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Revision 3

Mixed Oxide Fuel Fabrication Facility Environmental Report, Revision 4
Instructions for Page Insertions

Revision 4 of the Mixed Oxide Fuel Fabrication Facility Environmental Report consists of changes to reflect design improvements in the Waste Solidification Building since the publication of Revision 3. 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)
Inside Cover, Revision 3	Inside Cover, Revision 4
Revision 3 Description Sheet	Revision 4 Description Sheet
i through xxiv	i through xxx
5-23, 5-24	5-23, 5-24
5-92, 5-93	5-92, 5-93
G-1 through G-52	G-1 through G-56

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Mixed Oxide Fuel Fabrication Facility Environmental Report, Revision 4

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	Pg 5-93, Table 5-15c updated to reflect revised Waste Solidification Building low-level radioactive waste volume.
	Pg G1 through G-56, Updated to reflect design improvements to the Waste Solidification Building and revised accident analyses.

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LIST OF ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius (Centigrade)
°F	degrees Fahrenheit
46°26'07"	46 degrees, 26 minutes, 7 seconds
ac	acre
AFS	alternate feedstock
ALARA	as low as reasonably achievable
ALOHA	Areal Locations of Hazardous Atmospheres
ANS	American Nuclear Society
ANSI	American National Standards Institute
APSF	Actinide Packaging and Storage Facility
ARF	airborne release fraction
ARR	airborne release rate
bgs	below ground surface
BMP	Best Management Practice
Bq	Becquerel
Btu	British thermal unit
CAA	Clean Air Act
CAR	Construction Authorization Request
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
Ci	Curie
CISAC	Committee on International Security and Arms Control
cm	centimeter
COE	U.S. Army Corps of Engineers
CPT	cone penetration test
CSWTF	Central Sanitary Waste Treatment Facility
CWA	Clean Water Act
D&D	decontamination and decommissioning
dB	decibel
dBA	decibels A-weighted
DCS	Duke Cogema Stone & Webster, LLC
DOE	U.S. Department of Energy
DOE-MD	U.S. Department of Energy Office of Fissile Materials Disposition
DOE-SR	U.S. Department of Energy Savannah River Operations Office
DOI	U.S. Department of Interior
DOT	U.S. Department of Transportation
DR	damage ratio
DWPF	Defense Waste Processing Facility
EF	efficiency factor
EIS	Environmental Impact Statement

EPA	U.S. Environmental Protection Agency
ER	Environmental Report
ETF	Effluent Treatment Facility
FFCA	Federal Facility Compliance Act
FR	Federal Register
ft	foot
ft^2	square foot
ft^3	cubic foot
g	acceleration due to gravity
g	gram
gal	gallon
GDP	Gaseous Diffusion Plant
GE	General Electric
GPG	Good Practice Guide
GSAR	Generic Safety Analysis Report
ha	hectare
HEPA	high-efficiency particulate air
HEU	highly enriched uranium
HLW	high-level radioactive waste
hr	hour
HVAC	heating, ventilation, and air conditioning
ICRP	International Commission on Radiological Protection
in	inch
INEEL	Idaho National Engineering and Environmental Laboratory
IROFS	items relied on for safety
ISCST	Industrial Source Complex Short-Term
kg	kilogram
km	kilometer
km^2	square kilometer
kV	kilovolt
kW	kilowatt
L	liter
LANL	Los Alamos National Laboratory
lb	pound
LCF	latent cancer fatality
LDR	Land Disposal Restrictions
LLC	Limited Liability Company
LLNL	Lawrence Livermore National Laboratory
LLW	low-level radioactive waste
LPF	leak path factor
LWR	light water reactor
m	meter
M	molar
M&O	Management and Operating

m^2	square meter
m^3	cubic meter
MACCS2	MELCOR Accident Consequence Code System for the Calculation of the Health and Economic Consequences of Accidental Atmospheric Radiological Releases
MAR	material at risk
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual NUREG-1575
MEI	maximally exposed individual
MEPA	moderate-efficiency particulate air
MFFF	Mixed Oxide Fuel Fabrication Facility
MFFP	MOX Fresh Fuel Package
mg	milligram
mi	mile
mi^2	square mile
min	minute
MOX	mixed oxide
mph	miles per hour
mRad	milliRad
mrem	millirem
MSA	Metropolitan Statistical Area
msl	mean sea level
MW	megawatt
MWh	megawatt hour
MWMF	Mixed Waste Management Facility
N	normal
NAAQS	National Ambient Air Quality Standards
NAS	National Academy of Sciences
nCi	nanocurie
NEPA	National Environmental Policy Act
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NMSS	Nuclear Materials Safety and Safeguards
NNSA	National Nuclear Security Administration
NOI	Notice of Intent
NO_x	Nitric Oxide
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NTS	Nevada Test Site
OFASB	Old F-Area Seepage Basin
OML	Oxalic Mother Liquors
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
OSHA	Occupational Safety and Health Administration
Pa	Pascal
pCi	picocurie

PCV	primary containment vessel
PDCF	Pit Disassembly and Conversion Facility
PEIS	Programmatic Environmental Impact Statement
pH	hydrogen ion concentration
PIDAS	Perimeter Intrusion Detection and Assessment System
PIP	Plutonium Immobilization Plant
PM_{10}	particulate matter less than or equal to 10 μm in diameter
PMF	probable maximum flood
PMOA	Programmatic Memorandum of Agreement
PMP	probable maximum precipitation
ppm	parts per million
PSD	prevention of significant deterioration
psf	pounds per square foot
PuO_2	plutonium dioxide
rad	radiation absorbed dose
RCRA	Resource Conservation and Recovery Act
rem	roentgen equivalent man
RF	respirable fraction
RFETS	Rocky Flats Environmental Technology Site
ROD	Record of Decision
ROI	region of influence
S&D	Storage and Disposition
SA	Safety Assessment
SAMS	secondary alarm monitoring station
SCAPA	Subcommittee on Consequence Assessment and Protective Action
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
SDWA	Safe Drinking Water Act
sec	second
SGT	SafeGuards Transporter
SHPO	State Historic Preservation Officer, State Historic Preservation Office
Sv	Sievert
SNM	special nuclear material
SPCC	Spill Prevention Control and Countermeasures
SPD	Surplus Plutonium Disposition
SRS	Savannah River Site
SSCs	structures, systems, and components
SST	safe secure transport
ST	source term
SWPPP	Stormwater Management Pollution Prevention Plan
TCE	trichloroethylene
TEEL	Temporary Emergency Exposure Limit
TIGR	Thermally induced gallium removal
ton	short ton

TRU	transuranic
TSCA	Toxic Substances Control Act
UCNI	Unclassified Controlled Nuclear Information
UF_6	uranium hexafluoride
UO_2	uranium dioxide
UPS	uninterruptible power supply
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Services
USGS	United States Geological Service
USNRCS	U.S. Natural Resources Conservation Service
UST	underground storage tank
VOC	volatile organic compound
VRM	Visual Resource Management
WA	watt ampere
WAC	Waste Acceptance Criteria
WIPP	Waste Isolation Pilot Plant
WPB	Waste Processing Building
WSB	Waste Solidification Building
WSI	Wackenhut Services Inc.
WSRC	Westinghouse Savannah River Company
wt %	weight percent
yd	yard
yr	year
µg	microgram
µm	micrometer (micron)
µSv	microsievert

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Metric Conversion Chart

To Convert Into Metric			To Convert Out of Metric		
If You Know	**Multiply By**	**To Get**	**If You Know**	**Multiply By**	**To Get**
Length					
inches	2.54	centimeters	centimeters	0.3937	inches
feet	30.48	centimeters	centimeters	0.0328	feet
feet	0.3048	meters	meters	3.281	feet
yards	0.9144	meters	meters	1.0936	yards
miles	1.60934	kilometers	kilometers	0.6214	miles
Area					
sq. inches	6.4516	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.092903	sq. meters	sq. meters	10.7639	sq. feet
sq. yards	0.8361	sq. meters	sq. meters	1.196	sq. yards
acres	0.40469	hectares	hectares	2.471	acres
sq. miles	2.58999	sq. kilometers	sq. kilometers	0.3861	sq. miles
Volume					
fluid ounces	29.574	milliliters	milliliters	0.0338	fluid ounces
gallons	3.7854	liters	liters	0.26417	gallons
cubic feet	0.028317	cubic meters	cubic meters	35.315	cubic feet
cubic yards	0.76455	cubic meters	cubic meters	1.308	cubic yards
Weight					
ounces	28.3495	grams	grams	0.03527	ounces
pounds	0.45360	kilograms	kilograms	2.2046	pounds
short tons	0.90718	metric tons	metric tons	1.1023	short tons
Temperature					
Fahrenheit	Subtract 32 then multiply by 5/9ths	Celsius	Celsius	Multiply by 9/5ths, then add 32	Fahrenheit

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APPENDIX G. WASTE PROCESSING BUILDING
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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 6,530 yd^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 5000 m^3 TRU waste from the WSB represents an increase of 3% in the projected waste disposed. Any increase in impacts resulting from disposing WSB solid TRU waste at WIPP should be within the error associated with any projected impacts of WIPP operation. Furthermore, the *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* projected that, "No LCFs would be expected in the population around WIPP from radiation exposure (3 E-4 LCFs). ... no cancer incidence (2 x 10^{-5} cancers) would be expected in the population from hazardous chemical exposure." (DOE 1997e, pg 5-29) The addition of 5,000 m^3 TRU waste from the MFFF and WSB would not be expected to change this conclusion.

The MFFF solid low level waste (LLW) is estimated to be 134 yd^3 (102 m^3) per year. The WSB would produce an additional 265 yd^3 (205 m^3) of solid LLW per year. Over its lifetime, the MFFF and WSB would expect to generate 3,990 yd^3 (3,070 m^3) of LLW. The forecast for SRS LLW generation over the next 30 years ranges from a minimum estimate of 480,310 yd^3 (367,223 m^3) to 1,837,068 yd^3 (1,404,539 m^3), with an expected forecast of 620,533 yd^3 (474,431 m^3) (DOE 1995b, Table A-1). The estimated MFFF LLW quantity is only a small fraction of any of the SRS estimates. Consequently, the waste volumes generated from MOX are small in comparison to the annual SRS volumes and impacts to SRS waste management are well within the bounds evaluated in the *SRS Waste Management Final Environmental Impact Statement* (DOE 1995b).

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

Table 5-12 illustrates that the MFFF waste generation rates are generally less than 5% of the SRS generation rates, except for solid TRU waste, which is projected to be about 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.

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

Waste Type	SRS Operations [a,b]	MFFF [c]	PDCF and WSB [d]	SNF Management [e]	Tank Closure [f]	Salt Processing [g]	Environmental Restoration/ D&D [d]	Other Waste Volume [d]
High-level	14,129	0	0	11,000	97,000	45,000	0	69,552
Low-level	118,669	16,000	10,000	140,000	19,260	920	61,630	110,102
Hazardous/mixed	3,856	120	10	270	470	56	6,178	4,441
Transuranic	6,012	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.

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
PDCF 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

APPENDIX G.

ENVIRONMENTAL IMPACTS OF CONSTRUCTION AND OPERATION OF THE WASTE SOLIDIFICATION BUILDING

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

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

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:

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 is 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.

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 TRU and 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.

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 MFFF high alpha system and the cementation processes 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 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. [Text deleted] The pipes are maintained in a drained state between waste transfers.

Evaporation with cementation will be used to process the PDCF Laboratory Liquid Stream, MFFF High Alpha Stream, and MFFF Stripped Uranium Stream. Evaporation will be used 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 an [Text deleted] approved facility and processed to allow release to the environment.

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

G.1.2.1 PDCF Laboratory Liquid Stream Receipts

The PDCF Laboratory Liquids Stream is 0.18 Molar (average) acidic with very little radionuclides. This stream will be pumped approximately 800 ft (243.8 m) to the WSB from PDCF in a welded-jacketed stainless steel pipe, which will be direct buried. The volume of this 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 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 up eight weeks of PDCF processing capacity in the event of a shutdown of WSB operations for maintenance or processing anomalies. The WSB tanks will be agitated to mix the waste and flush water.

Table G-8 gives the radionuclide concentrations for the PDCF waste stream. The radionuclide concentrations are based on a receipt of 11,000 gallons of waste per year, containing a maximum of 7 grams of plutonium and 5.9 grams of uranium. For accident analysis purposes, the radionuclide concentrations given in table G-8 include a 25% safety margin.

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.

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.

The radionuclide concentrations for the MFFF Stripped Uranium Stream are given in Table G-10. The concentrations are based on the waste containing approximately 0.1 milligram of plutonium per liter and a maximum of about 11,000 pounds of uranium per year. The isotopic distribution assumes the uranium will be diluted to less than 1 weight percent U-235, which is a requirement for the WSB to ensure criticality safety. Earlier revisions of this document showed an isotopic distribution that included far more than 1 weight percent U-235, which was unrealistic and over-conservative. The isotopic distribution in this revision was changed to reflect a more accurate representation of the waste expected to be received in the WSB. The radionuclide concentrations in Table G-10 also include a 25% safety margin.

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

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.

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 may be up to 600 gallons with a continuous feed from the head tank during steady state operation. Bottoms will be pumped to the LAW bottoms collection tank, cooled and sampled before being pumped to the

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.

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.

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.

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 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 operations.

G.1.2.4 PDCF Lab Concentrates Processing

[Text deleted]

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 combined stream, which will be received in approximately 25 transfers, at a frequency of about once every two weeks.

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

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.

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.

Table G-11 gives the radionuclide concentrations for the High Alpha Waste Stream. The americium concentration is based on receiving a maximum of 24.5 kilograms of Am-241 per year in 15,000 gallons of waste, which is the minimum expected annual volume. The High Alpha stream is also assumed to include 221 grams of plutonium annually, along with a small amount of uranium. The plutonium and uranium are negligible contributors to dose. The radionuclide concentrations in Table G-11 include a 25% safety margin.

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. 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.

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. 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. 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 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.

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.

G.2 EFFECTS OF FACILITY CONSTRUCTION

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

G.2.1 Impacts to Air Quality

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

G.2.2 Impacts to Water Quality

G.2.2.1 Water Use

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

G.2.2.2 Surface Water Quality

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

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

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

G.2.2.3 Groundwater Quality

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

G.2.3 Impacts to Terrestrial Ecology

G.2.3.1 Land Use

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

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

G.2.3.2 Non-Sensitive Habitat

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

G.2.3.3 Sensitive Habitat

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

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

G.2.3.4 Noise

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

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

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

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

G.2.4 Impacts to SRS Infrastructure

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

G.2.5 Impacts from Construction Waste

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

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

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

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

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

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

G.2.7 Socioeconomic Impacts

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

G.2.8 Environmental Justice Impacts

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

G.3 EFFECTS OF FACILITY OPERATION

G.3.1 Impacts to Air Quality

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

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

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

The potential airborne chemical emissions from waste processing are comprised of nitric acid and sodium hydroxide. A chemical consequences analysis was performed and determined that the airborne releases from the WSB at both 328 ft (100 m) from the WSB and at the SRS site boundary are well below the Temporary Emergency Exposure Limits (TEELs) for each chemical. Therefore, the impact on air quality from process chemicals is low.

G.3.2 Impacts to Water Quality

G.3.2.1 Water Use

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

G.3.2.2 Surface Water Quality

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.

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

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.

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.

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

The total radioactivity in the waste streams processed by the WSB on an annual basis is estimated to be approximately 85,000 Curies, of which 99.7% is a result of the Am-241 in the High Alpha Waste Stream from the MFFF. 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.

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.

G.3.4.2 Radiation Doses to Site Workers

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

G.3.4.3 Radiation Doses to Facility Workers

The annual dose to facility workers in the WSB is estimated to be below 200 person-rem/yr. The maximum dose to the worker from normal operations will be below the DOE Administrative Control Level of 2,000 mrem/year. Assuming a staff of 100, meeting the DOE Administrative Control Level would result in an annual population dose of 200 person-rem/yr. The average annual dose will be below the current SRS guideline of 500 mrem/year.

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 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. 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 a small fraction (<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 (2×10^{-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 [Text deleted] 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.

The WSB will produce a maximum of 265 yd^3 (205m^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.

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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."

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 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] DOE O 430.1A, Life Cycle Asset Management.

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

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

5. **Structural, mechanical, instrumentation, and electrical components:** Numerous design features of the WSB (e.g., use of washable epoxy coatings, segregation of waste streams, remote readout for instrumentation, and location of breaker boxes and electrical cabinets in low-dose-rate areas) facilitate decontamination, minimize the spread of contamination, and maintain doses to facility personnel ALARA.

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

G.3.10.3 Administrative Programs to Facilitate Decommissioning

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

G.3.10.4 Projected Environmental Impacts of Potential Decommissioning

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

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

2. The summary estimate methodology identified the RFETS buildings that were most representative of the MFFF since the majority of the waste is from the MFFF. The

methodology assumed that the secondary systems (i.e., ventilation, instrumentation and control, power, etc.) were similar. It also assumed that the decommissioning methods used for these facilities would be similar to those that were used for RFETS facilities.

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

G.3.10.5 Accessibility of Land After Decommissioning

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

G.4 FACILITY ACCIDENTS

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

G.4.1 Environmental Risk Assessment Method

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

- Internal Hazard Identification – A systematic and comprehensive identification of radioactive, hazardous material, and energy sources in the WSB
- External Hazard Identification – A systematic and comprehensive identification of applicable natural phenomena and events originating from nearby facilities
- Hazard Evaluation – A systematic and comprehensive evaluation to postulate event scenarios involving the information developed in the Hazard Identification
- Accident Analysis – A Preliminary Hazards Analysis is performed for the WSB to identify possible accident events and to estimate consequences and frequencies and to identify preliminary prevention and mitigation features. The accident analysis evaluates all credible events. Thus, all internally initiated accidents are evaluated without regard to their initiating frequency, and all natural phenomena hazard and external man-made hazard generated events are evaluated unless their probability of impacting the WSB is

extremely low. The results of the evaluation include events with no or low consequences, design basis events, and severe accidents.

G.4.2 Environmental Risk Assessment Summary

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

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

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

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

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

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

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

where:

ST = source term

χ/Q = atmospheric dispersion factor

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

[Text deleted]

f = specific activity of nuclide x

DCF = dose conversion factor of nuclide x

N = total number of dose-contributing radionuclides

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

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

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

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

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

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

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

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

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

[Text deleted}

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

The damage ratio (DR) is the fraction of the MAR actually impacted by the accident-generated conditions. The DR is estimated based upon engineering analysis of the response of structural

materials for containment to the type and level of stress or force generated by the event. For conservatism, the DR is conservatively assumed to be 1.0 for all accident analyses for the WSB.

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

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

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

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

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

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

G.4.2.1 Natural Phenomena

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

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

Natural phenomena could result in the dispersion of radioactive material and hazardous chemicals. 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 cells, and cementation areas. 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 and cementation areas, 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 and cementation areas will be designed to withstand the effects of the design basis extreme wind of 133 mph and the associated missiles. The missile criteria include the ability to withstand the force of a 2x4 timber plank weighing 15 pounds being driven at the structure at a horizontal velocity of 50 mph at a maximum height of 30 ft (9.1 m). In addition, the above ground high activity waste transfer line will be encased in reinforced concrete (or equivalent) to protect it from design basis extreme wind and associated missiles.

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 cementation areas, 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 cementation areas, 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 cementation areas, 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 and cementation areas, 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).

[Text deleted]

During a seismic event, it is assumed all of the material in the low activity process area is spilled. The vessels and piping in the high activity hardened structure and the high activity cementation area are designed to withstand a design basis earthquake and do not spill their contents during an earthquake. Section G.4.2.2 provides more detail on the material involved in a loss of confinement accident. For the spilling of the vessels, an ARF*RF value of 1.00E-4 was applied. Aerodynamic entrainment and resuspension was assumed to last for 8 hours with an Airborneelease Rate (ARR) of 4.00E-07 and RF of 1.0.

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

G.4.2.1.4 Tornadoes

Tornadoes may occur in extreme weather such as thunderstorms or hurricanes. All process areas and equipment are designed in accordance with the SRS-specific tornado wind load criteria given in Section 5.2.8 of *SRS Engineering Standards Manual: Structural Design Criteria* (WSRC 2001b). For the high activity cells and cementation areas, 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, and cementation areas 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 the WSB building structure itself and the associated ventilation system which maintains a negative differential pressure relative to the outside atmospheric pressure. Confinement capabilities will ensure that a controlled, continuous airflow pattern from the environment to the WSB, and from the non-contaminated areas of the building to potentially contaminated areas, to the normally contaminated areas, and through HEPA filters and the stack prior to release to the environment.

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

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

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

[Text deleted]

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

[Text deleted]

G.4.2.3 Fire

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

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

Postulated fire events include the following:

- Fires involving the low activity, and effluent processing sections of the WSB (process feed tanks, evaporators, and/or piping containing waste solutions)
- Cell fires involving the high alpha storage and processing tanks and cementation areas (receipt tank, head tank, evaporator, bottoms collection tank, cement head tanks)

- Full facility fire that affects the entire facility inventory
- An area fire affecting just the low activity, and effluent processing sections of the facility

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

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

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

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

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

G.4.2.4 Explosion

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

- Hydrogen accumulation in any of the tanks or evaporators used to process radiological material (caused by radiolysis)
- Inadvertent caustic addition to the acidic waste streams causing an energetic acid/base chemical reaction

- Red Oil Explosion in the High or Low Activity Evaporator
- Overpressurization of the High or Low Activity Evaporator.

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

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

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

G.4.2.5 Direct Radiation Exposure

A direct radiation hazard arises from the presence of radioactive material within the WSB. Direct radiation exposure events include those events that result in a radiation dose from radiation sources external to the body. Due to the nature of the radioactive material present in the WSB (within tanks, process vessels and containers), there are no accidents at the WSB that produce a direct radiation exposure hazard to the public or site workers from routine operations. A number of events were postulated that result in high radiation exposure to the facility worker as a result of either entering a high activity 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.

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

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

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

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

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

G.4.3 Evaluation of Facility Workers

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

Key design features include confinement systems, the robust construction of the high activity waste tanks and processing 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.

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.

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-15. For the accident analysis, the MEI is assumed to be located at the point of maximum exposure. The locations of maximum exposure were 160 m (525 ft) from the

[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.

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 containers and shipped offsite to permitted commercial recycling, treatment, and disposal facilities.

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

The WSB 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. The dose from the bounding accident (earthquake induced spill with a subsequent fire) was negligible to the onsite and offsite individuals.

Figures

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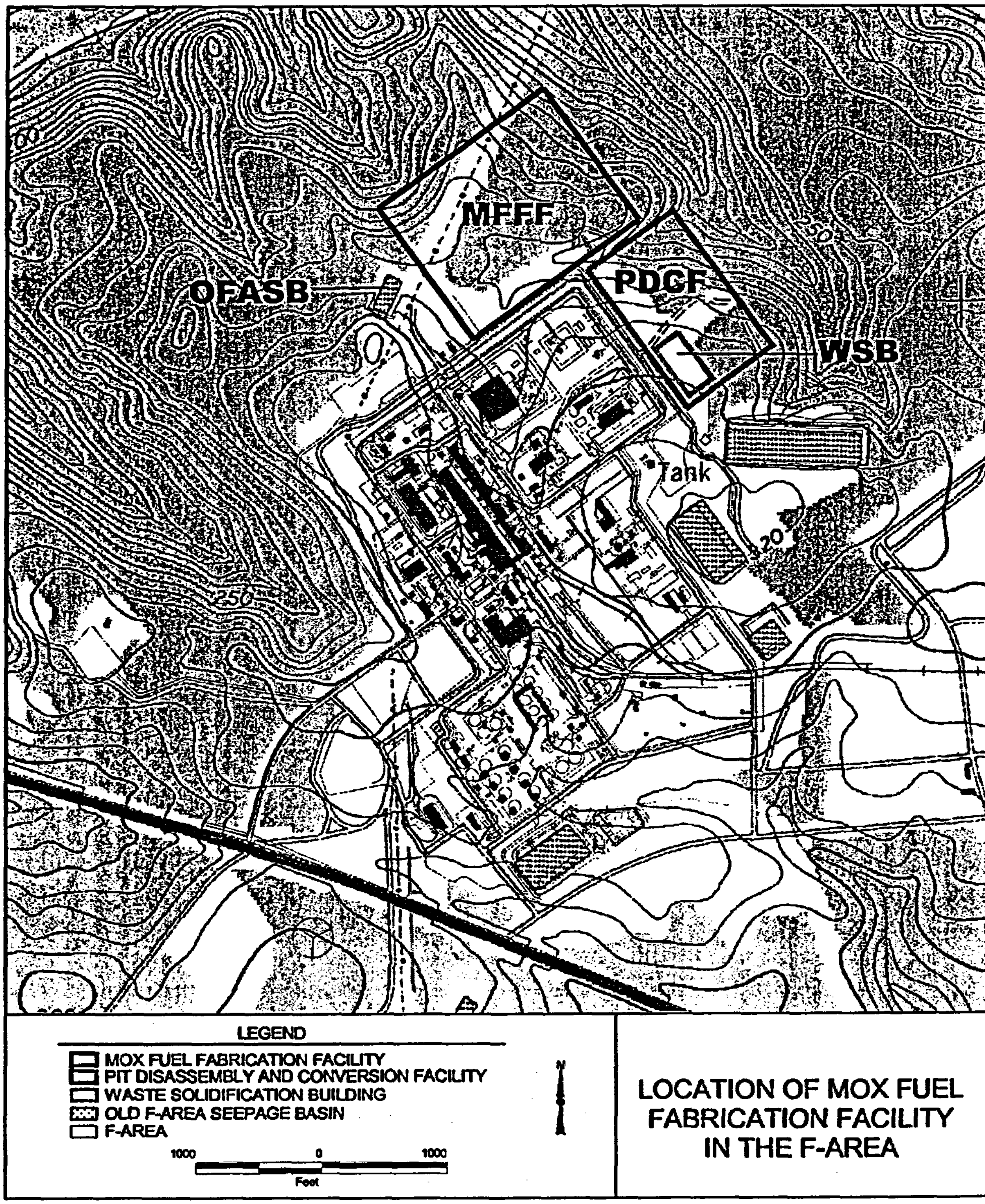

Figure G-1. Location of Waste Solidification Building in the F Area

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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)

Table G-2. Waste Treatment Chemicals

Chemical	Annual Consumption	Anticipated Onsite Inventory
[Text deleted]		
Dry Cement	<750,000 lb	<100,000 lb
Nitric acid (64%)	2,000 gal	350 gal
Sodium hydroxide (50%)	<7,000 gal	4,500 gal

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

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

Source: DOE 1999c, Table G-61

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

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

Source: DOE 1999c, Table E-12

[a] Capacity minus current usage

[b] WSB will use roads constructed for MFFF

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

Table G-5. Wastes Generated During Construction

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

Source: DOE 1999c, Table H-29.
[a] Capacity of CSWTF.

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

[Table deleted]

Table G-7. Volume of WSB Tanks and Vessels

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]			

Table G-8. PDCF Lab Liquids Waste Radionuclide Concentration

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

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

[Table deleted]

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

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

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

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

Table G-12. High Activity Evaporation Process Concentrations

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

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

I. Low Activity Receipt and Head Tanks Splashing Source Term

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

II. Low Activity Receipt and Head Tanks Resuspension Source Term

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

III. Low Activity Bottoms Splashing Source Term

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

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

IV. Low Activity Bottoms Resuspension Source Term

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

V. Low Activity Overheads Splashing Source Term

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

VI. Low Activity Overheads Resuspension Source Term

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

Table G-14. Facility Fire Source Term

I. Low Activity Receipt and Head Tanks Fire Source Term

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

II. Low Activity Bottoms Fire Source Term

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

III. Low Activity Overheads Fire Source Term

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

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

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

Source: DOE 1997a, Table E-26

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

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

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