction of this amount would be involved in the event. However, the evaluation conservatively uses the entire glovebox inventory in the consequence calculations. The damage ratio is assumed to be one, the bounding respirable release fraction is 6E-04, and the bounding leak path factor is 1E-04. The bounding radiological consequences associated with this event are provided in Table 5-13a.

The MFFF utilizes many features to reduce the likelihood and consequences of this event as well as other load-handling events. Key features include loadpath restrictions, crane-operating procedures, maintenance procedures, operator training, qualified canisters, reliable load-handling equipment, and ventilation systems with multiple banks of HEPA filters.

The frequency associated with this event is estimated to be Unlikely or lower because multiple failures are required for this event to occur.

The bounding low consequence load handling event involves waste drums located in the truck bay. Waste drums are stored inside the MFFF, then moved to the truck bay and placed on a truck for transportation off of the MFFF site. Waste drums contain small amounts of radioactive material, and only a small number of waste drums are transported at one time, thus the maximum MAR estimated to be involved in the load handling event is 240 grams of unpolished plutonium powder. The ARF is 1E-3, the RF is 0.1, and the DR and LPF are conservatively assumed to be 1.0. Consequences are presented in Table 5-13b.

F.6.4 Hypothetical Criticality Event

The MFFF processes are designed to preclude a criticality event through the use of reliable engineered features and administrative controls. Adherence to the double contingency principle, as specified in ANSI/ANS-8.1 (ANSI/ANS 1983b), is employed. Simultaneous failure of the criticality controls is Highly Unlikely.

Although criticality events at the MFFF are prevented, a generic hypothetical criticality event is evaluated. A bounding source term of 10^{19} fissions in solution is evaluated consistent with guidance provided in Regulatory Guide 3.71 (NRC 1998c). Airborne releases and direct radiation result from the criticality. The direct radiation contribution is negligible due to the shielding provided by the building and the distance to the site worker and the offsite public. Airborne releases are calculated consistent with the guidance of Regulatory Guide 3.35 (NRC 1979). The leak path factor for gases and particulates is 1.0 and 1E-04, respectively. The evaluation is based on [*Text removed under 10 CFR 2.390.] The radiological consequences associated with this event are shown in Table 5-13a.

F.6.5 Hypothetical Explosion Event

The MFFF processes are designed to preclude explosions through the use of reliable engineered features and administrative controls, the simultaneous failure of which is Highly Unlikely.

Although explosion events at the MFFF are Highly Unlikely, a generic hypothetical explosion event is evaluated. The evaluation conservatively assumes that an explosion occurs and involves the entire material at risk within a process cell. [*Text removed under 10 CFR 2.390.] Because the material at risk is in three separate tanks within this cell, only a fraction of this amount would be involved in the event. However, the evaluation conservatively uses the entire process cell inventory in the consequence calculation. The damage ratio and airborne release fraction are assumed to be one, the bounding respirable release fraction is 0.01, and the bounding leak path factor is 1E-04. The radiological consequences of this hypothetical event are presented in Table 5-13a.

F.6.6 Chemical Releases

Consequences of chemical releases were determined for a potential release of each chemical. For evaporative releases, the chemical consequence analysis modeling for public consequences used the ALOHA code (EPA 1999), the ARCON96 code (NRC 1997), and the MACCS2 code (NRC 1998a) to calculate the maximum airborne chemical concentration at the SRS boundary (5 mi [8 km] from the MFFF). The chemical consequence modeling for site worker impacts (i.e., at a distance of 100 meters from the MFFF stack) used ALOHA code along with the ARCON96 code (NRC 1997) to calculate maximum chemical concentrations.

An evaporation model extracted from the ALOHA code was used to calculate a release from a spilled or leaked chemical, which is assumed to form a puddle one-centimeter deep. A spill or leak from the largest tank or container holding the chemical was modeled. Consideration for spill size, location, container integrity, and chemical concentration was included in the evaluation.

Calculated concentrations were compared to Emergency Response Planning Guidelines (ERPGs) or to Temporary Emergency Exposure Limits (TEELs). TEELs describe temporary or equivalent exposure limits for chemicals for which official Emergency Response Planning Guidelines have not yet been developed. This method was adopted by DOE's Subcommittee on Consequence Assessment and Protective Action (SCAPA). The SCAPA-approved methodology published in the American Industrial Hygiene Association Journal was used to obtain hierarchy-derived TEELs (WSRC 1998). TEELs are provided for nearly 1,200 additional chemicals. TEELs are equal to the Acute Exposure Guideline Level and Emergency Response Planning Guidelines, where these values are available.

The definitions of TEEL levels consistent with 10 CFR §70.61 are as follows:

- TEEL-1 – The maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor.

- TEEL-2 – The maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.

- TEEL-3 – The maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing or developing life-threatening health effects.

Three severity consequence levels identified are Low, Intermediate, and High. The consequence severity level defined in Table F-4 is based on 10 CFR §70.61.

Based on the results of the chemical evaluation, DCS concludes that the chemical consequences at the site boundary and to the site worker are low.

Table F-2. Consequence Severity Categories Based on 10 CFR §70.61

Consequence Category	Facility Worker and MFFF Site Worker TEDE	Offsite Public and SRS Site Worker TEDE/Uranium Intake	Environmental Release
3: High	> 1 Sv (> 100 rem)	> 0.25 Sv (> 25 rem) >30 mg soluble uranium intake	Not applicable
2: Intermediate	0.25 Sv to ≤ 1 Sv (25 rem to ≤ 100 rem)	0.05 Sv to ≤ 0.25 Sv (5 rem to ≤ 25 rem)	> 5,000 times the concentrations in Table 2, Attachment B of 10 CFR Part 20
1: Low	Events of lesser radiological exposures to workers than those above in this column	Events of lesser radiological exposures to the public than those above in this column	Radioactive releases producing effects less than those specified above in this column

TEDE – Total Effective Dose Equivalent

Table F-4. Consequence Severity Categories Based on TEEL

Consequence Category	Facility Workers and MFFF Site Workers	SRS Site Workers and Offsite Public
High	> TEEL-3	> TEEL-2
Intermediate	TEEL-2 < x < TEEL-3	TEEL-1< x < TEEL-2
Low .	< TEEL-2	< TEEL-1

APPENDIX G.

ENVIRONMENTAL IMPACTS OF CONSTRUCTION AND OPERATION OF THE WASTE SOLIDIFICATION BUILDING

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The DOE has decided to construct the Waste Solidification Building (WSB) as part of the PDCF. This building will remove radioisotopic and conventional pollutants from the MFFF and PDCF liquid wastes and convert them into solid waste that will be disposed of as transuranic waste or low-level radioactive waste. Because the environmental impacts of constructing and operating the WSB were not explicitly evaluated as part of the SPD EIS, and the WSB is a connected action, the impacts are included in those evaluated for the MFFF in this ER. The environmental impacts of constructing and operating the WSB are less than the projected impacts in most cases from the construction and operation of the Plutonium Immobilization Plant evaluated in the SPD EIS but subsequently cancelled.

The WSB design is at the preliminary design stage. Information and impact projections presented in this appendix are bounding projections based upon the following design description. Design evolution will be limited by the projected environmental impact (e.g. any design change in the WSB will not result in consequences exceeding those limits established in 10 CFR 830 and DOE-STD-1027 [DOE 1997f]).

G.1 DESCRIPTION OF THE WASTE SOLIDIFICATION BUILDING

G.1.1 Building Description

The 75,000 ft^2 WSB, which is not part of the NRC licensed MFFF, will be constructed by the DOE on the PDCF site south of the PDCF Processing Building to process the following typical liquid streams from the PDCF and the MFFF:

MFFF High Alpha Stream

MFFF Stripped Uranium Stream

PDCF Laboratory Liquid Stream

PDCF Low Level Liquid Streams

MFFF Low Level Liquid Streams

The building will be a combination of concrete and standard industrial structure. Concrete will be utilized as necessary to protect against the potential impact of Natural Phenomena Hazards (NPH) events. [*Text removed under 10 CFR 2.390.] A concrete room configuration will be utilized as this stream is processed through the building. Process enclosures adjacent to the rooms will provide worker protection to accommodate operations and maintenance activities. The shielding and confinement barriers will also serve as fire isolation barriers. [Text deleted] Secondary confinement features such as dikes, sumps and leak detection will be provided for those areas with liquid spill potential. The major pieces of process equipment are tanks, evaporators, and cementation equipment. Other equipment may include reverse osmosis, filtration, activated carbon and ion exchange columns.

The building will contain approximately 12,000 gallons of high alpha liquid and 24,000 gallons (including transfer pipeline flush water from PDCF) of low activity liquid. Liquid waste processed from the WSB and located in the material handling area will be in cement form after processing, and is not considered to be at risk because the cement matrix immobilizes the radionuclides. Cold chemical processing, drum storage, and truck loading/unloading operations may also be contained in hardened structures. The material storage area will be at grade.

The receipt area will have tanks to separately receive high alpha, stripped uranium, and the PDCF laboratory liquid streams. The tank volumes will be sufficient to receive and store liquid from six weeks of processing by the MFFF and eight weeks by PDCF. Additional receipt storage will be available for low level liquid waste streams from MFFF, PDCF and WSB internal sources.

The MFFF will transfer transuranic (TRU) liquid and low-level radioactive liquid streams to the WSB. The PDCF will transfer low level radioactive liquid streams. The WSB will produce TRU and low level solid waste forms acceptable for shipment and disposal. The TRU waste form will be sent to WIPP. The low level waste form will be sent to a DOE approved disposal site.

Within the WSB, the waste streams will be collected into receipt tanks, chemically adjusted, evaporated, neutralized, combined with cement into waste containers, stored and shipped. These processes will be located inside a hardened (reinforced concrete) structure. [Text deleted] The process areas will be exhausted through a HEPA filtration confinement system prior to release through a stack. The building will be divided into individual fire zones to reduce potential doses to the on and off-site receptor under accident conditions.

G.1.2 Liquid Waste Processing

The WSB will receive liquid streams from the MFFF and PDCF. As noted in Chapter 3, Table 3-3, three of the MFFF liquid streams (liquid americium, excess acid, and solvent regeneration alkaline wash) can be combined by MFFF into the high alpha stream. The stripped uranium stream is transferred separately to the WSB. The two streams are batch transferred through separate double-walled stainless steel pipes to the WSB. PDCF Laboratory Liquid is also transferred through double-walled stainless steel pipes to the WSB. [Text deleted]

Evaporation with cementation will be used to process the PDCF Laboratory Liquid Stream, MFFF High Alpha Stream, and MFFF Stripped Uranium Stream. Evaporation will be used as necessary to reduce the "water" content of the streams to that needed for efficient cement mixing. Excess water will be recycled where practical or further processed to allow release to the environment. All liquid wastes will be treated as required to meet EPA, SCDHEC and DOE limits for discharge to site streams.

Bulk chemicals used in the treatment process are listed in Table G-2.

G.1.2.1 PDCF Laboratory Liquid Stream Receipts

The PDCF Laboratory Liquids Stream will be 0.18 Molar (average) acidic with very little radionuclides. This stream will be pumped approximately 800 ft (243.8 m) to the WSB from PDCF in a welded-jacketed stainless steel pipe, which will be direct buried. The volume of this stream is anticipated to be a nominal 11,000 gallons per year, and will be received in approximately 12 transfers (900 gallons each) at a frequency of about one transfer every month.

Each transfer may be accompanied by a line volume flush which is estimated to be 150 gallons total, provided by PDCF.

[Text deleted]

The WSB receipt tanks will be sized to hold two transfers (eight weeks of PDCF Laboratory Liquid Stream capacity) in one 3,000 gallon tank. The PDCF tank is sized to provide storage of up to eight weeks of PDCF processing capacity in the event of a shutdown of WSB operations for maintenance or processing anomalies. The WSB tanks will be agitated or recirculated to mix the waste and flush water.

Table G-8 lists the anticipated radionuclide concentrations for the PDCF waste stream. The radionuclide concentrations are based on a receipt of 12,800 gallons per year, containing a maximum of 7 grams of plutonium and 5.9 grams of uranium. For accident analysis purposes, the radionuclide concentrations given in table G-8 include a 25% safety margin. While the volumes may change based upon feed source material and operational flexibility, the safety analysis calculations conservatively use the maximum radiological source term.

G.1.2.2 MFFF Stripped Uranium Stream Receipts

The MFFF Stripped Uranium Stream will be nominally 0.1 Molar acidic with large quantities of Uranium (<0.96% ^{235}U). This stream will be pumped approximately 2,000 ft (609.6 m) from the MFFF to the WSB in a double-walled stainless steel pipe. The volume of this stream will be 46,000 gallons per year, received in approximately 42 transfers at a frequency of about one every week.

The WSB receipt tanks will be sized to hold six transfers (six weeks of MFFF capacity). The MFFF tanks are sized to hold three months of MFFF process liquid. The WSB tanks will be agitated or recirculated to mix the waste.

The radionuclide concentrations for the MFFF Stripped Uranium Stream are given in Table G-10. The concentrations are based on a 46,000 gallon per year stream containing approximately 0.1 milligram of plutonium per liter and a design basis of 11,000 pounds of uranium per year (bounding mass for accident analysis). The isotopic distribution assumes the uranium will be diluted to less than 0.96 weight percent U-235, which is a requirement for the WSB to ensure criticality safety. The radionuclide concentrations in Table G-10 also include a 25% safety margin. While the volumes may change based upon feed source material and operational flexibility, the safety analysis calculations conservatively use the maximum radiological source term.

G.1.2.3 PDCF and MFFF Low Level Radioactive Liquid Receipts

PDCF, MFFF and the WSB will generate various aqueous liquid streams with either very low radioactive contamination, or the potential for radioactive contamination due to their origin. These streams will be transferred, through double walled transfer lines to a receipt tank(s) at the WSB. The streams will then be pumped to a final treatment processing unit for discharge to a permitted outfall.

G.1.2.4 Processing of PDCF Lab Liquids and MFFF Stripped Uranium

Both streams are anticipated to be low level radioactive liquid with a pH less than 2. Due to extremely low fissile material content, criticality is not a credible event. In addition, these streams are compatible for mixing after evaporation. The WSB will be able to process these streams in any combination necessary. Sampling will be done to support downstream processing.

G.1.2.4.1 Evaporator

The low activity waste (LAW) evaporator will be designed to operate at approximately 110°C and may be electrically or steam heated. The bottoms size of the evaporator may be up to 600 gallons with a continuous feed from the head tank during steady state operation. Bottoms will be pumped to the LAW bottoms collection tank, cooled and sampled before being pumped to the cementation equipment. If the sample results are unacceptable, the bottoms may be pumped back to the LAW head tank for reprocessing. Overheads will be condensed and collected in the effluent hold tank and sampled. If the overheads meet the radiological limits for the final treatment system then they will be treated for discharge, otherwise they will be recycled for additional processing.

G.1.2.4.2 Neutralization

The acidic bottoms from evaporation must be pH adjusted in order to be compatible with the cementation process. Sodium hydroxide (50%) was selected to mix in the neutralization tank to achieve a free hydroxide normality of 0.8 to 1.2. Chemical reaction heat will require dissipation via cooling coils and a heat transfer system. Any overflows will be contained.

G.1.2.4.3 Cement Process

Neutralized waste will be pumped to a cement mixer. A pump will inject controlled amounts of the waste stream from the neutralization tank(s) to a cement mixer to be continuously mixed with supplied dry cement powder. The cement mixture will be caught in a ST-45 waste container. The equipment will be designed to minimize the spread of contamination. This sequence will be repeated until the LAW bottoms tank is emptied.

Dust control measures and collection will be provided for the dry cement powder. The output air stream will be pre-filtered before being introduced to the main exhaust ventilation system, preventing cement blinding of the building HEPA system. In addition, this air is pulled from around the mixer and at the dry cement addition zone, and is anticipated to contain radionuclides.

G.1.2.4.4 Overheads Processing for Final Effluent Release

[Text deleted] Overheads from the evaporation process will be condensed, collected, and sampled in the Effluent Hold Tank to verify acceptability for transfer to the final processing system, identified as the Clean Water Treatment System (CWTS). The CWTS will be designed using standard wastewater treatment technologies to meet EPA, SCDHEC and DOE discharge limits for the Savannah River Site. [Text deleted]

G.1.2.5 PDCF Lab Concentrates Processing

[Text deleted]

G.1.2.6 MFFF High Alpha Stream

G.1.2.6.1 Receipts

The MFFF high alpha stream will be pumped approximately 2,000 ft (609.6 m) from MFFF to the WSB in a double-walled stainless steel pipe. The design basis volume received is 22,000 gallons per year of this combined stream, which will be received in approximately 25 transfers, at a frequency of about once every two weeks.

The WSB receipt tanks will be sized to hold three transfers (six weeks capacity in two 2,500-gallon tanks). The MFFF high alpha stream collection tanks are sized for three months capacity. This arrangement will provide continued MFFF processing capacity in the event of a shutdown of WSB operations due to maintenance or other disruptions. The tanks are agitated or recirculated to mix the contents.

These receipt tanks will generate a radiation field and will be contained in concrete walled rooms. [Text deleted] The waste stream is anticipated to include a silver constituent and to have a pH less than 2, necessitating leak detection and confinement. Overflows will be collected in a dedicated overflow tank.

Hydrogen gas generated by the radiolysis of water in this waste stream will be vented and purged by a purge air system in order to prevent hydrogen from reaching the lower flammability limit. A backup nitrogen system will automatically activate if purge air is lost.

Table G-11 gives the radionuclide concentrations for the High Alpha Waste Stream. The americium concentration is based on receiving a maximum of 24.5 kilograms of Am-241 per year in 15,000 gallons of solution, and accounts for potential dilution to optimize the WSB treatment process. The High Alpha stream is also assumed to include 221 grams of plutonium annually, along with a small amount of uranium. The plutonium and uranium are negligible contributors to dose. The radionuclide concentrations in Table G-11 include a 25% safety margin. While the volumes may change based upon feed source material and operational flexibility, the safety analysis calculations conservatively use the maximum radiological source term.

G.1.2.6.2 Evaporator

The High Alpha Waste (HAW) evaporator will be designed to operate at approximately 110°C and may be electrically or steam heated. Bottoms will be pumped to the bottoms collection tank where it will be cooled and sampled before being pumped to the HAW cementation equipment. If the sample results are unacceptable, the bottoms will be pumped back to the HAW head tank for reprocessing. Overheads will be condensed and collected in the HAW condensate hold tank, sampled, and may be pumped to the LAW head tank for a second evaporator cleanup. If the sample results are not acceptable, the overheads may be pumped back to the HAW head tank for reprocessing.

The HAW evaporator will be able to be bypassed, and the HAW head tank directed to the HAW bottoms collection tank. This arrangement will allow continued processing if necessary during an evaporator outage, as well as processing directly to the cement process if evaporation is not necessary. In this case, the amount of dilution water used in the process would be adjusted, in order to reduce the total amount of cement produced while keeping the americium loading at an acceptable level for shipment to WIPP. [Text deleted]

G.1.2.6.3 Neutralization

The acidic bottoms from evaporation must be pH adjusted in order to be compatible with the cementation process. Sodium hydroxide (50%) was selected to mix in the Cement Head Tanks to achieve a free hydroxide Normality of 0.8 to 1.2. Chemical reaction heat will require dissipation via cooling coils and a heat transfer system. Caustic [Text deleted] feed rates will be controlled to limit the rate of heat generation. Overflows will be contained and recycled. [Text deleted] Capability to remove buildup in the tank bottom will be provided. Neutralized bottoms will be sampled to ensure that the input to the cement process is within anticipated parameters.

G.1.2.6.4 Cement Process

Neutralized high alpha waste will be pumped from one of three 120 gallon cement head tanks. One tank can receive material and another tank can be in the process of being neutralized while the third tank is being pumped to the cement mixer. A pump will inject controlled amounts of the waste stream into the 120-gallon head tanks in order to ensure precise loading of americium in the waste container. One cement head tank corresponds to one cement waste container. The mix is caught in a Standard Waste Box container. Equipment will be designed to minimize the spread of contamination. This sequence will be repeated until the high activity waste Bottoms Tank is emptied.

The high activity waste cementation process area is anticipated to have a high background radiation level. Equipment requiring regular operator access will be shielded. Remote operation will be used to limit exposure, where required. Some components may be located in gloveboxes to prevent the spread of contamination, to provide shielding for operations and maintenance, and to facilitate maintenance and disposal. Dikes or other methods of leak detection and confinement [Text deleted] will be provided.

G.1.3 Solid Waste Handling

The solid waste forms, both low level and high activity, as well as TRU and Low Level solid job control waste generated in the WSB, PDCF and MFFF, will be staged in a designated area of the WSB while awaiting curing, aging and/or any documentation pending shipping. Under current WIPP shipping requirements, it is anticipated that certain TRU job control wastes may require up to 142 days of aging time prior to head space gas sampling for Volatile Organic Carbon (VOC). The solidified TRU waste form (cement) will require validation sampling, to confirm the absence of VOC, after an aging time of approximately 15 days.

G.1.4 Excess Solvent Handling

One of the low level streams to be coordinated for disposal by the SRS for the MFFF will be the excess solvent stream. Space has been allocated in the vicinity of the WSB for segregation of this stream prior to shipment to an offsite disposal facility. This stream is to be segregated, due to the combustibility hazard, in a separate structure with spill containment and fire protection capabilities. Transfer between MFFF, WSB and the final disposal facility will be performed in containers approved for offsite shipment.

G.2 EFFECTS OF FACILITY CONSTRUCTION

The WSB will be located on the south end of the PDCF site (Figure G-1). The ecological description of this land is provided in the SPD EIS and is similar to the terrestrial ecology of the MFFF site described in Chapter 4.

G.2.1 Impacts to Air Quality

Potential impacts to local air quality during construction of the WSB are anticipated to be bounded by the impacts presented in Section G.4.2.3.1 of the SPD EIS (DOE 1999c) for the immobilization plant. These impacts are summarized in Table G-3 of this ER.

G.2.2 Impacts to Water Quality

G.2.2.1 Water Use

All water (520,000 gallons per year) for construction activities will be provided from existing SRS utilities. Local surface water would not be used in the construction of proposed facilities at SRS. Thus, there would be no impact on the local surface water availability to downstream users.

G.2.2.2 Surface Water Quality

Sanitary waste will be collected using portable toilets or processed through the SRS Central Sanitary Wastewater Treatment Facility. Because this sanitary wastewater is a small fraction of the SRS Central Sanitary Wastewater Treatment Facility capacity, no impacts on surface water quality would be expected from the discharge of these flows to the treatment system and, subsequently, to the receiving stream.

Proven construction techniques will be used to mitigate the impact of soil erosion on receiving streams. The WSB construction stormwater pollution prevention plan will be consistent with the existing SRS stormwater and erosion management practices. Because of the effectiveness of these techniques, no long-term impacts from soil erosion due to construction activities would be expected.

To comply with *South Carolina State Standards for Stormwater Management and Sediment Reduction* (SCDHEC 2000b), detention ponds designed to control the release of the stormwater runoff at a rate equal to or less than that of the pre-development stage will be built at strategic locations as part of SRS infrastructure development.

G.2.2.3 Groundwater Quality

The estimated water usage for constructing the WSB site is estimated to be 520,000 gal/yr (1.9 million L/yr). Current water usage in F Area is 98.8 million gal/yr (374 million L/yr) (DOE 1999c). The total construction requirement represents approximately 1.6% of the A-Area loop groundwater capacity, which includes F Area, of about 1.58 billion gal/yr (6.0 billion L/yr) (Tansky 2002). WSB groundwater withdrawals are not anticipated to have any impact on SRS or local groundwater supplies.

G.2.3 Impacts to Terrestrial Ecology

G.2.3.1 Land Use

The WSB will be constructed on the PDCF site. Construction of the WSB will require approximately 5 acres (2 ha) of land. Construction on the site is consistent with other SRS uses and with the industrial land use activity in the surrounding area. It is also consistent with the SRS Land Use Technical Committee's *Draft SRS Long Range Comprehensive Plan* (DOE 2000a) for land use in the area.

Part of the land within F Area has been previously disturbed and is partially developed. The area where the WSB will be located is mostly grass and pine plantation. This area was already designated to be cleared for the PDCF construction. Some changes in topography have already taken place.

G.2.3.2 Non-Sensitive Habitat

There should be no direct impacts on non-sensitive aquatic habitats because best-management practices for soil erosion and sediment control will be used to prevent construction runoff to these habitats, and direct construction disturbance would be avoided. Any scrub vegetation located on the site will be removed. The associated animal populations would be affected. Some of the less-mobile or established animals within the construction zone could perish during land-clearing activities and from increased vehicular traffic. Furthermore, activities and noise associated with construction could cause larger mammals and birds to relocate to similar habitat in the area. Also, animal species inhabiting areas surrounding F Area could be disturbed by the increased noise associated with construction activities, and the additional vehicular traffic could result in higher mortality for individual members of local animal populations. The recent survey of the site (DOA 2000) did not reveal any migratory bird nests. There would be no impacts on aquatic habitat from surface water consumption because water required for construction will be drawn from groundwater by the SRS utilities.

G.2.3.3 Sensitive Habitat

Wetlands associated with floodplains, streams, and impoundments will not be directly impacted by construction activities. No runoff or sediments are expected to be deposited in these areas because appropriate erosion and sedimentation controls will be used during construction.

No critical habitat for any threatened or endangered species exists on SRS. However, as discussed in Section 4.6.2.1, the bald eagle, red-cockaded woodpecker, wood stork, American alligator, smooth purple coneflower, and Oconee azalea might occur near F Area. Surveys conducted in 1998 and 2000 for the proposed WSB did not find any federally listed threatened, endangered, proposed, or sensitive plant or animal species (DOA 2000). Consultations were initiated by DOE with the U.S. Fish and Wildlife Service (USFWS) and the South Carolina Department of Natural Resources (SCDNR) to request comments on potential impacts on animal and plant species and to request any additional sensitive species information. The USFWS field office in Charleston, South Carolina, provided a written response indicating that the proposed facilities at SRS do not appear to present a substantial risk to federally listed species or other species of concern.

G.2.3.4 Noise

Construction impacts on local noise levels were evaluated in Section 4.4.1.1 of the SPD EIS (DOE 1999c).

The location of the WSB relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during construction would include heavy construction equipment, employee vehicles, and truck traffic. Traffic noise associated with the construction of the WSB would occur on the site and along offsite local and regional transportation routes used to bring construction materials and workers to the site.

Given the distance to the SRS site boundary (about 5 mi [8 km]), noise emissions from construction equipment would not be expected to annoy the public. These noise sources would be far enough away from offsite areas that the contribution to offsite noise levels would be small. Some noise sources could have onsite impacts, such as the disturbance of wildlife. However, noise would be unlikely to affect federally-listed threatened or endangered species or their critical habitats because none are known to occur in F Area (see ER Section 4.6.2.2). Noise from traffic associated with the construction of the WSB would likely produce less than a 1-dB increase in traffic noise levels along roads used to access the site, and thus would not result in any increased annoyance of the public.

Construction workers could be exposed to noise levels higher than the acceptable limits specified by the Occupational Safety and Health Administration (OSHA) in its noise regulations (29 CFR §1926.52). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts on workers. These programs include the use of standard silencing packages on construction equipment, administrative controls, engineering controls, and personal hearing protection equipment.

G.2.4 Impacts to SRS Infrastructure

The WSB will use the same roads and utility headers as the MFFF and PDCF. Less than one acre of land will be used for new roads within the WSB boundary, beyond those described for the MFFF in ER Section 5.1.11. Construction would require only a fraction of the available resources and thus would not jeopardize the resources required to operate the site. Total construction requirements for diesel fuel might be higher than currently available in storage, but the majority of fuel usage would be connected to construction vehicle usage. Therefore, storage would not be limiting. Table G-4 reflects estimates of the additional infrastructure requirements for construction of the proposed facilities. Site resource availability is also presented.

G.2.5 Impacts from Construction Waste

Construction wastes for the WSB are expected to be bounded by the values projected in the SPD EIS for the immobilization plant. Table G-5 compares these waste values to the existing treatment, storage, and disposal capacity for the various waste types. It is anticipated that no TRU waste, LLW, or mixed LLW would be generated during the construction period. In addition, no soil contaminated with hazardous or radioactive constituents should be generated during construction. However, if any were generated, the waste would be managed in accordance with site practice and applicable federal and state regulations.

Hazardous wastes generated during construction would be typical of those generated during the construction of an industrial facility. Any hazardous wastes generated during construction would be packaged in DOT-approved containers and shipped offsite to permitted commercial recycling, treatment, and disposal facilities.

G.2.6 Impacts to Historic, Scenic, and Cultural Resources

The area that will be used for the WSB is part of the area designated for the PDCF. Historic, scenic and cultural resource investigations were performed in this area for the SPD EIS. WSB construction will not affect pre-historic or historic resources, including those associated with the Cold War Era, nor will construction affect resources of value to Native Americans. Preliminary consultations with appropriate American Indian Tribal Governments and the State Historic Preservation Office have been performed by DOE. Consultations with Native American groups indicate that it is unlikely that significant Native American resources will be impacted.

Inadvertent discoveries of cultural resources will be handled in accordance with 36 CFR §800.11 (historic properties) or 43 CFR §10.4 (Native American human remains, funerary objects, objects of cultural patrimony, and sacred objects) as well as with the terms of the SRS Programmatic Memorandum of Agreement.

The WSB will have a minimal effect on the scenic character of the surrounding area and is consistent with the VRM Class IV designation for the area. The buildings are low-rise structures of varying heights less than 100 ft (30 m). This height is consistent with, and does not exceed, the other building heights in the area, which range from 10 to 100 ft (3 to 30 m). The distance from sensitive receptors and screening by trees will minimize its impact as a visual intrusion to the scenic character of the area.

G.2.7 Socioeconomic Impacts

Construction of the WSB at SRS would have some beneficial socioeconomic impacts on the region. Construction will employ 1,000 workers. The impacts on the local economy are anticipated to be similar to those for the MFFF discussed in Section 5.1.8.

G.2.8 Environmental Justice Impacts

The WSB is located within SRS and is over 5 mi (8 km) from the nearest minority or low-income community. Impacts from construction activities that could affect public health, such as the generation of noise and dust, will be limited to the construction site area. As presented in Section 4.4.1.6 of the SPD EIS (DOE 1999c), there are no anticipated environmental justice issues associated with construction of the WSB at SRS. Construction would pose no significant health risks to the public regardless of racial or ethnic composition, or economic status.

G.3 EFFECTS OF FACILITY OPERATION

G.3.1 Impacts to Air Quality

There are three sources of non-radioactive air emissions from the WSB operations:

- NO_X emissions from the WSB stack derived from acidic waste evaporation
- Fugitive emissions from chemical and cement storage tanks
- Emissions from employee and site vehicles.

Maximum air pollutant concentrations resulting from operation of the WSB are anticipated to be bounded by the concentrations projected for the immobilization plant in the SPD EIS, with the exception of NO_X. Depending upon the final design, the new WSB could generate a maximum of 14,000 lbs[1] of NO_X annually. While this is more NO_X than considered for the PIP, the WSB offgas system design will include NO_X emission control equipment as needed to cost effectively control the WSB emissions so that SRS site boundary NO_X concentrations due to the WSB are less than 10% of the most stringent standard or guideline for total SRS site emissions.

The potential airborne chemical emissions from waste processing are comprised of nitric acid and sodium hydroxide. A chemical consequences analysis was performed and determined that the airborne releases from the WSB at both 328 ft (100 m) from the WSB and at the SRS site

[1] Assumes complete evaporation of all waste streams and no offgas treatment to reduce NOx.

boundary are well below the Temporary Emergency Exposure Limits (TEELs) for each chemical. Therefore, the impact on air quality from process chemicals is low.

G.3.2 Impacts to Water Quality

G.3.2.1 Water Use

The annual domestic and process water uses for the WSB are anticipated to be 5,000,000 gal/yr (19,000,000 L/yr).

G.3.2.2 Surface Water Quality

[Text deleted] The WSB design will include discharges of water (treated wastewater, HVAC condensate, storm water, etc.) to an NPDES outfall. All liquid discharges to NPDES outfalls will meet state and federal regulations. The environmental impact of these discharges will be controlled by the NPDES permitting process and the radionuclide limits established in DOE Order 5400.5. The WSB will be designed and permitted to treat approximately 1,000,000 gallons per year of radioactive wastewater. This represents <0.2 % of the current permitted capacity of the SRS Effluent Treatment Facility, which is 510,000,000 gallons per year (1.93E+06 m^3/yr). It also represents a negligible contribution to the 134,000,000 gallon per day average flow of Upper Three Runs Creek, which will be the ultimate receiving stream for the treated effluents.

[Text deleted]

G.3.2.3 Groundwater Quality

The WSB does not employ settling or holding basins as part of the waste treatment system. There will be no direct discharge of wastewater to the groundwater. Therefore, no impacts on groundwater quality are expected.

G.3.3 Impacts to Terrestrial Ecology

G.3.3.1 Land Use

Operation of the WSB is not projected to have any impact on land use other than the continued removal of the 5-acre (2-ha) site from other uses. The operation of the WSB should not impact site geology.

G.3.3.2 Non-Sensitive Habitat

Noise disturbance will probably be the most significant impact of routine operation of the WSB on local wildlife populations. Disturbed individual members of local populations could migrate to adjacent areas of similar habitat. However, impacts associated with airborne releases of criteria pollutants, hazardous and toxic air pollutants, and radionuclides would be unlikely because scrubbers and filters will be used. Impacts on aquatic habitats will be limited because all liquid will be discharged in accordance with approved permits and procedures.

G.3.3.3 Sensitive Habitat

Operational impacts on wetlands or other sensitive habitats would be unlikely because airborne and aqueous effluents would be controlled through state permits.

It is also unlikely that any federally listed threatened or endangered species would be affected, although South Carolina state-classified special-status species (American alligator) could be affected by noise or human activity during operations.

G.3.3.4 Noise

The location of the WSB relative to the SRS site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise sources during operations would include new or existing sources (e.g., cooling systems, vents, motors, material-handling equipment), employee vehicles, and truck traffic. Given the distance to the site boundary (about 5.8 mi [9.4 km]), noise emissions from equipment would not be expected to annoy the public.

G.3.4 Impacts from Ionizing Radiation

All potential sources of radioactivity associated with the WSB were evaluated for potential releases during normal operations. This includes both the vapors from the waste receipt tanks exhausted through the stack (after HEPA filtration) and the liquid discharged to NPDES outfalls.

G.3.4.1 Radiation Doses to the Public

[*Text removed under 10 CFR 2.390.]

Radioactive releases to the air from the WSB are dominated by Am-241 entrained in vapors which may escape from the High Alpha Waste Receipt Tanks. The plutonium isotopes do not significantly contribute to the dose. [Text deleted] The emission and resulting projected dose to the general public at the SRS boundary (see Chapter 5 ad 5.2.10.1) is below the 40 CFR Part 61, Subpart H regulated limit.

A series of evaporation steps will be available to reduce the waste volume for the LLW and TRU waste that will be mixed with cement to form an acceptable solid waste form. The resulting effluent will be further processed to meet DOE Order 5400.5 limitations for exposure of the public. DOE Order 5400.5 establishes a dose limit to the public from DOE operations of less than 100 mrem/year, and compliance with EPA drinking water standards, which are 4 mrem/year from drinking water exposure, and mandates the use of the ALARA (As Low As Reasonably Achievable) methodology. The SRS manages this requirement through the ALARA process, which incorporates all of the site releases from all of the facilities. The most recent published data, from the Savannah River Site Environmental Monitoring Report for 2002, (WSRC-TR-

2003-00026, Table 5-2) calculated a total potential dose to the maximally exposed member of the public from liquid discharges from DOE operations of 1.2E-01 mrem/yr. The ALARA goals for the Waste Solidification Building will be established by the DOE and its M&O contractor to maintain the same minimal level of impact to the public. [Text deleted]

G.3.4.2 Radiation Doses to Site Workers

Under 10 CFR 835, which governs operations of the WSB, site workers are treated the same as facility workers. Radiation dose to individual site workers who do not enter radiological control areas will be below 100 mrem/year.

G.3.4.3 Radiation Doses to Facility Workers

The annual dose to facility workers in the WSB is estimated to be below 200 person-rem/yr. The maximum dose to the worker from normal operations will be below the DOE Administrative Control Level of 2,000 mrem/year. Assuming a staff of 100, meeting the DOE Administrative Control Level would result in an annual population dose of 200 person-rem/yr. The average annual dose will be below the SRS guideline (currently 1,000 mrem/year).

G.3.5 Impacts to SRS Infrastructure

The WSB is anticipated to use approximately 30,000 MWh /yr.

As noted in Section G.3.2.1, the annual domestic and process water uses for the WSB are bounded by the water use of five million gallons (19 million liters) projected for the immobilization facility in the SPD EIS. This represents a groundwater withdrawal rate of 10 gal/min (38 L/min). The domestic water capacity from deep wells supplying the A area loop, which includes F Area, is 3,000 gpm and that the average domestic water consumption from the A area domestic water loop in 2000 was 754 gpm (about 1,200 gpm peak). F area process water system capacity is 2,100 gpm with an average demand of 350 gpm (800 gpm peak). WSB groundwater withdrawals are not anticipated to have any impact on SRS or local groundwater supplies.

G.3.6 Impacts to SRS Waste Management

[Text deleted]

As discussed in Section G.1.2.6.4, the salts, silver, etc. in the MFFF high alpha stream will be transferred to the cement process. The SWB final package sent to WIPP will contain approximately 180 grams of Am-241 per container if optimized for curie loading. The WSB is estimated to produce between 160 and 570 yd^3 (120 to 440 m^3) of TRU waste annually, depending upon the degree of waste stream segregation and volume reduction. The upper end of the range is based upon combining the MFFF high alpha and stripped uranium streams with the PDCF laboratory liquids stream and processing directly to TRU cement without volume reduction, which represents a bounding TRU waste generation case. The forecast in DOE

(1995b) for SRS TRU waste generation over the next 30 years ranges from a minimum estimate of 7,578 yd^3 (5,793 m^3) to 710,648 yd^3 (543,361 m^3), with an expected forecast of 16,433 yd^3 (12,564 m^3) (*Savannah River Site Waste Management Final Environmental Impact Statement* [DOE 1995b], Table A-1). The estimated bounding WSB lifetime contribution (5,720 m^3) to the SRS TRU solid waste quantity is roughly 1% of the maximum estimate. The estimated actual WSB TRU waste generation, based upon an assumed concentration factor of 3 in the volume reduction step, and stream blending will be 190 yd^3 (147 m^3) per year or 2470 yd^3 (1911 m^3) over the thirteen year operational life of the facility. This represents roughly 8% of the expected forecast, which is within the range of error of the estimate. The environmental impacts of adding this waste to the SRS inventory are bounded by the environmental impacts projected in the *Savannah River Site Waste Management Final Environmental Impact Statement* (DOE 1995b).

The environmental impacts resulting from the disposal of TRU waste at the Waste Isolation Pilot Plant (WIPP) are discussed in *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* (DOE 1997e). The impacts projected in DOE 1997e (Table 2-2 in DOE 1997e) were based on disposal of 170,000 m^3 TRU waste. The additional 1,900 m^3 TRU waste from the WSB represents an increase of < 2% in the projected waste disposed. Any increase in impacts resulting from disposing WSB solid TRU waste at WIPP should be within the error associated with any projected impacts of WIPP operation. Furthermore, the *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* projected that, "No LCFs would be expected in the population around WIPP from radiation exposure (3 E-4 LCFs). ... no cancer incidence (2×10^{-5} cancers) would be expected in the population from hazardous chemical exposure." (DOE 1997e, pg 5-29) The addition of 1,900 m^3 of TRU waste from the WSB would not be expected to change this conclusion.

[Text deleted]

The WSB will be designed and permitted to treat approximately 1,000,000 gallons per year of radioactive wastewater. This represents <0.2 % of the current permitted capacity of the SRS Effluent Treatment Facility, which is 510,000,000 gallons per year (1.93E6 m^3/yr). It also represents a negligible contribution to the 134,000,000 gallon per day average flow of Upper Three Runs Creek, which will be the ultimate receiving stream for the treated effluents.

The WSB will produce a maximum of 413 yd^3 (316m^3) of solid LLW per year from cementing the low activity streams with no volume reduction. The forecast for SRS LLW generation over the next 30 years ranges from a minimum estimate of 480,310 yd^3 (367,000 m^3) to 1,837,068 yd^3 (1,400,000 m^3), with an expected forecast of 620,533 yd^3 (475,000 m^3) (DOE 1995b, Table A-1). The estimated lifetime WSB contribution to SRS solid LLW waste quantity is only a small fraction (<1%) of the expected SRS estimate. The environmental impacts of adding this waste to the SRS inventory are bounded by the environmental impacts projected in the *SRS Waste Management FEIS* (DOE 1995b).

The building job control waste will be in compliance with WSRC Manual 1S, *SRS Waste Acceptance Criteria Manual* (2002). The solid waste forms, both low level and high activity, as well as job control waste generated in the WSB, PDCF and MFFF, will be staged in designated areas of the WSB while awaiting curing, aging and/or any documentation pending shipping.

through decontamination and/or dismantlement to demolition or entombment. Four guidance documents have been developed to support the disposition of contaminated, excess facilities:

- DOE G 430.1-2, Implementation Guide For Surveillance and Maintenance During Facility Transition And Disposition
- DOE G 430.1-3, Deactivation Implementation Guide
- DOE G 430.1-4, Decommissioning Implementation Guide
- DOE G 430.1-5, Transition Implementation Guide.

Upon completion of WSB activities, a preliminary characterization will be performed to establish a baseline of information concerning the physical, chemical, and radiological condition of the facility. These results will serve as the technical basis for decommissioning.

G.3.10.2 Design Features to Facilitate Decommissioning

Design features are incorporated into the WSB design that will facilitate both deactivation and the eventual decommissioning or reutilization of the facility; these features minimize the spread of radioactive contamination and maintain occupational and public doses at as low as reasonably achievable (ALARA) levels during WSB operations. Design features that will minimize the spread of radioactive contamination and maintain occupational and public doses ALARA:

1. **Plant layout:** All areas of the WSB will be sectioned off into clean areas and potentially contaminated areas with appropriate radiation zone designations to meet 10 CFR Part 835 criteria. Process equipment and supporting systems will be situated according to radiation zone designations and have adequate space to facilitate access for required maintenance to permit easy installation of shielding. The plant layout provides for ready removal of equipment and appropriate space for equipment decontamination.

2. **Access control:** In accordance with ALARA design considerations in 10 CFR Part 835, an appropriate entry control program for WSB radiological areas will be established with associated ingress and egress monitoring to minimize the spread of contamination.

3. **Radiation shielding:** The radiation shielding design will be based on conservative estimates of quantity and isotopic materials anticipated during operations. The analyses address both gamma and neutron radiation and include exposures due to scatter and streaming radiation. Therefore, the shielding design will minimize the occupational doses during deactivation.

4. **Ventilation:** The WSB ventilation system will be designed with the capability of capturing and filtering airborne particulate activity and is continuously maintained under a slight negative pressure.

5. **Structural, mechanical, instrumentation, and electrical components:** Numerous design features of the WSB (e.g., use of washable epoxy coatings, segregation of waste streams,

remote readout for instrumentation, and location of breaker boxes and electrical cabinets in low-dose-rate areas) facilitate decontamination, minimize the spread of contamination, and maintain doses to facility personnel ALARA.

6. **Radiation monitoring:** The WSB is designed with radiation monitoring systems to monitor working spaces and potential releases to the environment for the purpose of protecting the health and safety of the workforce, the public, and the environment.

G.3.10.3 Administrative Programs to Facilitate Decommissioning

The WSB design utilizes lessons learned from the operation of similar waste processing facilities to minimize contamination during operations, thereby reducing the effects of contamination on deactivation/decommissioning. Good housekeeping practices are essential to minimize the buildup of contamination and the generation of contaminated waste.

G.3.10.4 Projected Environmental Impacts of Potential Decommissioning

If NNSA should decide to decommission the WSB, a conservative approach to decommissioning is to assume that the facility will be decontaminated, dismantled, and the environment restored as presently being implemented at the Rocky Flats Environmental Technology Site (RFETS) near Denver, Colorado. The values for decommissioning waste volumes for the WSB were estimated using waste volumes from the decommissioned RFETS facilities. The following assumptions apply to this analysis:

1. The WSB waste estimate was based on the decommissioning waste estimating method used for RFETS plutonium handling facilities. This method used the physical characteristics and waste generated from the decommissioning of the first DOE site plutonium facility that was completed in 2000. Relevant metrics (e.g., process area square feet, cubic meters of process equipment) were compared against the TRU, low-level, low-level mixed, and construction demolition waste generated during the decontamination, strip-out, and decommissioning of the building.

2. The summary estimate methodology identified the RFETS buildings that were most representative of the MFFF since the majority of the waste is from the MFFF. The methodology assumed that the secondary systems (i.e., ventilation, instrumentation and control, power, etc.) were similar. It also assumed that the decommissioning methods used for these facilities would be similar to those that were used for RFETS facilities.

The results of the comparison projected 78 yd^3 (60 m^3) of TRU waste, 13,830 yd^3 (10,570 m^3) of LLW and 22,400 tons of nonradioactive demolition waste.

G.3.10.5 Accessibility of Land After Decommissioning

Accessibility to the land surrounding the WSB will be controlled by NNSA or DOE and subject to its applicable security requirements. A final radiological survey will verify that accessibility will not be limited as a result of radioactive contamination.

G.4 FACILITY ACCIDENTS

This section summarizes the evaluation of potential facility accidents applicable to the WSB. The volumes of the various tanks, vessels, evaporators, etc. upon which this accident analysis is based are specified in Table G-7. The assumed concentrations of the waste streams processed are provided in Tables G-8 through G-11. The assumed concentrations of the high activity evaporation process feed, bottoms and overhead are provided in Table G-12. The accident evaluation includes internal process-related events, external man-made events, and events associated with natural phenomena. The evaluations of these events show that the risk from a facility accident is low.

G.4.1 Environmental Risk Assessment Method

Accidents that could occur as a result of WSB operations are identified and evaluated in a systematic, comprehensive manner. The general approach includes the following evaluations:

- Internal Hazard Identification – A systematic and comprehensive identification of radioactive, hazardous material, and energy sources in the WSB
- External Hazard Identification – A systematic and comprehensive identification of applicable natural phenomena and events originating from nearby facilities
- Hazard Evaluation – A systematic and comprehensive evaluation to postulate event scenarios involving the information developed in the Hazard Identification
- Accident Analysis – A Preliminary Hazards Analysis is performed for the WSB to identify possible accident events and to estimate consequences and frequencies and to identify preliminary prevention and mitigation features. The accident analysis evaluates all credible events. Thus, all internally initiated accidents are evaluated without regard to their initiating frequency, and all natural phenomena hazard and external man-made hazard generated events are evaluated unless their probability of impacting the WSB is extremely low. The results of the evaluation include events with no or low consequences, design basis events, and severe accidents.

G.4.2 Environmental Risk Assessment Summary

From the Hazard Evaluation, those WSB accidents that represent the highest risk to the worker or public were identified. These potential accidents were then grouped into one of the following event types based on similar initiators:

- Natural phenomena
- Loss of confinement (Spill)
- Fire
- Explosion
- Direct Radiation Exposure
- Nuclear Criticality
- Chemical Releases.

The environmental risk assessment addresses the consequences associated with accidents in each event type up to and including design basis accidents. The environmental impacts of beyond design basis events are remote and speculative and do not warrant consideration under NEPA. While beyond design basis events are theoretically possible, their likelihood of occurrence is so low as to not result in any significant, additional risk from WSB operations.

For each potential accident, accident consequences and frequencies are evaluated for two types of receptors: (1) a site worker, and (2) the maximally exposed member of the public. The first receptor, a site worker or SRS worker, is a hypothetical individual working on the SRS site but not involved in the proposed activity. The worker is conservatively evaluated downwind at a point 328 ft (100 m) from the accident. The second receptor, a maximally exposed member of the public, is a hypothetical individual assumed to be downwind at the SRS boundary. The SRS boundary is conservatively evaluated at a distance of 5.8 mi (9.4 km). Exposures received by this individual are intended to represent the highest doses to a member of the public.

The unmitigated consequences of the events identified in the hazard evaluation have been estimated based on the quantities and types of hazardous material, the release mechanisms associated with the accident, and the release pathway of the hazardous material to the environment.

The Total Effective Dose Equivalent (TEDE) to the receptors of interest is equal to the dose from the inhalation pathway. Air submersion, ingestion, water immersion, and contaminated soil dose pathways are assumed negligible contributors to the TEDE for the accident source terms postulated from WSB. The Inhalation Dose is calculated as follows:

$$[\text{Inhalation Dose}]_{\text{effective}} = [ST]\cdot[\chi/Q]\cdot[BR]\cdot[C]\cdot\sum_{X=1}^{N} f_X \cdot [DCF]_{\text{effective},X}$$

where:

ST = source term

χ/Q = atmospheric dispersion factor

BR = breathing rate (3.33E-04 m^3/s)

[Text deleted]

f = specific activity of nuclide x

DCF = dose conversion factor of nuclide x

N = total number of dose-contributing radionuclides

Based on local SRS meteorological data, the atmospheric dispersion factor (χ/Q) for the MEI member of the public at the SRS boundary (5.8 mi [9.4 km]) from a ground level release of 30-minutes duration for a fire in the low activity process area is 1.0E-06 s/m^3. The associated χ/Q for the site worker located within 328 ft (100 m) of a ground level release of 30-minutes duration from the WSB based on the local SRS meteorological conditions is 5.5E-04 s/m^3 for a fire. The dose associated with a spill of process solution is calculated by accounting for the splashing and resuspension aspects of a spill. For the splashing of process solutions, the fire event release durations and dispersion factors were used to calculate the dose. For the resuspension of process solution, an 8-hour duration (entrainment) and a dispersion factor of 2.2E-4 s/m^3 was used for the site worker and a dispersion factor of 4.9E-07 s/m^3 was used for offsite.

Onsite atmospheric dispersion factors are evaluated at the 50th percentile, direction-independent level of consequence. Offsite atmospheric dispersion factors are evaluated at the 95th percentile, direction-independent level of consequence. Both onsite and offsite meteorological conditions are evaluated systematically with the source term of interest using the MACCS code (described below), and model the effects of dry deposition over the region of transport.

Radiological consequences calculated for releases of radionuclides under postulated accident conditions (listed in Table G-16) are estimated with MACCS code and dose factor values based on Publication 30 of the International Commission on Radiological Protection (ICRP). MACCS models the dispersion of radioactivity in the atmosphere from the nuclear facility and computes plume depletion effects. MACCS then calculates the effects of this radioactivity to downwind receptors and to the environment. During plume passage, doses and associated health effects are computed for inhalation from the plume, immersion or cloudshine, groundshine, deposition on the skin, and inhalation of resuspended ground contamination. Long-term effects such as ground contamination and economic impacts, and ingestion of contaminated water and foodstuffs, inhalation of resuspended material, and groundshine to the individual may also be calculated. Both individual and population consequences may be calculated with MACCS.

For regulatory applications, MACCS is used to calculate the 50-year Effective Dose Equivalent (EDE) to specified stationary receptors from the plume passage phase of a hypothetical release. The EDE is calculated for both onsite and offsite receptors using standard uptake assumptions and dose conversion database values. Sensitivity studies may also be performed with MACCS to show the relative benefits of evacuation, sheltering, interdiction, and the effects of various shielding assumptions.

MACCS predicts dispersion of radionuclides by the use of multiple, straight-line Gaussian plumes. Although each plume treats the released material as a neutrally buoyant gas, the direction, duration, sensible heat, and initial radionuclide concentration may be varied from plume to plume. Crosswind dispersion is treated by a multi-step function, and both wet and dry depositions features can be modeled as independent processes. Meteorological variability is treated in MACCS with a stratified random sampling algorithm. MACCS uses the Latin Hypercube Sampling (LHS) mode of one year of site-specific meteorological data to analyze under the random-sampling option. Based on the LHS distribution, and application of user-specified dose and/or health effects models, complementary cumulative distribution functions are calculated for various measures of consequence. The average, median, 95th, and 99.5th percentile doses are provided in the output.

Normal contamination in the process rooms is not included in the consequence analysis for events in the rooms. This is because the contamination is anticipated to be insignificant when compared to the source term associated with the process upset and natural phenomena events involving solutions.

The radiological doses are based on the amount of respirable radioactive material released to the air, the source term (ST). The initial source term is the amount of radioactive material driven airborne at the accident source. The initial respirable source term, a subset of the initial source term, is the amount of radioactive material driven airborne at the accident source that is effectively inhalable. The Source Term, is defined by one of the following equations:

ST = MAR * DR * ARF * LPF * RF, or

ST = MAR * DR * (ARR * t) * LPF * RF

[Text deleted]

The material at risk (MAR) is the amount of radioactive material (in grams or curies of activity) available to be acted on by a given physical stress. For facilities, processes, and activities, the MAR is a value representing some maximum quantity of radionuclide present or reasonably anticipated for the process or structure being analyzed. Different MARs may be assigned for different accidents since it is only necessary to define the material in those discrete physical locations that are exposed to a given stress.

The damage ratio (DR) is the fraction of the MAR actually impacted by the accident-generated conditions. The DR is estimated based upon engineering analysis of the response of structural materials for containment to the type and level of stress or force generated by the event. For conservatism, the DR is conservatively assumed to be 1.0 for all accident analyses for the WSB.

The airborne release fraction (ARF) is the coefficient used to estimate the amount of a radioactive material suspended in air as an aerosol and thus available for transport due to physical stresses from a specific accident. For discrete events, the ARF is a fraction of the material affected.

The respirable fraction (RF) is the fraction of airborne radionuclides as particles that can be transported through air and inhaled into the human respiratory system.

Values for RF and ARF were selected for these dose consequence analyses based on bounding values obtained from *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities* (DOE 1994c) based on the release mechanism for solutions.

The airborne release rate (ARR) is the coefficient used to estimate the amount of a radioactive or hazardous material that can be suspended in air (per hour) by continuously acting mechanisms such as aerodynamic entrainment/resuspension. The duration of the release (t) is given in hours.

The leak path factor (LPF) is the fraction of the radionuclides in the aerosol transported through some confinement deposition or filtration mechanism. There can be many LPFs for some hazard events, and their cumulative effect is often expressed as one value that is the product of all leak-path multiples. Inclusion of these multiples in a single LPF is done to clearly differentiate between calculations of unmitigated doses (where the LPF is assumed equal to 1.0) and calculations of mitigated doses (where the LPF reflects the dose credit provided to the controls). For all unmitigated dose consequence calculations for the WSB, a value of 1.0 is used. For most of the identified hazard events, a value of 1.0 for the LPF is also used for the mitigated dose consequences. Any deviations from a LPF of 1.0 are identified in the summary of the accident events that follow.

Design basis events for each event type are discussed in the following sections.

G.4.2.1 Natural Phenomena

A screening process is performed on a comprehensive list of natural phenomena to identify those credible natural phenomena that have the potential to affect the WSB during the period of facility operation. Credible natural phenomena that could have an impact on WSB operations include the following:

- Extreme winds
- External flooding
- Earthquakes
- Tornadoes
- Rain, snow, and ice.

Natural phenomena could result in the dispersion of radioactive material and hazardous chemicals. [Text deleted] The hardened reinforced concrete structure will be designed for a performance goal for annual probability of exceedance of 1E-04. Natural phenomena events are discussed in the following sections.

G.4.2.1.1 Extreme Winds

Extreme winds are straight-line winds associated with thunderstorms or hurricanes. Extreme wind loads include loads from wind pressure and wind-driven missiles.

For portions of the WSB outside the hardened reinforced concrete structure, the equipment is assumed, for safety analysis purposes, to be affected by the natural phenomenon hazards (NPH) events. Because of the lower quantity of radioactive material in the areas processing the low activity waste streams, there is no design criteria for the wind-driven missiles. However, no significant radioactive or hazardous material release at the WSB is postulated to occur as a result of damage from wind-driven missiles caused by extreme wind events.

The process rooms housing the High Alpha Waste stream and cementation areas will be designed to withstand the effects of the design basis extreme wind of 133 mph and the associated missiles. The missile criteria include the ability to withstand the force of a 2x4 timber plank weighing 15 pounds being driven at the structure at a horizontal velocity of 50 mph at a maximum height of 30 ft (9.1 m). In addition, the above ground high activity waste transfer line will be encased in reinforced concrete (or equivalent) to protect it from design basis extreme wind and associated missiles. Because of the lower quantity of radioactive material in the areas processing the low activity waste streams, there is no design criteria for the wind-driven missiles. However, no significant radioactive or hazardous material release at the WSB is postulated to occur as a result of damage from wind-driven missiles caused by extreme wind events.

G.4.2.1.2 External Flooding

External flooding includes floods associated with rising rivers or lakes. For all process areas and equipment, the structures are designed for the flooding consequences associated with flooding events with an annual exceedance probability of 1E-04 (return period of 10,000 years). [Text deleted]

G.4.2.1.3 Earthquakes

Earthquakes may result from movement of the earth's tectonic plates or volcanic activity. [Text deleted] The hardened reinforced concrete structure is designed for the seismic consequences associated with an earthquake with a minimum annual exceedance probability of 1E-04 (return period of 10,000 years). For the high activity rooms and cementation areas, the process equipment will also be designed to withstand the consequences associated with an earthquake event with a minimum annual hazard exceedance probability of 1E-04 (return period of 10,000 years). Earthquake load design for the WSB is performed in accordance with the SRS-specific structural design criteria given in Section 5.2.9 of *SRS Engineering Standards Manual: Structural Design Criteria* (WSRC 2001b).

[Text deleted]

During a seismic event, it is assumed all of the material in the low activity process area is spilled. The vessels and piping in the high activity hardened structure and the high activity cementation area are designed to withstand a design basis earthquake and do not spill their contents during an earthquake. Section G.4.2.2 provides more detail on the material involved in a loss of confinement accident. For the spilling of the vessels, an ARF*RF value of 1.00E-4 was applied.

Aerodynamic entrainment and resuspension was assumed to last for 8 hours with an Airborne Release Rate (ARR) of 4.00E-07 and RF of 1.0.

A fire is then assumed to occur throughout the entire facility, except for the portion of the structure which contains the high activity rooms and cementation areas. The hardened structure acts as a fire barrier and prevents the fire from entering the high activity rooms and cementation areas. For a release due to the fire, an ARF*RF of 2.00E-03 for boiling liquid was applied to the low activity process area. Table G-13 lists the source term for each nuclide resulting from loss of confinement and Table G-14 lists the source term from a fire. The source term for an earthquake was obtained by adding the loss of confinement and the fire source terms. Table G-16 shows the impact to the site worker and the offsite public to be negligible from the effects of an earthquake.

G.4.2.1.4 Tornadoes

Tornadoes may occur in extreme weather such as thunderstorms or hurricanes. All process areas and equipment are designed in accordance with the SRS-specific tornado wind load criteria given in Section 5.2.8 of *SRS Engineering Standards Manual: Structural Design Criteria* (WSRC 2001b). The hardened reinforced concrete structure will be designed to withstand the consequences associated with a design basis tornado having an annual exceedance probability of 2E-05. Tornado loads include loads due to tornado wind pressure, loads created by the tornado-created differential pressure, and loads resulting from tornado-generated missiles. Because of the lower quantity of radioactive material in the areas processing the low activity waste streams, there is no design criteria for the wind-driven missiles. However, no significant radioactive or hazardous material release at the WSB is postulated to occur as a result of damage from wind-driven missiles caused by extreme wind events.

The associated wind load criteria and differential pressure load criteria for the WSB's hardened concrete structures are based on the following criteria used for the MFFF site:

- Maximum tornado wind speed: 180 mph
- Pressure drop across tornado: 70 psf
- Rate of pressure drop: 31 psf/sec.

The associated tornado-generated missile load criteria are based on the following:

Missile Description	Mass (lb)	Size (in)	Horizontal Impact Speed (mph)	Maximum Height (ft)	Vertical Impact Speed (mph)
Penetrating missile – 3-in (7.6-cm) diameter steel pipe	75	3 ½ (outside diameter)	50	75	35
Small missile – 2- by 4-in (5.1- by 10.2-cm) timber plank	15	1 ½ by 3 ½	100	150	70
Automobile	3,000	not applicable	19	rolls and tumbles	not applicable

The MFFF High Alpha waste stream receipt tanks and process rooms, and cementation areas are enclosed with hardened reinforced concrete and will be designed to withstand the effects of the design basis tornado. [Text deleted] For the purposes of safety analysis, the remaining waste streams and processes were assumed to be subject to damage and release following this natural phenomenon event. Because of the lower quantity of radioactive material in the areas processing the low activity waste streams, there is no design criteria for the wind-driven missiles. No significant radioactive or hazardous material release at the WSB is postulated to occur for tornadoes (see bounding loss of confinement (spill) event).

G.4.2.1.5 Rain, Snow, and Ice

Rain, snow, and ice are postulated to occur at the WSB several times during operation of the facility. These loads are defined according to the methodology in Sections 5.2.5, 5.2.6, and 5.2.7 of *SRS Engineering Standards Manual: Structural Design Criteria* (WSRC 2001b). The minimum drainage system design corresponds to a 25-year, 6-hour rainfall event (4.5 inches total accumulation). Snow loads are based on an annual exceedance probability of 4E-04, or a return period of about 2,500 years.

The WSB will be designed to withstand the effects of rain, snow, and ice. Thus, no radioactive or hazardous material release at the WSB is postulated to occur during or following these conditions.

G.4.2.2 Loss of Confinement

Within the WSB, radioactive material is confined within one or more confinement barriers. Confinement barriers include the concrete process rooms. Additional confinement barriers include the WSB building structure itself and the associated ventilation system which maintains a negative differential pressure relative to the outside atmospheric pressure. Confinement capabilities will ensure that a controlled, continuous airflow pattern from the environment to the WSB, and from the non-contaminated areas of the building to potentially contaminated areas, to the normally contaminated areas, and through HEPA filters and the stack prior to release to the environment.

The loss or damage of the primary confinement barrier may result in the dispersion of radioactive materials and hazardous chemicals. The effects of hazardous chemicals are discussed in Section G.4.2.7. [Text deleted]

Damage to or failure of the confinement barriers can be caused by human error or equipment failure resulting in the following:

- Breaches of container boundaries due to crushing, shearing, grinding, cutting, and handling errors
- Corrosion-induced confinement failures
- Pipe or vessel breaks or leaks

- Clogging or failure of HEPA filters.

[Text deleted]

The bounding credible loss-of-confinement event involves a spill of all material in the low activity process area due to a natural phenomena. The vessels and piping in the high activity hardened structure, which contains the high activity process vessels and cementation areas, are designed to survive the event. In addition, the process vessel vent (PVV) system piping up to and including the PVV HEPA filters remain intact during a seismic event. The total amount spilled includes 16,500 gallons from the low activity receipt and head tanks, 1,190 gallons of low activity bottoms, and 6,000 gallons of low activity overheads. For the spilling of the vessels an ARF*RF of 1.00E-4 was used. Aerodynamic entrainment and resuspension was assumed to last for 8 hours with an Airborne Release Rate (ARR) of 4.00E-07 and RF of 1.0. Table G-13 lists the source term for a loss of confinement event. The Leak Path Factor (LPF) from the low activity process area is assumed to be 1.0. As part of the Emergency Response Plan, personnel would be directed to proceed to assembly points away from the facility in order to limit potential radiological exposures. With these controls in place, the radiological consequences associated with a spill at the SRS boundary and to the site worker are negligible as shown in Table G-16.

[Text deleted]

G.4.2.3 Fire

A fire hazard arises from the simultaneous presence of combustible materials, an oxygen source, and a sufficient ignition source. A fire can spread from one point to another by conduction, convection, or radiation. The immediate consequence of a fire is the destruction, by combustion or by thermal damage, of elements in contact with the fire. A fire can lead to the dispersion of radioactive materials and hazardous chemicals.

Fires can be caused by human error, electrical equipment failures, equipment that operates at high temperatures, uncontrolled chemical reactions, or static electricity.

Postulated fire events include the following:

- Fires involving the low activity, and effluent processing sections of the WSB (process feed tanks, evaporators, and/or piping containing waste solutions)
- Room fires involving the high alpha storage and processing tanks and cementation areas (receipt tank, head tank, evaporator, bottoms collection tank, cement head tanks)
- Full facility fire that affects the entire facility inventory
- An area fire affecting just the low activity, and effluent processing sections of the facility

The control strategies used to reduce the risk of the postulated fire events include a combination of administrative controls and design features. A Fire Protection Program provides controls to reduce the probability of a fire and the means to ensure protection of personnel and equipment if a fire should occur. Key elements of the administrative control program include: a fire pre-plan, a transient combustible control program, a control on the use of flammable liquids and gases, fire department response, and worker training. These administrative controls are supplemented with the following design features: fire barriers between the high activity process area and/ cementation areas) and the low activity process area, fires sprinkler systems, fire resistant construction materials, and the building confinement system. Robust construction of the rooms, process vessels, and piping used in the high activity process and cementation areas prevents fires in these areas and the potential release of its large source term.

The bounding credible fire event is a fire in the low activity processing section of the WSB, causing structural damage to the facility and causing the release of radionuclides in this area. The fire would involve 16,500 gallons from the low activity receipt and head tanks, 1,190 gallons of low activity bottoms, and 6,000 gallons of low activity overheads. For a release due to the fire, an ARF*RF of 2.00E-03 for boiling liquid was applied for the low activity process area.

The source term associated with this event is summarized in Table G-14 and the radiological consequences associated with this event are provided in Table G-16.

The WSB utilizes many features to reduce the likelihood and consequences of this event as well as other fire-related events. Key features include minimization of combustibles and ignition sources through mitigative programs, fire suppression and detection systems (designed to NFPA standards), and emergency procedures. As part of the emergency response program, facility and onsite workers would be directed to proceed to assembly locations away from the WSB to limit potential exposures.

Given the low consequences and/or small likelihood of this type of accident, the radiological risk from fire events is negligible.

G.4.2.4 Explosion

Internal explosion events within the WSB could result from the presence of potentially explosive mixtures and potential overpressurization events. These events may result in the dispersion of radioactive materials and hazardous chemicals. Explosions may be caused by human error or equipment failure and include the following:

- Hydrogen accumulation in any of the tanks or evaporators used to process radiological material (caused by radiolysis)
- Inadvertent caustic addition to the acidic waste streams causing an energetic acid/base chemical reaction
- Red Oil Explosion in the High or Low Activity Evaporator
- Overpressurization of the High or Low Activity Evaporator.

The control strategy for hydrogen explosion events associated with the WSB high activity tanks and vessels is to prevent the explosions through the use of an air purge on the tanks. Hydrogen gas generated by the radiolysis of water in the MFFF High Alpha Waste stream will be purged in order to prevent hydrogen from reaching the lower flammability limit. A backup nitrogen purge system will be available to provide purge if air pressure is lost. Radiolysis is not a concern for the other waste streams due to their low activities.

A configuration control program and a chemical control program will be implemented to ensure no caustic is introduced to the tank and to prevent possible energetic chemical reactions. Organics in the waste streams will be eliminated or at least minimized through waste constituents limits and sampling and/or the use of inert oils or lubricants. Design features of temperature and pressure interlocks will also be utilized to shut down the High Activity and Low Activity Evaporator upon detection of high temperature or pressure conditions. For overpressurization events in the High Activity Evaporator, the temperature and pressure interlocks used to shut down the evaporator are also credited.

By crediting these reliable engineering features, there are no explosion events that are considered credible in the WSB. However, even though an overpressurization event would not result in an explosion, it could result in release of material that could impact the facility worker. By taking credit for the room walls that separate the worker from the evaporator, and the room exhaust HEPA filter, the consequence is minimized.

G.4.2.5 Direct Radiation Exposure

A direct radiation hazard arises from the presence of radioactive material within the WSB. Direct radiation exposure events include those events that result in a radiation dose from radiation sources external to the body. Due to the nature of the radioactive material present in the WSB (within tanks, process vessels and containers), there are no accidents at the WSB that produce a direct radiation exposure hazard to the public or site workers from routine operations. A number of events were postulated that result in high radiation exposure to the facility worker as a result of either entering a high activity room during process operations or performing maintenance on process equipment. The probability and consequences of these events is controlled through adequate shielding provided by the tank walls, and administrative controls to control access to these radiation areas and a radiation protection program.

G.4.2.6 Nuclear Criticality

Because the waste streams processed in the WSB have low concentrations of fissile material, criticality is not a concern.

G.4.2.7 Chemical Releases

A chemical hazard arises mainly from the use of chemicals in the waste processing operations, dry cement, nitric acid, and sodium hydroxide. Chemicals evaluated include those used during all modes of operation. Accidental chemical releases are postulated to occur from human error and equipment failures.

Consequences of chemical releases were determined for a potential release of each chemical. For evaporative releases, the chemical consequence analysis modeling for public consequences used the ALOHA (ALOHA 2000), and MACCS codes to calculate maximum airborne chemical concentrations to onsite and offsite receptors. Calculated concentrations were compared to TEELs. TEELs describe temporary or equivalent exposure limits for chemicals for which official Emergency Response Planning Guidelines have not yet been developed.

An evaporation model extracted from the ALOHA code was used to calculate a release from a spilled or leaked chemical, which is assumed to form a puddle one-cm deep. The entire anticipated onsite inventory of individual chemicals in the WSB was assumed to be in a single tank and a spill or leak was modeled. No credit was taken for an enclosure (such as a building) or a dike or containment/impoundment basin. For leaks or spills of nitric acid, credit was taken for the partial pressure of the nitric acid in a 13.6 N solution. For leaks or spills of dry cement and sodium hydroxide, which have negligible partial pressures in a solution, an airborne release fraction was applied in a direct release calculation.

The results indicate that the concentration of all chemicals at the SRS boundary following a release from the WSB is low. The results also indicate that the maximum chemical concentration for an site worker is low. The release due to a leak or spill of the entire anticipated onsite inventory of chemicals in the Waste Solidification Building is calculated to not exceed the applicable TEEL-2 concentration at 328 ft (100 m).

WSB features to reduce the frequency and magnitude of a chemical release include at least the following: vessel level indications, leak detection, sumps, drains, operating procedures, emergency procedures, operator training, hazardous material control, and ventilation systems.

Given the low consequences and/or small likelihood of this type of accident, the risk from chemical releases is low.

G.4.3 Evaluation of Facility Workers

The risk to workers is qualitatively evaluated for all WSB events. Sufficient engineering design features and administrative controls have been incorporated into the WSB design to ensure that any unacceptable consequence is highly unlikely.

Key design features include confinement systems, the robust construction of the high activity waste tanks and processing rooms, explosion mitigation structures, systems, and components (SSCs), radiation monitoring systems, instrument air purge and backup nitrogen system, and fire protection systems. Key administrative controls include operator training, radiation protection, fire safety, and industrial hygiene programs. In addition, workers are trained and qualified and perform their work in accordance with approved procedures.

Given the low consequences and/or low likelihood of events, the overall radiological risk to the WSB worker is low.

G.4.4 Conclusions

The impacts that have been considered include potential radiation and chemical exposures to individuals and to the population as a whole, and the risk of near- and long-term adverse health effects that such exposures could entail. The evaluation demonstrates that the environmental risk associated with potential accidents at the WSB is low.

G.5 TRANSPORTATION

The MFFF High Alpha Waste will likely be treated separately for processing at the WSB. The waste will be neutralized, mixed with a solidification additive, placed in a Standard Waste Box and sampled as necessary to assure that the WIPP waste acceptance criteria are met for the TRU waste. The waste will be loaded in a TRUPACT II shipping container for transport via truck to WIPP.

The number of SWB shipments per year in TRUPACT-II shipping containers for the WSB cemented waste could range from a low of 23 to a high of 178. The low end of the range assumes a 3 to 1 volume reduction of the H/A stream and that the shipments are only limited by a wattage limit of 40 W per TRUPACT II. The high end assumes no volume reduction of the blended stream (combining the High Alpha with the Stripped Uranium and PDCF Laboratory Liquid streams) and the shipments are limited by weight limit of 2000 pounds per SWB. In either case, the total annual americium mass is assumed to be constant, so the total annual dose ascribed to transportation effects should be constant.

[*Text removed under 10 CFR 2.390.]

The environmental impacts of transportation of waste from the SRS waste management facilities to ultimate disposal sites are documented in the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste*. DOE/EIS-0200-F and the SRS Waste Management FEIS (DOE 1995b). This included the transportation of TRU waste from the SRS site to WIPP for disposal. Although the waste volumes cited in the Waste Management PEIS are different than that being analyzed for the WSB (up to 178 shipments), a dose per shipment value can be calculated from the Waste Management PEIS and applied to the WSB shipments to WIPP. The Waste Management PEIS calculated the cumulative dose and lifetime risk to a Maximally Exposed Individual (MEI) living along the SRS site entrance who is assumed to be present for all the shipments. The dose per shipment[4] to this MEI is 1.5E-04 mrem based upon an assumed average dose rate of 3 mrem/hr at 1 meter (based on DOE 1997a). This dose rate can be approximated if the maximum annual Am throughput is distributed into 28 shipments. For 28 shipments of TRU waste, the total additional dose to the MEI is 4.2E-03 mrem which equates to an increase in lifetime cancer risk of 2.1E-09. The environmental impacts of these shipments to WIPP are within the range of error

[4] DOE 1997a, Table E-25 projects a dose of 3.6E-04 Rem for 2,370 shipments passing the MEI located at the site entrance for SRS in the decentralized option. This yields an average dose of 1.5E-07 Rem (1.5E-04 mrem) per shipment.

and bounded by the environmental impacts projected in the Waste Management PEIS (DOE 1997a).

The consequences from the most severe transportation accidents involving the transport of the TRU waste were also evaluated by DOE in the Waste Management PEIS. The transportation accidents involving TRU waste shipments from the WSB at SRS to WIPP are bounded by those analyzed in the Waste Management PEIS. The consequences from the most severe transportation accidents are summarized in Table G-15. For the accident analysis, the MEI is assumed to be located at the point of maximum exposure. The locations of maximum exposure were 160 m (525 ft) from the accident site under neutral atmospheric conditions, and 400 m (1,312 ft) for stable atmospheric conditions.

G.6 IMPACTS SUMMARY

The WSB will convert the radioactive liquid streams received from the MFFF and PDCF into solid waste that will be disposed as transuranic waste or low-level radioactive waste. The environmental impacts of constructing and operating the WSB are less than the projected impacts from the construction and operation of the Plutonium Immobilization Plant evaluated in the SPD EIS but subsequently cancelled.

The WSB will be constructed on five acres of the existing PDCF site. Potential impacts to local air quality and water quality during construction of the WSB are anticipated to be bounded by the impacts presented in the SPD EIS (DOE 1999c) for the immobilization plant. Any scrub vegetation located on the site will be removed. There should be no direct impacts on non-sensitive aquatic habitats because best-management practices for soil erosion and sediment control will be used to prevent construction runoff to these habitats, and direct construction disturbance would be avoided. There are no sensitive habitats located on the WSB site. The WSB will use the same roads and utility headers as the MFFF. Less than one acre of land will be used for new roads within the WSB boundary, beyond those described for the MFFF.

Construction wastes for the WSB are expected to be bounded by the values projected in the SPD EIS for the immobilization plant. It is anticipated that no TRU waste, LLW, or mixed LLW would be generated during the construction period. Hazardous wastes generated during construction would be typical of those generated during the construction of an industrial facility. Any hazardous wastes generated during construction would be packaged in DOT-approved containers and shipped offsite to permitted commercial recycling, treatment, and disposal facilities.

Maximum air pollutant concentrations resulting from operation of the WSB are anticipated to be bounded by the concentrations projected for the immobilization plant in the SPD EIS, with the exception of NO_X. The WSB offgas system design will include NO_X emission control equipment as needed to cost effectively control the WSB emissions so that SRS site boundary NO_X concentrations due to the WSB are less than 10% of the most stringent standard or guideline for total SRS site emissions. The potential airborne chemical emissions from waste processing are comprised of nitric acid, sodium hydroxide and dry cement. A chemical consequences analysis was performed and determined that the airborne releases from the WSB at both 100 m and the SRS boundary are well below the TEEL limits for each chemical.

The WSB design will include discharges of water (treated wastewater, HVAC condensate, storm water, etc.) to one or more NPDES outfalls. All liquid discharges to NPDES outfalls will meet state and federal regulations. The environmental impact of these discharges will be controlled by the NPDES permitting process. [Text deleted]

The dose to the public from WSB normal operations has been estimated to be within 40 CFR Part 61, Subpart H limits. The annual dose to facility workers in the WSB is estimated to be below 200 person-rem/yr). The average annual dose will be below the SRS guideline (currently 1000 mrem/year). The dose from the bounding accident (earthquake induced spill with a subsequent fire) was negligible to the onsite and offsite individuals.

Figures

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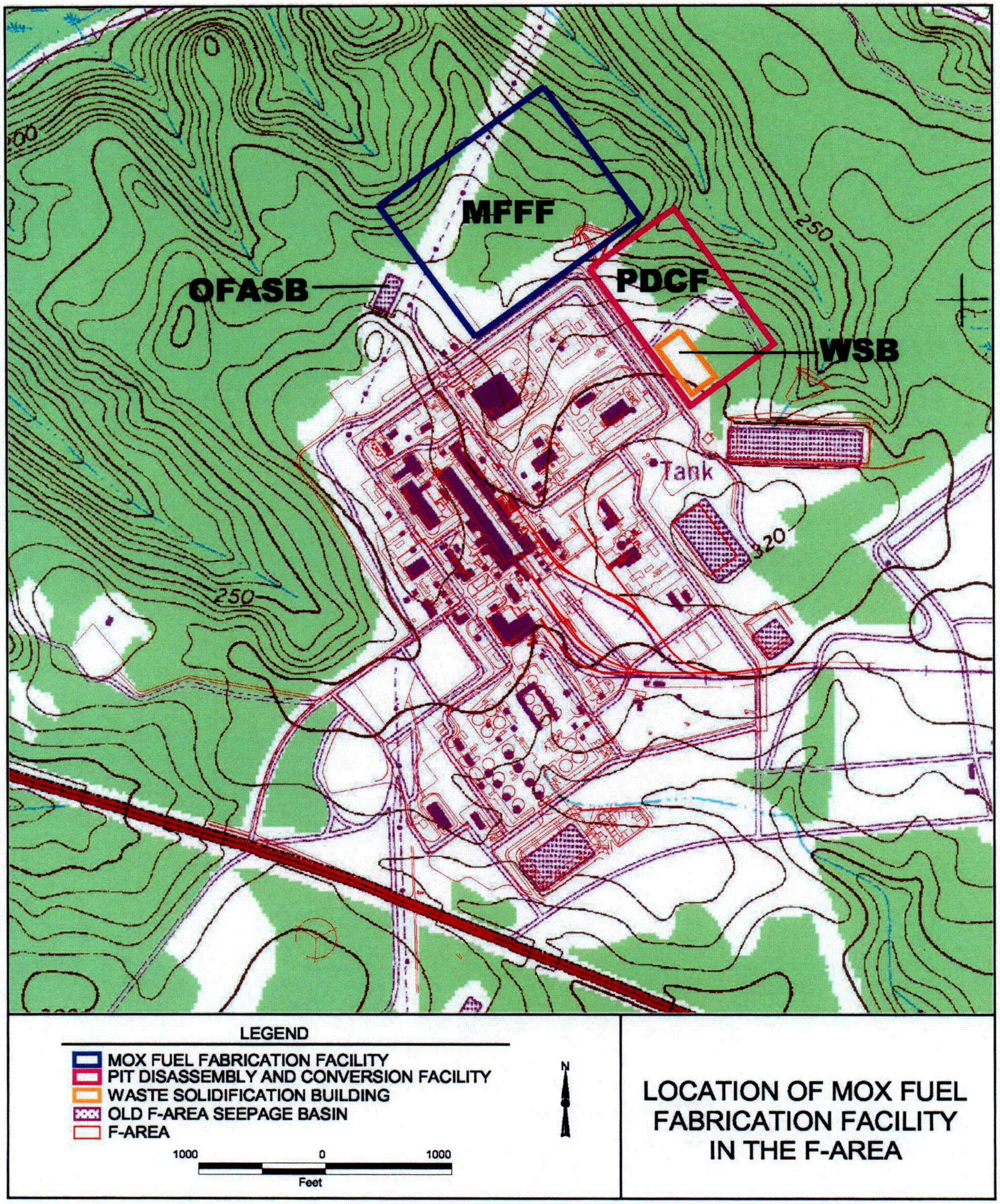

Figure G-1. Location of Waste Solidification Building in the F Area

C02

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Tables

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Table G-1. Liquid Waste Streams Processed by the Waste Solidification Building

[Table deleted]

Table G-2. Waste Treatment Chemicals

***Table removed under 10 CFR 2.390.**

Table G-3. Emissions (kg/yr) from Construction of the Waste Solidification Building

Pollutant	Diesel Equipment	Construction Fugitive Emissions	Concrete Batch Plant	Vehicles
Carbon Monoxide	20,300	0	0	48,700
Nitrogen dioxide	52,700	0	0	14,100
Sulfur dioxide	24,400	0	0	0
Volatile organic compounds	3,900	<1	0	6,520
Total suspended particulates	3,930	21,600	2,610	49,900

Source: DOE 1999c, Table G-61

Table G-4. Maximum Additional Site Infrastructure Requirements for WSB Construction in F Area at SRS

Resource	WSB	Availability[a]
Transportation[b]		
Roads (mi)	1	142
Electricity (MWh)	6.6	482,700
Diesel Fuel (gal/yr)	9,600	NA[c]
Water (gal/yr)	520,000	321,000,000

Source: DOE 1999c, Table E-12

[a] Capacity minus current usage

[b] WSB will use roads constructed for MFFF

[c] Not applicable due to the ability to procure additional resources.

Table G-5. Wastes Generated During Construction

Waste Type	Estimated Additional Waste Generation (m^3/yr)	Disposal Capacity (m^3/yr)
Hazardous	35	74
Nonhazardous		
Liquid	21,000	1,033,000 [a]
Solid	2,200	6,670

Source: DOE 1999c, Table H-29.

[a] Capacity of CSWTF.

Table G-6. Increments to Ambient Concentrations (μg/m³) from WSB Operation

[Table deleted]

Table G-7. Volume of WSB Tanks and Vessels

***Table removed under 10 CFR 2.390.**

Table G-8. PDCF Lab Liquids Waste Radionuclide Concentration

Radionuclide	Concentration (g/l)
Pu-238	8.94E-08
Pu-239	1.67E-04
Pu-240	1.18E-05
Pu-242	1.79E-07
Am-241	1.78E-06
U-234	1.54E-06
U-235	1.45E-04
U-236	7.68E-07
U-238	8.36E-06

Table G-9. PDCF Lab Concentrated Liquid Waste Radionuclide Concentration

[Table deleted]

Table G-10. MFFF Stripped Uranium Waste Stream Radionuclide Concentration

Radionuclide	Concentration (g/l)
Pu-238	6.19E-08
Pu-239	1.12E-04
Pu-240	1.13E-05
Pu-241	1.21E-06
U-234	7.31E-03
U-235	3.70E-01
U-238	3.63E+01

Table G-11. MFFF High Alpha Waste Stream Radionuclide Concentration

Radionuclide	Concentration (g/l)
Pu-238	2.45E-06
Pu-239	4.42E-03
Pu-240	4.43E-04
Pu-241	4.79E-05
Am-241	5.42E-01
U-234	1.46E-06
U-235	7.40E-05
U-238	7.26E-03

Table G-12. High Activity Evaporation Process Concentrations

Radionuclide	Feed Concentration (with 3X dilution) (g/L)	Bottoms Concentration (g/L)	Overhead Concentration (g/L)
Pu-238	8.16E-07	6.83E-06	6.83E-10
Pu-239	1.47E-03	1.24E-02	1.24E-06
Pu-240	1.48E-04	1.25E-03	1.25E-07
Pu-241	1.60E-05	1.34E-04	1.34E-08
Am-241	1.81E-01	1.52E+00	1.52E-04
U-234	4.88E-07	7.84E-05	7.84E-09
U-235	2.47E-05	3.96E-03	3.96E-07
U-238	2.42E-03	3.90E-01	3.90E-05

Table G-13. Source Term for a Loss of Confinement Event

I. Low Activity Receipt and Head Tanks Splashing Source Term

Radionuclide	Concentration (g/L)	Volume (L)	DR	ARF	RF	LPF	Quantity Released (g)
Am-241	0.00E+00	6.24E+04	1.0	2.0E-04	0.5	1.0	0.00E+00
Pu-238	6.19E-08	6.24E+04	1.0	2.0E-04	0.5	1.0	3.86E-07
Pu-239	1.12E-04	6.24E+04	1.0	2.0E-04	0.5	1.0	7.01E-04
Pu-240	1.13E-05	6.24E+04	1.0	2.0E-04	0.5	1.0	7.04E-05
Pu-241	1.21E-06	6.24E+04	1.0	2.0E-04	0.5	1.0	7.57E-06
Pu-242	0.00E+00	6.24E+04	1.0	2.0E-04	0.5	1.0	0.00E+00
U-234	7.31E-03	6.24E+04	1.0	2.0E-04	0.5	1.0	4.56E-02
U-235	3.70E-01	6.24E+04	1.0	2.0E-04	0.5	1.0	2.31E+00
U-236	0.00E+00	6.24E+04	1.0	2.0E-04	0.5	1.0	0.00E+00
U-238	3.63E+01	6.24E+04	1.0	2.0E-04	0.5	1.0	2.26E+02

II. Low Activity Receipt and Head Tanks Resuspension Source Term

Radionuclide	Concentration (g/L)	Volume (L)	DR	ARR	RF	Time (hr)	LPF	Quantity Released (g)
Am-241	0.00E+00	6.24E+04	1.0	4.0E-07	1.0	8.0	1.0	0.00E+00
Pu-238	6.19E-08	6.24E+04	1.0	4.0E-07	1.0	8.0	1.0	1.24E-08
Pu-239	1.12E-04	6.24E+04	1.0	4.0E-07	1.0	8.0	1.0	2.24E-05
Pu-240	1.13E-05	6.24E+04	1.0	4.0E-07	1.0	8.0	1.0	2.25E-06
Pu-241	1.21E-06	6.24E+04	1.0	4.0E-07	1.0	8.0	1.0	2.42E-07
Pu-242	0.00E+00	6.24E+04	1.0	4.0E-07	1.0	8.0	1.0	0.00E+00
U-234	7.31E-03	6.24E+04	1.0	4.0E-07	1.0	8.0	1.0	1.46E-03
U-235	3.70E-01	6.24E+04	1.0	4.0E-07	1.0	8.0	1.0	7.38E-02
U-236	0.00E+00	6.24E+04	1.0	4.0E-07	1.0	8.0	1.0	0.00E+00
U-238	3.63E+01	6.24E+04	1.0	4.0E-07	1.0	8.0	1.0	7.25E+00

III. Low Activity Bottoms Splashing Source Term

Radionuclide	Concentration (g/L)	Volume (L)	DR	ARF	RF	LPF	Quantity Released (g)
Am-241	0.00E+00	4.50E+03	1.0	2.0E-04	0.5	1.0	0.00E+00
Pu-238	6.83E-07	4.50E+03	1.0	2.0E-04	0.5	1.0	3.08E-07
Pu-239	1.24E-03	4.50E+03	1.0	2.0E-04	0.5	1.0	5.57E-04
Pu-240	1.25E-04	4.50E+03	1.0	2.0E-04	0.5	1.0	5.61E-05
Pu-241	1.34E-05	4.50E+03	1.0	2.0E-04	0.5	1.0	6.03E-06
Pu-242	0.00E+00	4.50E+03	1.0	2.0E-04	0.5	1.0	0.00E+00
U-234	7.92E-02	4.50E+03	1.0	2.0E-04	0.5	1.0	3.57E-02
U-235	4.00E+00	4.50E+03	1.0	2.0E-04	0.5	1.0	1.80E+00
U-236	0.00E+00	4.50E+03	1.0	2.0E-04	0.5	1.0	0.00E+00
U-238	3.93E+02	4.50E+03	1.0	2.0E-04	0.5	1.0	1.77E+02

Table G-13. Source Term for a Loss of Confinement Event (cont'd)

IV. Low Activity Bottoms Resuspension Source Term

Radionuclide	Concentration (g/L)	Volume (L)	DR	ARR	RF	Time (hr)	LPF	Quantity Released (g)
Am-241	0.00E+00	4.50E+03	1.0	4.0E-07	1.0	8.0	1.0	0.00E+00
Pu-238	6.83E-07	4.50E+03	1.0	4.0E-07	1.0	8.0	1.0	9.84E-09
Pu-239	1.24E-03	4.50E+03	1.0	4.0E-07	1.0	8.0	1.0	1.78E-05
Pu-240	1.25E-04	4.50E+03	1.0	4.0E-07	1.0	8.0	1.0	1.79E-06
Pu-241	1.34E-05	4.50E+03	1.0	4.0E-07	1.0	8.0	1.0	1.93E-07
Pu-242	0.00E+00	4.50E+03	1.0	4.0E-07	1.0	8.0	1.0	0.00E+00
U-234	7.92E-02	4.50E+03	1.0	4.0E-07	1.0	8.0	1.0	1.14E-03
U-235	4.00E+00	4.50E+03	1.0	4.0E-07	1.0	8.0	1.0	5.76E-02
U-236	0.00E+00	4.50E+03	1.0	4.0E-07	1.0	8.0	1.0	0.00E+00
U-238	3.93E+02	4.50E+03	1.0	4.0E-07	1.0	8.0	1.0	5.65E+00

V. Low Activity Overheads Splashing Source Term

Radionuclide	Concentration (g/L)	Volume (L)	DR	ARF	RF	LPF	Quantity Released (g)
Am-241	0.00E+00	2.27E+034	1.0	2.0E-04	0.5	1.0	0.00E+00
Pu-238	6.83E-11	2.27E+03	1.0	2.0E-04	0.5	1.0	1.55E-11
Pu-239	1.24E-07	2.27E+03	1.0	2.0E-04	0.5	1.0	2.81E-08
Pu-240	1.25E-08	2.27E+03	1.0	2.0E-04	0.5	1.0	2.83E-09
Pu-241	1.34E-09	2.27E+03	1.0	2.0E-04	0.5	1.0	3.04E-10
Pu-242	0.00E+00	2.27E+03	1.0	2.0E-04	0.5	1.0	0.00E+00
U-234	7.92E-06	2.27E+03	1.0	2.0E-04	0.5	1.0	1.80E-06
U-235	3.96E-04	2.27E+03	1.0	2.0E-04	0.5	1.0	8.99E-05
U-236	0.00E+00	2.27E+03	1.0	2.0E-04	0.5	1.0	0.00E+00
U-238	3.93E-02	2.27E+03	1.0	2.0E-04	0.5	1.0	8.91E-03

VI. Low Activity Overheads Resuspension Source Term

Radionuclide	Concentration (g/L)	Volume (L)	DR	ARR	RF	Time (hr)	LPF	Quantity Released (g)
Am-241	0.00E+00	2.27E+03	1	4.0E-07	1.0	8.0	1.0	0.00E+00
Pu-238	6.83E-11	2.27E+03	1	4.0E-07	1.0	8.0	1.0	4.96E-13
Pu-239	1.24E-07	2.27E+03	1	4.0E-07	1.0	8.0	1.0	9.00E-10
Pu-240	1.25E-08	2.27E+03	1	4.0E-07	1.0	8.0	1.0	9.05E-11
Pu-241	1.34E-09	2.27E+03	1	4.0E-07	1.0	8.0	1.0	9.73E-12
Pu-242	0.00E+00	2.27E+03	1	4.0E-07	1.0	8.0	1.0	0.00E+00
U-234	7.92E-06	2.27E+03	1	4.0E-07	1.0	8.0	1.0	5.75E-08
U-235	3.96E-04	2.27E+03	1	4.0E-07	1.0	8.0	1.0	2.88E-06
U-236	0.00E+00	2.27E+03	1	4.0E-07	1.0	8.0	1.0	0.00E+00
U-238	3.93E-02	2.27E+03	1	4.0E-07	1.0	8.0	1.0	2.85E-04

Table G-14. Facility Fire Source Term

I. Low Activity Receipt and Head Tanks Fire Source Term

Radionuclide	Concentration (g/L)	Volume (L)	DR	ARF	RF	LPF	Quantity Released (g)
Am-241	0.00E+00	6.24E+04	1.0	2.0E-03	1.0	1.0	0.00E+00
Pu-238	6.19E-08	6.24E+04	1.0	2.0E-03	1.0	1.0	7.73E-06
Pu-239	1.12E-04	6.24E+04	1.0	2.0E-03	1.0	1.0	1.40E-02
Pu-240	1.13E-05	6.24E+04	1.0	2.0E-03	1.0	1.0	1.41E-03
Pu-241	1.21E-06	6.24E+04	1.0	2.0E-03	1.0	1.0	1.51E-04
Pu-242	0.00E+00	6.24E+04	1.0	2.0E-03	1.0	1.0	0.00E+00
U-234	7.31E-03	6.24E+04	1.0	2.0E-03	1.0	1.0	9.13E-01
U-235	3.70E-01	6.24E+04	1.0	2.0E-03	1.0	1.0	4.61E+01
U-236	0.00E+00	6.24E+04	1.0	2.0E-03	1.0	1.0	0.00E+00
U-238	3.63E+01	6.24E+04	1.0	2.0E-03	1.0	1.0	4.53E+03

II. Low Activity Bottoms Fire Source Term

Radionuclide	Concentration (g/L)	Volume (L)	DR	ARF	RF	LPF	Quantity Released (g)
Am-241	0.00E+00	4.50E+03	1.0	2.0E-03	1.0	1.0	0.00E+00
Pu-238	6.83E-07	4.50E+03	1.0	2.0E-03	1.0	1.0	6.15E-06
Pu-239	1.24E-03	4.50E+03	1.0	2.0E-03	1.0	1.0	1.11E-02
Pu-240	1.25E-04	4.50E+03	1.0	2.0E-03	1.0	1.0	1.12E-03
Pu-241	1.34E-05	4.50E+03	1.0	2.0E-03	1.0	1.0	1.21E-04
Pu-242	0.00E+00	4.50E+03	1.0	2.0E-03	1.0	1.0	0.00E+00
U-234	7.92E-02	4.50E+03	1.0	2.0E-03	1.0	1.0	7.13E-01
U-235	4.00E+00	4.50E+03	1.0	2.0E-03	1.0	1.0	3.60E+01
U-236	0.00E+00	4.50E+03	1.0	2.0E-03	1.0	1.0	0.00E+00
U-238	3.93E+02	4.50E+03	1.0	2.0E-03	1.0	1.0	3.53E+03

III. Low Activity Overheads Fire Source Term

Radionuclide	Concentration (g/L)	Volume (L)	DR	ARF	RF	LPF	Quantity Released (g)
Am-241	0.00E+00	2.27E+04	1.0	2.0E-03	1.0	1.0	0.00E+00
Pu-238	6.83E-11	2.27E+03	1.0	2.0E-03	1.0	1.0	3.10E-10
Pu-239	1.24E-07	2.27E+03	1.0	2.0E-03	1.0	1.0	5.62E-07
Pu-240	1.25E-08	2.27E+03	1.0	2.0E-03	1.0	1.0	5.66E-08
Pu-241	1.34E-09	2.27E+03	1.0	2.0E-03	1.0	1.0	6.08E-09
Pu-242	0.00E+00	2.27E+03	1.0	2.0E-03	1.0	1.0	0.00E+00
U-234	7.92E-06	2.27E+03	1.0	2.0E-03	1.0	1.0	3.60E-05
U-235	3.96E-04	2.27E+03	1.0	2.0E-03	1.0	1.0	1.80E-03
U-236	0.00E+00	2.27E+03	1.0	2.0E-03	1.0	1.0	0.00E+00
U-238	3.93E-02	2.27E+03	1.0	2.0E-03	1.0	1.0	1.78E-01

Table G-15. Estimated Consequences for the Most Severe Accidents Involving Truck Shipments of TRU Waste

Accident Location	Neutral Conditions				Stable Conditions			
	Population		MEI		Population		MEI	
	Dose (person-rem)	Risk (cancer fatalities)	Dose (rem)	Risk (cancer fatalities)	Dose (person-rem)	Risk (cancer fatalities)	Dose (rem)	Risk (cancer fatalities)
Urban	4.0E+03	2.0E+00	3.5E+00	1.8E-03	3.2E+04	1.6E+01	1.2E+01	6.0E-03
Suburban	7.4E+02	3.7E-01	3.5E+00	1.8E-03	5.9E+03	3.0E+00	1.2E+01	6.0E-03
Rural	6.5E+00	3.0E-03	3.5E+00	1.8E-03	5.2E+01	3.0E-02	1.2E+01	6.0E-03

Source: DOE 1997a, Table E-26

Table G-16. Summary of Consequences for WSB Bounding Credible Events

Accident Event	Maximum Impact to Site Worker (rem)	Maximum Impact to Public at SRS Boundary (rem)
Loss of Confinement (Spill)	2.39E-02	4.83E-05
LA Process Area Fire	5.05E-01	9.32E-04
Earthquake induced spill and fire	5.29E-01	9.8E-04

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