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Document Title: ____Mixed Oxide Fuel Fabrication Facility Environmental Report______________________

Revision Number ____3_____ Quality Level ____NA________ Revision Date ___20 June 2003___

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This transmittal includes the following documents and instructions:

Remove and Insert per the Instruction Sheet, for Revision 3, Mixed Oxide Fuel Fabrication Facility Environmental Report

Please return your transmittal within twenty calendar days per the date of this transmittal.

Return acknowledgement to: Duke Cogema Stone & Webster OR
Attention: _Tanya R. Mitchell/FC12A
128 S. Tryon Street
Charlotte, NC 28202

E-Mail to: tmitchel@duke-energy.com
or
Fax to: 704-373-5686

NMSS01

24 copies are to D Persinko

Form PP7-4A
Revision 3

Duke Cogema Stone & Webster

Mixed Oxide Fuel Fabrication Facility Environmental Report, Revision 3

Docket Number 070-03098

Prepared by
Duke Cogema Stone & Webster
400 South Tryon Street
Charlotte, NC 28202

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

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

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U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

20 June 2003
DCS-NRC-000143
Response Required: *No*

SUBJECT: Docket Number 070-03098
Duke Cogema Stone and Webster
Mixed Oxide Fuel Fabrication Facility
Revision 3 of *Mixed Oxide Fuel Fabrication Facility Environmental Report*
(Change Pages to Revisions 1&2)

Enclosed are 25 copies of change pages for Mixed Oxide Fuel Fabrication Facility Environmental Report. Revision 2 of the ER (incorporating Revision 1) was provided to the Nuclear Regulatory Commission (NRC) on 11 July 2002 (DCS-NRC-000102). The enclosed change pages, which constitute Revision 3, provide the following:

1. Update the document to include responses provided previously to NRC Staff Requests for Additional Information on Revisions 1&2.

2. Update the document to include corrections to Revisions 1&2 that were previously sent to NRC.

3. Update the document in response to questions from the NRC Staff preceding the public meetings on the *Draft Environmental Impact Statement on the Construction and Operation of a Mixed Oxide Fuel Fabrication Facility at the Savannah River Site, South Carolina* (Draft EIS), where Duke Cogema Stone and Webster (DCS) determined that Revision 2 contained an error in ER Table D-1. In the table, wind speed is identified as meters/second but should be miles/hour. This correction was previously conveyed to the Staff by telephone.

4. Update the document to reflect the latest design of the Department of Energy's Waste Solidification Building.

Additionally, DCS has received confirmation from the South Carolina Department of Health and Environmental Control (SCDHEC) that the Mixed Oxide Fuel Fabrication Facility does not need a Clean Water Act 401 Certification. The SCDHEC letter is also enclosed.

PO Box 31847
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If you have any questions, please contact me at 704-373-7820 or Mary Birch at 704-382-1401.

Sincerely,

Peter S. Hastings, P.E.
Manager, Licensing and Safety Analysis

Enclosures: (1) Change pages constituting Revision 3 of the MFFF ER (25 copies)
(2) Letter from Mr. Q. Epps (SCDHEC)

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	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)

Mixed Oxide Fuel Fabrication Facility Environmental Report, Revision 3
Instructions for Page Insertions

Revision 3 of the Mixed Oxide Fuel Fabrication Facility Environmental Report consists of changes to reflect updates and responses to Requests for Additional Information that have been provided to NRC since the publication of Revision 2. The following Table provides instruction on how to change the pages in the Mixed Oxide Fuel Fabrication Facility Environmental Report.

Remove Page(s)	Insert New Page(s)
Revision 2 Description Sheet	Revision 3 Description Sheet
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3-11, 3-12	3-11, 3-12
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D-25, D-26	D-25, D-26
F-5, F-6	F-5, F-6
F-7, F-8	F-7, F-8
F-9, F-10	F-9, F-10
G-1 through G-54	G-1 through G- 52

	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

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3.2.1 Pretreatment for Alternative Feedstock

All feedstock will be received as plutonium oxide. Some of the alternative feedstock may contain higher than normal salt contaminants, some will contain chloride contaminants, and some will contain trace amounts of enriched uranium. All alternate feedstock will be milled to a uniform particle size to facilitate dissolution. The alternative feedstock will be analyzed for contaminants. R2

If chloride contaminants are above feedstock specifications they are removed as a chlorine gas waste steam. The chlorine gas is passed through a scrubber to convert the chlorine to a sodium chloride solution. R2

If the chloride contaminants are within feedstock specifications the feed stock is processed as described in 3.2.2.

3.2.2 Plutonium Polishing

Plutonium polishing is schematically represented in Figure 3-5. The polishing process can be divided into five discrete steps:

1. Plutonium oxide (PuO_2) is first electrochemically dissolved in nitric acid.
2. The plutonium nitrate solution is solvent extracted using tributyl phosphate in an aliphatic diluent (dodecane) to remove impurities. The solution containing plutonium nitrate is washed with nitric acid. The plutonium is removed from the solvent by an aqueous solution of hydroxylamine nitrate, hydrazine, and nitric acid.
3. The plutonium valence is oxidized back to Pu(IV) by driving nitrous fumes (NO_x) through the plutonium solution.
4. The plutonium is then precipitated with excess oxalic acid as plutonium oxalate that is collected on a filter.
5. The moist oxalate is dried and calcined to PuO_2 that is packaged in cans for use in the MOX fuel fabrication process.

The plutonium losses and liquid waste generation are maintained as low as technically and economically possible by specific solvent treatment and by reuse of nitric acid and silver in the polishing process. The MFFF design has a very stringent requirement imposed for plutonium loss in accordance with the DOE contract. The various liquid waste streams from the aqueous polishing process are illustrated in Figure 3-6, listed in Table 3-3, and described in the following paragraphs.

Plutonium oxide (PuO_2) is milled (only AFS feeds), analyzed, dechlorinated if necessary and electrochemically dissolved with silver (Ag^{2+}) in nitric acid. A solvent (tributyl phosphate) in an aliphatic diluent (dodecane) then extracts the plutonium nitrate from the nitrate solution. Nitrate R2 impurities (i.e., americium, gallium, and silver) remain in the aqueous (i.e., raffinate) phase. After diluent washing, the raffinate stream is routed to an acid recovery unit.

The extracted plutonium is washed with nitric acid. The plutonium is then reduced to trivalent plutonium by the introduction of hydroxylamine nitrate. The plutonium is removed from the solvent using a solution of nitric acid, hydrazine, and hydroxylamine nitrate. The organic solvent that has had the plutonium removed is mixed with an additional stripping solution in a plutonium barrier before being routed to the uranium removal process. Uranium impurities are removed from the organic solvent with dilute nitric acid. Criticality is an issue because of the high uranium-235 content of the stream. It is therefore necessary to perform an isotopic dilution through the addition of depleted uranium to reduce the uranium-235 concentration to below 30%. The solvent that has had the plutonium and uranium removed is routed to solvent recovery mixer-settlers to be recycled back into the process. R3

For uranium-rich feeds, a scrubbing column allows uranium to be removed to maintain the uranium content specification in the purified Pu stream. For batches with low uranium content, this column is by-passed. R2

After the extraction steps, the plutonium is oxidized back to quadravalent plutonium by driving nitrous fumes (NO_x) through the plutonium solution. Nitrous acid is removed in an air-stripping column. The NO_x-containing gas stream is demisted to limit plutonium loss, then treated through an NO_x scrubbing column, before being released to the process offgas treatment unit. Recombined acid is routed to acid recovery.

The oxidized plutonium is reacted with excess oxalic acid ($H_2C_2O_4$) to precipitate plutonium oxalate, which is collected on a filter, then dried in a screw calciner, to produce purified plutonium oxide powder (PuO_2), which is stored in cans. Offgas from the screw calciner is treated before discharge to the downstream Very High Negative Pressure main filters. The filtered oxalic mother liquors are concentrated, reacted with manganese to destroy the oxalic acid, and recycled to the beginning of the extraction cycle to minimize plutonium loss from the process.

3.2.3 Material Recovery and Recycling

3.2.3.1 Acid Recovery

Spent acid, consisting of oxalic mother liquor distillates, raffinates, calcination concentrates, and recombined acid, is mixed in a buffering tank and injected into an evaporator. The first evaporator of the acid recovery unit is a concentration step. Trace impurities removed in this process constitute the liquid americium stream of the high alpha waste. R3

[4] Footnote deleted.

After an additional evaporation step, the vapor is injected into a distillation column dedicated to acid rectification. Nitric acid is recovered from the rectification evaporator bottoms and partly reused as reagent feedstock for the plutonium dissolution subprocess. Distillates from the rectification evaporator are collected and partly reused in the process. The offgas is routed to a cooler and a demister before treatment. Process ventilation offgas treatment is described in Section 3.2.5.

Any nitric acid not reused is transferred to SRS for waste treatment as the excess acid component of the liquid high alpha waste. R2

3.2.3.2 Silver Recovery

[Text deleted] R3

3.2.3.3 Stripped Uranium Collection

Before the commencement of the purification cycle, HEU impurities, which are present in the plutonium, are stripped from the plutonium and isotopically diluted to approximately 30% with depleted uranium. After the uranium stripping process, uranium removed from the plutonium stream is diluted with depleted uranium to approximately 1%. The diluted uranium is collected in storage vessels prior to subsequent processing within the SRS waste management infrastructure. R1 R2

3.2.3.4 Solvent Regeneration

The regeneration of spent solvent from the plutonium separation step is accomplished by washing with sodium carbonate, sodium hydroxide, and nitric acid to remove degradation products from organic compounds, including trace amounts of plutonium and uranium. These degradation products are the alkaline wash component of the liquid high alpha waste (see Section 3.3.2.3). The regenerated solvent is adjusted with the addition of tributyl phosphate and reused in the purification process. R1

3.2.4 MOX Fuel Fabrication

The remaining steps in the MOX fuel fabrication process (i.e., powder, pellet, and rod processing) are dry subprocesses and are illustrated in Figure 3-7. The solid wastes produced from these steps are listed in Table 3-4.

Polished plutonium oxide is mixed with uranium oxide and recycled scraps to produce an initial MOX mixture that is 20% plutonium. This mixture is subjected to a micronized homogenization process in a ball mill and mixed with additional uranium oxide and recycled scraps to produce a final blend with the required plutonium content of 2.3% to 4.8%. The MFFF design is capable of producing MOX with a plutonium content of 6%. This final blend is further homogenized to meet the stringent plutonium distribution requirements. During the final homogenization process, lubricants and poreformers are added to control specific gravity.

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Powder processing is performed in closed containers located in gloveboxes to contain any contamination. Gaseous exhaust points from the gloveboxes are equipped with HEPA filters to contain particulate emissions.

The homogenized powder is pneumatically transferred from the homogenizer to the press feeding hopper under negative pressure. The powder is then transferred by gravity to the press shoe.

The sintering process is performed in a furnace by heating the fuel pellets to a temperature of 3,092°F (1,700°C) under gas scavenging, using a nonexplosive mixture of argon and hydrogen. This specific furnace atmosphere controls sintering and pellet stoichiometry and is not subject to inadvertent detonations and deflagrations due to low hydrogen content. The pellet boats, which contain 22 lb (10 kg) of pellets each, are positioned on a molybdenum plate and then transferred to the furnace. An inlet and outlet furnace airlock is required for changes in atmospheric pressure. A pusher system provides continuous motion of the sets (i.e., boat on shoe) through the furnace. The last set introduced in the furnace pushes the preceding ones.

The sintered pellets are dry ground to meet the size and roughness of the fuel specifications for the specific reactor. The grinding process is performed in four dedicated gloveboxes. A dust removal system, composed of an extractor and a decloggable filter, is installed in the unit to minimize the spread of powder in the gloveboxes. This dust abatement technique minimizes waste production in the form of disposable filters and allows recovery and recycle of the captured dust. Grinding dust and pellet chips are routed back as feedstock to the scrap recycling process.

Pellet processing is performed in gloveboxes with HEPA filters on the vents to contain any dust. Glovebox exhausts are equipped with HEPA filters to contain any particulate emissions.

After the pellets are ground, they are automatically and visually inspected and sorted. Pellets that meet specifications are lined up and loaded into rods. Discarded pellets are routed to scrap processing and reintroduced to the blending feedstock (see Figure 3-7).

Within a glovebox environment, the rods are capped, welded, pressurized with helium, sealed, and then decontaminated. The decontaminated rods are removed from the gloveboxes and placed on trays for inspection and assembly.

Rods are inspected by testing for leaks and performing x-ray analysis of welds. The rods are then gamma-scanned to ensure that the plutonium content and length of the pellet column are

Table 3-1. Key MFFF Design and Operation Parameters

Parameter	Projected Value
Site area (ac)	41
Building total floor area (ft^2)	441,000
Building footprint (ft^2)	145,000
Stack height (ft)	120
Electricity (MWh/yr)	130,000
Fuel oil (gal /yr)	111,000
Maximum projected water consumption (gal /yr)	2,438,410
Total employees	400

R2

R3

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%)	700 gal	60 gal
Hydroxylamine nitrate (1.9 M)	6100 gal	180 gal
Manganese nitrate (1M)	7 gal	1 gal
Nitric acid (13.6N)	3720 gal	126 gal
Nitrogen	160,000,000 scf	500,000 lbs (liquid)
Nitrogen Tetroxide	147,000 scf	4,000 lbs (liquid)
Oxalic acid	9,000 lb	850 lb
Oxygen	30,500 scf	12,500 scf
Porogen (MP only)	310 lbs	440 lbs
Silver nitrate (10M) [1]	75 gal	7 gal
Sodium carbonate	430 lb	40 lb
Sodium hydroxide (10M)	800 gal	150 gal
Tributyl Phosphate	700 gal	126 gal
Zinc Stearate (MP only)	460 lbs	660 lbs

Table 3-3. Aqueous Polishing Waste Streams

Waste Stream	Maximum Annual Volume (gal)[c]	Main Chemical or Isotope Concentration or Annual Quantity	Disposition (gal)	
Liquid americium stream Concentrated stream from acid recovery after silver recovery[a]	10,000 (PDCF) 16,520 (AFS)	Am-241: < 24.5 kg/yr (84,000 Ci) Pu: < 205 g/yr Hydrogen ions: 180,000 moles [H^+]/yr Nitrate salts: 1,500 kg/yr+ nitrates from silver Silver: < 300 kg/yr Trace quantities of thallium, lead and mercury	**High Alpha Waste to WSB** **15,358(PDCF)** **21,841 (AFS)**	R1, R3
Excess acid stream	1,321 (AFS) 2,378 (PDCF)	Am: < 14 mg/y (rectification step after two evaporation steps) Hydrogen ions: 13.6 N		
Alkaline stream	2,980 (PDCF) 4,000 (AFS)	Pu: < 16 g/yr U: < 13 g/yr Na: < 147 kg/yr		R2
Stripped uranium stream	42,530 (PDCF) 46,000 (AFS))	Plutonium: < 0.1 mg/L Stripped U quantity: < 5,000 kg/yr [~1% U-235] Hydrogen ions: 26,000 moles [H^+]/yr	**Stripped Uranium to WSB** **42,530 (PDCF)** **46,000 (AFS)**	
Excess low-level radioactive solvent wastes	2,700 (PDCF) 3,075 (AFS)	Solvent: 30% tributyl phosphate in dodecane Pu: < 17.2 mg/yr	**SRS Solvent Recovery** **2,700 (PDCF)** **3,075 (AFS)**	R1
Distillate waste[b]	109,000 (PDCF) 111,000 (AFS)	Am-241: < 0.85 mg/yr Activity 1. 12 x 10^8 Bq/yr [H+] = <6,240 moles [H^+]/yr	**Liquid LLW to ETF** **292,000 (PDCF)** **385,800 (AFS)**	R2, R3
Chloride removal waste	76,000 (AFS)	This waste is produced only when alternate feedstock with chlorides is used. < 0.75 g/L (will be diluted with distillate and rinse water to <0.15 g/L to meet ETF WAC)		
Rinsing water[b]	158,000 (PDCF) 173,800 (AFS)	Alpha activity: < 4 Bq α/L		
Internal HVAC condensate	25,000	Trace contamination		

[a] DOE may eliminate silver recovery. silver quantity represents that expected if silver recovery is eliminated. volumes include silver recovery for bounding purposes.

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

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

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 122 yd^3 134 yd^3 (max)
Zirconium swarfs and samples	2 yd^3 4 yd^3 (max)	< 0.2	
Stainless Steel Inner and Outer Cans	10 yd^3	< 0.2	
Building and U area ventilation filters	100 yd^3	< 0.3	
Miscellaneous LLW	< 1 yd^3 2 yd^3 (max)	< 0.2	
Cladding area TRU	9 yd^3 11yd^3 (max)	< 2.8	Solid TRU Waste 205 yd^3 248 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 50 yd^3 (max)	approximately 600	
Miscellaneous TRU waste	1.6 yd^3 6.6 yd^3 (max)	approximately 600	

R2

R1

[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. R1

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

planning also occurs within the state, which is divided into 10 planning districts guided by regional advisory councils (DOE 1996b). The counties of Aiken, Allendale, and Barnwell together constitute part of the Lower Savannah River Council of Governments. Private lands bordering SRS are subject to the planning regulations of these three counties.

No onsite areas are subject to Native American Treaty Rights. However, five Native American groups (the Yuchi Tribal Organization, the National Council of Muskogee Creek, the Indian Peoples Muskogee Tribal Town Confederacy, the Pee Dee Indian Association, and the Ma Chis Lower Alabama Creek Indian Tribe) have expressed concern over sites and items of religious significance on SRS. DOE routinely notifies these organizations about major planned actions at SRS and asks them to comment on SRS documents prepared in accordance with NEPA.

4.2.2 Proposed Facility Location

Land use in F Area is industrial, as described previously in Section 3.5.10.1.2 of the SPD EIS (DOE 1999c). Many buildings are situated within F Area. Included is Building 221-F, one of the canyons where plutonium was recovered from targets during DOE's plutonium production phase. Land use at Building 221-F in F Area is classified as heavy industrial.

F Area occupies approximately 395 ac (160 ha) of SRS. The proposed MFFF will occupy a 41-ac (16.6-ha) area just north of the cancelled Actinide Packaging and Storage Facility (DOE 2002a). R2

During 2000 and 2001 SRS staff conducted soil sampling at 50 locations associated with the Plutonium Disposition Project (Fledderman 2002). Thirteen of these sample locations were on the MFFF site. At each location, a shallow core sample (12 inches deep) was collected and analyzed for a detailed suite of nonradiological analytes; each core also was split into 3-inch segments, and each segment was analyzed for a detailed suite of radiological analytes. Soil samples were collected as a one-time event. Observed concentrations of Pu-239 ranged from R3 below the detection limit to 4.38E+03 pCi/kg with a mean of 1.25E+02 pCi/kg. Likewise, Am-241 ranged from below the detection limit to 7.66E+02 pCi/kg with a mean of 2.61E+01 pCi/kg. Nonradiological toxic contaminants were well below EPA guidelines for soil at remediated sites (EPA 2000)

4.3 GEOLOGY

Section 3.5.6 of the SPD EIS (DOE 1999c) describes the geology of the MFFF site. Section 1.4.3 of the SRS GSAR (WSRC 1999a) provides a comprehensive presentation of the regional and SRS site geology. This section presents an overview of the site geology as presented in these two references and based on a detailed geotechnical program conducted in calendar year 2000 to provide site-specific design information for the MFFF site (WSRC 2000). R1

4.3.1 Regional Geology

The southeastern continental margin, within a 200-mi (322-km) radius of SRS, contains portions of all the major divisions of the Appalachian orogen (mountain belt) in addition to the elements that represent the evolution to a passive margin.

Within the Appalachian orogen, several lithotectonic terranes that have been extensively documented include the foreland fold belt (Valley and Ridge) and western Blue Ridge Precambrian-Paleozoic continental margin; the eastern Blue Ridge-Chauga Belt-Inner Piedmont terrane; the volcanic-plutonic Carolina Terrane; and the geophysically defined basement terrane beneath the Atlantic Coastal Plain. These geological divisions record a series of compressional and extensional events that span the Paleozoic. The modern continental margin includes the Triassic-Jurassic rift basins that record the beginning of extension and continental rifting during

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the early to middle Mesozoic. The offshore Jurassic-Cretaceous clastic-carbonate bank sequence covered by younger Cretaceous and Tertiary marine sediments, and the onshore Cenozoic sediments represent a prograding shelf-slope and the final evolution to a passive margin. Other offshore continental margin elements include the Florida-Hatteras shelf and slope and the unusual Blake Plateau basin and escarpment.

The two predominant processes sculpting the landscape during this tectonically quiet period included erosion of the newly formed highlands and subsequent deposition of the sediments on the coastal plain to the east. The passive margin region consists of a wedge of Cretaceous and Cenozoic sediments that thickens from near zero at the Fall Line to about 1,100 ft (335 m) in the center of SRS, and to approximately 4,000 ft (1,219 m) at the South Carolina coast. The fluvial to marine sedimentary wedge consists of alternating sand and clay with tidal and shelf carbonates common in the downdip Tertiary section.

4.3.1.1 Coastal Plain Stratigraphy

The sediments of the Atlantic Coastal Plain in South Carolina are stratified sand, clay, limestone, and gravel that dip gently seaward and range in age from Late Cretaceous to Recent. The sedimentary sequence thickens from essentially zero at the Fall Line to more than 4,000 ft (1,219 m) at the coast. Regional dip is to the southeast, although beds dip and thicken locally in other directions because of locally variable depositional regimes and differential subsidence of basement features such as the Cape Fear Arch and the South Georgia Embayment.

The Coastal Plain sedimentary sequence near the center of the region (i.e., SRS) consists of about 700 ft (213 m) of Upper Cretaceous quartz sand, pebbly sand, and kaolinitic clay, overlain by about 60 ft (18 m) of Paleocene clayey and silty quartz sand, glauconitic sand, and silt. The Paleocene beds are in turn overlain by about 350 ft (107 m) of Eocene quartz sand, glauconitic quartz sand, clay, and limestone grading into calcareous sand, silt, and clay. The calcareous strata are common in the upper part of the Eocene section in downdip parts of the study area. In places, especially at higher elevations, the sequence is capped by deposits of pebbly, clayey sand, conglomerate, and clay of Miocene or Oligocene age. Lateral and vertical facies changes are characteristic of most of the Coastal Plain sequence.

4.3.1.2 Coastal Plain Sediments

Upper Cretaceous sediments overlie Paleozoic crystalline rocks or lower Mesozoic sedimentary rocks throughout most of the study area. The Upper Cretaceous sequence includes the basal Cape Fear Formation and the overlying Lumbee Group, which is divided into three formations (see Figure 4-7). The sediments in this region consist predominantly of poorly consolidated, clay-rich, fine- to medium-grained, micaceous sand, sandy clay, and gravel and are about 700 ft (213 m) thick near the center of the study area. Thin clay layers are common. In parts of the section, clay beds and lenses up to 70 ft (21 m) thick are present.

respectively. The state of Georgia estimates that the population of Columbia County grew by an additional 50% to a total of 88,812 people between 1990 and 1997. In 1997, Columbia County issued the largest number of construction permits for new housing (i.e., 868 permits) when compared to the other six ROI counties.

4.10.3 Community Services

4.10.3.1 Education

Five public schools are located within a 10-mi (16-km) radius of the MFFF site, all over 6 mi (9.6 km) from the site. These schools, and their 1999-2000 enrollments, are listed in Table 4-18. The schools operate for 180 days each year, from early-August through mid-May. There are no private schools or colleges in the 10-mi (16-km) area. R1

4.10.3.2 Public Safety

The five-county ROI (excluding Bamberg County) was served by a total of 973 sworn police officers in 1997, with an average officer-to-population ratio of 2.1 officers per 1,000 persons (DOE 1999c). In 1990, Georgia averaged 2.0 officers per 1,000 persons and South Carolina averaged 1.8 officers per 1,000 persons (DOE 1999c).

Firefighting services in the SRS ROI (excluding Bamberg County) were provided by 1,712 paid and volunteer firefighters in 1997. The average firefighter-to-population ratio in the ROI was 3.8 firefighters per 1,000 persons (DOE 1999c). The average 1990 firefighter-to-population ratios for Georgia and South Carolina were 1.0 firefighter per 1,000 persons, and 0.8 firefighter per 1,000 persons, respectively (DOE 1999c).

4.10.3.3 Health Care

No hospitals are located within a 10-mi (16-km) radius of the MFFF site. The nearest hospital, the Aiken Regional Medical Center, is located about 20 mi (32.2 km) from the MFFF site in the city of Aiken. In 1996, a total of 1,722 physicians served the ROI (excluding Bamberg County). The average physician-to-population ratio in the ROI was 3.8 physicians per 1,000 persons. This ratio compares with a 1996 state average of 2.3 physicians per 1,000 persons for Georgia and 2.2 physicians per 1,000 persons for South Carolina. In 1997, there were 10 hospitals serving the ROI (excluding Bamberg County). The hospital bed-to-population ratio averaged 7.7 beds per 1,000 persons. This ratio compares with a 1990 state average of 4.1 beds per 1,000 persons for Georgia and 3.3 beds per 1,000 persons for South Carolina (DOE 1999c)

4.10.3.4 Local Transportation

Vehicular access to SRS is provided by South Carolina Highways 19, 64, 78, 125, and 278. there are a few minor road improvements in the Aiken, SC and North Augusta, SC area as part of the Augusta Regional Transportation Study (ARTS): R3

- FY03: Widen Pine Log Road (SC 302), Knox Avenue (US 25); and SC 118 (Aiken By-Pass);
- FY04: Completion of SC 118 widening, and West Avenue Extension;
- FY05: Completion of West Avenue Extension, various intersection improvements in Aiken, SC, East Buena Vista Avenue, Hitchcock Parkway passing lanes, and Richardson Lake Road;
- FY06: Continuation of East Buena Vista Avenue and Richardson Lake Road improvements; and, R3
- FY07: Completion of East Buena Vista Avenue and Richardson Lake Road improvements and commencement of Atomic Road (SC 125).

In addition, improvements to an 8.28-mile length of US 78 from Montmorenci, SC to Windsor, SC (i.e., east of Aiken, SC) are planned but an actual construction date has not been set because of a lack of funding.

Lastly, the extension of the Bobby Jones Expressway (I-520) across the Savannah River into North Augusta is scheduled to be complete in 2 phases. The Phase I completion from Sand Bar Ferry Road to US 1 in North Augusta, SC is targeted to 2006, while the Phase II completion to complete the entire I-520 circle is targeted for 2009.

According to information included in the Georgia Department of Transportation (GADOT) State Transportation Improvement Program (STIP) for 2003-2005, there are also a few minor road improvements in the vicinity of Augusta-Richmond County and Columbia County. The following summarizes these improvements:

- FY03-04: Widening of River Watch Parkway in Columbia County; R3
- FY06: Widening of SR 104 (Washington Road);
- FY05: Widening of Flowing Wells Road; and,
- FY05: The I-520 Bobby Jones Expressway interchange reconstruction at GA 56 exit.

There is no public transportation to SRS. Rail service in the ROI is provided by the Norfolk Southern Corporation and CSX Transportation. SRS is provided rail access via Robbins Station on the CSX Transportation line.

Waterborne transportation is available via the Savannah River. Currently, the Savannah River is used primarily for recreation. SRS has no commercial docking facilities, but it has a boat ramp that has accepted large transport barge shipments.

Columbia Metropolitan Airport in the city of Columbia, South Carolina, and Augusta Regional Airport (Bush Field) in the city of Augusta, Georgia, receive jet air passenger and cargo service from both national and local carriers. Numerous smaller private airports are located in the ROI (DOE 1999c).

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from U.S. 25 Business at North Augusta to U.S. Routes 25, 78, and 278. Three road improvement projects are planned that are independent of the proposed action but would alleviate traffic congestion leading into SRS.

The first improvement project is the widening of South Carolina Highway 302 (Pine Log Road) from U.S. Route 78 and the construction of new segments to extend the route to South Carolina Highway 19. U.S. Route 25 is also being widened for one-half mile south of I-20. The widening project will be in conjunction with the second improvement project, the new construction of the Bobby Jones Expressway (I-520). The expressway will head in a southwest direction crossing South Carolina Highways 126 and 125 and U.S. Route 1 and continue over the Savannah River to connect with the Georgia portion of the Bobby Jones Expressway, which is already constructed. The third improvement project is the completion of South Carolina Highway 118 around Aiken. South Carolina Highway 118 will be widened with the construction of new segments to complete the by-pass (DOE 1999c). With the exception of the U.S. Route 25 project, which is expected to be completed the year MFFF construction begins, these projects will be completed prior to MFFF construction (SCDOT 2000).

There is no public transportation to SRS. Rail service in the ROI is provided by the Norfolk Southern Corporation and CSX Transportation. SRS is provided rail access via Robbins Station on the CSX Transportation line.

Waterborne transportation is available via the Savannah River. Currently, the Savannah River is used primarily for recreation. SRS has no commercial docking facilities, but it has a boat ramp that has accepted large transport barge shipments.

Columbia Metropolitan Airport in the city of Columbia, South Carolina, and Augusta Regional Airport (Bush Field) in the city of Augusta, Georgia, receive jet air passenger and cargo service from both national and local carriers. Numerous smaller private airports are located in the ROI (DOE 1999c).

4.10.4 Environmental Justice

"Environmental Justice" refers to a federal policy under which federal actions should not result in disproportionately high and adverse environmental impacts on low-income or minority populations. As a general matter, a minority population is defined to exist if the percentage of minorities within a specified area exceeds the percentage of minorities in an entire state by 20%, or if the percentage of minorities within the area is at least 50%. Executive Order 12898 directs federal executive agencies to consider environmental justice under NEPA. Although it is not subject to the executive order, the NRC has voluntarily committed to undertake environmental justice reviews. The scope of DCS' review includes an analysis of impacts on low-income and minority populations.

In determining the area to review for environmental justice, guidance provided by the NRC specifies that "If a facility is located outside the city limits or in a rural area, a 4-mi (6.4-km) radius (50 mi^2 [130 km^2]) should be used. ... The goal is to evaluate the "communities,"

5. ENVIRONMENTAL CONSIDERATIONS

This chapter discusses potential environmental impacts resulting from site preparation and facility construction (Section 5.1), facility operation (Section 5.2), deactivation (Section 5.3), radioactive material transportation (Section 5.4), and potential facility accidents (Section 5.5). Also presented is a discussion of cumulative impacts (Section 5.6), impacts from alternatives to the proposed action (Section 5.7), impacts on short-term uses and long-term environmental productivity (Section 5.8), and commitment of resources (Section 5.9). Finally, an overview of environmental monitoring is discussed in Section 5.10. Environmental impacts that were projected in the SPD EIS (DOE 1999c) and remain valid in this ER are incorporated by reference but not discussed extensively.

The MFFF facility will be located on SRS land adjacent to F Area. F Area will be expanded to include the material disposition facilities. F Area has been used for over 40 years for the separation of plutonium. The area is highly industrialized and has undergone numerous land disturbances. The MFFF will be located on 41 ac (16.6 ha) of land, some of which most recently was used as the spoils area from the excavation of the Actinide Packaging and Storage Facility (APSF). F Area, near the geographic center of SRS, is at least 5 mi (8 km) away from public access. The public will be relatively insulated from any near-field impact of the MFFF. The previous use of the land in and adjacent to F Area and the relative isolation from the public are important factors in evaluating the environmental impacts of the construction and operation of the MFFF.

5.1 IMPACT OF SITE PREPARATION AND FACILITY CONSTRUCTION

This section discusses the effects of site preparation and construction activities on various environmental resources.

5.1.1 Land Use

Construction and grading on and contiguous to the MFFF site will require approximately 52 ac (21 ha); the completed facility will occupy 41 ac (16.6 ha) of land. A number of construction areas exist within F Area but are currently inactive. F Area has ample space available for construction (UC 1998). Land area requirements for the MFFF are relatively small. Because the land is used for industrial activities and could continue to be used for industrial activities after the MFFF deactivation, no permanent loss of land use would result from construction and operation of the facility at SRS. R1, R3

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 *Discussion Draft SRS Long Range Comprehensive Plan* (DOE 2000a) for land use in the area. R1

Part of the land within F Area has been previously disturbed and is partially developed. The area where the MFFF will be located is mostly evergreen plantation. Some changes in topography have already taken place. The MFFF site will be graded to a mean elevation of 272 ft (83 m) above MSL. The spoils pile currently in the middle of the MFFF site will be moved.

Grading the MFFF site (Figure 5-1) will result in 52 ac (21 ha), including the 41-acre (16.6-ha) MFFF site, being impacted by the site preparation activities. These site preparation activities include grading the site to 272 ft (82.9 m) (msl), reshaping the existing F-Area stormwater basin to 0.6 ac (0.2 ha) and grading a 1.5 ac (0.6 ha) MFFF stormwater basin. Some of the excess MFFF dirt would be used as fill for approximately 17 ac (6.9 ha) on the northeast corner of the PDCF site. The fill area would be logged, removing primarily pine plantations and a few hardwoods. The fill would be graded to blend in with the existing topography. The filled areas would be graded and seeded as part of the construction erosion and sedimentation control measures. Alternately, DOE may direct that a portion of the excess material may be stockpiled in a nearby previously-disturbed area.

R1

Based on soil type, some areas of SRS could be considered prime farmlands; however, they are not designated as such because they are depleted from excessive past agricultural uses and are no longer available for agricultural purposes.

R2

To support the MFFF activities, DOE will construct the WSB for the processing of liquid high alpha activity waste and stripped uranium waste. This facility, to be located near the MFFF and PDCF, will be connected to the MFFF by two stainless steel double-walled pipelines. The pipelines will be used to convey the liquid high alpha activity waste and stripped uranium waste to the WSB. The WSB will also treat liquid waste from the PDCF. The route for the 2,000-ft (609.6-m) pipeline is projected to be from the southwest corner of the MFFF to an existing utility corridor on the north side of the F-Area perimeter roadway, east and south along the F-Area perimeter road to the WSB. The width of the disturbed area is expected to be less than 25 ft (7.6 m) comprising a total disturbed area less than 1.5 ac (0.6 ha).

R1
R2
R1

During construction, utilities and waste pipelines will be put in place. A discussion of these impacts is provided in Section 5.1.11. The industrial nature of the site and absence of critical habitat suggests that sensitive vegetated areas can be avoided in selecting routes, thus minimizing impacts of construction.

5.1.2 Geology

The following discussion of construction impacts to geology and soils is taken from Section 4.26.4.1.1 of the SPD EIS (DOE 1999c). In general, grading and construction results in disturbance of about 52 ac (21 ha) of soils for the MFFF site [Text Deleted]. Soils on the site will be moved, as appropriate, to achieve a uniform elevation. To date, no offsite borrow pits or spoil piles have been identified.

R1

Actual creation of foundations and building of structures on the site will be limited to upper geological layers, minimizing impacts to geology and groundwater.

The soils at SRS are considered suitable for standard construction techniques. No economically viable geologic resources have been identified at SRS. While soils at SRS could be classified as prime farmlands, the U.S. Department of Agriculture does not classify them as prime farmlands because all of SRS is removed from public access.

[Text Deleted] R1

5.1.3 Water Use and Quality

Environmental impacts resulting from water use during MFFF construction were discussed in Section 4.26.4.2.1 of the SPD EIS (DOE 1999c) and are addressed in the following paragraphs.

All water 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. Sanitary waste will be collected using a combination of portable toilets and semi-permanent facilities connected to the SRS CSWTF. All wastewater would be treated in the sitewide treatment system, which has sufficient hydraulic and organic capacity to treat the flows expected from these activities. 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 (Sessions 1997a).

The estimated annual average water usage for constructing all the proposed facilities at the MFFF site is 33.0 million gal (125 million L). Current water usage in F Area is 98.8 million gal/yr (374 million L/yr) (DOE 1999c). The DOE decision to close out operations of the F Canyon will reduce water use in F Area. The total construction requirement represents approximately 2% 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). Therefore, no impact on water availability is anticipated. R2

Proven construction techniques will be used to mitigate the impact of soil erosion on receiving streams. The MFFF 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.

Because the construction of the MFFF will involve building structures, parking lots, and roadways, which will increase the impervious surface area, the stormwater runoff quantity at peak discharge would increase accordingly. The area within the boundary of the selected site is estimated to be 41 ac (16.6 ha). The total area of the impervious surfaces (e.g., roofs, roadways, paved parking lots) as a result of construction of the MFFF is estimated to be 17 ac (6.9 ha) or 41.4% of the site area.

To comply with *South Carolina State Standards for Stormwater Management and Sediment Reduction* (SCDHEC 2000b), stormwater 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 the SRS infrastructure program. A stormwater basin would likely be located southeast of the MFFF and north of the PDCF along the path of the existing discharge to the unnamed tributary of Upper Three Runs upstream of the designated wetlands area. Preliminary design of this basin has a surface area of approximately 1.5 ac (0.6 ha). The existing F-Area basin would be reshaped to 0.6 ac (0.2 ha) and would be located just west of the MFFF basin. R1 R1 R1

[Text deleted]

The stormwater runoff flow from MFFF and PDCF will discharge through the existing SRS stormwater NPDES outfall or new outfalls. If the existing stormwater outfalls are impacted by construction of the surplus plutonium disposition facilities, they will be relocated and/or new outfalls will be constructed.

As discussed in Section 4.4.3.3, any potential groundwater contaminants are approximately 76 to 93 ft (23.2 to 28.3 m) below the surface. Because MFFF grading will only extend to 40 ft (12.2 m) below the surface, any potential groundwater contaminants should not interact with construction activities. R1

5.1.4 Air Quality

Potential impacts to local air quality during construction of the MFFF are presented in Section 4.4.1.1 of the SPD EIS (DOE 1999c).

Potential air quality impacts from construction of new MOX and support facilities at SRS were analyzed using ISCST3 as described in Appendix B. Construction impacts, which are considered intermittent in nature, result from diesel fuel emissions from construction equipment, particulate matter emissions from disturbance of soil by construction equipment and other vehicles (i.e., construction fugitive emissions), operation of a concrete batch plant, construction worker vehicles, and trucks moving materials and wastes. Emissions from these sources are summarized in Table 5-1. Maximum air pollutant concentrations from construction activities are summarized in Table 5-2. R3

The incremental MFFF construction impacts are compared to the existing pollutant concentrations caused by SRS sources in Table 5-2 and the total impacts are shown to be well below the most stringent air quality standard or guideline. R3

5.1.5 Ecology

Construction impacts to ecological systems were discussed in Section 4.26.4.3.1 of the SPD EIS (DOE 1999c). Impacts to the local ecology are not expected to be significantly different from those described in the SPD EIS. The following discussion of construction impacts is derived from the SPD EIS with updated data reflecting the present MFFF design and specific location adjacent to F Area.

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. R1

Liquid LLW will be transferred to the F-Area process sewer system that connects to the SRS Effluent Treatment Facility (ETF). Liquid LLW is estimated to be less than 10% of the remaining capacity of the ETF. Therefore, impacts on the system should not be major. Liquid LLW from MFFF will be discharged to Upper Three Runs after treatment at ETF. 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 ETF is able to treat these flows adequately to meet SRS NPDES permit limitations, negligible impacts on surface water quality are expected. R1

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. R1

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 chlorine emissions from the MFFF stack derived from the aqueous polishing process R3
- 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.

Potential air quality impacts from operation of the new MOX and support facilities at SRS were analyzed using ISCST3 as described in Appendix B. Emissions from these sources are summarized in Table 5-7. Emergency and standby generators were modeled as a point source. R3

Maximum air pollutant concentrations resulting from the emergency and standby diesel generators and process sources, plus the SRS baseline concentrations, are summarized in Table 5-8.

The increased concentrations of nitrogen dioxide, PM_{10}, and sulfur dioxide from the operation of the MFFF would be a small fraction of the PSD Class II area increments, as summarized in Table 5-9.

Total vehicle emissions associated with activities at SRS would likely decrease somewhat from current emissions because of a decrease in overall site employment during this time frame.

The combustion of fossil fuels associated with MFFF operations would result in the emission of carbon dioxide, one of the atmospheric gases that are believed to influence the global climate. Annual carbon dioxide emissions from operations would represent less than 0.0002% of the annual United States emissions of carbon dioxide from fossil fuel combustion and industrial processes, and therefore would not appreciably affect global concentrations of this pollutant.

5.2.5 Ecological Impacts

The environmental impacts of MFFF operations on local ecology are discussed in Section 4.26.4.3.2 of the SPD EIS (DOE 1999c), and updated in the following discussion.

5.2.5.1 Nonsensitive Habitat

Noise disturbance would probably be the most significant impact of routine operation of the MFFF 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 should be limited because all liquid will be transferred to SRS for disposal in accordance with approved permits and procedures (see Section 7.2).

5.2.5.2 Sensitive Habitat

Operational impacts on wetlands or other sensitive habitats would be unlikely because airborne and aqueous effluents would be controlled through state permits (see Section 7.2).

less than those used for this calculation. DCS determined that additional dose to the public from operations of the WSB are bounded by the conservative estimate of public dose for the MFFF (see Appendix G)[3]. Because the MFFF does not discharge any liquid directly to the environment, the liquid/aquatic pathway was not considered in the dose calculations. R2

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. R3 R3 R3

5.2.10.2 Radiation Doses to Site Workers

Site workers are defined as those that work within the SRS boundaries 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.

[3] Using process inventory information and models for release of radionuclides from the MFFF and WSB processes, DCS projected emissions that are an order of magnitude lower than the emissions used in this ER

- Exposure pathways of inhalation uptake, external exposure to the airborne plume, and inadvertent soil ingestion.
- All site workers are adults.
- There are no food products grown within the SRS boundary.
- The MEI is located at a distance of 328 ft (100 m) from the release point. R2
- The MEI is located in the direction from the release point that gives the maximum dose based on dose calculations for the 16 directions considered by GENII (in the east-northeast direction for the elevated release and in the southwest direction for the groundlevel release).
- The population dose can be bounded by a maximum dose calculated as the MEI dose at the MFFF boundary times the total number of site workers and a minimum dose calculated as the MEI dose at the SRS boundary times the total number of workers.
- A total number of site workers equal to the number of site workers in 2000 (approximately 13,616 workers).
- No previous contamination of the ground surface.
- A finite plume model (i.e., center of the plume located at ground level) for the calculation of dose.
- The annual external exposure time to the plume and to soil contamination is 0.7 year for the MEI (NRC 1977a).
- The annual inhalation exposure time to the plume is 1 year for the MEI (NRC 1977a).
- A stack height equal to the actual stack height rather than the effective stack height to negate plume rise.
- Airborne releases used in the SPD EIS (DOE 1999c), which are about one order of magnitude higher than the releases expected during normal MFFF operations.
- No resuspension of soil particles into the air.
- The meteorological data used to determine dose to the public (see Appendix D) were also used to determine dose to the site workers.

The calculation of dose to the site workers was essentially identical to that for the general public with the following exceptions:

1. The distance from the release point.

2. The number of persons exposed.
3. The spatial distribution of persons exposed.

Radiation dose due to the ingestion of food products was not included for the calculation of dose to the site workers because no agriculture occurs within the SRS boundary and, therefore, consumption of food grown within the SRS boundary is impossible. Workers are also assumed to be members of the public (see Section 5.2.10.1).

Doses were calculated for a groundlevel release (1 ft [0.3 m] above grade). The reason for providing dose calculations using a groundlevel release is to bound the calculated dose and provide a buffer in the event that the designed building and/or vent stack heights are modified in the future. R2

Given incident-free operation of the MFFF, the dose to the maximally exposed site worker located at the MFFF boundary from annual operation of the MFFF would be 6.6 mrem/yr. The maximum dose to the site worker population would range from 0.042 person-rem/yr for the site workers located at the SRS boundary to a maximum of 90 person-rem/yr for the site workers located at 100 m from the MFFF. As previously indicated, the maximum population dose was calculated as the dose to the MEI times the total number of site workers (i.e., 13,616 workers). The potential radiological impacts on the general public and site workers due to MFFF normal operations are summarized in Table 5-11 and Appendix D, Table D-8. Details regarding calculation of the radiological impact of normal operations of the MFFF on site workers are presented in Appendix D. R3

5.2.10.3 Radiation Doses to Facility Workers

Facility workers are those workers that work on MFFF activities within the MFFF fence. The estimate of average worker dose was calculated based on process and facility design and source term information. Although worker exposures vary, a design objective is to minimize the number of operators submitted to a dose equivalent higher than 500 mrem/yr during normal operation.

The annual dose to facility workers is projected to be 20 person-rem/yr, based on preliminary information concerning facility design and source terms. This dose could increase or decrease as a function of design or operation changes. This dose can also be expressed as an average worker dose of 50 mrem/yr. The dose to facility workers represents a latent cancer fatality (LCF) risk of 2E-05. Doses to individual workers will be kept to a minimum by instituting administrative limits and ALARA programs including worker rotations. R2

5.2.11 Impacts to SRS Infrastructure

SRS infrastructure will be modified and upgraded prior to and during the MFFF construction to accommodate the needs of the MFFF and other surplus plutonium disposition facilities. 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.

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. R2 R1

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. R:

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. R1

The waste streams that comprise the 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 volume of this combined high alpha waste stream is estimated to be just under 22,000 gallons (83.3 m^3). The composite stream contains approximately 84,000 Curies of americium-241.

The stripped uranium stream will average 42,530 gallons (134 m^3) annually during normal operations and 46,000 gallons (175 m^3) annually during startup. 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 385,800 gal (1,460 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 acceptance criteria for the SRS Effluent Treatment Facility (ETF). After confirming waste acceptability, it will be pumped on a batch basis to a tie-in with the existing F-Area process sewer. The F-Area process sewer is used to transfer similar low level waste streams from existing operations to the ETF. R1

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. R2

The liquid LLW generated by the MFFF and WSB will be treated at the ETF before release to Upper Three Run. The volume of these wastes [620,800 gal/yr (2,350 m^3/yr)] would be less than 0.1% of the 1,930,000 m^3/yr capacity of the ETF and less than 0.01% of the 7-day, 10-year low flow for Upper Three Run.

The SRS ETF treats low-level radioactive wastewater from the F- and H-Area separations and waste management facilities. The ETF removes chemical and radioactive contaminants before releasing the water in Upper Three Runs, which flows to the Savannah River. Operation of the ETF is approved and permitted by SCDHEC and EPA. R1

The ETF is permitted to treat up to 430,000 gal (1,628 m^3) per day. The ETF includes wastewater collection and treatment operations that were modified for radioactive use. It is designed to remove heavy metals, organic and corrosive chemicals, as well as radiological contaminants.

ETF effluents are discharged within limits of permits issued by SCDHEC. All personnel operating ETF are certified by the South Carolina Environmental Certification Board.

With the proposed addition of 620,800 gal (2,350 m^3/yr) per year of MFFF and WSB low level liquid waste being only a fraction of the facility's design and permit capacity (<0.1%), the additional environmental impacts associated with treatment of this stream will be negligible. The MFFF and WSB contribution to ETF discharges would be 0.000093 m^3/sec compared to the receiving water (Upper Three Runs) 7-day 10-year low flow of 2.8 m^3/sec. R2

Potentially contaminated wastewater will be discharged to the ETF for processing. R3

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 3,075 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* R1

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 248 yd^3 (190 m^3) per year. The WSB would produce an additional 405 yd^3 (310 m^3) of TRU waste per year. Over its lifetime, the MFFF and WSB would expect to generate 6,530yd^3 (5,000 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 40% 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 5,000 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 (2×10^{-5} cancers) would be expected in the population from hazardous chemical exposure." (DOE 1997e, pg 5-29) The addition of 11,238 m^3 TRU waste from the WSB would not be expected to change this conclusion.

The MFFF solid low level waste (LLW) is estimated to be 134 yd^3 (102 m^3) per year. Assuming that solidification of stripped uranium waste does not result in any volume reduction, the WSB would produce an additional 228 yd^3 (175 m^3) of solid LLW per year. Over its lifetime, the MFFF and WSB would expect to generate 3,620 yd^3 (2,767 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). R2

R1

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 700% 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. R1

[Text deleted] R.

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. R2 R2

The bounding low consequence event consequence is a drop of waste drums in the truck bay. Consequences are presented in Table 5-13b. The frequency of this event is estimated to be not unlikely or lower. R2, R3

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. R2 R1

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: R2

- Fires within a fire area involving gloveboxes containing plutonium powder, pellets, solutions, or fuel rods R2
- Fires within a fire area involving aqueous polishing process equipment containing plutonium and/or americium in solution form R2
- Fires within a fire area involving fuel rods, fuel assemblies, canisters of plutonium, HEPA filters, or waste drums
- Fires within a fire area involving plutonium in transportation packages or uranium in drums.

The bounding fire event is a fire in the fire area containing the Final Dosing Unit. This unit contains polished plutonium powder for the purpose of down blending the mixed oxide powder to the desired blend for fuel rod fabrication. 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. The bounding radiological consequences associated with this event are provided in Table 5-13a. The frequency associated with this event is estimated to be unlikely or lower since multiple failures are required for this event to occur. R2

The bounding low consequence fire event is a fire in a waste drum located in the truck bay. The frequency of this event is estimated to be not unlikely or lower as a fire could occur following the ignition of combustible material due to an electrical short or an unknown ignition source. Consequences of the event are presented in Table 5-13b. R2

The MFFF utilizes many features to reduce the likelihood and consequences of these events 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, nitrogen blanket systems, qualified canisters and containers, fire suppression and detection systems, emergency procedures, worker training, and local fire brigades. R1

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. R2 R2

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

5.5.2.4 Explosion

Internal explosion events within the MFFF result from the presence of potentially explosive mixtures and potential overpressurization events. These events 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. Explosions may be caused by human error or equipment failure and include the following:

- Loss of instrument air or offgas exhaust flow in units where radiolysis is possible
- High flow of fluids into tanks or vessels
- Pressurizing chemical reactions in vessels or tanks
- Increase in temperature beyond the safety limit in tanks and vessels
- Incorrect chemical addition/reagent preparation
- Excessive introduction of hydrogen into furnace
- Hydrogen accumulation
- Oxygen leaks
- Organic liquid vapor/methane reactions.

Postulated explosions include explosions involving flammable gases, chemical interactions, and overpressurization events.

The MFFF processes are designed to preclude explosions through the use of reliable engineering features and administrative controls. Key features include scavenging air systems, hydrogen monitoring systems, temperature control systems, chemical addition and concentration control systems, sampling systems, process shutdown controls, operator training, and operations and maintenance procedures. Simultaneous failure of the design features and administrative controls resulting in an explosion and the subsequent release of radioactive materials is highly unlikely. Thus, explosions at the MFFF resulting in a radioactive material release are remote and speculative and need not be considered under NEPA.

Explosions are prevented by design features and administrative controls except in the laboratory. The radiological consequences of an explosion in the laboratory will not exceed regulatory limits. R2
Although explosion events resulting in a radioactive material release at the MFFF are remote and speculative events, a hypothetical explosion event is evaluated. The evaluation conservatively assumes that an explosion occurs in an aqueous polishing process cell and involves the maximum material at risk in any process cell. The radiological consequences of this hypothetical event are presented in Table 5-13a. As shown, the impacts to the public and the SRS workers are R3
low.

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

5.5.2.5 Load Handling

A load-handling hazard arises from the presence of lifting or hoisting equipment used during either normal operations or maintenance activities. A load-handling event occurs when either the lifted load is dropped or the lifted load or the lifting equipment impacts other nearby items. A load-handling event 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.

Load-handling events can be caused by equipment failure or human error.

Load-handling events are postulated to occur and are evaluated for all primary confinements throughout the MFFF without regard to the probability of the initiating event. Postulated load-handling events include the following:

- Drops impacting a glovebox containing powders, pellets, solutions or fuel rods
- Drops impacting aqueous polishing process equipment containing plutonium and/or americium in solution form R2
- Drops involving plutonium in canisters, fuel rods, fuel assemblies, HEPA filters, or waste drums
- Drops involving plutonium in transportation packages or uranium in drums.

The bounding load-handling event is a drop event involving the glovebox in the Jar Storage and Handling Unit. This glovebox contains jars of plutonium powder. 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. The bounding radiological consequences associated with this event are provided in Table 5-13a. The frequency associated with this event is estimated to be unlikely or lower since multiple failures are required for this event to occur. R2 R2, R3,

The bounding low consequence load handing event involves waste drums located in the truck bay. The frequency of this event is estimated to be not unlikely or lower as a waste drum drop could occur due to human error or equipment failure. Consequences are provided in Table 5-13b. R2

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 HEPA filters.

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. R2 R2

Table 5-1. Emissions (kg/yr) from MFFF Construction

(update of Table G-65 of the SPD EIS, p. G-40)

Pollutant	Diesel Equipment	Construction Fugitive Emissions[a]	Concrete Batch Plant	Vehicles[d]
Carbon monoxide	28,481	0	0	33,574
Nitrogen dioxide	71,204	0	0	9,738
PM_{10}	10,743[b]	104,036	1,973	34,359
Sulfur dioxide	6,371	0	0	0
Volatile organic compounds	10,743	0	0	4,494
Total suspended particulates	10,743	221,989	9,072	34,359
Air toxics[c]	0	<1	0	0

R2, R3

[a] Does not include fugitive emissions from potential concrete batch plant.

[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] Various toxic air pollutants (e.g., lead, benzene, hexane) could be emitted during construction.

[d] Vehicle emissions based on construction worker, construction material, and waste shipment mileage.

Table 5-2. Increments to Ambient Concentrations (µg/m^3) at the SRS Site Boundary from MFFF Construction

(update of Table G-66 of the SPD EIS, p. G-40)

Pollutant	Averaging Period	Most Stringent Standard or Guideline[a]	SRS Maximum Concentration[b]	MFFF Contribution	Total
Carbon monoxide	8 hours	10,000	66	16.7	82.7
	1 hour	40,000	254	54.8	308.8
Nitrogen dioxide	Annual	100	17.2	0.17	17.4
PM_{10}	Annual	50	7	0.29	7.29
	24 hours	150	97	23.5	120.5
Sulfur dioxide	Annual	80	24	0.015	24
	24 hours	365	337	1.3	338.3
	3 hours	1,300	1,171	5.6	1,176
Total suspended particulates	Annual	75	46	0.56	46.6
Air toxics[b]	24 hours	150	20.7	0.0002	20.7

R2

[a] The more stringent of the federal and state standards is presented if both exist for the averaging period.

[b] Hunter (2001), Represents maximum SRS emissions impact at SRS boundary R3

[c] Various toxic air pollutants (e.g., lead, benzene, hexane) could be emitted during construction.

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	1,855	0	32,658
Nitrogen dioxide	19,355	1,303[a]	9,472
PM_{10}	182[b]	0	33,422[b]
Sulfur dioxide	1,125	0	0
Volatile organic compounds	831	0.9[c]	4,372
Total suspended particulates	182	0	33,422
Chlorine	0	15[d]	0

R2

[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	0.048	17.2
PM_{10}	Annual	50	7	0.0004	7
	24 hours	150	97	0.78	97
Sulfur dioxide	Annual	80	24	0.002	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

R2

[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. R3

Table 5-11. Potential Radiological Impacts on the General Public and Site Workers Due to Normal Operations of the MFFF

RADIATION DOSE TO THE GENERAL PUBLIC	Impact	
Maximally Exposed Individual		
Annual Dose (mrem/yr)[a]	3.3E-03	
Percentage of 10 CFR Part 20, Subpart D Standard[b]	3.3E-03	
Percentage of Natural Background Radiation[c]	1.1E-03	
Annual LCF Risk[d]	1.7E-09	
General Population Within 50 mi (80 km)		
Annual Dose (person-rem/yr)[a]	0.28	
Percentage of Natural Background Radiation[e]	9.1E-05	
Annual LCF Risk[d]	1.4E-04	
Average Exposed Individual Within 50 mi (80 km)		
Annual Dose (mrem/yr)[f]	2.7E-04	
Percentage of 10 CFR Part 20, Subpart D Standard[b]	2.7E-04	
Percentage of Natural Background Radiation[e]	9.1E-05	
Annual LCF Risk[d]	1.3E-10	
RADIATION DOSE TO SITE WORKERS	**Impact**	
Maximally Exposed Site Worker		
Annual Dose (mrem/yr)[g]	6.6	
Percentage of 10 CFR Part 20, Subpart C Standard[h]	1.3E-01	
Percentage of Natural Background Radiation[c]	2.2	
Annual LCF Risk[i]	2.6E-06	
General Site Worker Population	**Minimum[j]**	**Maximum[k]**
Maximum Annual Dose (person-rem/yr)[l]	0.042	90
Percentage of Natural Background Radiation[m]	1.0E-03	2.2
Annual LCF Risk[i]	1.7E-05	3.6E-02
RADIATION DOSE TO FACILITY WORKERS	**Impact**	
Average Worker Dose (mrem/yr)[n]	50	
Percentage of 10 CFR Part 20, Subpart C Standard[h]	1	
Percentage of Natural Background Radiation[c]	17	
Annual LCF Risk[i]	2.0E-05	

R2, R3

Table 5-11. Potential Radiological Impacts on the General Public and Site Workers Due to Normal Operations of the MFFF (continued)

[a] Source is GENII model results for general public (see Appendix D).

[b] 10 CFR Part 20, Subpart D standard is an annual dose of 100 mrem.

[c] Natural background radiation is 295 mrem/yr (see Table 4-23).

[d] Calculated using a cancer risk factor of 0.0005 per rem (500 cancers/10^6 person-rem).

[e] Natural background radiation for the public was calculated as the individual background radiation (295 mrem/yr) times the number of people projected to live in the 50-mi (80-km) assessment area in 2030 (1,042,483 people). The calculated value is 307,532 person-rem/yr.

[f] Calculated as the population dose divided by the number of people projected to live in the 50-mi (80-km) assessment area in 2030 (1,042,483 people).

[g] Source is GENII model results for site workers (see Appendix D).

[h] 10 CFR Part 20, Subpart C standard is an annual dose of 5,000 mrem.

[i] Calculated using a cancer risk factor of 0.0004 per rem (400 cancers/10^6 person-rem).

[j] Minimum values based on a distance of 5 mi (8 km) from the release point (i.e., at the SRS boundary).

[k] Maximum values based on a distance of 328 ft (100 m) from the release point (i.e., at the MFFF boundary).

[l] Dose for the site worker population was determined by multiplying the MEI dose at the respective distance from the release point by the total number of site workers (13,616 workers). The MEI doses are as follows:

[Text Deleted] K

MEI dose at the MFFF boundary for a groundlevel release = 3.0 mrem/yr

MEI dose at the SRS boundary for a groundlevel release = 1.4E-03 mrem/yr

[m] Natural background radiation for the site workers was calculated as the individual background radiation (295 mrem/yr) times the number of site workers in 2000 (13,616 workers). The calculated value is 4,017 person-rem/yr.

[n] Based on preliminary dose analyses for the MFFF.

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] (yd³/yr)			
Liquid LLW	385,800	Disposed as Liquid LLW at ETF	Not available	Not available	
Solid LLW		134	10,615	4	
Stripped Uranium (solidified and added to LLW)	46,000	228			R1
Liquid High Alpha Activity Waste (solidified and added to TRU waste)	21,841	405	93	700[d]	R2
Solid TRU Waste		248			
Excess Low-Level Radioactive Solvent Waste	3,075	Disposed as Mixed LLW	NA	NA	
Liquid Nonhazardous Waste	4,389,710	Disposed Through Approved NPDES Facilities	90,867,868	5	
Solid Nonhazardous Waste		1,754	40,000	4	

[a] From Table 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] Annual MFFF TRU waste generation exceeds current annual SRS generation but the MFFF cumulative volume is well below the maximum projected SRS cumulative volume. R1

[Text Deleted]

R3

Table 5-13a. Summary of Bounding Mitigated MFFF Event Consequences

Bounding Accident [a]	Meteorology [b]	Maximum Impact to Site Worker (mrem)	Maximum Impact to Site Worker (probability of cancer deaths)	Maximum Impact to Public 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)
Internal Fire	bounding – 95% percentile	<100	<2E-5	<0.5	<1E-7	<1	<4E-4
Load Handling	bounding – 95% percentile	<150	<6E-5	<1.0	<5E-7	<3	<2E-3
Hypothetical Explosion Event	bounding – 95% percentile	<750	<3E-4	<5.0	<2E-6	<2E+1	<7E-3
Hypothetical Criticality Event	bounding – 95% percentile	<2200	<9E-4	<12	<6E-6	<6	<3E-3

R2

[a] The bounding loss of confinement event is bounded by the load-handling event.
[b] Values calculated for 50th percentile indicate that median meteorology is at least three times lower than the bounding values.

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 Site Boundary (mrem)	Maximum Impact at Site 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	<500	<3E-4	<4	<2E-6	<1E+1	<5E-3
Internal Fire	bounding – 95% percentile	<500	<3E-4	<4	<2E-6	<1E+1	<5E-3
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

R2
R3

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

Table 5-14. Potential Impacts from Construction of the PDCF and WSB Facilities in the SRS F Area

R2

Pollutant	Impact from PDCF and WSB Construction[a]
8-hr Carbon Monoxide Increase ($\mu g/m^3$)[b]	3.8
Annual Nitrogen Dioxide Increase ($\mu g/m^3$)[b]	0.17
Annual PM_{10} Increase ($\mu g/m^3$)[b]	0.078
Annual Sulfur Dioxide Increase ($\mu g/m^3$)[b]	0.054
Annual Total Suspended Particulate Increase ($\mu g/m^3$)[b]	0.156
Dose to Workers[c] (person-rem/yr)	2.8
Average Worker Dose[c] (mrem/yr)	4
Hazardous waste[d] (m^3/yr)	85
Nonhazardous Waste[d]	
Liquid[d] (m^3/yr)	26,300
Solid[d] (m^3/yr)	2,320

[a] Source: MFFF ER Appendix G; SPD EIS (DOE 1999c)
[b] Table G-70 of the SPD EIS (DOE 1999c)
[c] Table J-55 of the SPD EIS (DOE 1999c)
[d] Table H-33 of the SPD EIS (DOE 1999c)

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 (μg/m³)	SRS Maximum Concentration (μg/m³)[a]	MFFF (μg/m³)[b]	PDCF and WSB[c]	SNF[d]	Tank Closure (μg/m³)[e]	Salt Processing Alternative[f]	Other Foreseeable Planned SRS Activities (μg/m³)[a]
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	0.048	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 0.002	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 (μg/m³)	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

R2

R3

R3

Table 5-15b. Estimated Average Annual Cumulative Radiological Doses and Resulting Health Effects to Offsite Population and Facility Workers

Activity	Maximally exposed individual				Offsite Population				Facility Workers	
	Dose from airborne releases (rem)	Dose from liquid releases (rem)	Total dose (rem)	Probability of fatal cancer risk	Collective dose from airborne releases (person-rem)	Collective dose from liquid releases (person-rem)	Total collective dose (person-rem)	Excess latent cancer fatalities	Collective dose (person-rem)	Excess latent cancer fatalities
SRS Baseline [a]	5.0×10^{-5}	1.3×10^{-4}	1.8×10^{-4}	9.0×10^{-8}	2.2	2.4	4.6	2.3×10^{-3}	165	0.066
MFFF [b]	3.3×10^{-6}	(n)	3.3×10^{-6}	1.7×10^{-9}	0.28	(n)	0.28	1.4×10^{-4}	20	8×10^{-3}
PDCF and WSB [c]	6.6×10^{-6}	(n)	6.6×10^{-6}	1.9×10^{-8}	1.6	(n)	1.6	8.0×10^{-5}	446	0.18
Management of Spent Nuclear Fuel [d]	1.5×10^{-5}	5.7×10^{-5}	7.2×10^{-5}	3.6×10^{-8}	0.56	0.19	0.75	3.8×10^{-4}	55	0.022
Surplus HEU Disposition [e]	2.5×10^{-6}	(o)	2.5×10^{-6}	1.3×10^{-8}	0.16	(o)	0.16	8.0×10^{-5}	11	4.4×10^{-3}
Tritium Extraction Facility [f]	2.0×10^{-5}	(o)	2.0×10^{-5}	1.0×10^{-8}	0.77	(o)	0.77	3.9×10^{-4}	4	1.6×10^{-3}
Defense Waste Processing Facility [g]	1.0×10^{-6}	(o)	1.0×10^{-6}	5.0×10^{-11}	0.71	(o)	0.71	3.6×10^{-5}	120	0.048
Management Plutonium Residues/Scrub Alloy [h]	5.7×10^{-7}	(o)	5.7×10^{-7}	2.9×10^{-10}	6.2×10^{-3}	(o)	6.2×10^{-3}	3.1×10^{-6}	7.6	3×10^{-3}
DOE complex miscellaneous components [i]	4.4×10^{-6}	4.2×10^{-8}	4.4×10^{-6}	2.2×10^{-9}	7.0×10^{-3}	2.4×10^{-4}	7.2×10^{-3}	3.6×10^{-6}	2	0.001
Sodium-Bonded Spent Nuclear Fuel [j]	3.9×10^{-7}	1.2×10^{-7}	5.1×10^{-7}	2.6×10^{-11}	1.9×10^{-2}	6.8×10^{-4}	2.0×10^{-2}	9.8×10^{-6}	38	0.015
Tank Closure [k]	5.2×10^{-8}	(o)	5.2×10^{-8}	2.6×10^{-11}	3.0×10^{-3}	(o)	3.0×10^{-3}	1.5×10^{-6}	490	0.20
Salt Processing [l]	3.1×10^{-4}	(o)	3.1×10^{-4}	1.6×10^{-7}	18.1	(o)	18.1	9.1×10^{-3}	29	0.12
Plant Vogtle [m]	5.4×10^{-7}	5.4×10^{-5}	5.5×10^{-5}	2.7×10^{-8}	0.042	2.5×10^{-3}	0.045	2.2×10^{-5}	NA	NA

a Arnett and Mamatey, 1998, *Savannah River Site Environmental Data for 1997*, WSRC-TR-97-00322 as cited in DOE 2000, *Savannah River Site Spent Nuclear Fuel Management Final Environmental Impact Statement*, DOE/EIS-0279

b MFFF ER: Table 5-11

c MFFF ER Appendix G; DOE 1999, *Surplus Plutonium Disposition Final Environmental Impact Statement*, DOE/EIA-0283; Tables J-56 and J-57

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

e DOE 1996, *Disposition of Highly Enriched Uranium Final Environmental Impact Statement*, DOE/EIS-0240

f DOE 1999, *Final Environmental Impact Statement for the Construction and Operation of a Tritium Extraction Facility at the Savannah River Site*, DOE/EIS-0271

g DOE 1994, *Final Defense Waste Processing Facility Supplemental Environmental Impact Statement*, DOE/EIS-0082-S

h DOE 1998, *Final Environmental Impact Statement on Management of Certain Plutonium Residues and Scrub Alloy at the Rocky Flats Environmental Technology Site*, DOE/EIS-0277F

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

j DOE 1999, *Draft Environmental Impact Statement for the Treatment and Management of Sodium-Bonded Spent Nuclear Fuel*, DOE/EIS-0306D

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

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

m NRC 1996, *Dose Commitments Due to Radioactive Releases from Nuclear Power Plant Sites in 1992*. NUREG/CR 2850

n All radioactive liquids are transferred to SRS waste management facilities.

o Cited in originals as less than minimum reportable levels

R1, R3

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 [a]	Other Waste Volume [a]
High-level	14,129	0	0	11,000	97,000	45,000	0	69,552
Low-level	118,669	17,000	24,850	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	5,000	180[h]	3,700	0	0	0	8,820
Nonhazardous Liquid	416,000	166,000	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] WSB TRU waste is derived from solidification of high alpha waste and is included in the 5,000 m^3 listed for MFFF.

R2, R3

R1

Table 5-15d. Estimated Average Annual Cumulative Utility Consumption

Activity	Electricity (megawatt-hours)	Water usage (liter)
SRS baseline [a]	4.11×10^5	1.70×10^{10}
MFFF [b]	1.3×10^5	9.2×10^6
PDCP and WSB[c]	4.8×10^5	1.42×10^8
SNF management [a]	1.58×10^4	2.11×10^8
Tank closure [d]	Not Available	8.65×10^6
Salt processing [e]	2.4×10^4	1.2×10^7
Other SRS foreseeable activities [a]	1.51×10^3	6.73×10^8

R2

R1

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

[b] MFFF ER

[c] MFFF ER, Appendix G; DOE 1999, *Surplus Plutonium Disposition Final Environmental Impact Statement*, DOE/EIS-0283; Table E-7 and E-17

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

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

Table 5-19. F-Area Site Evaluation Matrix

Qualification Criteria	Area			
	3	2	4	5
Free from Subsurface Contamination	No		No	No
Adequate Terrain and Area			No	
Free from RCRA / CERCLA Features				No

Evaluation Criteria	Weight	Rating			
Protected Species	3	2	2	2	2
Water Table	3	2	2	1	3
Topography	3	3	3	1	2
Accessibility	2	1	3	2	3
Soft Zones	2	2	2	2	2
Utilities / Infrastructure	2	1	3	2	2
Wetlands	1	2	2	1	2
Archaeological Features	1	1	1	2	2
Interference with Existing SSCs	1	1	2	2	1
Sum of the (weights) x (ratings)		33	42	29	40

Rating:

3 = More than Adequate

2 = Adequate

1 = Marginal

Table 5-20. Irreversible and Irretrievable Commitments of Construction Resources for the MOX Fuel Fabrication Facility

Resource	Commitment	Comments
Land	106 acres	Land will be returned to industrial use after completion of the MFFF mission
Electricity (MWh)	16,000	
Fuel (gal/yr)	330,000	
Water (gal/yr)	33,000,000	Water will be treated and returned to the environment
Concrete (yd^3)	156,000	
Steel (tons)	38,000	

R2, R3

6. ANALYSIS OF ENVIRONMENTAL IMPACTS OF PROPOSED ACTION AND ALTERNATIVES

This chapter summarizes each alternative examined in this ER, considering both the benefits and environmental costs of each alternative. The conclusion of the environmental analysis conducted in this ER is that the proposed action is the appropriate course of action.

6.1 PROPOSED ACTION

6.1.1 Benefits of the Proposed Action R2

As discussed previously, the proposed action is the issuance of an NRC license to possess and use SNM in an MFFF at SRS. The primary benefit of the proposed action is that it meets the purpose and need for action discussed in Chapter 2. The proposed action provides the mechanism to implement the joint United States and Russian Federation Agreement (White House 2000) [Text Deleted]. R2

In addition to the significant national security benefit of implementing the joint United States and Russian Federation Agreement, the proposed action also results in additional benefits to the local community around SRS by providing approximately 500 to 900 construction jobs and 400 R2 full-time jobs over the lifetime of the project. This increase in jobs will partially offset the planned job reductions as the SRS mission changes. The process of converting the surplus plutonium to MOX fuel will also consume up to 728 tons (660 metric tons) of surplus depleted uranium.

6.1.2 Monetary Costs of the Proposed Action

In February 2002, DOE submitted *Report to Congress: Disposition of Surplus Defense Plutonium at Savannah River Site* (NNSA 2002). This report provided updated cost estimates R1 for various program alternatives requested by Congress. DOE estimated the budget cost of the MFFF (Table 6-1) to be $2.1 billion with the added cost of the PDCF and WSB at $1.7 billion yielding a total cost $3.8 billion (NNSA 2002).

6.1.3 Environmental Costs of the Proposed Action

The direct environmental impacts of the proposed action are summarized in Table 6-2. Construction of the MFFF will disturb 106 ac (43 ha), most of which will be returned to original use once construction is finished. Once constructed, the MFFF will occupy 41 ac (16.6 ha) of land in the SRS F Area. All liquid and solid wastes will be transferred to the appropriate SRS waste treatment facility. Because the MFFF does not have any process liquid effluent, there are no expected impacts on surface water or groundwater. The MFFF site will have a stormwater collection and routing system that will discharge through the existing SRS stormwater NPDES outfall or new outfalls. There may be slight temporary impacts from construction runoff, but these should disappear once construction is completed.

The MFFF will have emergency and standby diesel generators that will be tested periodically, resulting in criteria pollutant emissions during the testing periods. Incremental increases in ambient concentrations of these criteria pollutants will be well below the ambient air quality standards for southwestern South Carolina. The MOX fuel fabrication process also will release small quantities of NO_X. The annual releases are accounted for in the nitrogen dioxide projections for the facility.

Dose to the public from normal MFFF operations (0.28 person-rem/yr population dose; 3.3E-03 mrem/yr for the MEI) will be well below NRC and EPA criteria and also below background radiation levels. R1, R3

Although the construction and operation of the MFFF will disturb approximately 106 ac (43 ha) of SRS land, some of this land is already designated the site of the PDCF. There will be no impacts to sensitive ecological areas because no such areas were identified on the MFFF site. R1 The construction of the MFFF will require the excavation and recovery of two archaeological sites. Mitigation of one of these sites was completed in April 2002 and mitigation completion for the second site is anticipated for August 2002. The archaeological site is not expected to contain any human or sacred artifacts and so the excavation and recovery of the artifacts may represent a benefit through the preservation of the artifacts. R1

[Text Deleted] With the exception of the solid TRU waste, the amounts of waste generated are a small fraction of annual SRS waste generation and will therefore have minimal impacts on SRS waste management resources. R The liquid high alpha activity waste generated by the MFFF will be solidified and disposed as 405 yd^3/yr solid TRU waste at WIPP. This additional waste represents a < 1% increase in waste disposed at WIPP. R2 The *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* projected no latent cancer fatalities to the public from disposal activities. Addition of an insignificant amount of MFFF solid TRU waste is not expected to change this projection. [Text Deleted]

Cumulative impacts in the geographic vicinity of the MFFF and SRS are dominated by the impacts of existing SRS activities. SRS is currently in substantial compliance with applicable federal, state, and local air quality regulations, and compliance would be maintained even with the cumulative effects of all surplus plutonium disposition activities. Cumulative dose to the maximally exposed member of the public from all SRS activities would increase by 3.3E-03 mrem/yr or about 0.2% over the current SRS dose of 0.18 mrem/yr (Arnett and Mamatey 2001). R1, [Text Deleted] R3

Dose to the public and workers from the transportation of plutonium feedstock to SRS was evaluated in the SPD EIS (DOE 1999c) R2

The total dose to transportation workers associated with the UF_6 shipments is estimated to be 1.06 person-rem, corresponding to 4.22E-04 LCFs. The total dose to transportation workers associated with the UO_2 shipments is estimated to be 0.78 person-rem, corresponding to 3.10E-04 LCFs. R2

Table 6-1. MFFF implementation costs (Thousands of 2001 dollars)[a]

Facility	R&D and Pre-Capital Costs	Design and Construction and Capital Equipment Costs	Operations Costs	Deactivation Costs	Contingency Costs	Total Costs
PDCF	249,300	440,900	718,200	9,100	267,700	$1,695,200
MFFF	326,800	1,058,200	1,226,800	9,100	497,800	$2,154,500
Total	$576,100	$1,509,100	$1,945,000	$18,200	$765,500	$3,849,700

[a] Source: NNSA 2002

R1

Table 6-2. Comparison of Environmental Impacts for the Proposed Action and the No Action Alternative R2

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	0.048	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)	385,800	No change
Solid LLW (yd^3/yr)	362	No change
[Text Deleted]		
Solid TRU Waste (yd^3/yr)	653	No change
Excess Low-Level Radioactive Solvent Waste (gal/yr)	3,075	No change
Liquid Nonhazardous Waste (gal/yr)[d]	4,389,710	No change
Solid Nonhazardous Waste (yd^3/yr)	1,754	No change
Cost ($ Billion)	3.8[e]	4.6

R2
R2, R3
R1

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November 21, 2002

Mr. A.B. Gould, Director
Environmental Quality
Department of Energy, Savannah River Operations Office
P.O. Box A
Aiken, SC 29802

RE: Data Recovery Projects 38AK546 and 38AK757 at the Savannah River Site R3

Dear Mr. Gould:

I am writing to inform you that our office concurs with the Department of Energy's determination that field obligations have been met for data recovery investigations at 38AK546 and 38AK757. The excavations exceeded the requirements of the approved data recovery plans. We look forward to reviewing the results.

This letter was written to assist you with your obligations under Section 106 of the National Historic Preservation Act, as amended, and the regulations codified at 36 CFR Part 800. Please contact me at 803-896-6181 if you have any questions or comments regarding this matter.

Sincerely,

Chad C. Long
Staff Archaeologist
State Historic Preservation Office

cc: Mark Brooks

S. C. Department of Archives & History • 8301 Parklane Road • Columbia • South Carolina • 29223-4905 • (803) 896-6100 • www.state.sc.us/scdah

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Department of Energy
Savannah River Operations Office
P.O. Box A
Aiken, South Carolina 29802

DEC 0 8 2000

Mr. D. L. Johnson
South Carolina Department of Natural Resources
1201 Main Street
Suite 1100
Columbia, SC 29201

Dear Mr. Johnson:

Re: U.S. Department of Energy, Savannah River Site
Surplus Plutonium Disposition - Mixed Oxide Fuel Fabrication Facility

In July 1998, the Department of Energy notified the South Carolina Department of Natural Resources, Lower Coastal Wildlife Diversity, of plans to locate the Surplus Plutonium Disposition Facilities at the Savannah River Site and solicited comment on the Surplus Plutonium Disposition Environmental Impact Statement (letter from Mr. M. Jones to Mr. T. Murphy July 28,1998).

The Department of Energy has determined a preliminary site layout for the Mixed Oxide Fuel Fabrication Facility (one of the three surplus plutonium disposition facilities) which is illustrated on the enclosed map as site "2M". The Department of Energy also performed a survey of the Mixed Oxide Fuel Fabrication Facility site for wetlands, and endangered and threatened species or critical habitat. Enclosed is the survey report. We request your review and concurrence with the results of our survey.

Sincerely,

A. B. Gould, Director
Environmental Quality and Management Division

kwd/aco
Enc.

D H E C

PROMOTE PROTECT PROSPER

2600 Bull Street
Columbia, SC 29201-1708

03-14-03 A09:15 IN

March 3, 2003

Mary L. Birch, Manager
Environment, Safety and Health
Westinghouse Savannah River Company
P.O. Box 31847
Charlotte, NC 28231-1847

RE: Duke Cogema Stone and Webster (DCS)
Mixed Oxide Fuel Fabrication Facility
401 Water Quality Certification

Dear Ms. Birch:

We are providing comments regarding the above referenced project plan outlined in your letter dated January 15, 2003. The proposed project consists of constructing and operating a Mixed Oxide Fuel Fabrication Facility on the Department of Energy (DOE) Savannah River Site (SRS) in Aiken County. The South Carolina Department of Health and Environmental Control, Bureau of Water administers applicable regulations pertaining to water quality standards and classifications, including 401 Water Quality Certifications. You indicated that you did not believe a 401 Water Quality Certification was required for the proposed work. R2

A 401 Water Quality Certification would be required for any part of the proposed work that impacts jurisdictional wetlands or waters of the U.S. This determination is made by the U.S. Army Corps of Engineers. If they determine that a 404 (dredge and fill) Permit is required, then a 401 Certification would be required. You have indicated that no 404 Permit is required and there will be no dredge or fill activities in waters of the U.S., therefore a 401 Certification would not be required. Based on this information, the Department agrees that a 401 Certification is not required for the above proposed work.

The Department requests that DCS implement best management practices during construction to minimize erosion and migration of sediments off site. These practices may include use of mulches, hay bales, silt fences, or other devices capable of preventing erosion and migration of sediments. All disturbed land surfaces should be stabilized upon project completion. Additionally, if nonjurisdictional wetlands are impacted SCDHEC will require compensation through the State Stormwater Permitting program. Thank you for the opportunity to comment on this project. If you have any questions, please feel free to call John Cofrum at (803) 898-4179.

Sincerely,

Dunnie Epps, Section Manager
Water Quality Certification, Standards, Navigable
Waters, and Wetlands Programs Section

DQE:JAC

Table D-1. Joint Frequency Distribution Used for Calculation of Dose to the Offsite Public and to Site Workers Due to Airborne Releases Resulting from Normal Operations of the MFFF

Wind Speed (mph)	Stability Class	Wind Direction															
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE
2.0	A	0.25	0.20	0.24	0.24	0.21	0.18	0.15	0.18	0.17	0.17	0.21	0.22	0.18	0.18	0.16	0.21
	B	0.02	0.03	0.03	0.03	0.01	0	0	0.01	0.01	0.01	0.03	0.03	0	0.03	0.03	0.02
	C	0.02	0.01	0.01	0.02	0.01	0.01	0.02	0.03	0.03	0.01	0.01	0.01	0.01	0.02	0.01	0.01
	D	0.01	0.02	0	0.02	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.03
	E	0	0	0	0	0	0	0	0	0.01	0.01	0	0	0	0	0	0
	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	G	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.5	A	0.88	0.73	0.92	1.04	1.06	0.79	0.70	0.55	0.74	0.78	1.12	1.37	1.19	0.82	0.56	0.57
	B	0.24	0.36	0.43	0.44	0.35	0.25	0.19	0.21	0.26	0.24	0.34	0.38	0.29	0.25	0.16	0.16
	C	0.15	0.39	0.73	0.50	0.39	0.24	0.24	0.29	0.33	0.36	0.43	0.49	0.34	0.28	0.23	0.18
	D	0.09	0.25	0.59	0.34	0.31	0.27	0.34	0.37	0.42	0.39	0.38	0.33	0.30	0.22	0.26	0.21
	E	0.01	0.09	0.28	0.11	0.08	0.16	0.17	0.18	0.26	0.22	0.19	0.20	0.13	0.13	0.11	0.13
	F	0.01	0.02	0.02	0.01	0	0.03	0.02	0.03	0.03	0.03	0.02	0.05	0	0.01	0.02	0.04
	G	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10.0	A	1.03	0.66	0.53	0.50	0.44	0.30	0.26	0.20	0.37	0.43	0.60	0.70	0.71	0.48	0.24	0.36
	B	0.21	0.57	0.65	0.67	0.32	0.23	0.16	0.19	0.31	0.33	0.55	0.75	0.55	0.36	0.16	0.18
	C	0.16	0.69	1.49	0.86	0.67	0.44	0.42	0.42	0.52	0.58	0.74	0.78	0.78	0.57	0.27	0.14
	D	0.12	0.52	1.64	0.95	0.81	0.70	0.84	1.12	1.48	1.05	1.26	1.27	1.01	0.88	0.50	0.20
	E	0.06	0.64	1.08	0.81	0.62	0.62	0.82	0.98	1.20	1.10	1.06	1.12	0.63	0.47	0.42	0.24
	F	0.02	0.22	0.19	0.07	0.10	0.16	0.18	0.17	0.22	0.16	0.21	0.27	0.07	0.06	0.05	0.06
	G	0	0.02	0.01	0	0	0.01	0.01	0.01	0.02	0.01	0.01	0.02	0	0	0	0
13.5	A	0.21	0.18	0.03	0.03	0.01	0.02	0.02	0.01	0.02	0.04	0.05	0.10	0.09	0.11	0.03	0.09
	B	0.02	0.17	0.12	0.04	0.04	0.03	0.05	0.04	0.04	0.09	0.18	0.31	0.46	0.34	0.09	0.03
	C	0	0.18	0.46	0.21	0.08	0.09	0.16	0.22	0.20	0.29	0.41	0.46	0.73	0.62	0.13	0.01
	D	0	0.09	0.19	0.08	0.05	0.06	0.13	0.46	0.43	0.24	0.24	0.12	0.13	0.11	0.07	0
	E	0	0.09	0.06	0.09	0.07	0.05	0.05	0.09	0.13	0.10	0.19	0.07	0.02	0.02	0.01	0
	F	0	0.04	0.02	0.03	0.01	0.03	0.02	0.01	0.01	0.01	0.03	0.02	0.01	0	0	0
	G	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table D-1. **Joint Frequency Distribution Used for Calculation of Dose to the Offsite Public and to Site Workers Due to Airborne Releases Resulting from Normal Operations of the MFFF (continued)**

Wind Speed (mph)	Stability Class	Wind Direction															
		S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE
21.5	A	0.01	0	0	0	0	0	0	0	0	0	0	0.01	0.02	0.02	0	0.01
	B	0	0.01	0	0	0	0	0	0	0	0	0.02	0.03	0.08	0.06	0.01	0
	C	0	0.01	0	0	0.01	0	0.01	0.04	0.04	0.05	0.05	0.08	0.18	0.10	0.02	0
	D	0	0	0	0	0	0	0	0.03	0.02	0.02	0.01	0	0.02	0	0	0
	E	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0	0	0
	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	G	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25.0	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	G	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table D-8. Potential Radiological Impacts on the General Public and Site Workers Due to Normal Operations of the MFFF

RADIATION DOSE TO THE GENERAL PUBLIC	Groundlevel Release[b]
Maximally Exposed Individual	
Annual Dose (mrem/yr)[c]	3.3E-03
Percentage of 10 CFR Part 20, Subpart D Standard[d]	3.3E-03
Percentage of Natural Background Radiation[e]	1.1E-03
Annual LCF Risk[f]	1.7E-09
General Population Within 50 mi (80 km)	
Annual Dose (person-rem/yr)[c]	0.28
Percentage of Natural Background Radiation[g]	9.1E-05
Annual LCF Risk[f]	1.4E-04
Average Exposed Individual Within 50 mi (80 km)	
Annual Dose (mrem/yr)[h]	2.7E-04
Percentage of 10 CFR Part 20, Subpart D Standard[d]	2.7E-04
Percentage of Natural Background Radiation[e]	9.1E-05
Annual LCF Risk[f]	1.3E-10

R2, R3

RADIATION DOSE TO SITE WORKERS	Groundlevel Release[b]	
Maximally Exposed Site Worker		
Annual Dose (mrem/yr)[i]	6.6	
Percentage of 10 CFR Part 20, Subpart C Standard[j]	1.3E-01	
Percentage of Natural Background Radiation[e]	2.2	
Annual LCF Risk[k]	2.6E-06	
General Site Worker Population	**Minimum[l]**	**Maximum[m]**
Maximum Annual Dose (person-rem/yr)[n]	0.042	90
Percentage of Natural Background Radiation[o]	1.0E-03	2.2
Annual LCF Risk[k]	1.7E-05	3.6E-02

R2

Table D-8. Potential Radiological Impacts on the General Public and Site Workers Due to Normal Operations of the MFFF

R2

[a] [Text Deleted]

[b] Height of groundlevel release is 1 ft (0.3 m) above grade.

[c] Source is GENII model results for the offsite public.

[d] 10 CFR Part 20, Subpart D standard is an annual dose of 100 mrem.

[e] Natural background radiation is 295 mrem/yr (see Table 4-23).

[f] Calculated using a cancer risk factor of 0.0005 per rem (500 cancers/10^6 person-rem).

[g] Natural background radiation for the offsite public was calculated as the individual background radiation (295 mrem/yr) times the number of people projected to live in the 50-mi (80-km) assessment area in the year 2030 (1,042,483 people). The calculated value is 307,532 person-rem/yr.

[h] Calculated as the population dose divided by the number of people projected to live in the 50-mi (80-km) assessment area in the year 2030 (1,042,483 people).

[i] Source is GENII model results for site workers.

[j] 10 CFR Part 20, Subpart C standard is an annual dose of 5,000 mrem.

[k] Calculated using a cancer risk factor of 0.0004 per rem (400 cancers/10^6 person-rem).

[l] Minimum values based on a distance of 5 mi (8 km) from the release point (i.e., at the SRS boundary).

[m] Maximum values based on a distance of 328 ft (100 m) from the release point (i.e., at the MFFF boundary).

[n] Dose for the site worker population was determined by multiplying the MEI dose at the respective distance from the release point by the total number of site workers (13,616 workers). The MEI doses are as follows:

MEI dose at the MFFF boundary for an elevated release =	2.2E-02 mrem/yr
MEI dose at the SRS boundary for an elevated release =	3.9E-04 mrem/yr
MEI dose at the MFFF boundary for a groundlevel release =	3.0 mrem/yr
MEI dose at the SRS boundary for a groundlevel release =	1.4E-03 mrem/yr

[o] Natural background radiation for the site workers was calculated as the individual background radiation (295 mrem/yr) times the estimated number of site workers in 2000 (13,616 workers). The calculated value is 4,017 person-rem/yr.

- Credible – Events that are not "Not Credible."
- Not Credible – Natural phenomena or external man-made events with an extremely low initiating frequency, or process events that are not possible.

Note that the Highly Unlikely category is not used in the unmitigated analysis. Only through the application of MFFF engineered features are events placed into this category. Also note that events deemed Not Credible are not considered in the MFFF design.

F.3 CONSEQUENCE CATEGORIES

Consequences are categorized according to three severity levels: High, Intermediate, and Low. The consequence severity levels are based on 10 CFR §70.61 and are shown in Table F-2.

F.4 RISK CATEGORIES

Risk is represented by the frequency and the consequence. Based on 10 CFR §70.61, the risk categories are shown in Table F-3. This matrix is applicable to all receptors.

In accordance with 10 CFR §70.61, the risk posed by those events falling in risk categories 6 and 9 must be addressed with engineered controls, administrative controls, or both to reduce the risk to an acceptable level.

Note that 10 CFR §70.61 places no consequence criteria for events considered Highly Unlikely. Thus, the environmental assessment does not report consequences for events deemed Highly Unlikely.

F.5 UNCERTAINTIES AND CONSERVATISM

The determination of risk is based on calculations associated with hypothetical sequences of events and models of their effects. The models provide estimates of the frequencies, source terms, pathways for dispersion, exposures, and the effects on human health and the environment that are as realistic as possible within the scope of the analysis. The uncertainty in the calculation of consequences and event frequency requires the use of models or input values that yield conservative consequence and frequency estimates. All events have been evaluated using uniform methods and data, allowing a fair comparison of all events.

The bounding consequence calculations are based on extremely conservative assumptions. The actual source term involved in the event would be far lower than the source term considered in the calculation due to the actual MFFF design. Specific conservative assumptions include 95% meteorology; an LPF of 1E-04 for more than two sets of HEPA filters; and bounding source terms, release fractions, and respirable fractions as described in Section F.6. When relied upon to mitigate the effects of an accident, the filters are assumed to have a 99% removal efficiency (i.e. 1% leak path factor) per stage. Each HEPA system relied upon for safety includes two banks or stages of HEPA filters in series. The effective leak path factor for a system of staged HEPA R1 filters is the product of the individual leak path factors for successive filter stages. Thus, a leak path factor of 1E-04 was applied for the HEPA system. The combination of efficiencies is more conservative than the value of 2E-06 presented in NRC 1998d (Section F.2.1.3) for filters protected by pre-filters, sprinklers and demisters. R1

The estimation of event frequency is especially subject to considerable uncertainty. The uncertainty in estimates of the frequency of Highly Unlikely events can be several orders of magnitude. For this reason, event frequency is reported qualitatively, in terms of broad frequency bins, as opposed to numerically.

The analysis uses an extremely conservative approach with respect to frequency. All natural phenomena hazards and external man-made hazards are considered unless their probability of impacting the MFFF is extremely low, and all internal hazards generated by the MFFF design and operations are considered. For these hazards, unmitigated events are evaluated without regard to the frequency of the initiating event. In most cases, the failure of many features is required for the bounding event to occur.

F.6 ADDITIONAL INTERNAL EVENT DESCRIPTIONS

This section provides supporting details for the bounding events described in Section 5.5. Two types of events are presented; bounding events and bounding low consequence events. Bounding events are defined as events that have a frequency greater than or equal to unlikely and that have the potential to produce the largest unmitigated consequences. Bounding low consequence events are defined as events that have the potential to produce the largest consequences that are below the intermediate consequence criteria of 10CFR70.61 for the public, site worker, and the environment. These events do not require mitigation or prevention, however mitigation may be available from features required for other events. All events identified in the PHA (Preliminary Hazards Analysis) are evaluated to determine the bounding and bounding low consequence events.

F.6.1 Loss of Confinement

R1, R3

The bounding loss of confinement event is an event caused by a load handling accident of the Jar Storage and Handling Unit. (See Section F.6.3 for a description of this event.) The bounding radiological consequences associated with this event are provided in Table 5-13a. 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 is a drop of waste drums located in the truck bay. (See Section F.6.3 for a description.) 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. R1, R3

F.6.2 Internal Fire

The bounding internal fire event is a fire in the fire area containing the Final Dosing Unit. This unit contains polished plutonium powder for the purpose of down blending the mixed oxide powder to the desired blend for fuel rod fabrication. This fire area is postulated to contain the largest source term for this event, thus producing the largest consequences. Fire areas with a larger material at risk have a lower damage ratio for this event resulting in a lower overall source term. R2

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. The maximum amount of plutonium in this fire area does not exceed 136 lb (64 kg) of polished powder. 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. R2 R2

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 80 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. R1, R3

F.6.3 Load Handling

The bounding load-handling event is a drop event involving the glovebox in the Jar Storage and Handling Unit. This glovebox contains jars of plutonium powder. This glovebox is postulated to contain the largest source term for this event, thus producing the largest consequences. 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. The maximum amount of plutonium in this glovebox is approximately 557 lb (254 kg) of polished powder. 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 transport off 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 80 grams of unpolished plutonium powder The ARF is 2E-3, the RF is 0.3, 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
(b)(4) 1979). The leak path factor for gases and particulates is 1.0 and 1E-04, respectively. [redacted] R3
The radiological consequences associated with this event are shown in Table 5-13a. R2

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
(b)(4) the entire material at risk within a process cell. [redacted] R3
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, R3
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. R1

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 (5.0 miles from the MFFF). R1

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. R2

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. R1

APPENDIX G.

ENVIRONMENTAL IMPACTS OF CONSTRUCTION AND OPERATION OF THE WASTE SOLIDIFICATION BUILDING

[NEW APPENDIX]

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The DOE has decided to construct the Waste Solidification Building (WSB) as part of the PDCF. This building will remove radioisotopes from the MFFF and PDCF liquid wastes and convert them into solid waste that will be disposed 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. R3

The WSB design is at the preliminary design stage. Information and impact projections presented in this appendix are bounding projections. R3

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 liquid waste streams from the PDCF and the MFFF: R3

MFFF High Alpha Stream

MFFF Stripped Uranium Stream

PDCF Laboratory Liquid Stream

The building will be a combination of concrete and soft structure. Concrete will be utilized to provide confinement of the high alpha exposure field caused by the MFFF high alpha stream. A concrete-cell configuration will be utilized as this stream is processed through the building. Process enclosures adjacent to the cells will provide worker protection to accommodate operations and maintenance activities. The shielding and confinement will also serve as fire isolation barriers. The soft-shell construction composed of a steel siding on structural steel members will house the low activity process, cold chemical feeds, storage, shipping areas and balance of plant services. Secondary confinement features such as dikes, sumps and leak detection will be provided for those areas with liquid waste spill potential. The major pieces of process equipment are tanks, evaporators, and cementation equipment.

The building will contain no more than 12,000 gallons of high alpha waste stream and 24,000 gallons (including transfer pipeline flush water from PDCF) of low activity waste. Liquid waste processed from the WSB and located in the material handling area will be in cement form and are not considered to be at risk because the cement matrix immobilizes the radionuclides. Cold chemical processing rooms, drum storage, and truck loading/unloading will be performed in non-hardened structures. The material storage area will be at grade. R3 R3

The waste receipt area has tanks to separately receive high alpha waste, stripped uranium waste, and the PDCF laboratory liquid stream waste. The tank volumes are sufficient to receive and store waste from six weeks of processing by the MFFF and eight weeks by PDCF.

The MFFF will transfer a transuranic (TRU) waste and a low-level radioactive waste (LLW) stream to the WSB. The PDCF will transfer a LLW stream. The WSB will produce a TRU and R3 a LLW solid waste form acceptable for shipment and disposal at their respective locations. The TRU waste form will be sent to WIPP. The LLW form will be sent to a permitted disposal site. R3

Within the WSB, the waste streams are collected into receipt tanks, chemically adjusted, evaporated, neutralized, combined with cement into waste containers, stored and shipped. The R3 MFFF high alpha stream receipt tanks and process rooms will be located inside a hardened (reinforced concrete) structure. The other streams will be processed in a steel construction building composed of steel siding on structural steel members. The process areas will be R3 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-site receptor.

G.1.2 Waste Processing

The WSB will receive waste from the MFFF and PDCF. Table G-1 provides a characterization of these waste streams. As noted in Chapter 3, 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 WSB. The two wastes are batch transferred through separate double-walled stainless steel pipes to the WSB. PDCF Laboratory Liquid Stream (Table G-1) is also transferred through double-walled stainless steel pipes to the WSB. Following each transfer, provisions exist to rinse the pipeline, if necessary. The pipes are maintained in a drained state between waste transfers.[Text deleted] R3

Evaporation with cementation will be used to process PDCF Laboratory Liquid Stream, MFFF High Alpha Stream, and MFFF Stripped Uranium Stream. Evaporation will be used to reduce the "water" content of the streams to that needed for efficient cement mixing. Excess water will be recycled where practical or transferred to the existing SRS Effluent Treatment Facility (ETF) and processed to allow release to the environment.

[Text deleted] Chemicals used in the treatment process are listed in Table G-2. R3

G.1.2.1 PDCF Laboratory Liquid Stream Receipts

The PDCF Laboratory Liquids Stream is 0.18 Molar (average) acidic with very little R3 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 waste 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 R3 total of water provided by PDCF.

The line flush technique for PDCF waste will be to pump one line volume of flush water (estimated to be 150 gallons) to the WSB tanks. The residual line volume will then be drained back to a PDCF flush water collection tank for use in the next flush.

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 eight to 8 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 to mix the waste and flush water. R3

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 nominal waste volume of this stream will be 42,530 gallons per year, received in approximately 42 transfers at a frequency of about one every week. [Text deleted] R3 R3

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 waste. The WSB tanks will be agitated to mix the waste.

G.1.2.3 Processing of PDCF Lab Liquids and MFFF Stripped Uranium R3

Both streams are anticipated to be LLW and to be RCRA corrosive wastes (pH will be 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. R3

G.1.2.3.1 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 can 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 cement head tanks. 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 waste requirement of the Effluent Treatment Facility (ETF) then they will be sent to ETF, otherwise they will need to be treated. R3 R3 R3

G.1.2.3.2 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 cooling tower. Any overflows will be contained. Rinse water will be provided. R3

G.1.2.3.3 Cement Process

Neutralized waste will be pumped to a cement mixer. A metering pump will inject controlled amounts of the waste stream from the neutralization tank 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. A splash apron will be utilized to minimize the spread of contamination. This sequence will be repeated until the LAW bottoms tank is emptied. R3

[Text deleted]

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.1.2.3.4 Overheads Processing to ETF

Overheads from the high activity waste (HAW) Condensate Hold Tank will be batch fed into the LAW head tank (separately from MFFF stripped uranium waste stream) for feed to the LAW Evaporator. Overheads from the LAW evaporator will be condensed, collected, and processed R3 through the Effluent Hold Tank to meet the SRS ETF Waste Acceptance Criteria (WAC) limits. This condensate can also be pumped to either the HAW Head Tank or LAW Head Tank and used for dilution purposes. Bottoms from this evaporation step will be transferred to the LAW Bottoms Collection Tank where it can mix with the bottoms evolved from LAW evaporator R3 operations.

[Text deleted] R3

G.1.2.4 PDCF Lab Concentrates Processing

[Text deleted] R3

G.1.2.5 MFFF High Alpha Stream

G.1.2.5.1 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 waste stream can vary within given ranges. The maximum volume received is anticipated to be approximately 22,000 gallons per year of this R3 combined stream, which will be received in approximately 25 transfers, at a frequency of about once every two weeks.

[Text deleted] R3

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 to mix the waste and flush.

These receipt tanks will generate a radiation field and will be contained in concrete walled cells. Sampling capability, pumps, and valves will be located in gloveboxes in order to minimize the potential for contamination, to provide shielding during operations and maintenance, and to facilitate disposal. The waste stream is anticipated to include a silver constituent and to exceed the RCRA threshold for corrosivity (pH < 2), necessitating leak detection and confinement. Overflows will be collected in a dedicated overflow tank. R3

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 activate if purge air is lost. R3

G.1.2.5.2 Evaporator

The 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 (approximately 280 gallon bottoms per batch), where it will be cooled and sampled before being pumped to the HAW cement head tanks. If the sample results are unacceptable, the bottoms will be pumped back to the HAW head tank for reprocessing. R3 Overheads will be condensed and collected in the HAW condensate hold tank, sampled, and if the results are acceptable, pumped to the LAW head tank for a second evaporator cleanup. If the sample results are not acceptable, the overheads will 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. While not as efficient, this arrangement will allow continued processing if necessary during an evaporator outage, with alternate processing directly to the cement process. 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. In using the bypass mode approximately 50 additional SWBs of TRU waste may be added to the annual waste values discussed in Section G.3.6. R3

G.1.2.5.3 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. R3 Chemical reaction heat will require dissipation via cooling coils and a cooling tower. Caustic solution will be batch fed into a Cold Chemical addition tank before being gravity fed to the HAW Cement Head Tanks. R3 This approach will prevent over-addition of caustic and will aid in controlling the rate of reaction. Any overflows will be directed to an overflow tank in order to contain the americium. Rinse water is connected to the HAW Cement Head Tanks in order to provide the capability to remove buildup in the tank R3 bottom. This tank is sampled to ensure that the input to the cement process is within anticipated parameters.

G.1.2.5.4 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 metering 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. The idea is that one cement head tank corresponds to one cement waste container. The mix is caught in a Standard Waste Box cement waste container. A splash apron will be utilized to minimize the spread of contamination. This sequence will be repeated until the high activity waste Bottoms Tank is emptied. R3

[Text deleted]

The high activity waste cementation process area is anticipated to have a high background radiation level. Equipment requiring regular operator access will be shielded. Remotely operated waste container handling, instrumentation, pumps, and valves will also be required to limit exposure. 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 prevent this silver containing waste from entering building drains and the NPDES permitted treatment system. R3

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. R3

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). R3
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 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: R3

- NO_X emissions from the WSB stack derived from acidic waste evaporation
- [Text deleted] R3
- 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. R3

The potential airborne chemical emissions from waste processing are comprised of aluminum nitrate, 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 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). R3

G.3.2.2 Surface Water Quality

The WSB does not discharge any process liquid directly to the environment. The WSB design will include discharges of water (HVAC condensate, storm water, etc.) to an NPDES outfall. All liquid discharges to NPDES outfalls will meet state and federal regulations. All liquid wastes are transferred to SRS waste management facilities for treatment and ultimate disposal. Liquid LLW generated by the treatment of MFFF and PDCF wastes in the WSB will be transferred to the SRS ETF for treatment and disposal. 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 waste streams. The ETF discharges treated wastewater to Upper Three Run. The LLW volume represents less than 0.001% of the 7-day, 10-year low flow of Upper Three Run.

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.

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

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 should be limited because all liquid will be transferred to SRS for disposal 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. R3

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 effluent pumped to the SRS ETF for further site processing.

G.3.4.1 Radiation Doses to the Public

(b)(4)

Radioactive releases 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. The emission is projected to result in a dose to the general public at the SRS site boundary of less than 2.9E-03 mrem/yr which is below the 10 CFR 835 regulated limit. R3

A series of evaporation steps will be used 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 sent to ETF and will meet the requirements for that facility. Consequently, the maximum amount of activity in the effluent waste stream that could be sent to the SRS ETF for further processing prior to release to the environment is 1.04 Curies. This is assuming the effluent is at the maximum levels for alpha and beta/gamma activity for ETF and the maximum amount of 235,000 gallons is sent. This source of radioactivity would have negligible impact on receptor doses. In addition, the waste streams are further treated by the onsite ETF prior to release to the environment. R3

[Text deleted] R3

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. R3

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 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 current SRS guideline of 500 mrem/year. R3

G.3.5 Impacts to SRS Infrastructure

The WSB is anticipated to use less than 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 R3

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

As discussed in Section G.1.2.5.4, after evaporation, the high alpha waste bottoms will contain essentially all of the salts, silver, etc. in the MFFF high alpha waste stream. This will be metered into the cement process. The SWB final package sent to WIPP will have approximately 180 grams Am-241 per container, and the remaining waste constituents as received from the MFFF. R3
The WSB will produce 405 yd^3 (310 m^3) of TRU waste annually. 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 (5,794 m^3) to 710,648 yd^3 (543,361 m^3), with an expected forecast of 16,433 yd^3 (12,564 m^3) (DOE 1995b, Table A-1). The estimated lifetime WSB contribution (4,050 yd^3 or 3,100 m^3) to SRS TRU solid waste quantity is a 25% increase over the expected volume but only 1% of the maximum SRS 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 3,100 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 x 10^{-5} cancers) would be expected in the population from hazardous chemical exposure." (DOE 1997e, pg 5-29) The addition of 3,100 m^3 TRU waste from the WSB would not be expected to change this conclusion.

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. This waste will be transferred to the ETF. This volume will be less than 0.1% of the 1,930,000 m^3/yr capacity of the ETF.

Assuming no volume reduction of the PDCF Lab Liquids or MFFF Stripped Uranium stream, the R3
WSB will produce a maximum of 228 yd^3 (175 m^3) of solid LLW per year. 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 *Savannah River Site Waste Management Final Environmental Impact Statement* (DOE 1995b).

The building job control waste will be in compliance with WSRC Manual 1S, *SRS Waste Acceptance Criteria Manual* (2002). All streams will be managed in accordance with applicable laws and regulations (e.g., RCRA).

G.3.7 Impacts to Historic, Scenic, and Cultural Resources

Operation of the WSB will not impact any historic, scenic or cultural resources.

G.3.8 Socioeconomic Impacts

Less than 100 new permanent jobs will be created in 2006 for WSB operation. To fill these jobs, some employees may be hired from other regions of the state or country. Over 400,000 people resided within the five-county region of influence (ROI) in 1990. Assuming that any WSB employees and their families that may move into the area as a direct result of WSB employment choose to live in one of the five ROI counties, their numbers would represent less than 1% of the total 1990 ROI population. Given the size of the population of the region, and the rate of growth it is already experiencing, no significant socioeconomic impacts are anticipated.

G.3.9 Environmental Justice Impacts

Nuclear Materials Safety and Safeguards policy and procedures[2] specify that a 4-mi (6.4-km) radius should be used as the area of consideration in rural areas or areas that are outside of city limits. The WSB is located on SRS. There is no resident population within a 5-mi (8-km) radius of the WSB site, and the nearest minority or low-income community is over 5 mi (8 km) away. As noted in Section 4.9 and shown on Figures 4-15 and 4-16, a disproportionate minority or low-income population does not exist even within a 10-mi (16-km) radius of the WSB site. As a result, WSB operation will pose no significant health risks to the public regardless of the racial or ethnic composition or economic status.

G.3.10 DECOMMISSIONING

G.3.10.1 Introduction

After all of the MFFF and PDCF waste is processed, NNSA will determine the future use of the WSB, including any decision to decommission or reutilize the facility. If NNSA should decide to decommission the WSB, the ultimate goal of decommissioning is unrestricted release or

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[2] *Environmental Justice in NEPA Documents* (NRC 1999) specifies the guidelines for determining the area for assessment. "If the facility is located outside the city limits or in a rural area, a 4 mile radius (50 square miles) should be used."

restricted use of the site.[3] In decommissioning, the facility is taken to its ultimate end state 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.

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[3] DOE O 430.1A, Life Cycle Asset Management.

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 Inhalation Dose. Air submersion, ingestion, water immersion, and contaminated soil dose pathways are assumed negligible contributors to the TEDE. The Inhalation Dose is calculated as follows:

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

where:

ST = source term

χ/Q = atmospheric dispersion factor

BR = breathing rate

C = unit's conversion constant

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 release is 2.8E-06 sec/m^3. The associated χ/Q for the site worker located within 328 ft (100 m) of a groundlevel release of 3-minutes duration from the WSB based on the local SRS meteorological conditions is 7.5E-04 sec/m^3.

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 following equation is used to determine the respirable airborne source term (ST) for each event:

$$[ST]=[MAR]\times[DR]\times[ARF]\times[RF]\times[LPF] \quad \text{(NRC 1998d)}$$

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 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. Performance goals for annual probability of exceedance were determined to be 5E-04 for all process areas and equipment except for the high activity waste processing and receipt cells. For those cells in which the high activity waste is stored or processed, 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 all portions of the WSB except those hardened reinforced concrete cells housing the MFFF High Alpha Waste, the equipment will be housed inside a standard metal-constructed building designed to withstand a 3-second wind speed of 107 mph. 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 cells housing the High Alpha Waste stream 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).

G.4.2.1.2 External Flooding

External flooding includes floods associated with rising rivers or lakes. For all process areas and equipment except for the high activity waste processing and receipt cells, the structures are designed for the flooding consequences associated with flooding events with an annual exceedance probability of 5E-04 (return period of 2,000 years). For the high activity cells, the hardened reinforced concrete structure will be designed to withstand the flooding consequences associated with a flooding event with an annual hazard exceedance probability of 1E-04.

G.4.2.1.3 Earthquakes

Earthquakes may result from movement of the earth's tectonic plates or volcanic activity. For all process areas and equipment except for the high activity waste processing and receipt cells, the structures are designed for the seismic consequences associated with an earthquake with a minimum annual exceedance probability of 1E-03 (return period of 1,000 years). For the high activity cells, the hardened reinforced concrete structure will be designed to withstand the consequences associated with an earthquake event with a minimum annual hazard exceedance probability of 5E-04 (return period of 2,000 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).

Although the MFFF High Alpha waste stream tanks (except for the receipt and head tanks) may fail as a result of the design basis earthquake, the concrete cells surrounding the tanks are designed to enhanced seismic criteria. The other waste streams will be included in a standard metal-constructed building and may be subject to full release as a result of structural damage caused by this natural phenomenon event. R3

R3

During a seismic event, it is assumed all of the material in the high activity cells (except for the receipt tanks and head tank) is spilled along with 2,500 gallons from one of the receipt tanks as a result of a ruptured transfer line. The consequences of this release are discussed in the loss of confinement section.

A fire is then assumed to occur throughout the entire facility, except for the hardened structure, which contains the high activity cells. The hardened structure acts as a fire barrier and prevents the full facility fire from entering the high activity cells. It is also assumed that a fire starts in the cell that contains the high activity receipt tanks and head tank. Since the cell walls also act as a fire barrier, it is assumed that the fire does not spread from that cell. Due to the low combustible loading in the cell, it is assumed that the solution in the cell does not boil therefore an ARF of 3.0E-05 was used instead of 2.0E-03 for boiling material. R3

Table G-13 shows the impact to the site worker to be moderate 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). For the high activity cells, 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.

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 are enclosed with hardened reinforced concrete and will be designed to withstand the effects of the design basis tornado. The other waste streams will be included in a standard metal-constructed building and may be subject to damage and release following this natural phenomenon event. 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. Primary confinement barriers include the concrete cells. Secondary confinement barriers include R3 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. The loss at each level of confinement is necessary for a non-negligible release from the WSB to occur.

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.

Loss-of-confinement events caused by fires, explosions, load-handling events, natural phenomena, and external events are covered in their respective event discussions.

The bounding credible loss-of-confinement event involves a facility-wide spill of all material in the building, except from the High Activity receipt tanks and head tanks, due to a natural phenomena or external event. The High Activity receipt tanks and head tanks will be designed to survive the event, but it was assumed that a 2,500 gallon spill would result from rupturing a transfer line within the building during a transfer of High Activity solution. Only the high activity waste and overheads were analyzed as the low activity waste would add only a slight increase to the dose. The total quantity of high activity waste includes 2,500 gallons lost during the transfer, 1,000 gallons of high activity bottoms each in the High Activity Evaporator, High Activity Bottoms Collection Tank, and three High Activity Cement Head Tanks, and 3,400 gallons of high activity overhead. The release factors applied for the release of waste from failed components was that based on a free fall spill, with an ARF of 2E-04 and a RF of 0.5 for material released prior to evaporation (i.e. Spg <1.2) and an ARF of 2E-05 and a RF of 1.0 was used for material released after evaporation (i.e. Spg >1.2). The radiological consequences associated with this event are mitigated by the robust cell structure design for the high activity waste processing area and implementation of an Emergency Response Plan. The Leak Path Factor (LPF) from the MFFF High Alpha Waste Stream tanks is calculated to be 0.69 due to the structural confinement capability of the cell. In addition, 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 are less than the limits, as shown in Table G-13. R3 R3 R3 R3

As shown in Table G-13, the radiological consequences at the SRS boundary are negligible. Such impacts would not be sufficient to warrant evacuation of the public or interdiction or decontamination of land or food supplies. Table G-13 also shows that the radiological consequences to the nearest site worker are moderate. R3

The WSB utilizes many features to reduce the likelihood and consequences of this event as well as other loss-of-confinement events. Key features include: piping design to take into consideration thermal and pressure stresses, erosion, corrosion, etc.; material selection for chemical compatibility; and facility emergency response procedures; and worker training. The waste transfer lines from the PDCF and the MFFF to the WSB are composed of welded, jacketed stainless steel piping. R3 R3

Given the low consequences and/or small likelihood of this type of accident, the radiological risk from the loss-of-confinement events is negligible. R3

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.

A number of fire events were postulated in the individual process cells. For each event, the value of ARF used is 2E-03 with an RF value of 1.0. It is assumed that the fire is severe enough to cause boiling of the material. Though limited combustibles are expected to be present in the process cells, the fire events assumed the fire spreads and impacts the entire cell inventory. In addition, both area fires and a full facility fire were postulated having potentially high consequences to facility and site workers. Postulated fire events include the following:

- Fires involving the low activity, cementation areas and effluent processing sections of the WSB (process feed tanks, evaporators, and/or piping containing waste solutions) R3
- Cell fires involving the high alpha storage and processing tanks (receipt tank, head tank, evaporator, bottoms collection tank, cement head tanks) R3
- Full facility fire that affects the entire facility inventory
- An area fire affecting just the low activity, cementation areas and effluent processing sections of the facility R3
- [Text deleted] R3

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 Alpha receipt tanks and within the high activity waste stream processing area, fires sprinkler systems, fire resistant construction materials, and the building confinement system. Robust construction of the cells used for storing and processing high activity waste prevents fires in these areas and the potential release of its large source term.

The bounding credible fire event postulated to produce the largest radiological consequences is a fire in the low activity and effluent processing sections and the low and high activity cementation areas of the WSB, causing structural damage to the facility and causing the release of radionuclides in these areas. R3 An area fire involving the low activity and effluent processing sections and the low and high activity cementation areas of the WSB could potentially release up to 16,500 gallons of the unprocessed low activity waste, 1,190 gallons of low activity bottoms, one batch of high activity bottoms (180 g of Americium) in the cement process and 6,000 gallons of low activity overheads. R3 The radiological consequences associated with this event are provided in Table G-13.

The MFFF 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. R3

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 the 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 R3
- Overpressurization of the High or Low Activity Evaporator.

The control strategy for explosion events associated with the WSB high activity tanks and vessels is to prevent the explosions through the use of a 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. R3

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. R3

[Text deleted]

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 cell walls that separate the worker from the evaporator, the consequence is minimized. R3

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 to the facility worker as a result of either entering a high activity cell 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. R3

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 (ALOHA 2000), the ARCON96 code (ARCON96 1997), and the MACCS2 code (MACCS2 1998) to calculate the maximum airborne chemical concentration at the SRS boundary (approximately 6 miles from the WSB). 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. R3

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 aluminum nitrate, 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 cells, 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. R3

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 be treated separately for processing at the WSB. However, the wastes will be neutralized and mixed with a solidification additive and 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 wastes will be loaded in a TRUPACT II shipping container for transport via truck to WIPP. Approximately 35 shipments of this TRU waste will be sent to WIPP annually. R3

The environmental impacts of transportation of waste from the SRS waste management facilities to ultimate disposal sites are documented in the Waste Management PEIS (DOE 1997a) and the SRS Waste Management Final EIS (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 35 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 on DOE 1997a). For 35 shipments of TRU waste, the total additional dose to the MEI is 5.3 E-03 mrem which equates to an increase in lifetime cancer risk of 2.6E-09. 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-14. 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 wastes 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

[4] DOE 1997a, Table E-27 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.

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 aluminum nitrate, 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 does not discharge any process liquid directly to the environment. The WSB design will include discharges of water (HVAC condensate, storm water, etc.) to an NPDES outfall. All liquid discharges to NPDES outfalls will meet state and federal regulations. All liquid wastes are transferred to SRS waste management facilities for treatment and ultimate disposal. 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. This waste will be transferred to the ETF. This volume would be less than 0.1% of the 1,930,000 m^3/yr capacity of the ETF.

The dose to the public from WSB operations has been estimated to be 2.9E-03 mrem/yr. 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 current SRS guideline of 500 mrem/year. R3

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Figures

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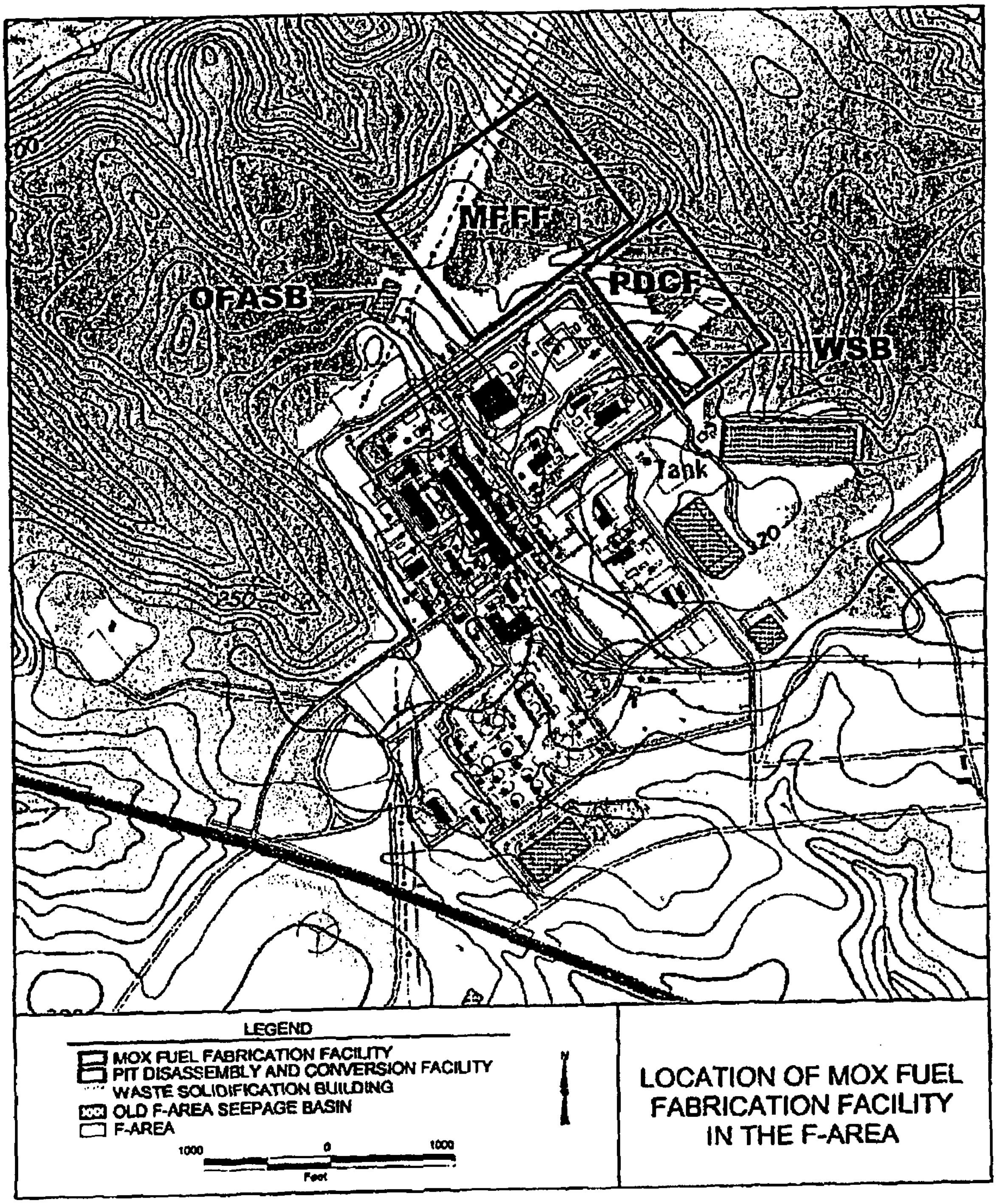

Figure G-1. Location of Waste Solidification Building in the F Area

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Tables

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

Waste Stream	Source	Nominal Characteristics	Annual Volume (gallons)
High Alpha	MFFF	Am-241: < 24.5 kg/yr (0.7% maximum Pu content) (84,000 Ci/yr) Pu: < 221 g/yr U: < 13 g/yr [H+] = 3 N Nitrate salts = 1500 kg/yr Silver: 300 kg/yr Na: 147 kg/yr	15,358 (min) 21,841 (max)
Stripped Uranium	MFFF	Pu: < 0.1 mg/L U: < 5000 kg/yr [~1% U-235] [H+] = 0.1 N	42,530 (min) 46,000 (max)
Lab Liquids	PDCF	0.18M HNO_3, 3.9g Pu, 2.5gU 0.28 kg Fl, 9.19 kg Cl, 334 kg nitrates, 0.3 kg sulfates	4,800 (min) 11,000 (nominal) 18,200 (max)
[Text deleted]			

R3

Table G-2. Waste Treatment Chemicals

(b)(4)

R3

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	240,000	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 ($\mu g/m^3$) from WSB Operation R3

[Table deleted]

Table G-7. Volume of WSB Tanks and Vessels

Tank/Vessel	Number of Tanks/Vessels	Contents	Volume (gal)
PDCF Lab Liquids Storage Tank	1	Unprocessed Waste	3000
MFFF Stripped Uranium Storage Tank	2	Unprocessed Waste	4000
MFFF High Alpha Storage Tank	2	Unprocessed Waste	2500
[Text deleted]			
High Activity Head Tank (Evaporator Feed)	1	Unprocessed Waste	5000
High Level Evaporator	1	HA Bottoms	280
High Activity Bottoms Collection Tank	1	HA Bottoms	600
High Activity Cement Head Tanks	3	HA Bottoms	120 each
High Activity Condensate Hold Tank (Overheads)	1	HA Overheads	4500
Low Activity Head Tank (Evaporator Feed)	1	Unprocessed Waste	5500
Low Level Evaporator	1	LA Bottoms	280
Low Activity Bottoms Collection Tank	1	LA Bottoms	600
Low Activity Cement Head Tanks	2	LA Bottoms	200 each
Effluent Hold Tank	1	LA Overheads	6000
[Text deleted]			
[Text deleted]			

R3

Table G-8. PDCF Lab Liquids Waste Radionuclide Concentration

Radionuclide	Concentration (g/l)
Pu-238	2.41E-07
Pu-239	4.50E-04
Pu-240	3.13E-05
Pu-242	4.82E-07
Am-241	4.82E-06
U-234	4.06E-06
U-235	3.78E-04
U-236	2.03E-06
U-238	2.19E-05

R3

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

[Table deleted] R3

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

Radionuclide	Concentration (g/l)
Pu-236	5.04E-21
Pu-238	5.04E-08
Pu-239	1.16E-04
Pu-240	7.56E-06
Pu-241	1.26E-06
Pu-242	1.26E-07
U-232	9.53E-09
U-233	4.24E-08
U-234	5.22E-03
U-235	3.48E-01
U-236	8.19E-03
U-238	3.59E+01

R3

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

Radionuclide	Concentration (g/l)
Pu-236	1.96E-19
Pu-238	1.96E-06
Pu-239	4.52E-03
Pu-240	2.95E-04
Pu-241	4.92E-05
Pu-242	4.92E-06
Am-241	5.41E-01
U-232	6.95E-12
U-233	3.09E-11
U-234	3.80E-06
U-235	2.54E-04
U-236	5.98E-06
U-238	1.68E-05

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-236	6.53E-20	3.56E-19	3.56E-24
Pu-238	6.53E-07	3.56E-06	3.56E-11
Pu-239	1.51E-03	8.24E-03	8.24E-08
Pu-240	9.83E-05	5.37E-04	5.37E-09
Pu-241	1.64E-05	8.95E-05	8.95E-10
Pu-242	1.64E-06	8.95E-06	8.95E-11
Am-241	1.80E-01	9.84E-01	9.84E-06
U-232	2.32E-12	1.26E-11	1.26E-16
U-233	1.03E-11	5.62E-11	5.62E-16
U-234	1.27E-06	6.91E-06	6.91E-11
U-235	8.47E-05	4.62E-04	4.62E-09
U-236	1.99E-06	1.09E-05	1.09E-10
U-238	5.60E-06	3.06E-05	3.06E-10

Table G-13. Summary of Consequences for WSB Bounding Credible Events

Accident Event	Maximum Impact to Site Worker (rem)	Maximum Impact to Site Worker (probability of cancer deaths)	Maximum Impact to Public at SRS Boundary (rem)	Maximum Impact Public at SRS Boundary (probability of cancer deaths)
Loss of Confinement (Spill)	33.5	1.34E-02	6.64E-02	3.32E-05
LA Process Area Fire	33.4	1.34E-02	6.65E-02	3.33E-05
Earthquake induced spill and fire	78.8	3.15E-02	1.35E-01	6.75E-05

R3

*These values were extracted from WSB Safety Analysis Reports which assume a safety limit 25% greater than the expected operating margin. The WSB operating margins were based on waste constituent sheets provided by MFFF which assumed an additional 20% margin of safety, therefore these projected doses are extremely conservative.

Table G-14. Estimated Consequences for the Most Severe Accidents Involving Truck Shipments of TRU Waste

(b)(4)